WITTMANN ADMSU VOLUME MA MCMICKEN DAM ALTERNATIVE ANALYSIS

FINAL REPORT
JUNE 2005

Flood Control District of Maricopa County

Entellus™
2355 N. 44th St., Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
www.entellus.com

Stantec

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A. 85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

WITTMANN AREA DRAINAGE MASTER STUDY UPDATE

ALTERNATIVES ANALYSIS FOR MCMICKEN DAM

VOLUME MA

Report Prepared for:

ENTELLUS
2255 N. 44th Street, Suite 125
Phoenix, AZ 85008

Report Prepared by:

STANTEC CONSULTING INC.
8211 South 48th Street
Phoenix, Arizona 85044
www.stantec.com

Stantec Project No. 82000267

June 2005

Contract FCD 2002C029

Registered Professional Engineer (Civil)
CERTIFICATE NO.
17928
GEORGE V.
SABOL
Date Signed 7 June 05
ARIZONA U.S.A.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
35150
R. MICHAEL C.
GERLACH
Date Signed 7 June 05
ARIZONA U.S.A.

Wittmann Area Drainage Master Study Update

FCD 2002C029

ALTERNATIVES ANALYSIS FOR MCMICKEN DAM

(Volume MA)

Table of Contents

MA 1. Introduction 1
MA 1.1. Background 1
MA 1.2. Purpose and Scope 8
MA 2. Data Collection 10
MA 2.1. Survey 10
MA 2.1.1. Crest Surveys 10
MA 2.1.2. Outlet Channel Survey 10
MA 2.1.3. GDACS 10
MA 2.2. Mapping 10
MA 2.3. Aerial Photography 13
MA 2.4. Existing Studies 13
MA 2.4.1. USACE Design Hydrology Report 13
MA 2.4.2. SHB Hydrology Report 14
MA 2.4.3. Rumann & Sutko Hydrology Study 14
MA 2.4.4. McMicken Dam Hydrology Report 14
MA 2.4.5. Outlet Channel Analysis 15
MA 2.4.6. Spillway Analysis 15
MA 2.4.7. Spillway Delineation Study 16
MA 2.4.8. Subsidence 16
MA 2.4.9. Geomorphology 17
MA 2.4.10. Earth Fissures Investigation 17
MA 2.4.11. FRZR Design Report 18
MA 2.4.12. White Tanks FRS #3 Alternatives Analysis 18
MA 2.4.13. McMicken Dam Outlet Channel Inundation 18
MA 3. Existing Condition Analysis 21
MA 3.1. General 21
MA 3.2. FLO-2D Grid 24
MA 3.3. Roughness Coefficients 27
MA 3.3.1. General 27
MA 3.3.2. Base Values 27
MA 3.3.3. Sensitivity Analysis 31
MA 3.4. Inflow Hydrographs 31
MA 3.4.1. General 31
MA 3.4.2. Model Input 35
MA 3.5. Structures and Outlet Rating Curves 40
MA 3.5.1. General 40
MA 3.5.2. Dam Embankment 40

MA 3.5.3 Principal Outlet 42
MA 3.5.4. Emergency Spillway 46
MA 3.3.5. Principal Outlet Channel 53
MA 3.5.6. Sun Valley Parkway 55
MA 3.6. Control Parameters 58
MA 3.7. Results 58
MA 3.7.1. General 58
3.7.2. Stage-Flood Magnitude Relations 59
MA 3.7.3. Reservoir Hydraulics 63
MA 3.7.4. PMF 65
MA 3.7.5. 100-Year, Future and Existing Land Use Conditions 68
MA 3.7.6. 200-Year, Future and Existing Land Use Conditions 72
MA 3.7.7. 500-Year, Future and Existing Land Use Conditions 75
MA 3.7.8. Comparison of Results 78
MA 3.8. Summary 82
MA 4. Alternatives Analysis 83
MA4.1. General 83
MA 4.2. Alternative Formulation 83
MA 4.2.1. Dam Rehabilitation Option 83
MA 4.2.3. Dam Decommissioning Option 86
MA 4.3. Alternative Evaluation 87
MA 4.3.1. Evaluation Criteria 87
MA 4.3.1. Selected Alternative 98
MA 4.4. Engineering Analysis 100
MA 4.4.1. General 100
MA 4.4.2. Dam Rehabilitation 100
MA 4.4.3. Dam Decommissioning 111
MA 4.4.4. Cost Estimate 121
MA 4.4.5. Summary 135
MA 5. Non-Structural Alternatives 136
MA 5.1. Acquire Properties/Flowage Easements 136
MA 5.2. Upgrade Emergency Action Plans 137
MA 5.3. Protect Critical Facilities 138
MA 5.4. Mitigate through Flood Insurance 140
MA 5.5. Mass Notification 141
MA 5.6. Public Education 143
MA 5.7. Summary of Non-Structural Alternatives Evaluation 143
MA 6. References 145

List of Tables

Table MA-1 Runoff Magnitudes for McMicken Dam Estimated by the USACE 14
Table MA-2 Runoff Magnitudes for McMicken Dam Estimated by Entellus 15
Table MA-3 Comparison of single and multiple storm results for 100-year storm with existing land use conditions 34
Table MA-4 Comparison of the modified results to the base model results for the PMF for future land use conditions 35
Table MA-5 Emergency spillway stage-discharge rating table 49
Table MA-6 Summary of volume conservation results 59
Table MA-7 Stage-flood magnitude relations 60
Table MA-8 Peak outflow for each flood magnitude for future land use conditions 66
Table MA-9 Peak outflow for each flood magnitude for existing land use conditions 69
Table MA-10 Comparison of results from previous studies 79
Table MA-11 Weighting factors for each evaluation category 87
Table MA-12 Performance criteria ranking for the dam rehabilitation alternatives 90
Table MA-13 Performance criteria ranking for the dam decommissioning alternatives 91
Table MA-14 Failure consequences criteria ranking for the dam rehabilitation alternatives 91
Table MA-15 Failure consequences criteria ranking for the dam decommissioning alternatives . 92
Table MA-16 Cost criteria ranking for the dam rehabilitation alternatives 93
Table MA-17 Cost criteria ranking for the dam decommissioning alternatives 93
Table MA-18 Time and schedule criteria ranking for the dam rehabilitation alternatives 94
Table MA-19 Time and schedule criteria ranking for the dam decommissioning alternatives 94
Table MA-20 Environmental criteria ranking for the dam rehabilitation alternatives 95
Table MA-21 Environmental criteria ranking for the dam decommissioning alternatives 95
Table MA-22 Additional benefits criteria ranking for the dam rehabilitation alternatives 96
Table MA-23 Additional benefits criteria ranking for the dam decommissioning alternatives 97
Table MA-24 Landscape, aesthetics and multiuse criteria ranking for the dam rehabilitation alternatives 97
Table MA-25 Landscape, aesthetics and multiuse criteria ranking for the dam decommissioning alternatives 98
Table MA-26 Dam rehabilitation option alternative rankings 99
Table MA-27 Dam decommissioning option alternative rankings 99
Table MA-28 Bulked inflow 103
Table MA-29 100-year, 24-hour future land use condition peak discharges along the Outlet Channel 103
Table MA-30 100-year, 24-hour future land use condition peak discharges along the proposed channel 112
Table MA-31 Unit costs 123
Table MA-32 Dam rehabilitation alternative cost estimate 128
Table MA-33 Dam decommissioning alternative cost estimate 132
Table MA-34 Current Costs for Preferred Risk Flood Insurance Policies 140

List of Figures

Figure MA-1 Vicinity map 4
Figure MA-2 Wittmann ADMSU –study area map 5
Figure MA-3 McMicken Dam vicinity map 6
Figure MA-4 McMicken Dam fissure risk zone site plan 7
Figure MA-5 Wittmann ADMSU – mapping resolution 12
Figure MA-6 Earth fissure risk zones 20
Figure MA-7 McMicken Dam 23
Figure MA-8 FLO-2D grid boundary 26
Figure MA-9 Vegetation conditions along the low flow channel 29
Figure MA-10 Vegetation conditions along a watercourse 30
Figure MA-11 Vegetation conditions in the floodplain 30
Figure MA-12 McMicken Dam watershed map 36
Figure MA-13 Inflow hydrographs for the PMF with future land use conditions 37
Figure MA-14 Inflow hydrographs for the 100-year, 24-hour storm with existing land use conditions 38
Figure MA-15 Inflow node locations 39
Figure MA-16 McMicken dam levee grid cells 41
Figure MA-17 McMicken Dam principal outlet 43
Figure MA-18 Principal outlet 44
Figure MA-19 Comparison of stage-discharge rating curves for the principal outlet 45
Figure MA-20 McMicken Dam emergency spillway 48
Figure MA-21 Comparison of existing stage-discharge relations for the emergency spillway 50
Figure MA-22 Comparison of stage-discharge relations at entrance to approach channel 51
Figure MA-23 Comparison of stage-discharge relations at weir crest 51
Figure MA-23 Comparison of stage-discharge relations at weir crest 52
Figure MA-24 Principal outlet channel 54
Figure MA-25 Sun Valley Parkway culvert 56
Figure MA-26 Sun Valley Parkway culvert stage-discharge relation 57
Figure MA-27 Maximum water surface elevations 61
Figure MA-28 Stage-flood magnitude relation 62
Figure MA-29 Inflow and outflow hydrographs for the PMF 67
Figure MA-30 Inflow and outflow hydrographs for the 100-year, 24-hour storm for future land use conditions 70
Figure MA-31 Inflow and outflow hydrographs for the 100-year, 24-hour storm for existing land use conditions 71
Figure MA-32 Inflow and outflow hydrographs for the 200-year, 24-hour storm for future land use conditions 73
Figure MA-33 Inflow and outflow hydrographs for the 200-year, 24-hour storm for existing land use conditions 74
Figure MA-34 Inflow and outflow hydrographs for the 500-year, 24-hour storm for future land use conditions 76
Figure MA-35 Inflow and outflow hydrographs for the 500-year, 24-hour storm for existing land use conditions 77
Figure MA-36 Comparison of stage-storage relations 80
Figure MA-37 Comparison of stage-discharge relations 81
Figure MA-38 Proposed emergency spillway typical section 105
Figure MA-39 Proposed emergency spillway rating curve 106
Figure MA-40 Proposed emergency spillway discharge hydrograph for the PMF 109

Figure MA-41 Maximum water surface elevations along the low flow channel for proposed conditions 110
Figure MA-42 Typical Section A-A 115
Figure MA-43 Typical Section B-B 116
Figure MA-44 Typical Section C-C 117
Figure MA-45 Typical Section D-D 118
Figure MA-46 Typical Section E-E 119
Figure MA-47 Typical Section F-F 120
Figure MA-48 Earth fissure zone typical section 125
Figure MA-49 Embankment cracking zone typical section 126
Figure MA-50 Outlet channel levee raise typical section 127

List of Exhibits

Exhibit MA-1 – Roughness Coefficient

Exhibit MA-2 – PMF Water Surface Profiles

Exhibit MA-3 – 100-Year Future Condition Water Surface Profiles

Exhibit MA-4 – PMF Inundation Limits

Exhibit MA-5 – 100-Year Future Condition Water Surface Profiles

Exhibit MA-11 – Dam Rehabilitation Alternative

Exhibit MA-12 – Dam Decommissioning Alternative

Registered Professional Engineer (Civil)
CERTIFICATE NO.
17928
GEORGE V.
SABOL
Date Signed 7 June 05
ARIZONA U.S.A.

List of Appendices

Appendix A – Survey Data

Appendix B – Sensitivity Analysis

Appendix C – Hydrology

Appendix D – Outlet Structures

Appendix E – Failure Modes

Appendix F – Dam Rehabilitation Alternative Supporting Calculations

Appendix G – Dam Decommissioning Alternative Supporting Calculations

Appendix H - CD of Digital Files

Registered Professional Engineer (Civil)
CERTIFICATE NO.
35150
R. MICHAEL C.
GERLACH
Date Signed 7 June 05
ARIZONA U.S.A.

Wittmann Area Drainage Master Study Update (ADMSU)

FCD 2002C029

ALTERNATIVES ANALYSIS FOR MCMICKEN DAM

(Volume MA)

MA 1. Introduction

This report is submitted as an element of the Wittmann Area Drainage Master Study Update (ADMSU) Project. Report titles for the other elements of the Wittmann ADMSU Project are listed below. The various tasks summarized herein were completed by Stantec Consulting and by LTM Consulting for the Flood Control District of Maricopa County (District), under subcontract to Entellus.

VOLUME NAME	VOLUME ID
Existing Conditions Analysis (Part 1)	EC
ADMSU Hydrology	HY
McMicken Dam Hydrology	MD
Floodplain Delineation	HD
Alternatives Identification (Part II)	AI
Alternative Analysis McMicken Dam	MA
Rules of Development (Part III)	RD
Report of Survey	SR
Geomorphology Report	GR
Subsidence Report	SU
Sun Valley Parkway Culvert Evaluation	SV
McMicken Dam Final Landscape Character Compatibility Analysis Report	LA
Administrative Report	AR

MA 1.1. Background

McMicken Dam is a homogeneous earthen embankment approximately 10 miles in length that is operated and maintained by the District. The dam is located in the northwest portion

of the Phoenix Metropolitan area as shown in Figure MA-1. The ADMSU study area is shown in Figure MA-2. The study area is part of the Agua Fria River Watershed. Outflow through the principal outlet is conveyed to the river via a six mile long channel (Outlet Channel) that discharges to a wash approximately four miles upstream of its confluence with the Agua Fria River. The dam was designed by the U.S. Army Corps of Engineers (USACE) and construction was completed in 1955. The purpose of the dam was to provide flood protection for Luke Air Force Base, Litchfield Park Naval Air Facility and adjacent areas. At that time, the majority of the surrounding area was farm land. Figure MA-3 shows the dam and vicinity. Currently, McMicken Dam is classified by the Arizona Department of Water Resources (ADWR) as a high hazard/intermediate dam.

Over time, groundwater withdrawal in the area resulted in large scale consolidation of the alluvial soils in which the dam is founded. The consolidation of these soils has in turn caused differential subsidence and the formation of earth fissures. In 1982, earth fissures were identified approximately 600 feet downstream of the dam at station 63+00 (south end). Subsequent studies identified the presence of earth fissures and/or horizontal strain conditions suitable for fissure formation extending from approximately station 56+00 to 75+00. In October of 2002, the District authorized the McMicken Dam Fissure Risk Zone Remediation Project. (FRZR). This project will mitigate the potential hazards associated with the existing known earth fissures. The project involves the construction of a new end of dam segment isolating the fissure risk zone from the rest of the dam and the breaching of the remnant dam section to a height required to provide a 500-year level of flood protection. Figure MA-4 shows the features of the FRZR project.

In addition to fissures and subsidence, the dam was not designed for the Probable Maximum Flood (PMF). The full PMF is required as the Inflow Design Flood (IDF) to the dam by ADWR. Thick vegetation has grown up in the approach channel to the emergency spillway limiting the movement of floodwater towards the spillway. Analysis has shown that the spillway may not be able to pass the IDF without overtopping the dam.

In addition to fissures, subsidence and inadequate spillway capacity, the following additional potential safety deficiencies/failure modes have been identified in the structures assessment report Failure Modes Effects Analysis (FMEA) and safety inspections were considered in the alternatives analysis.

- Level pool routing of flow along the dam is considered inadequate to properly estimate the stage – frequency response of the dam. Two-dimensional analysis is recommended to analyze the hydraulic performance of the dam.

- Embankment cracking due to desiccation and subsidence presents a risk of embankment erosion and failure.

- The embankment is founded on collapsible, uncompacted Holocene soils that present a risk of foundation erosion and failure.

- Emergency spillway discharge will cause significant inundation of downstream urban areas

- Emergency spillway flows could cause erosion of the north abutment of the dam embankment.

- Lack of a filter drain along / around the principal outlet structure could cause a piping failure.

- Corrugated metal pipes located within the embankment may collapse or allow piping.

Figure MA-1
Vicinity map

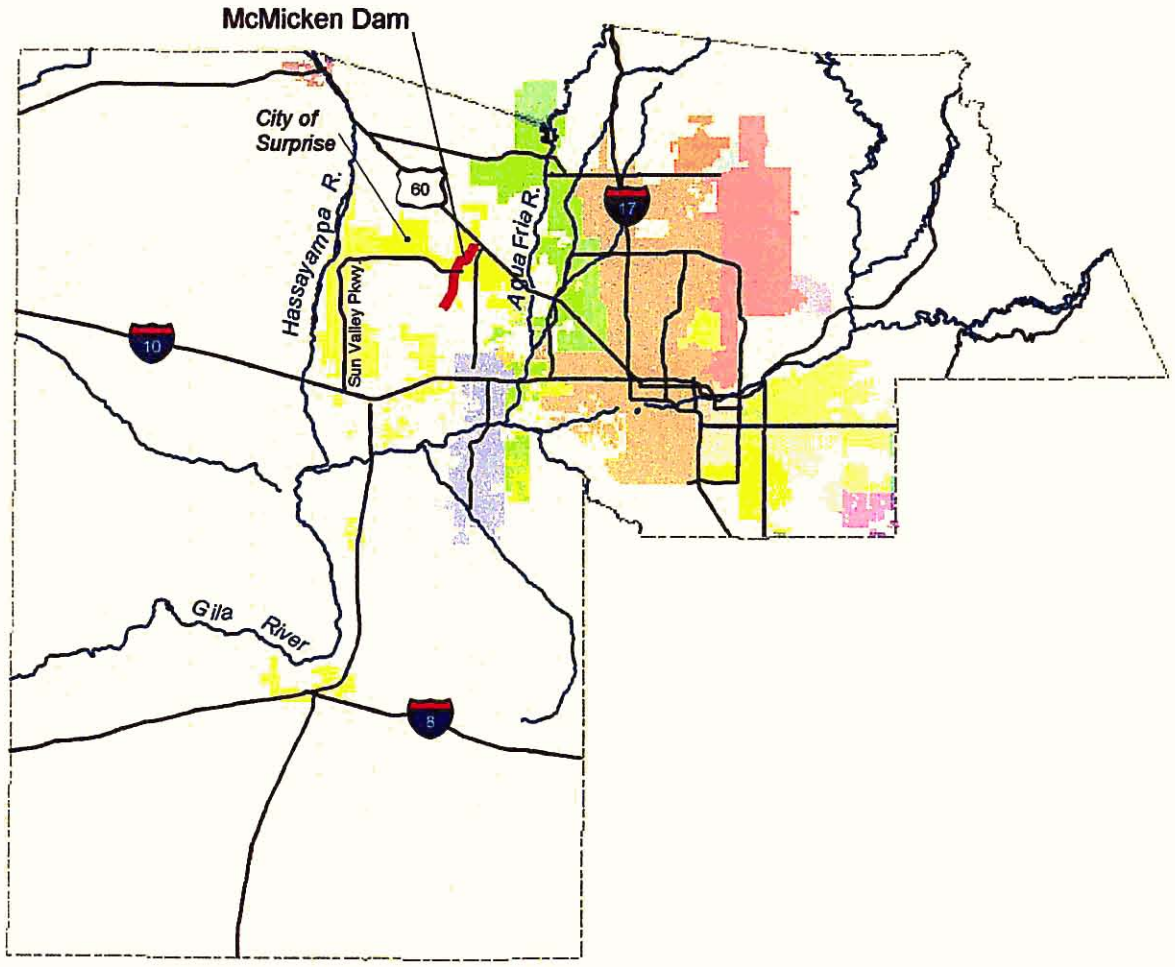


Figure MA-2
Wittmann ADMSU –study area map

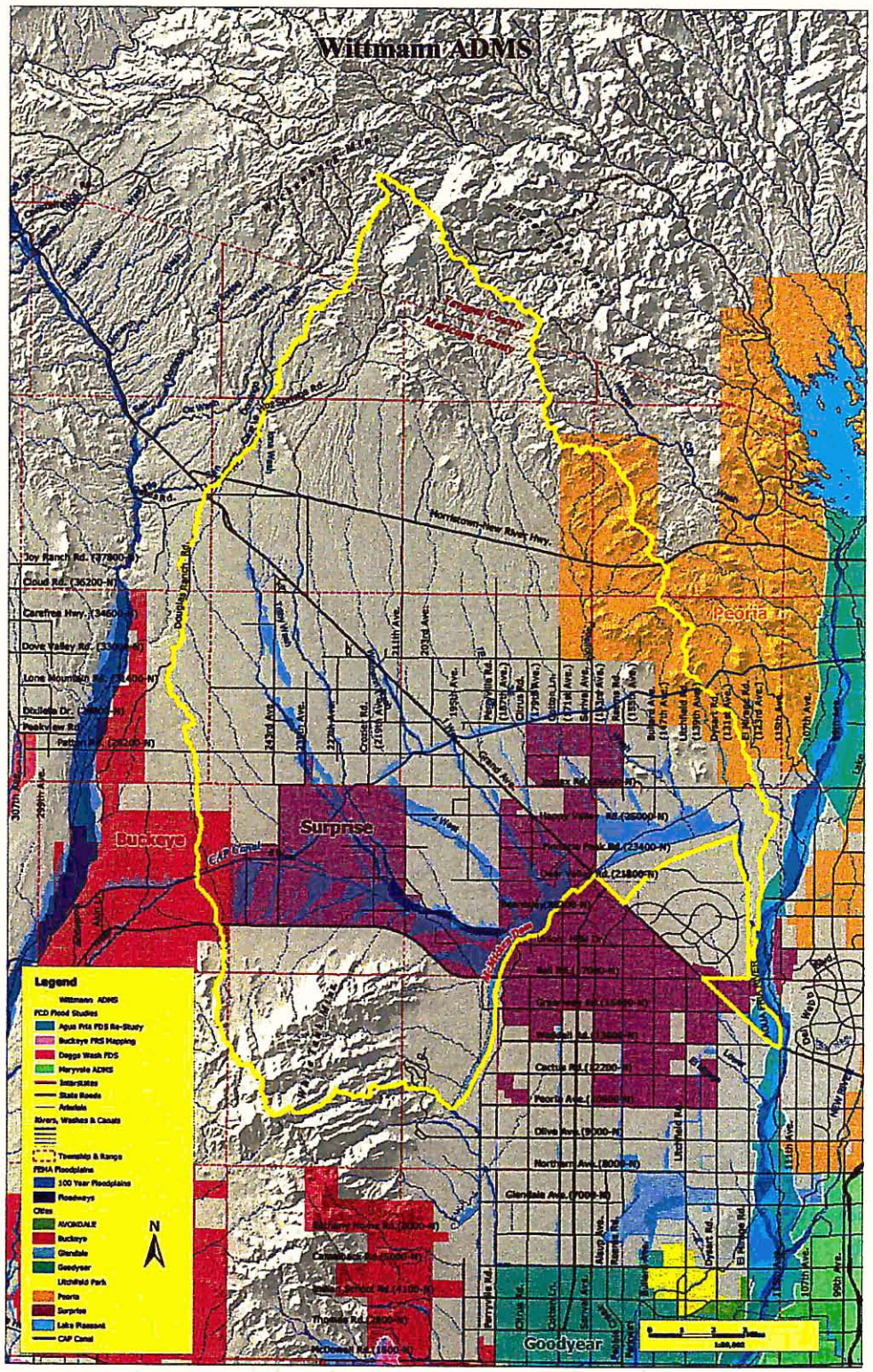
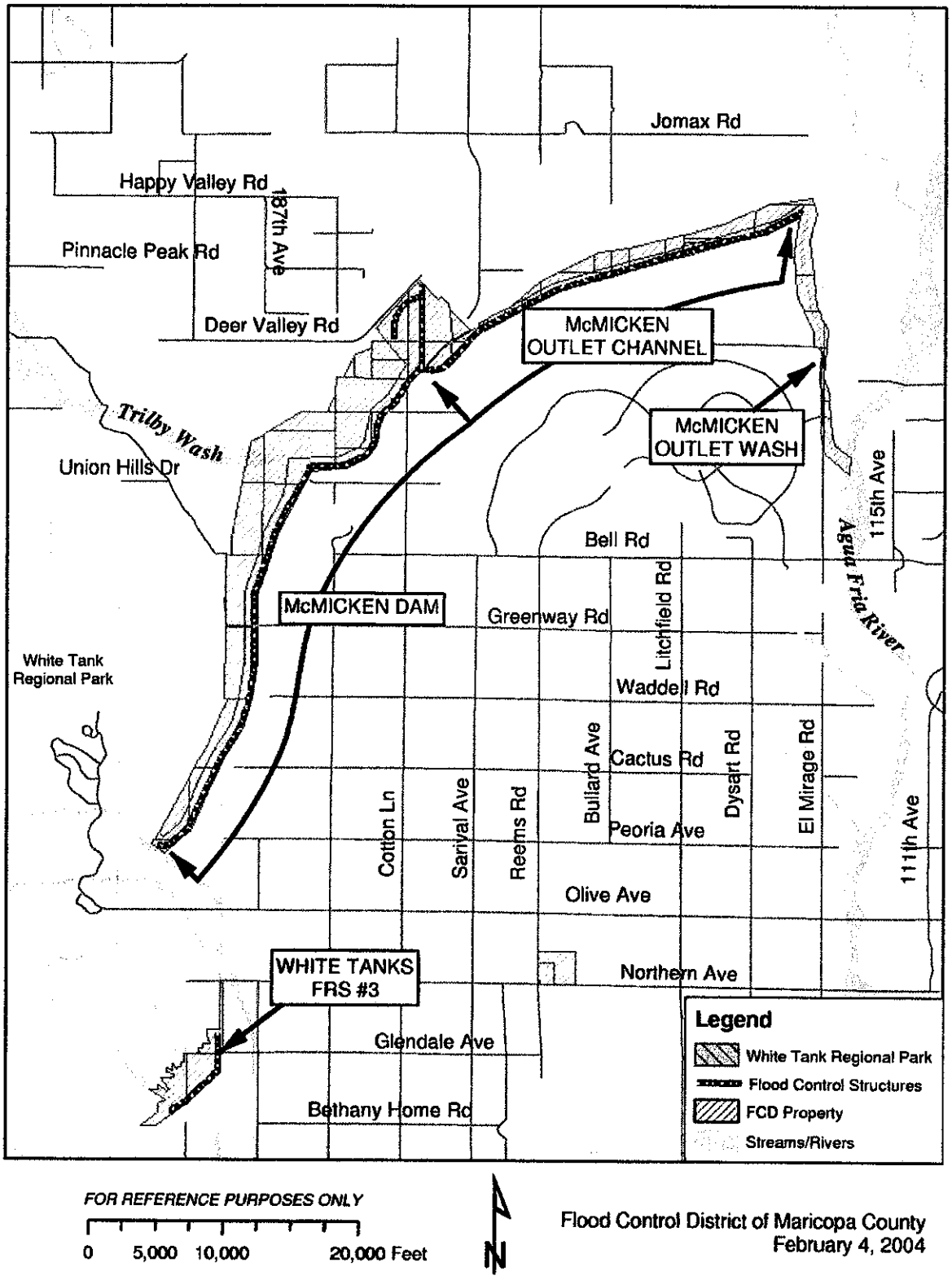


Figure MA-3
McMicken Dam vicinity map



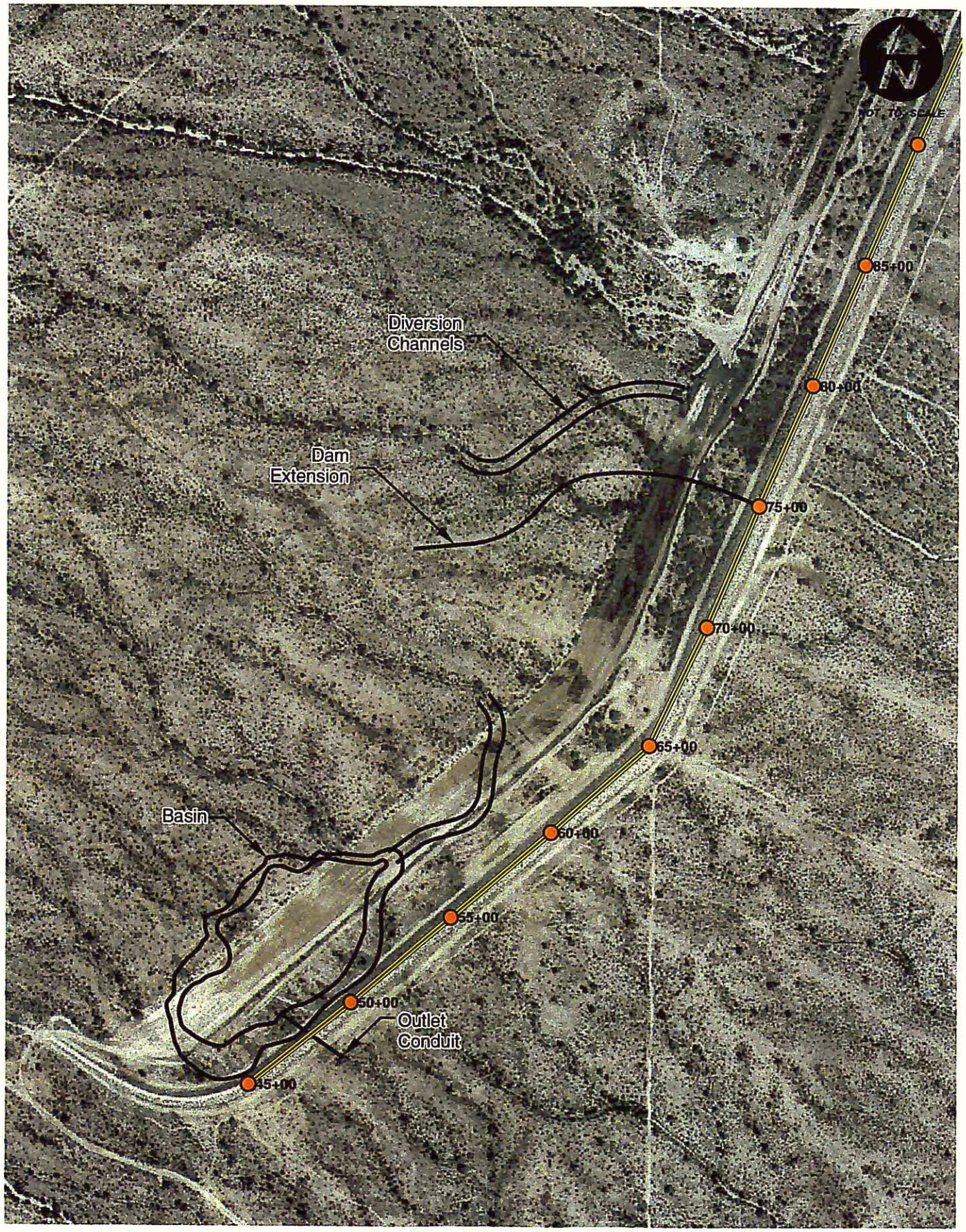
FOR REFERENCE PURPOSES ONLY

0 5,000 10,000 20,000 Feet

N

Flood Control District of Maricopa County
February 4, 2004

Figure MA-4
McMicken Dam Fissure Risk Zone site plan



MA 1.2. Purpose and Scope

The District operates and maintains 22 flood control dams and is mandated by state and federal law to comply with flood control and dam safety regulations. The District has initiated a program called the Structures Assessment Program to assess and evaluate these structures and related features due to an ever-increasing urbanized environment and to achieve continued compliance with current standards and guidelines. The first phase of that program for McMicken Dam is finished and the results are presented in a report entitled *McMicken Dam Individual Structures Assessment* (URS, 2002). Tasks for the Wittmann ADMSU involves identification and analysis of implementable solutions for McMicken Dam based on the results of the Structures Assessment Report. This includes preliminary analysis of the identified alternatives for remediation, developing an alternatives analysis for the dam, and the development of new hydrology including the PMF.

The scope of work for the McMicken Dam Analysis includes the following activities and requirements necessary to evaluate alternatives for improvements to the dam:

- Develop a two-dimensional dynamic routing hydraulic model to analyze the existing conditions of the dam.
- Collect and review pertinent data, initial failure modes analyses, and field examination of the McMicken Dam necessary for the development of preliminary alternatives analysis for future actions to be considered for the dam.
- Organize and attend meetings with the District, Consultants and other Stakeholders to discuss issues and screen the alternatives.
- Analyze two structural alternatives as further described below:
    - Structural Alternative 1 - Dam Rehabilitation to address all dam safety deficiencies and failure modes.
    - Structural Alternative 2 – Flood Conveyance Facility to Replace McMicken Dam.

- Evaluation of structural alternatives to be conducted in two phases. The first phase shall develop the main features of the alternatives. The second phase will be an engineering analysis of the alternative.

- Consider the following non-structural alternatives for potential inundation areas upstream and downstream of the dam - acquire properties/flowage easements; upgrade emergency action plans; protect critical facilities; mitigation through flood insurance; use of reverse 9-1-1 for flood warning.

- Determine the controlling design storm for inflow and outflow for use in alternatives analyses.

- Develop the following information for each of the alternatives - conceptual sketches depicting the alternative; narrative description of the alternative; preliminary cost estimates; advantages and disadvantages; data gaps or uncertainties associated with the alternative; concept-level construction cost estimate; right-of-way requirements or excess property

- Qualitatively evaluate the risk reduction afforded by each alternative and compare each alternative with McMicken Dam as it currently exists.

- Evaluate each alternative in light of safety deficiencies identified by ADWR.

- Identify opportunities for multi-use functions, improved aesthetics, environmental enhancement, and potential for partnering with others.

MA 2. Data Collection

MA 2.1. Survey

The following survey data is available for McMicken Dam.

MA 2.1.1. Crest Surveys

Monuments have been placed at 500-foot intervals on the crest of the dam. These monuments are surveyed annually as part of the monitoring plan for the dam and are referenced to the North American Vertical Datum of 1988 (NAVD 88). The monitoring plan also includes periodic surveys of the emergency spillway and principal outlet. Survey data used in the analyses for this study are from the circa 2002 survey and that data is provided in Appendix A. The 2002 survey was the most current data set at the start of this project. Since then, circa 2003 and circa 2004 surveys were completed. For comparative purposes, the circa 2004 survey data is also provided in Appendix A.

MA 2.1.2. Outlet Channel Survey

Survey data of the principal outlet channel was provided by the District. The data includes cross sectional geometry at a spacing of 2,000 feet and levee crest elevation data at 250-foot intervals. Elevations are referenced to NAVD 88.

MA 2.1.3. GDACS

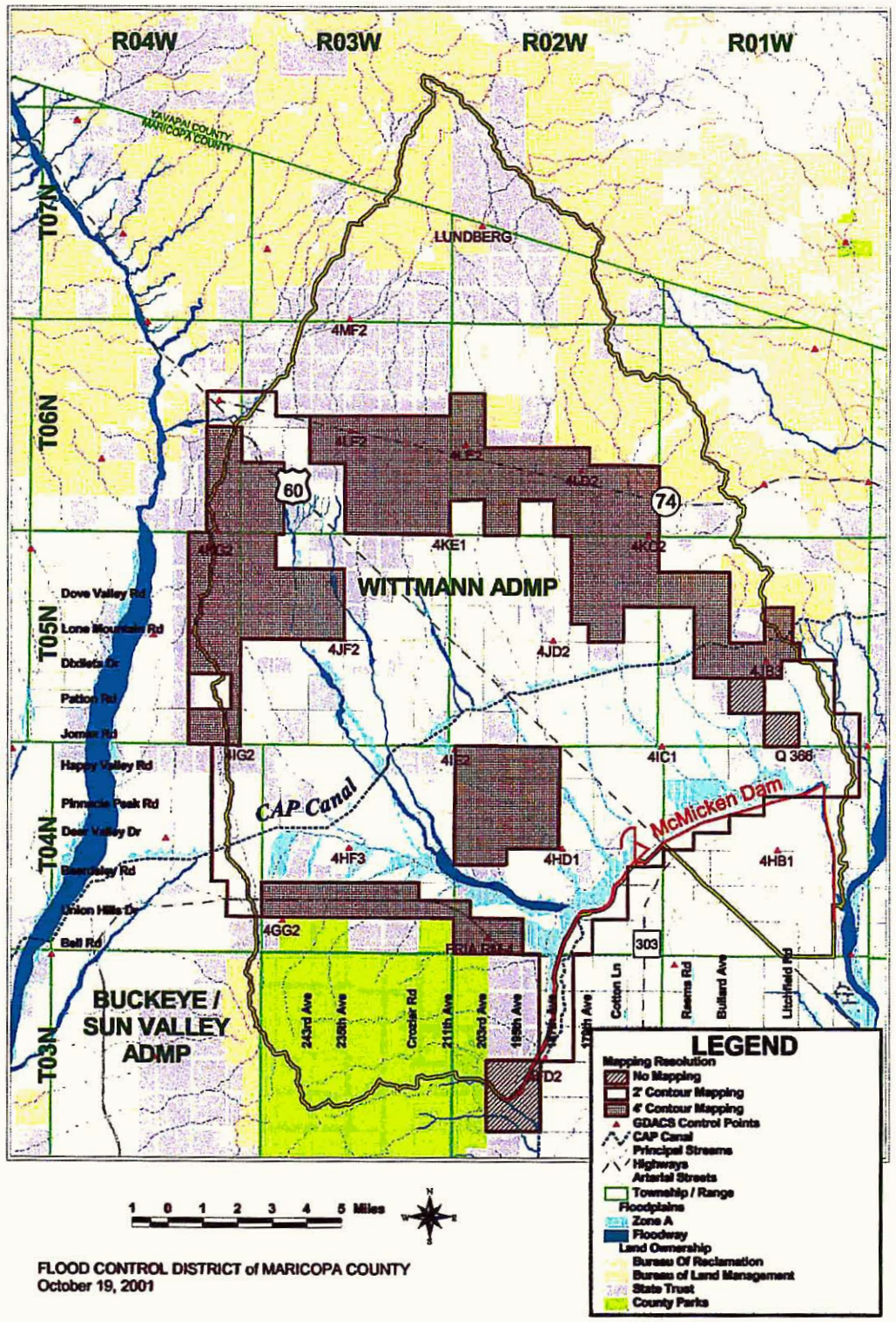
Maricopa County began implementing the Geodetic Densification and Cadastral Survey (GDACS) project in about 1998. The survey includes a network of primary control points averaging 35 – 40 kilometers apart and secondary control points approximately 7 kilometers apart. This geodetic control network allows accurate RTK GPS in nearly any location of the county, tied to one control system. NGS control points as well as Elevation Reference Marks (ERM) and Reference Marks (RM) monument data are available on the MCDOT website at **http://www.mcdot.maricopa.gov/SURVEY/gdacs/gdac_home.htm**.

MA 2.2. Mapping

Topographic mapping of the ADMSU project area was provided by the District in ASCII grid format at a cell size of 10 feet. The grid data is a mosaic of USGS digital elevation models

and circa 2002 detailed mapping. Horizontal coordinates are referenced to the Arizona Central 0202 zone of the U.S. State Plane 1983 system projected to the North American Datum of 1983 (NAD 93). Elevations are referenced to NAVD 88. The USGS mapping covers the portion of the project area that extends outside of Maricopa County. The circa 2002 mapping was prepared by Landata Inc. under a separate contract with the District and consists of 1 inch = 100 feet, 2-foot Contour Interval (CI); 1 inch = 200 feet, 4-foot CI and 1 inch = 400 feet, 10-foot CI mapping. The limits of each map set are shown in Figure MA-5. The majority of the dynamic routing study area is covered by the 1 inch = 100 feet, 2-foot CI mapping.

Figure MA-5
Wittmann ADMSU – mapping resolution



MA 2.3. Aerial Photography

Circa 2001 otrho-rectified aerial photography of the ADMSU project area within the limits of Maricopa County was provided by the District. The photography was prepared as part of the countywide mapping program at a pixel size of one foot. This photography is the primary base layer used in the preparation of the inundation exhibits.

In addition, circa 2003 aerial photography of the Phoenix Metropolitan area purchased by Stantec (Aerials Express) is used as a base layer for alternative formulation and presentation purposes. This photography is semi-rectified with a pixel size of one meter.

MA 2.4. Existing Studies

Several existing hydrologic, geomorphologic and geotechnical studies have been conducted for McMicken Dam, watershed, emergency spillway, outlet channel and for the downstream inundation analysis. The following is a brief summary of each of those analyses.

MA 2.4.1. USACE Design Hydrology Report

Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel, Design Memorandum No. 1 (USACE, 1953)

The watershed area contributing to McMicken Dam, computed by the USACE is 247 square miles. The watershed was delineated into two basins, subbasins A and B. Subbasin A represented the White Tank Mountain area and was estimated to be 21.7 square miles in size. Subbasin B was estimated to be 225 square miles in size. Runoff magnitudes were estimated for three flood events; the Standard Project Flood (SPF), the Spillway Design Flood (SDF) and the Maximum Probable Flood (MPF). The design rainfall event for the SPF is the Standard Project Storm (SPS). The SPS for McMicken Dam was developed from the historic storm of August 26 – 29, 1951. A total rainfall depth of 8.6 inches was used which was uniformly distributed over the watershed. The only difference in the SDF from the SPF is a change in the rainfall loss rate curve. For the MPF, the design rainfall event is based on the Maximum Possible Storm developed for Alamo Dam on the Bill Williams River. The resulting runoff magnitudes for each flood event are listed in Table MA-1.

Table MA-1
Runoff Magnitudes for McMicken Dam Estimated by the USACE

Flood Event	Peak Inflow		Peak Outflow	Stage[2]
	cfs	acre-feet	cfs	Feet
SPF	35,000	32,800	4,450[1]	1354
SDF	52,000	44,000	22,000	1356
MPF	120,000	---	95,000	1360

Notes:
1. Outflow from principal outlet only
2. Elevations based on NGVD 29, not adjusted to NAVD 88

MA 2.4.2. SHB Hydrology Report

Surface Water Hydrology Report, McMicken Dam Restoration Study, Maricopa County, Arizona (SHB, 1983)

The watershed area computed by Sergent, Hauskins & Beckwith (SHB) was 247 square miles. The watershed was subdivided into eight subbasins. The inflow hydrograph to the dam was generated from the Probable Maximum Precipitation (PMP) as determined from the procedures presented in Hydrometeorological Report (HMR) No. 49 (Hansen and Others, 1984). The resulting PMP for the 72-hour general storm was estimated to be 15.0 inches and the PMF inflow to the dam was 155,800 cfs.

MA 2.4.3. Rumann & Sutko Hydrology Study

A Hydrologic Analysis of the McMicken Dam Watershed (Rumann & Sutko, 1987)

The watershed area computed by Rumann & Sutko was 247 square miles. The watershed was subdivided into 44 subbasins. The inflow hydrograph to the dam was generated from the PMP as determined from the procedures presented in HMR49. The resulting PMP for the 72-hour general storm was estimated to be 15.7 inches. Potential attenuation of peak flows at the Central Arizona Project canal crossings as well as several crossings of State Route 79 and U.S. 60 were modeled using the Modified Puls storage routing option. The resulting PMF inflow to McMicken Dam was 114,850 cfs.

MA 2.4.4. McMicken Dam Hydrology Report

Wittmann ADMSU – Volume MD, McMicken Dam Hydrology Report (Entellus, 2004)

The report, prepared as part of the Wittmann ADMSU, presents the results of the hydrologic analysis for McMicken Dam. The analysis includes 100-, 200-, and 500-year flood hydrology as well as the PMF. The hydrology from this analysis is used in the existing condition dynamic routing analysis of McMicken Dam as well as for analysis of the alternatives. Runoff magnitudes at the dam estimated by Entellus are listed in Table MA-2

Table MA-2
Runoff Magnitudes for McMicken Dam Estimated by Entellus

	Existing Conditions		Future conditions	
Flood Event	**cfs**	**acre-feet**	**cfs**	**acre-feet**
100-year	25,600	16,500	29,500	20,500
200-year	30,900	19,300	35,300	23,500
500-year	37,600	22,800	42,900	27,400
72-hour PMF	---	---	127,500	107,500

MA 2.4.5. Outlet Channel Analysis

McMicken Dam Outlet Channel Analysis (Michael Baker, Jr., Inc 2003)

This report documents the results of an engineering analysis to determine the channel capacity for the principal outlet works at McMicken Dam. The analysis was determined necessary due to the discovery of significant subsidence in the area, as well as sedimentation and erosion that may reduce the channel conveyance capacity. The results of the HEC-RAS model indicated that the channel banks would be overtopped by as much as 2.5 feet. Subsequently, modifications to the channel were constructed to correct the deficiencies. The channel was designed to carry 4,700 cfs. The limits of this study are at the Grand Avenue / US 60 bridge.

MA 2.4.6. Spillway Analysis

McMicken Spillway Analysis Memorandum (Rumann, 2003)

The purpose of the memo was to present the results of a hydraulic analyses to evaluate the performance of the emergency spillway at the dam. The analyses were performed to document the hydraulic sensitivity associated with the existing vegetation in the spillway. The HEC-1 model for the spillway channel created by Cruff was modified to account for spillway blockage, adjustments to the stage storage relationship based on the 2002 aerial

mapping of the impoundment area and for Manning's n value. The following conclusions are drawn:

- Appropriate Manning's n value for the heavily vegetated portion of the emergency spillway approach channel is 0.08.
- Increasing the n-value to 0.12 and partially blocking the spillway channel reduces the percentage of the PMF contained by the dam from 85 to 77 percent.
- Stage – storage relation based on the newest topography didn't significantly affect the hydraulic condition.
- The dam embankment would have to be raised approximately 1 foot to contain the full PMF with no residual freeboard.

MA 2.4.7. Spillway Delineation Study

McMicken Dam Spillway Delineation Study (Hoskins Engineering Consultants, Inc, 2001)

The inundation limits downstream of the McMicken Dam emergency spillway were mapped as part of this project. Inundation limits were prepared for the 1/3, 2/3 and full PMF spillway discharges. The full PMF discharge used in the analysis is 95,000 cfs. HEC-RAS was used to determine the lateral extend of flooding for each discharge.

MA 2.4.8. Subsidence

Wittmann ADMSU – Volume SU, Land Subsidence and Earth Fissure Investigation Report (Geological Consultants Inc, 2004)

The report, prepared as part of the Wittmann ADMSU, presents the results of an evaluation of land subsidence and earth fissures within the study area. The following conclusions are reported:

- There is an ongoing process of land subsidence occurring within portions of the study area. The earth fissuring process appears to be ongoing in the vicinity of McMicken Dam. This process could be exacerbated and extend into other areas.

- The amount of subsidence that has occurred, in general, along the length of McMicken Dam since 1948 varies from approximately 3.2 feet to 5.0 feet.

- The only documented earth fissure within the study area is located near the south end of McMicken Dam, northeast of Fenne Knoll.

MA 2.4.9. Geomorphology

Wittmann ADMSU – Volume GR, Geomorphology Report. (West Consultants Inc, 2004)

The report, prepared as part of the Wittmann ADMSU, presents the results of a geomorphic assessment of the piedmont and a stream classification of portions of the study area. The objective was to delineate areas of defined channels with tributary drainage networks and areas of poorly defined channels with a distributary drainage network and two dimensional flow characteristics. The second objective was to conduct a sedimentation and erosion hazard analysis, including a 100-year sediment yield study for McMicken Dam. Results of the study indicate that an average value for sediment yield is 0.4 acre-ft/square mile/year for the entire study area. On the sub-basin level, the sediment yield should be calculated based on the methodology presented in the report using the Case 3 - PSIAC or LS equation form 1 of the RUSLE method. Using these methods, sediment yield from the White Tank Mountains ranges from 0.4 to 1.5 acre-ft/square mile/year.

MA 2.4.10. Earth Fissures Investigation

Earth Fissures Investigation Report, McMicken Dam (AMEC Earth & Environmental, 2003)

AMEC completed a study in 2003 to determine if earth fissures are present within the shallow foundation soils supporting McMicken Dam, and to define the hazard zone along the southern end of the dam. The study concluded that there exists a high probability that earth fissures are present beneath the dam between stations 58+00 and 65+00. Based on the results of the study, the southern end of McMicken Dam was zoned based on the earth fissure hazard. Additional strain in segments of the embankment between station 56+00 to 105+00 may also cause other fissures to develop. AMEC presented a hazard zone map for the southern end of McMicken Dam.

The map is presented in Figure MA-6. The zoning includes low, moderate and high hazard zones. For purposes of the fissure study, the three hazard zones are defined as follows:

High Hazard - Region where earth fissures were field identified. There is a distinct possibility that earth fissures are present in the alluvial foundation soils under the dam.

Moderate Hazard - The probability of open fissures present in close proximity to the base of the embankment is low, but continued strain could produce future fissuring to the surface.

Low Hazard – The portion of the dam alignment and adjacent areas that are lacking in significant numbers of intersecting photo-lineaments and seismic anomalies, coupled with interferometric and crest settlement profile data indicating the lack of appreciable horizontal strain.

MA 2.4.11. FRZR Design Report

Design Report, McMicken Dam Fissure Risk Zone Remediation Project (AMEC Earth & Environmental, 2004)

This report prepared jointly by AMEC and Stantec presents the analysis and design for the remediation of the dam within the fissure risk zone.

MA 2.4.12. White Tanks FRS #3 Alternatives Analysis

Design Report, McMicken Dam Fissure Risk Zone Remediation Project (AMEC Earth & Environmental, 2004)

This report presents the analysis and selected alternatives for remediation of White Tanks FRS #3 for embankment cracking as well as within a fissure risk zone.

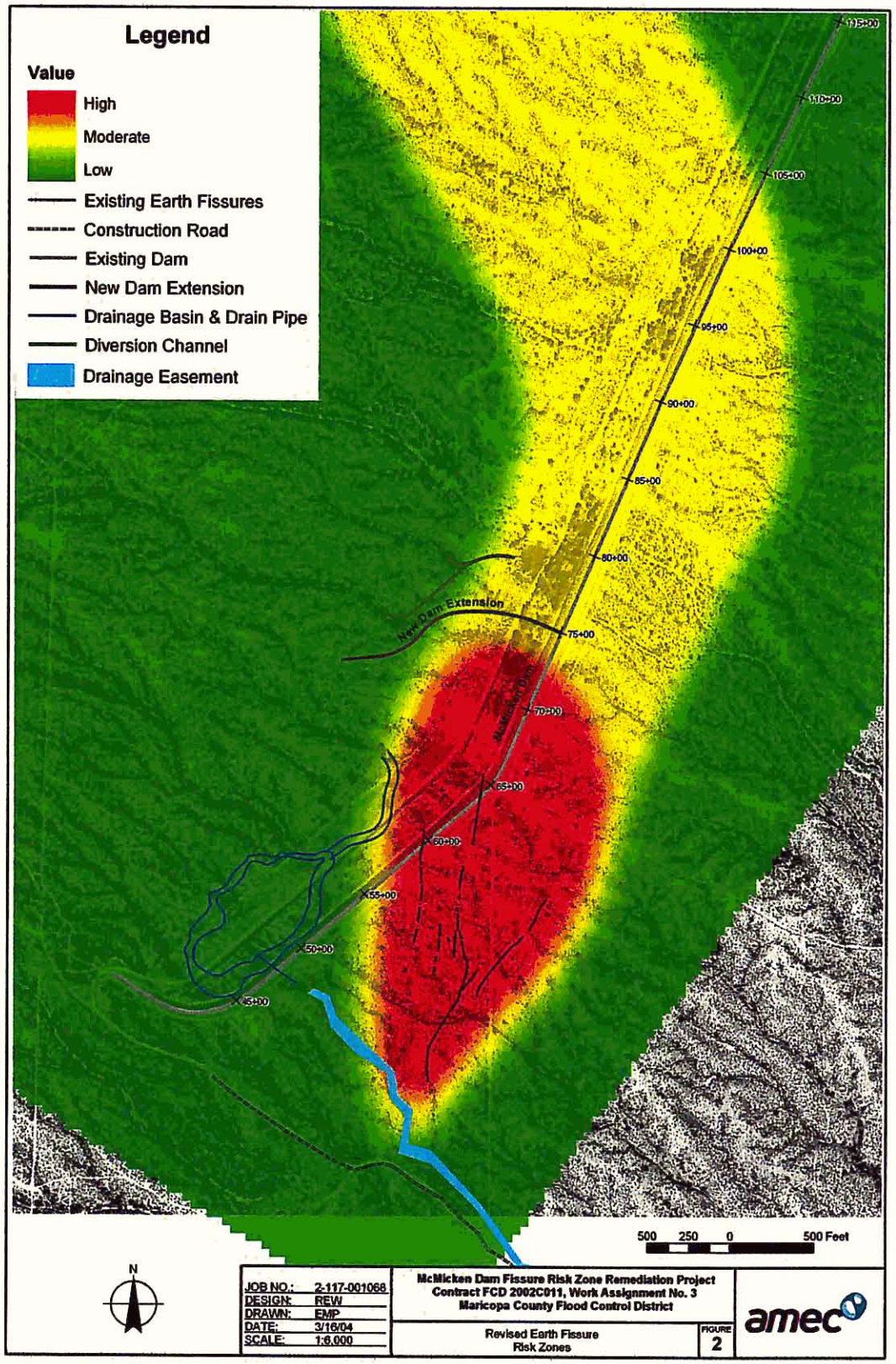
MA 2.4.13. McMicken Dam Outlet Channel Inundation

Emergency Action Plan Update for McMicken Dam Outlet Channel (Kimley-Horn and Associates, 2004).

This report presents the results of a hydraulic analysis of the outlet channel. The limits of the analysis are the Outlet Wash at the downstream end and the BNSF railroad bridge at

the upstream end. Hydrologic data used in the analysis is taken from the McMicken Dam Hydrology Report (Entellus, 2004) for both existing and future land use conditions plus a constant discharge from the principal outlet of 4,450 cfs. The model results show that the levee is not overtopped at any point along the study reach. In addition, recommendations were made to raise the levee in areas where the freeboard does not meet the FEMA criteria of 3 feet.

Figure MA-6
Earth fissure risk zones



MA 3. Existing Condition Analysis

MA 3.1. General

McMicken Dam is approximately 10 miles in length. The height of the dam increases from approximately 18 feet at the southern end to 24 feet at the principal outlet, which is located near the northern end of the dam. The maximum storage capacity is approximately 36,500 acre-feet. The contributing watershed is approximately 245 square miles in size and contains a network of distributary watercourses. The magnitude and timing of the inflow to the dam varies across its length, impacting the progression of the floodwave through the impoundment to the outlet works. The majority of the inflow to the dam occurs in the northern half, particularly from Trilby Wash. Trilby Wash enters the impoundment area near the midpoint of the dam as shown in Figure MA-7 and has a contributing watershed of approximately 120 square miles.

Existing routing studies of McMicken Dam were approached using the hydrologic routing method. The hydrologic routing method is a simplistic approach that involves the balancing of inflow, outflow and storage volume and is accomplished using a direct application of the continuity equation. This approach does not account for attenuation due to flow resistance and assumes that the floodwave travels through the reservoir in one time step. Because of the size and linear nature of the dam, movement of the floodwave through the reservoir cannot be accurately predicted using the hydrologic routing method. In addition, the distributive nature of the inflow results in complex hydraulic conditions with respect to time. Therefore, a two-dimensional dynamic flood routing model is used to evaluate the existing hydraulic conditions. The purpose of the existing condition analysis is to evaluate the performance of the dam in regard to dam safety concerns and to establish baseline data for the identification and analysis of potential alternative solutions.

The existing condition analysis involves routing of storm runoff through the impoundment area to the outlet works. The analysis is performed for the 100-, 200- 500- year storms for both existing and future land use conditions and the Probable Maximum Precipitation (PMP) with future land use conditions only for a total of seven hydrologic conditions. Routing of

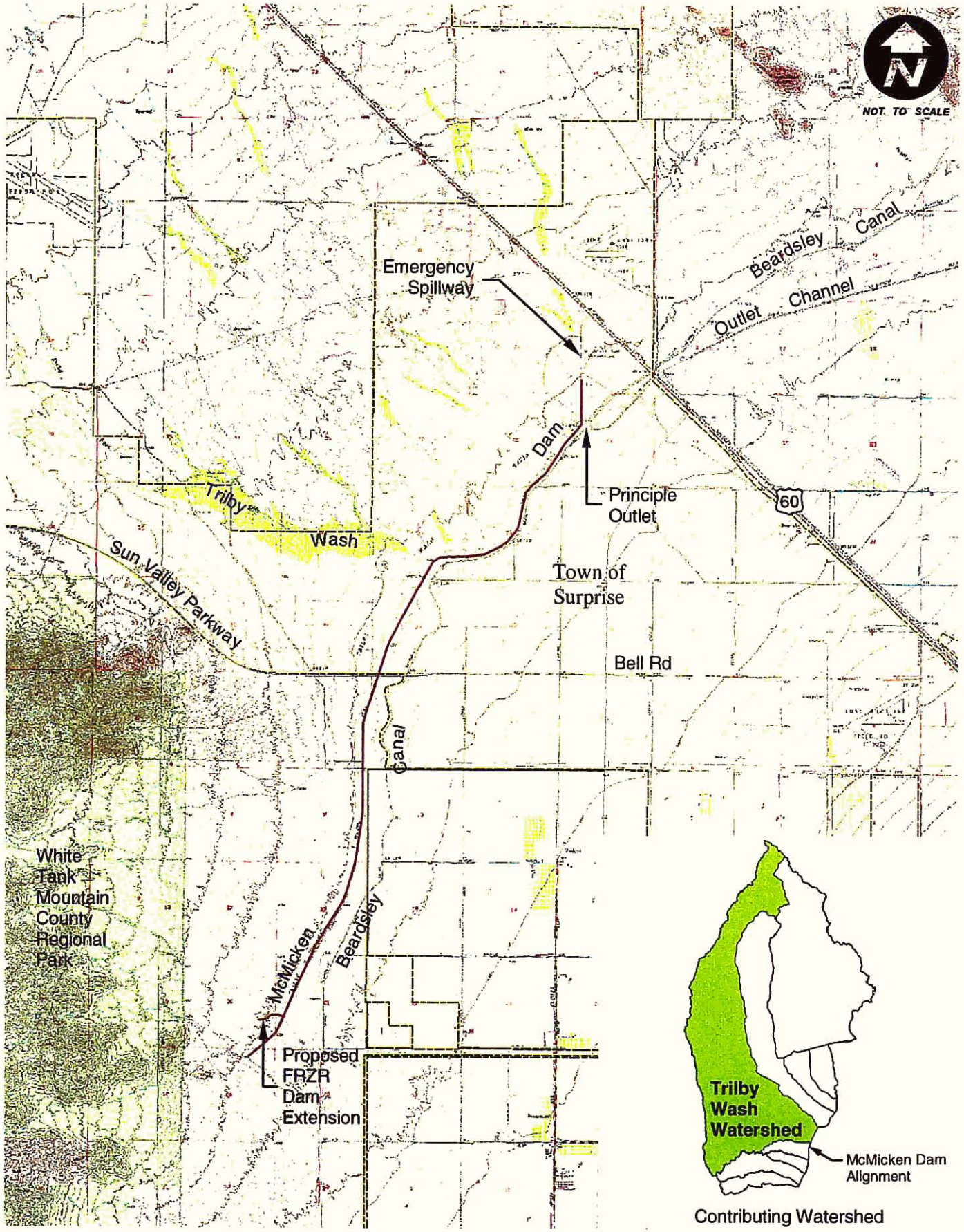
inflow from each storm event through the reservoir is accomplished using the two-dimensional flow routing model FLO-2D.

FLO-2D is a volume conservation model that routes runoff hydrographs across a surface represented as a system of square grid elements. Routing of the runoff is accomplished using a central, finite difference solution of the dynamic wave momentum equation and conservation of volume. Progression of the floodwave is controlled by topography, resistance to flow and the presence of hydraulic structures or obstructions. The general approach to the solution of the dynamic wave momentum equation is as follows:

- Velocity is the dependent variable,
- Manning's equation is used to solve for an initial estimate of velocity,
- Estimated velocity is used as a first approximation in the Newton-Raphson second order method of tangents to solve for the roots of the dynamic wave momentum equation,
- Discharge is calculated in the four principal directions (north, south, ease and west) and the diagonals as the product of velocity and cross sectional area,
- The net change in volume is calculated as the product of the net change in discharge and the time step: finally,
- Change in depth is calculated by dividing the net change in volume with the surface area of the cell.

The version of FLO-2D used for the analysis is a modified form of version 2003.06 and is provided on CD as Appendix H. The modifications were made by the program developer for this application to correct a limitation encountered during the analysis due to the extremely large volumes associated with the inflow hydrograph, to enhance the levee output routine to provide more detailed results and to add a connection between a floodplain element and a channel element through a hydraulic structure.

Figure MA-7
McMicken Dam alignment



MA 3.2. FLO-2D Grid

In FLO-2D, the ground surface is represented as a system of square grid elements. The limits of the grid for this analysis are shown in Figure MA-8. In general, the western limits of the grid extend approximately to elevation 1380 feet. This translates to a distance from the dam of approximately 3,000 feet in the southern half of the impoundment and approximately 8,000 feet in the northern half of the impoundment. The northern limits of the grid extend approximately 4,000 feet beyond the emergency spillway approach channel. The eastern limits extend to just past the U.S. 60 crossing of the principal outlet channel at the northern end and approximately 1,500 feet downstream of the dam. The southern limits extend just past the new end of dam segment of the Fissure Risk Zone.

Selection of the grid cell size is a function of the base mapping resolution, numerical stability and the perceived accuracy of the model. For this study, the ponded water surface condition requires an extremely small time step in order to achieve numerical stability. Selection of a large grid element size will allow for faster model simulation times and fewer stability problems. However, because of the nature of this study the accurate representation of the available storage volume within the impoundment area is of significant importance. The maximum extent of the PMF flood pool is approximately 3,000 acres in size. The maximum storage volume is approximately 36,500 acre-feet. The grid element size selected for this study is 250 feet, an area of approximately 1.4 acres. The resulting grid contains 6,488 cells.

The grid is constructed using the Grid Developer System (GDS) provided with the FLO-2D software. Representative ground elevations for each grid element are assigned using the elevation interpolation routine of the GDS. Surface data used as input is the ASCII grid data with a cell size of 10 feet as discussed in Section MA 2.2. Overlaying the FLO-2D grid on the surface data yields 625 elevation points per grid for a total of 4,055,000 elevation data points.

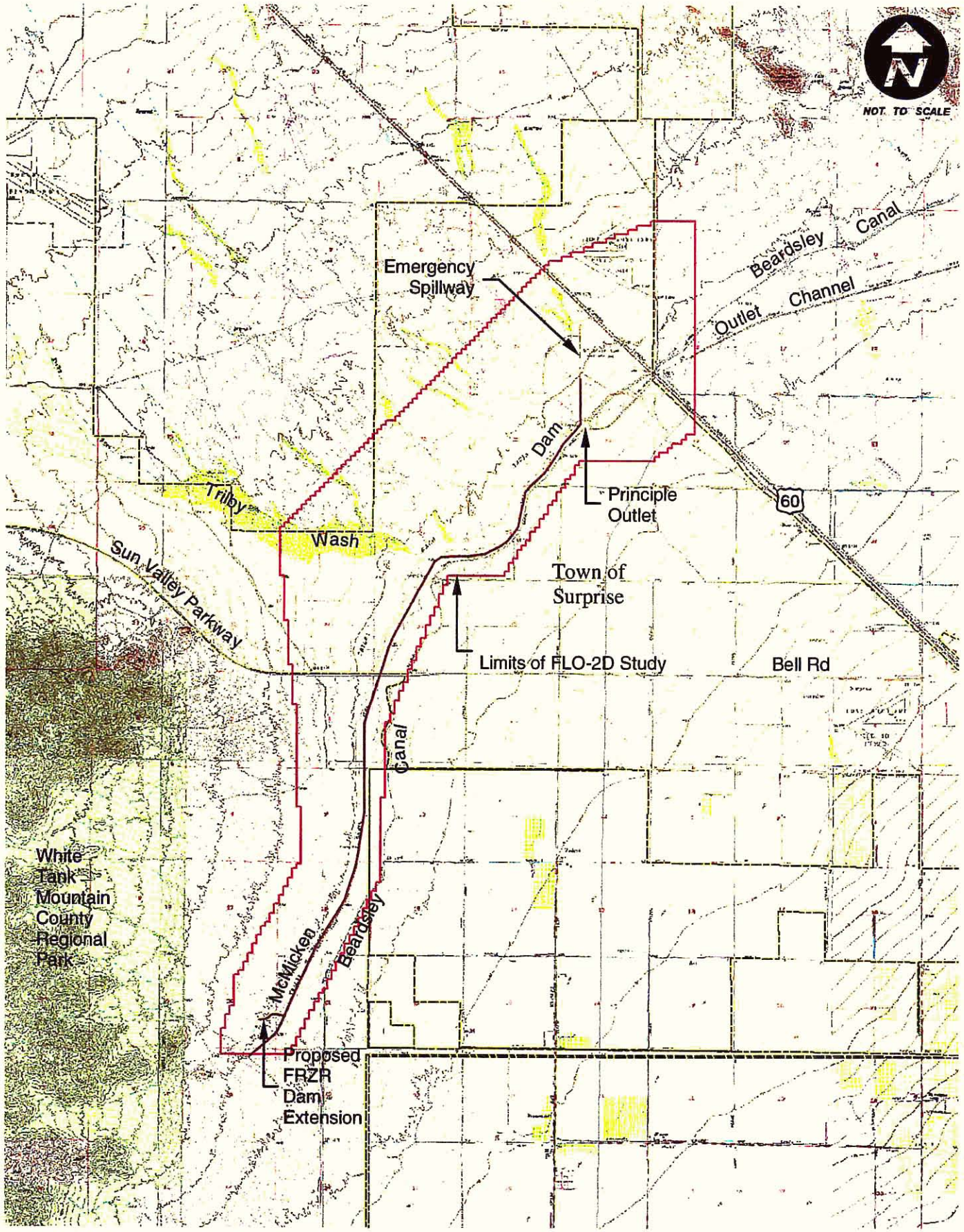
The representative ground elevations determined by the GDS were edited in several locations to improve model stability or to more accurately reflect the elevation of features that control the movement of the floodwave across the surface. Cell elevations that were adjusted to improve model stability generally were significantly lower than the elevations of the surrounding cells. These cells typically were located along the low flow channel. The occurrence of the low elevations is due to the grid layout in relation to the low flow channel

and the elevation weighting process. Key features within the study limits represented by cells with elevations that were edited to more accurately reflect the impact to the movement of the floodwave include the following:

- Emergency spillway weir crest,
- Dam section north of the emergency spillway,
- Outlet channel,
- U.S. Highway 60, and
- Loop 303

The refined elevations assigned to the grid cells representing the emergency spillway weir crest are based on the survey data discussed in Section MA 2.1.1. The refined elevations assigned to the grid cells representing the other features are based on inspection and interpretation of the circa 2002 2-foot CI mapping.

Figure MA-8
FLO-2D grid boundary



MA 3.3. Roughness Coefficients

MA 3.3.1. General

In FLO-2D, roughness coefficients are assigned to each grid element and are used in the solution of the Manning's equation for velocity as an initial estimate of the solution to the dynamic wave momentum equation. Selection of roughness coefficients must account for vegetation, surface roughness/irregularities and flow path direction. There are no relevant studies to use as a base of reference for the estimation of roughness coefficients. Therefore, determination of roughness coefficients for each grid cell was approached as a three-step process. The resulting roughness coefficients from this process are shown graphically in Exhibit MA-1.

MA 3.3.2. Base Values

First, initial estimates are made based on an assumption of overland flow conditions that represent the general physical characteristics of the impoundment area. The primary physical characteristics considered are the bed/ground surface material and obstructions to flow, particularly obstructions due to vegetation. Based on field reconnaissance trips, inspection of aerial photography and information in the FLO-2D manual, a base roughness coefficient for all grid cells of 0.06 was selected. This value was adjusted as necessary to account for the presence of vegetation. In general, vegetation present within the boundary of the grid is essentially limited to the banks of the watercourses and the low flow channel. Vegetation typically consists of Mesquite and Palo Verde trees along with Creosote and Catclaw. The most dense stands of vegetation typically occur along the low flow channel. Figure MA-9 is a ground photograph of the vegetation along the low flow channel at Trilby Wash and is representative of the reach from Trilby Wash to the outlet works. Figure MA-10 shows typical vegetative conditions along a watercourse in the southern portion of the impoundment area. Between the watercourses, vegetation is sparse and consists primarily of desert grasses and Creosotebush as can be seen in Figure MA-11.

Over the ten-mile length of the dam, to obtain consistent assignment of roughness coefficients two bracketing criteria were established. For cells with a vegetative cover density of approximately ten percent, a roughness coefficient of 0.07 was assigned. For cells with a vegetation cover density in excess of 90 percent, a roughness coefficient of

0.10 was assigned. Cells with vegetative cover densities ranging between these percentages were assigned values of 0.08 and 0.09 depending on the degree of vegetation present and the assigned coefficients of the surrounding cells. Vegetation cover densities for each grid cell were determined visually from aerial photography. Roughness coefficients of the surrounding cells were assigned to provide smooth transitions from one roughness extreme to the other. Grid cells representing Sun Valley Parkway, U.S. Highway 60 and Loop 303 were assigned a roughness coefficient of 0.04. Downstream of the dam and south of the principal outlet channel, grid cells representing areas of development were assigned a roughness coefficient of 0.10. All other grid cells were assigned a roughness coefficient of 0.06.

For many grid cells, it is anticipated that very shallow flow conditions exist. For such conditions, a different order of magnitude of roughness coefficient than for normal overland flow conditions must be used. In FLO-2D, this is addressed globally by specifying a shallow flow n-value. The shallow flow n-value is applied to all grid cells for depths less than 0.2 feet. Between 0.2 and 0.5 feet, the shallow flow n-value is reduced by 50 percent. For depths greater than 0.5 feet, the roughness coefficient assigned to the grid cell is used. For this analysis, a shallow flow n-value of 0.25 was selected.

The second step in the development of overland flow roughness coefficients is to run the model with a limiting Froude Number. Specification of a limiting Froude Number causes the model to gradually increment the roughness coefficient for every grid cell with a computed Froude Number greater than the limiting value until the constraint is satisfied. The limiting Froude Number selected to represent the hydraulic conditions anticipated to occur anywhere within the impoundment area is 0.2. A value of 0.2 for the limiting Froude Number was selected based on an estimation of a reasonable average floodwave velocity that would exist at any point in time at any location within the pool area. For a Froude Number of 0.2, treating the grid element as a rectangular section and varying the flow depth from 5 to 30 feet results in velocities ranging from 1.6 to 2.5 fps. The results of the limiting Froude Number analysis are that increases to the original roughness coefficient are primarily limited to the low flow channel portion of the impoundment area, particularly in the reach between Trilby Wash and the principal outlet. For many of the grid cells within this specific area, the original roughness coefficient is set to 0.06, and the calculated value seldom exceeded 0.1. Therefore, a roughness coefficient of 0.1

is adopted for these cells and the surrounding cells were adjusted as necessary to provide smooth transitions.

The third step is to adjust roughness coefficients for grid cells as necessary to improve the numerical stability of the model. The area of greatest instability occurs along the low flow channel in the reach between Trilby Wash and the principal outlet. This area is the lowest point in the impoundment and also the location where the majority of the inflow enters the impoundment area. In general, a roughness coefficient of 0.1 is used for the grid cells in areas of numerical instability.

Figure MA-9
Vegetation conditions along the low flow channel

Vegetation conditions upstream of McMicken Dam near Trilby Wash. The embankment is shown in the lower left. The low flow channel is near the heel of the embankment.

Figure MA-10
Vegetation conditions along a watercourse

Vegetation and channel roughness elements along a watercourse in the southern portion of the impoundment area.

Figure MA-11
Vegetation conditions in the floodplain

Typical vegetation for areas not contiguous to watercourses

MA 3.3.3. Sensitivity Analysis

Despite the roughness coefficient estimation process described previously, selection of coefficients is still relatively subjective, and is complicated by the limitation that the coefficient input to the model is applied to the entire range of flow depths outside of the shallow flow depth range. This limitation combined with a theoretical limitation of the use of Manning's equation in the solution scheme for ponded flow conditions leads to a potential concern regarding the appropriateness of FLO-2D for this study.

To address this concern, an analysis was performed to assess the sensitivity of the model to variability in roughness coefficients. Sensitivity to roughness coefficients was evaluated using the PMF model with a low range and high range of roughness coefficients. For the lower range, the base values were reduced by 25 percent. For the high range, the base values were increased by 50 percent.

A detailed discussion of the sensitivity model results is provided in Appendix B. In general, the results indicate that increasing or decreasing the roughness coefficients does not result in a meaningful difference in the calculation of the water surface elevations in the impoundment area.

MA 3.4. Inflow Hydrographs

MA 3.4.1. General

Watershed modeling for the dam and outlet channel was performed by Entellus and reviewed by Stantec for use in both the existing conditions and alternative analyses. Watershed models were developed for the 100-, 200- and 500-year storms for both existing and future land use conditions and for the PMF for future land use conditions. Hydrologic input parameters are, in general, developed in accordance with the methodologies and procedures presented in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (District, 1995). A letter summarizing Stantec's review is provided in Appendix C. A detailed discussion of the data, procedures and methodology used in the development of the watershed models is presented in Volume MD.

The total watershed area estimated by Entellus for the dam and outlet channel is approximately 318 square miles and is shown in Figure MA-12. Of that approximately

245 square miles contributes to the dam. The remaining 73 square miles, is intercepted by the outlet channel. The watershed is composed of two distinct physiographic regions. The northern physiographic region constitutes the majority of the watershed and can be characterized as undeveloped desert rangeland. The extreme upper regions of the watershed lie within the steep, rugged terrain of the Hieroglyphic and Wickenburg Mountains as can be seen in Figure MA-12. Runoff from the mountain slopes is concentrated in a dendritic network of relatively steep, well defined watercourses. Downstream of the mountainous region, the watercourses generally loose containment as the slopes flatten out and the drainage system transitions to more of a distributary network. The second physiographic region lies in the southwestern portion of the watershed. That area is approximately 23 square miles in size, the majority of which lies within the limits of the White Tank Mountain County Regional Park. This region is dominated by the steep, rugged terrain of the White Tank Mountains. Runoff from the mountains flows from west to east in steep narrow canyons. Near the park boundary, the terrain changes abruptly to a relatively steep piedmont terrace with a distributary network of watercourses.

Delineation of the watershed to accurately characterize the nature and location of the inflow to the dam was complicated given the distributive nature of the watercourses and the presence of the Central Arizona Project canal (CAP). The watershed was delineated at the dam into eight sub-watersheds. The limits of the sub-watersheds are shown in Figure MA-12. Runoff contributing to the dam from two of the sub-watersheds is impacted by the CAP. The alignment of the CAP is from the west to the east across the northern physiographic region of the watershed as shown in Figure MA-12. The canal is protected by an embankment on the north side. Runoff captured by the embankment is conveyed across the canal in 22 overchutes, 17 of these are located on the reach east of U.S. 60. The approximate location of the overchutes is shown in Figure MA-12. The significance of the reach east of U.S. 60 is that 14 of the overchutes distributed across a reach of the CAP approximately 5.8 miles in length function together to drain the impounded runoff from a 70 square mile watershed. However, only six of those are tributary to the dam. During the 100-, 200- and 500-year storms, runoff impounded behind the embankment is metered through the overchutes. During the PMF, the embankment is overtopped. The percentage of the 70 square mile watershed estimated to be tributary to the dam was based on a proportioning of the outflow and is discussed in

detail in Volume MD. For the 100-, 200- and 500-year storms, the total drainage area to the dam is approximately 230 square miles. For the PMF, the total drainage area to the dam is approximately 245 square miles.

The general approach to the hydrologic model development was to prepare a single base model of both the dam and outlet channel contributing watersheds that can be used for all storm events and is appropriate for existing condition hydraulic analysis of the dam as well as for the development of alternatives. This approach simplified the modeling effort and provided a set of base models that are easily tailored to meet the needs of both the existing condition analysis and the alternative analysis. Modifications to the model for alternative analysis purposes are discussed in Section MA 4.4.2. and MA 4.4.3. Modifications to the model for the existing condition analysis are summarized as follows:

- The model operations specific to the outlet channel are removed for simplicity.
- The hydrologic channel routing operations along the dam used to collect runoff from each of the sub-watersheds are removed.
- Hydrograph combine operations are added as needed to replace the channel routing operations.
- The multiple storm precipitation data, simulated as a family of depth-area reduction factors, used in the 100-, 200- and 500-year models were replaced with a single areally reduced point precipitation depth.

Traditionally, flood hydrology for a dam would be based on the use of a single storm uniformly distributed over the entire watershed regardless of the number of subbasins used to describe the hydrologic characteristics of the watershed. Multiple storm precipitation is generally used for flood hydrology studies with multiple points of interest within the watershed. For the flood conveyance alternative, use of the multiple storm precipitation data is the appropriate technique. For the existing condition analysis, use of the single storm precipitation data is the appropriate technique. Use of the multiple storm precipitation data for the existing condition analysis would result in a higher total volume input to the FLO-2D model due to the areal reduction associated with each sub-watershed compared to the areal reduction that would be applied for the total watershed area. A comparison of the results for the single storm and multiple storm precipitation data for

the 100-year, storm for existing land use conditions is provided in Table MA-3. Inspection of this table shows that the total inflow volume to the dam is essentially the same for the single storm as for the multiple storm models, as they should be. However, summing the multiple storm volumes for each sub-watershed as it would be represented in FLO-2D results in a total volume at the dam of 18,325 acre-feet, a difference of approximately 11 percent.

The results of the modified model and the base model developed by Entellus for the PMF for future land use conditions is provided in Table MA-4. As can be seen from this table, only the runoff magnitude at the dam (HEC-1 ID DAM) is different between the modified and base model. This difference is due to the removal of the hydrologic channel routing operations. Therefore, for the existing condition analysis, the single storm model is used. Input and output files of the modified HEC-1 models used for input to the FLO-2D model are provided digitally on CD as Appendix H.

Table MA-3
Comparison of single and multiple storm results for 100-year storm with existing land use conditions

Sub-Watershed	Drainage	Single		Multiple	
HEC-1	**Area**	**Discharge**	**Volume**	**Discharge**	**Volume**
ID	**sq. miles**	**cfs**	**acre-ft**	**cfs**	**acre-ft**
505	17.87	3,348	1,254	4,053	1,503
130	6.34	1,908	436	2,411	543
120	9.48	2,796	636	3,511	788
WT110	2.90	2,476	170	3,134	219
WT100	3.84	2,275	267	2,869	334
400	117.35	15,183	8,518	16,144	8,935
510	39.66	5,271	2,883	6,482	3,250
500.1	32.54	5,774	2,406	6,415	2,753
DAM	229.97	24,581	16,570	24,535	16,548

Table MA-4
Comparison of the modified results to the base model results for the PMF for future land use conditions

Sub-Watershed HEC-1 ID	Drainage Area sq. miles	Modified Discharge cfs	Modified Volume acre-ft	Base Discharge cfs	Base Volume acre-ft
505	25.56	13,131	9,569	13,131	9,569
130	6.34	3,540	2,338	3,540	2,338
120	9.48	5,287	3,434	5,287	3,434
WT110	2.90	1,645	982	1,645	982
WT100	3.84	2,221	1,505	2,221	1,505
400	117.35	61,123	54,869	61,123	54,869
510	39.66	25,841	18,349	25,841	18,349
500.1	39.54	20,225	16,465	20,225	16,465
DAM	244.67	**129,636**	107,511	**127,499**	107,511

MA 3.4.2. Model Input

Hydrologic data input to the FLO-2D model is in the form of an inflow hydrograph. The time interval of the hydrographs is 15 minutes. Plots of the runoff hydrographs for storm event for each sub-watershed are provided in Appendix C. For illustrative purposes, the PMF and 100-year existing land use condition runoff hydrographs for each sub-watershed are shown in Figures MA-13 and MA-14, respectively.

Grid cells used as inflow nodes were selected such that the distance to the maximum anticipated inundation limit was sufficient for the flow to fully expand mimicking the distributive behavior of the inflow. This distance ranges from a minimum of approximately 800 feet in the southern portion of the dam to approximately 2,000 feet in the northern portion of the dam. In addition, a total of 21 grid cells are used as inflow nodes for the eight inflow hydrographs to assist the model in expansion of the flow. The locations of the inflow nodes are shown in Figure MA-15. For the sub-watersheds with multiple inflow nodes, the ordinates of the inflow hydrograph were distributed uniformly, except for sub-watershed 130. For sub-watershed 130, the distribution of the inflow to the two nodes was based on a visual estimate of the contributing area at those locations.

Figure MA-12
McMicken Dam watershed map

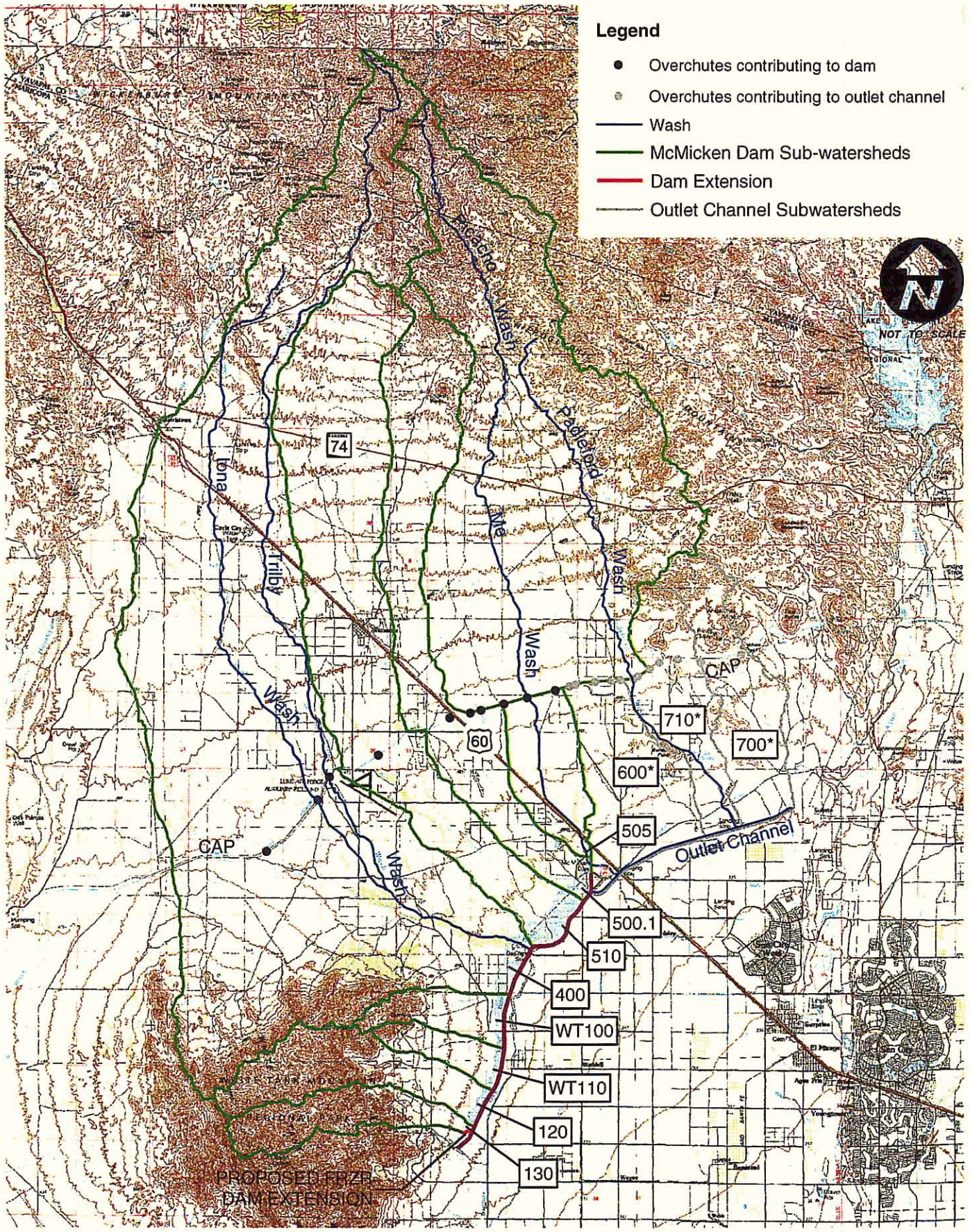


Figure MA-13
Inflow hydrographs for the PMF with future land use conditions

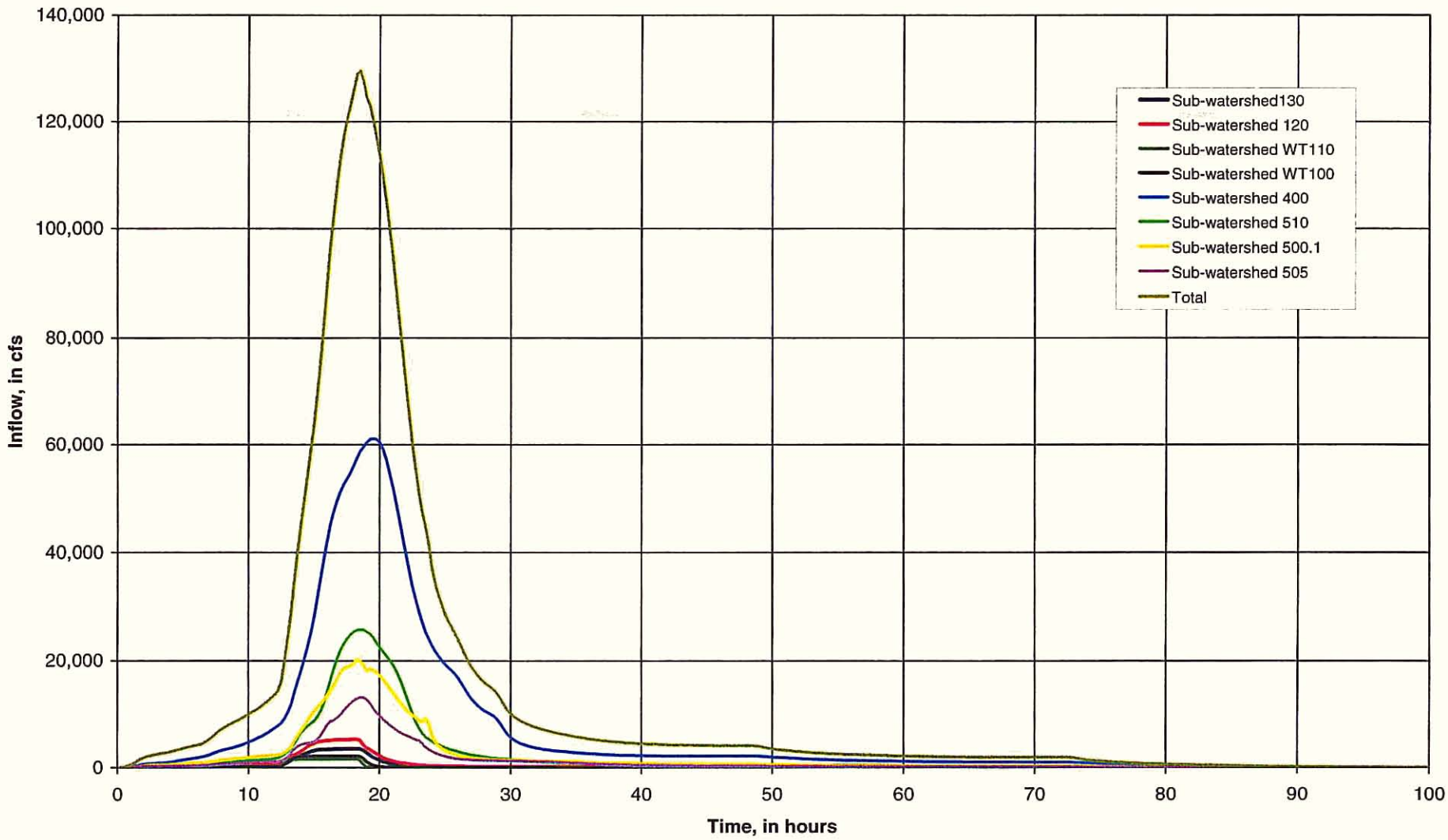


Figure MA-14
Inflow hydrographs for the 100-year, 24-hour storm with existing land use conditions

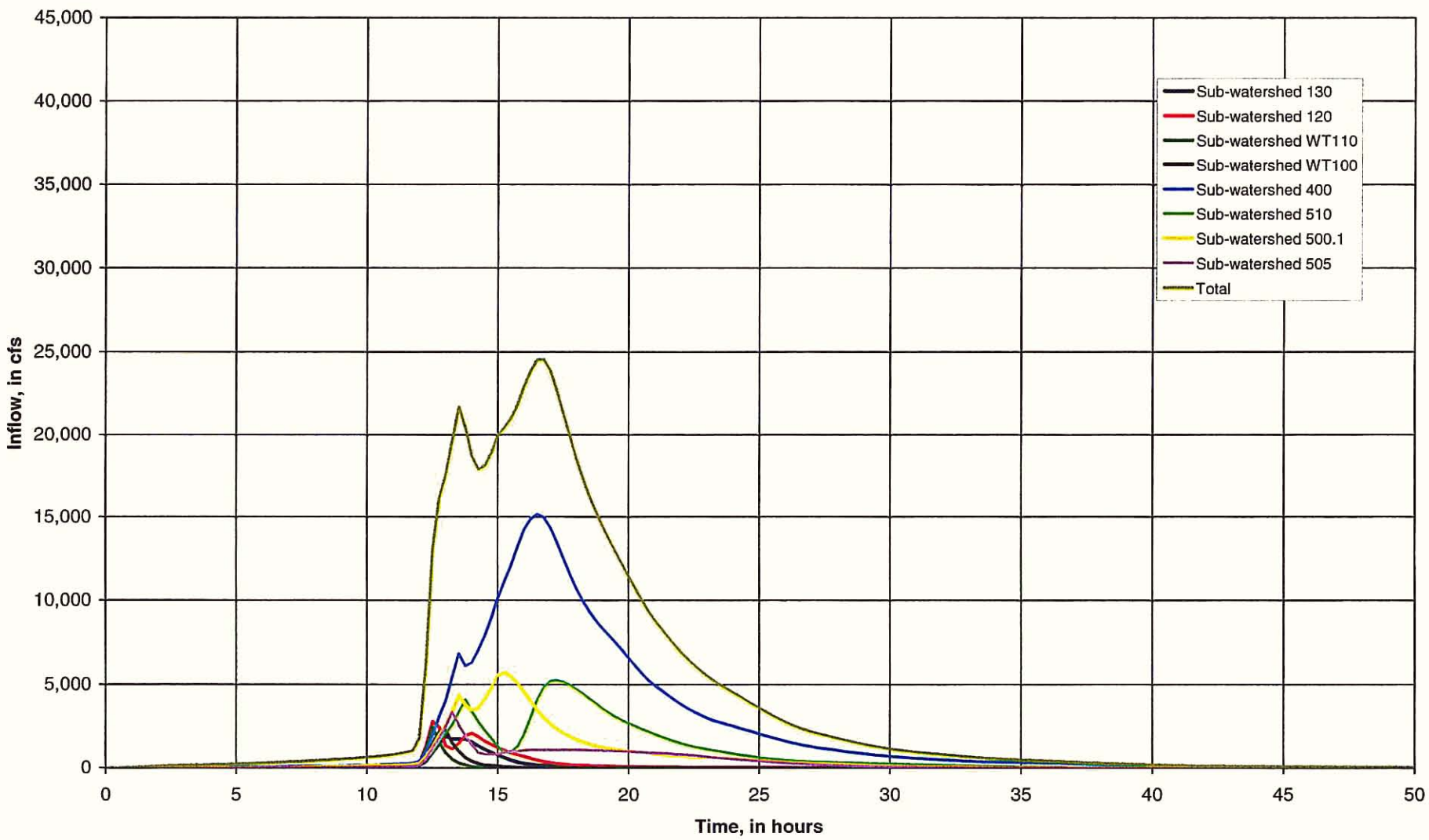
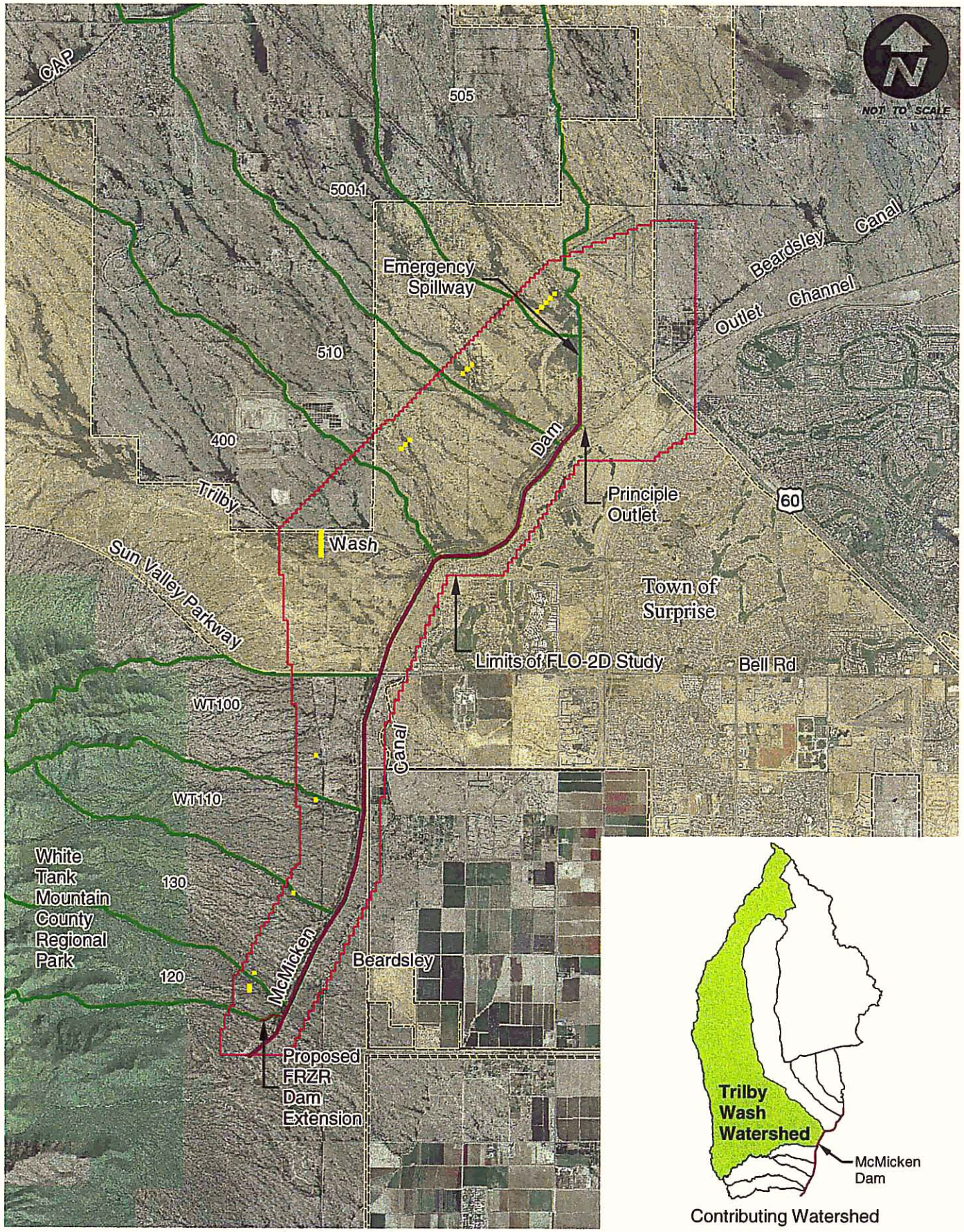


Figure MA-15
Inflow node locations



MA 3.5. Structures and Outlet Rating Curves

MA 3.5.1. General

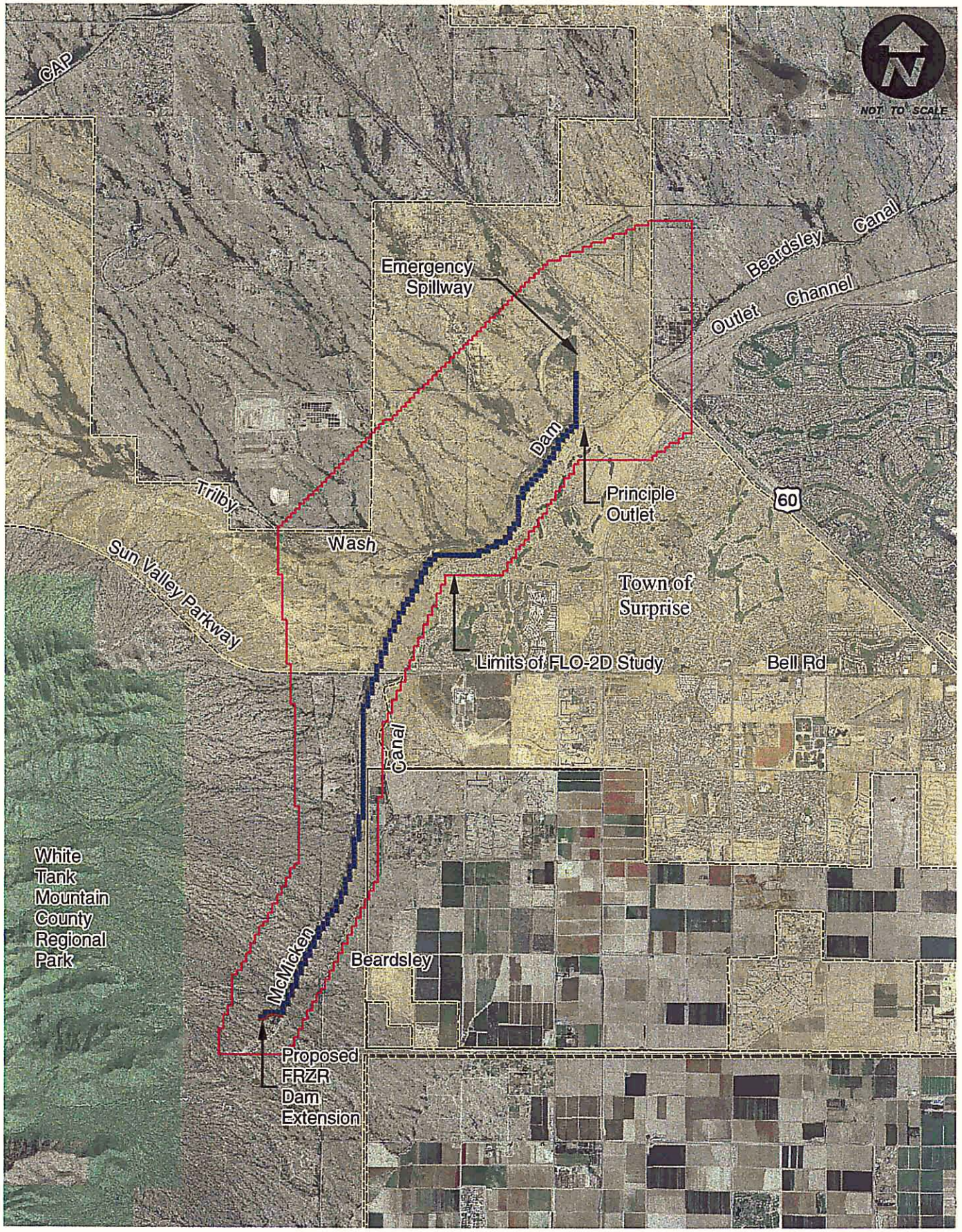
There are five hydraulic structures included in the model that control the movement of the floodwave. These structures are listed below. The approach for modeling each structure as well as the data used to develop the input parameters are discussed in the following sections.

- Dam Embankment
- Principal Outlet
- Emergency Spillway
- Principal Outlet Channel
- Sun Valley Parkway Culvert

MA 3.5.2. Dam Embankment

The dam embankment is modeled as a levee. Treatment of the dam in FLO-2D as a levee allows for easy modification of the elevations for alternative analysis purposes. In addition, the levee data can be easily modified for dam break simulations. Representation of the dam as a levee is accomplished using 217 grid cells as shown in Figure MA-16. Crest elevations are coded for each levee grid cell for each potential overtopping direction and are based on recent survey data discussed in Section MA 2.1.1.

Figure MA-16
McMicken Dam levee grid cells



MA 3.5.3 Principal Outlet

The principal outlet for McMicken Dam is an ungated 20-foot wide, rectangular flume approximately 90 feet in length with a vertical breastwall located approximately 70 feet from the upstream end. The breastwall was designed to restrict outflow at for the SPF (stage of approximately 1,355.4 feet) to 4,450 cfs. The required opening height was determined from 1:18 scale physical model studies to be 11 feet. At the end of the flume is a 65-foot concrete stilling basin. The general features of the structure are shown in Figure MA-17. Photographs of the principal outlet are shown in Figure MA-18. Modeling of the principal outlet in FLO-2D is accomplished using a stage-discharge rating curve.

The design stage-discharge rating curve for the principal outlet is based on the results of physical model studies performed by the USACE and is shown in Figure MA-19 (USACE, 1954). The USACE design was based on elevations referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). The design plans show the invert at the inlet to be at elevation 1,335.0 feet. New mapping and survey data is referenced to NAVD 88. The elevation of the invert at the inlet based on the recent survey is 1,336.12 feet. For comparative purposes, the elevations of the design rating curve are adjusted by 1.12 feet.

The hydraulics of the outlet is fairly complex. As the pool elevation increases, the location of the control section progresses downstream toward the breastwall. Below the lip of the breastwall, the outlet functions as an open channel in a supercritical flow regime. Above pool elevation 1,355 feet there is a shift in the hydraulic conditions at the control section resulting in an abrupt decrease in capacity. It is likely that this shift is due to the proximity of the control section to the breastwall. In order to understand the nature of this shift in control, a HEC-RAS model representing the principal outlet was created. A detailed discussion of the hydraulic analysis of the principal outlet is provided in Appendix D. The results of the hydraulic analysis indicate that the abrupt decrease in capacity is due to the location of the control section and the transition from a free flow to submerged flow conditions. A stage-discharge rating curve based on the HEC-RAS model is shown for comparison with the design rating curve in Figure MA-19. As can be seen from this figure, the HEC-RAS model results very closely match the physical model study except at pool elevation 1355.3 feet. For FLO-2D modeling purposes, the rating

curve from the HEC-RAS model is used to avoid potential instabilities that may result due to the abrupt change in capacity of the design rating curve.

Figure MA-17
McMicken Dam principal outlet

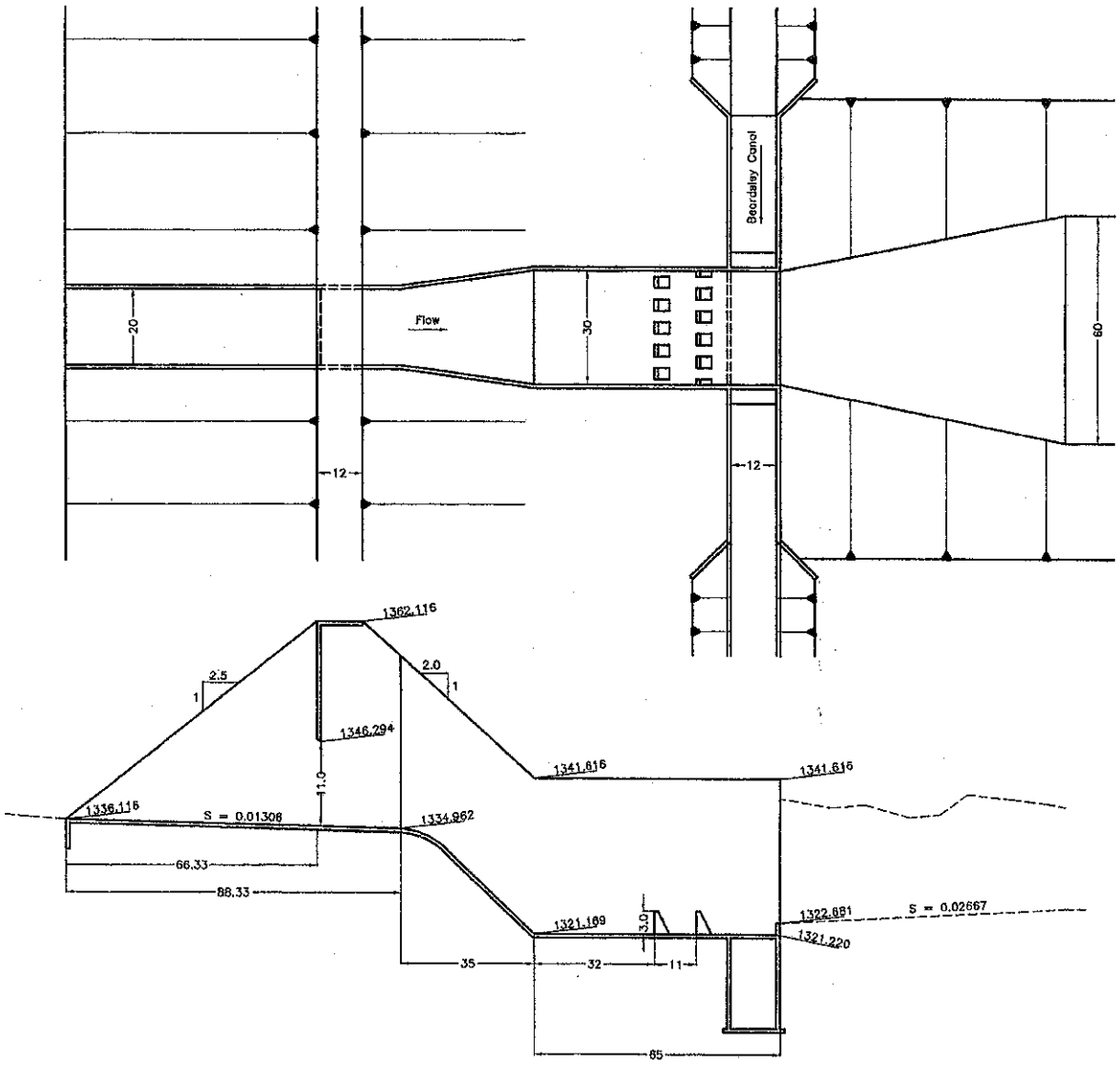
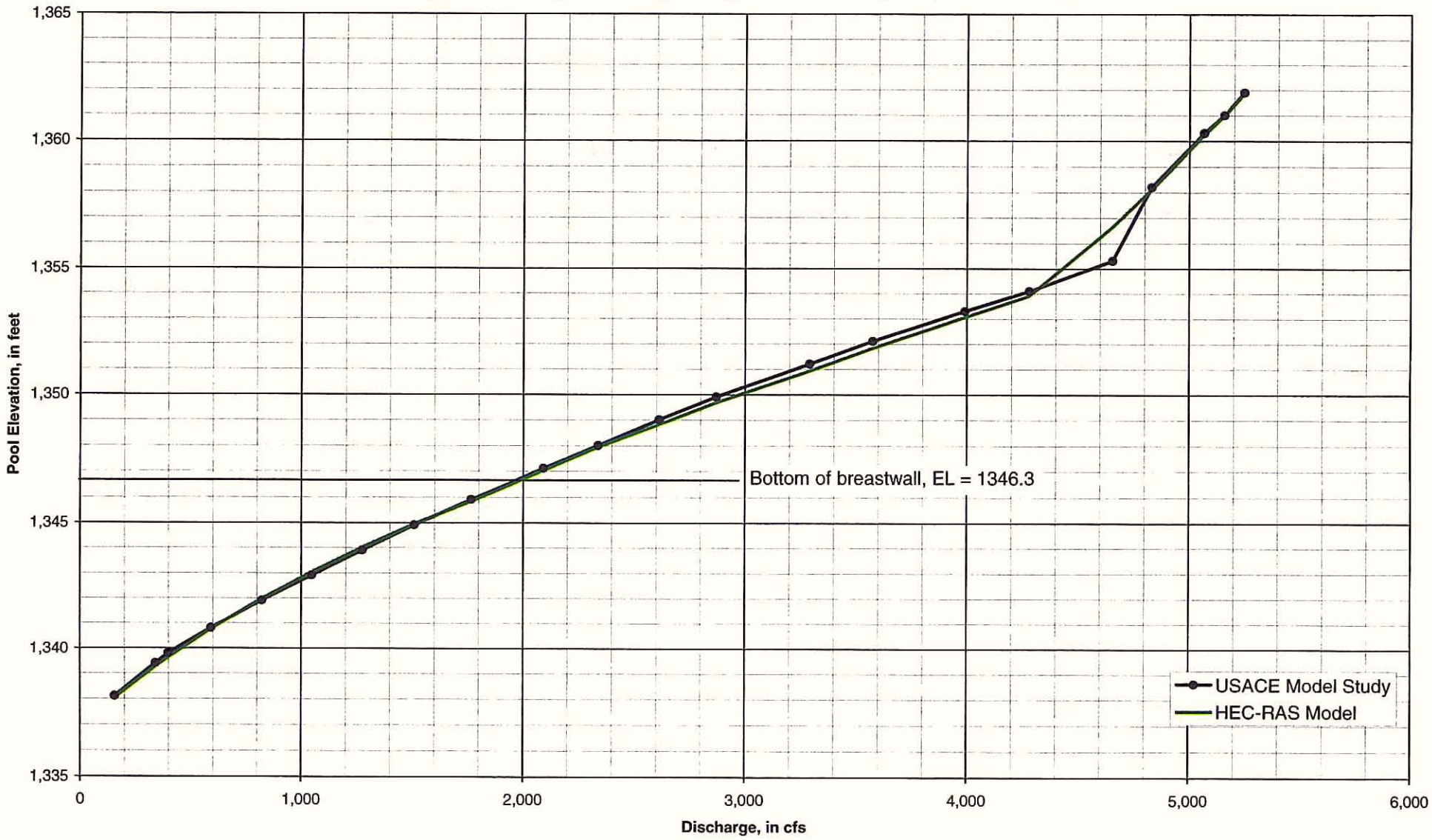


Figure MA-18
Principal outlet

Looking downstream at breastwall

Looking downstream at stilling basin

Figure MA-19
Comparison of stage-discharge rating curves for the principal outlet



MA 3.5.4. Emergency Spillway

The emergency spillway is a trapezoidal, grouted rock, broad crested weir approximately 2,000 feet in length with a 2,500-foot long, 2,000-foot wide approach channel. It is located at the left (north) abutment of the dam. The USACE design was based on elevations referenced to NGVD 29. The design plans show the spillway crest to be at elevation 1,354.0 feet. New mapping and survey data is referenced to NAVD 88. Recent survey data shows that the crest elevation varies across its length, ranging in elevation from 1,355.22 feet to 1,355.53 feet. The arithmetic average elevation of the spillway crest is 1,355.381. The spillway breadth is approximately 6 feet and the slope of the upstream and downstream face is 2.5H:1V. The approach channel is a trapezoidal section with a nearly level bed slope. The emergency spillway outlet channel is graded at a slope of 0.6 percent with a low flow section that directs flow over a siphon on the Beardsley Canal and to the principal outlet channel. Spillway releases are contained on the south side of the outlet channel by a levee that extends to the Beardsley Canal. Figure MA-20 is a recent aerial photo of the emergency spillway and is overlain with 2-foot contour interval mapping.

The emergency spillway stage-discharge rating curve was estimated by the USACE using the weir equation. The length and discharge coefficient vary with stage and were estimated from separate relations. Because the spillway length is much greater than the flow depth, the weir was treated as a rectangular section. A stage-length relation was computed by dividing the flow area of the trapezoidal section at critical flow by the assumed critical depth. The stage-discharge coefficient relation was determined using the results of a backwater analysis for the approach channel to estimate head. Head was assumed to be the difference of the energy grade line elevation at the entrance to the approach channel (pool elevation) and the crest of the weir section. Manning's n-values used in the backwater analysis are 0.025 and 0.030. The resulting stage-discharge rating curve is provided in Table MA-5 and shown graphically in Figure MA-21.

Over time, parts of the approach channel have become occupied by dense vegetation as can be seen from Figure MA-20. In 1999, the District developed a HEC-RAS model to simulate the impacts of vegetation on the performance of the emergency spillway. The results of the analysis show that the capacity is significantly less than the design condition. The resulting stage-discharge rating curve is shown in Figure MA-21.

Modeling of the emergency spillway and approach channel hydraulics is accomplished by allowing FLO-2D to route the flow through the approach channel and over the weir section using topography and roughness coefficients. FLO-2D is used to route the flow through the approach channel as opposed to the use of a rating curve based on a one-dimensional model in order to more accurately account for losses associated with the small radius of curvature and the effects of inflow from sub-watershed 505 entering the approach channel (see Figure MA-20). This inflow enters the approach channel at the northern end and flows south into the reservoir. Eventually, the water surface elevation in the reservoir becomes high enough to force flow northward through the approach channel and over the weir section. Consequently, the stage at the onset of flow over the weir section is higher than what is predicted using a one-dimensional model further reducing the efficiency of the emergency spillway as shown in Figure MA-22. The rating curves shown in Figure MA-22 represent the hydraulic conditions at the entrance to the emergency spillway approach channel. Because of the inflow from sub-watershed 505, analysis of the emergency spillway is explicitly linked to the hydrologic modeling. Thus, changes in the hydrologic conditions and/or modeling parameters (different rainfall distribution, land use conditions, etc.) may potentially alter the performance of the emergency spillway.

A basic assumption in the design of the emergency spillway is the occurrence of critical depth over the weir section. The occurrence of critical depth is supported by the results of the HEC-RAS model developed by the District. Achieving critical depth at the weir section is accomplished in FLO-2D with the selection of an appropriate roughness coefficient for the grid cells representing the weir crest. The roughness coefficient that yields critical depth is 0.025. The occurrence of critical depth at the weir section minimizes the potential miss representation of the physical geometry with grid cell 250 feet on a side. The resulting stage-discharge relation at the weir section is shown in Figure MA-23. Also shown in that figure is the stage-discharge relation at the weir section based on the results of a HEC-RAS model developed as part of this study. A HEC-RAS model of the emergency spillway is developed as part of this study to provide hydraulic data tied to the same elevations as the FLO-2D model for comparative and verification purposes. A detailed discussion of this model is provided in Appendix D.

Figure MA-20
McMicken Dam emergency spillway

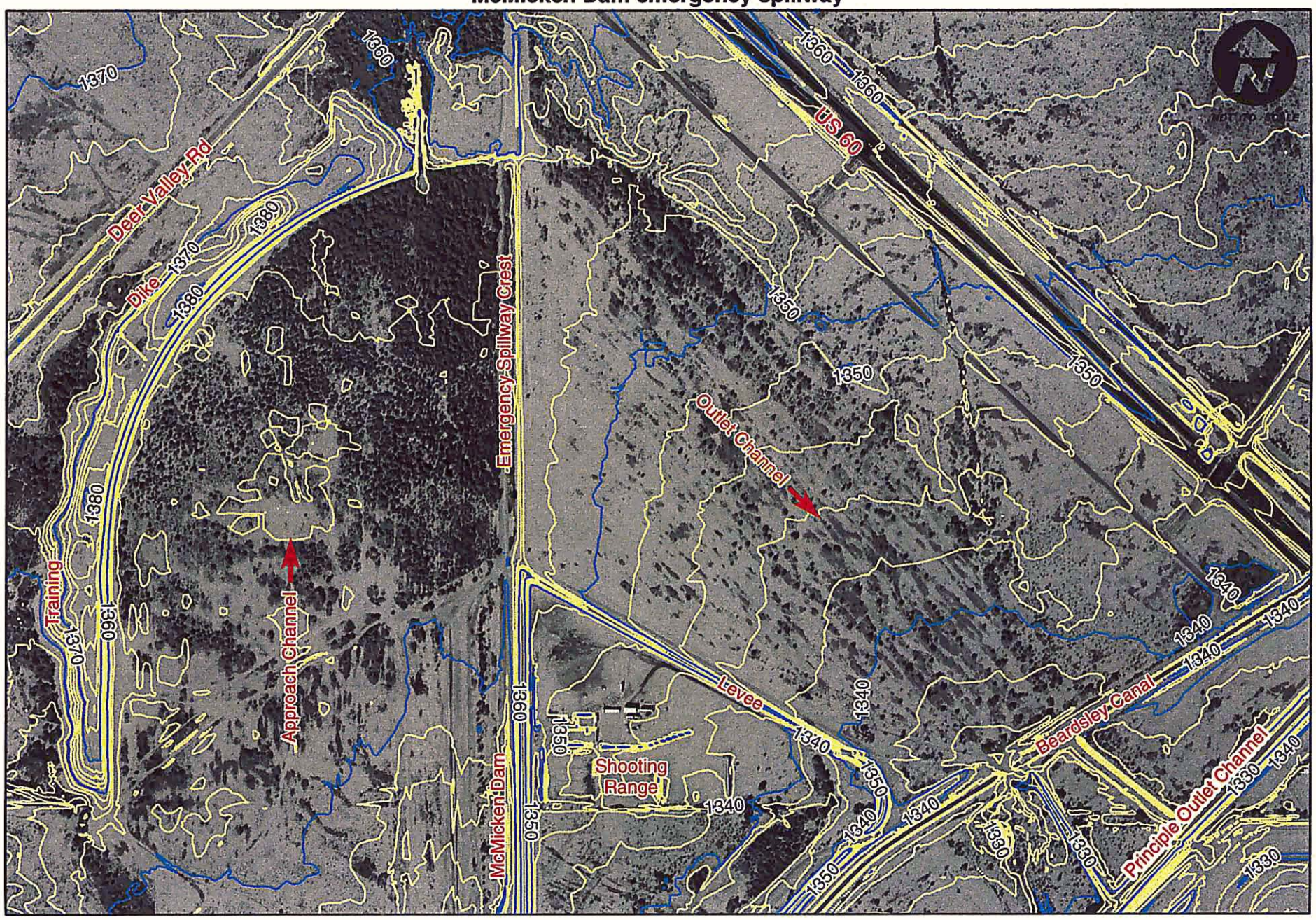


Table MA-5
Emergency spillway stage-discharge rating table

Pool Elevation Feet[1]	Head feet	Length feet	C_d	Discharge cfs
1,355.4	0.0	1,980.0	3.09	0
1,355.9	0.5	1,983.3	3.08	2,160
1,356.4	1.0	1,986.5	3.01	5,969
1,356.9	1.5	1,989.7	2.92	10,721
1,357.4	2.0	1,992.5	2.82	15,890
1,357.9	2.5	1,995.5	2.73	21,567
1,358.4	3.0	1,998.4	2.69	28,027
1,359.4	4.0	2,003.3	2.65	42,507
1,360.4	5.0	2,007.3	2.62	58,800
1,361.4	6.0	2,010.3	2.60	76,800

1. Pool elevations estimated by the USACE are increased from NGVD 29 to NAVD 88 by 1.381 feet to reflect recent survey data.

Figure MA-21
Comparison of existing stage-discharge relations for the emergency spillway

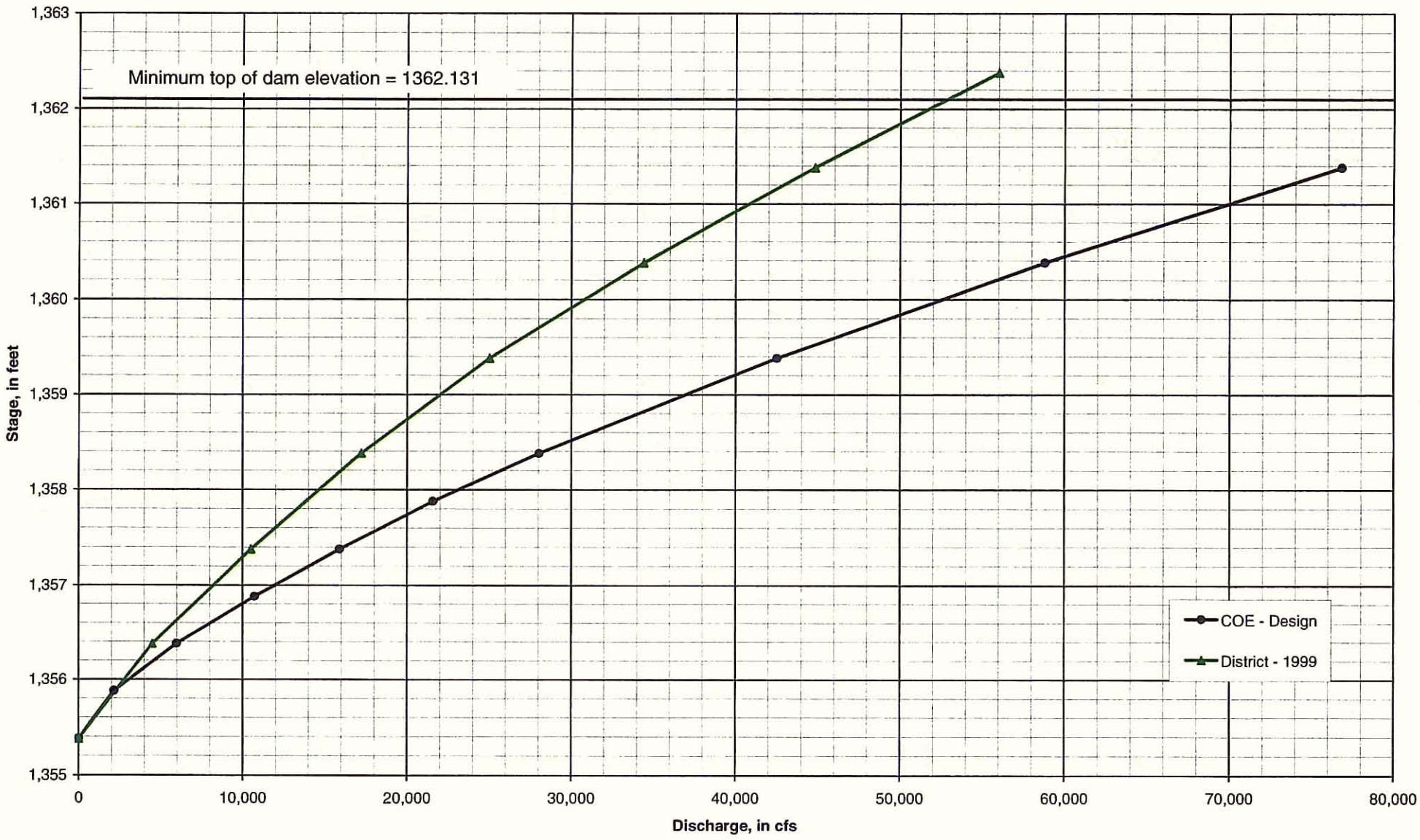


Figure MA-22
Comparison of stage-discharge relations at entrance to approach channel

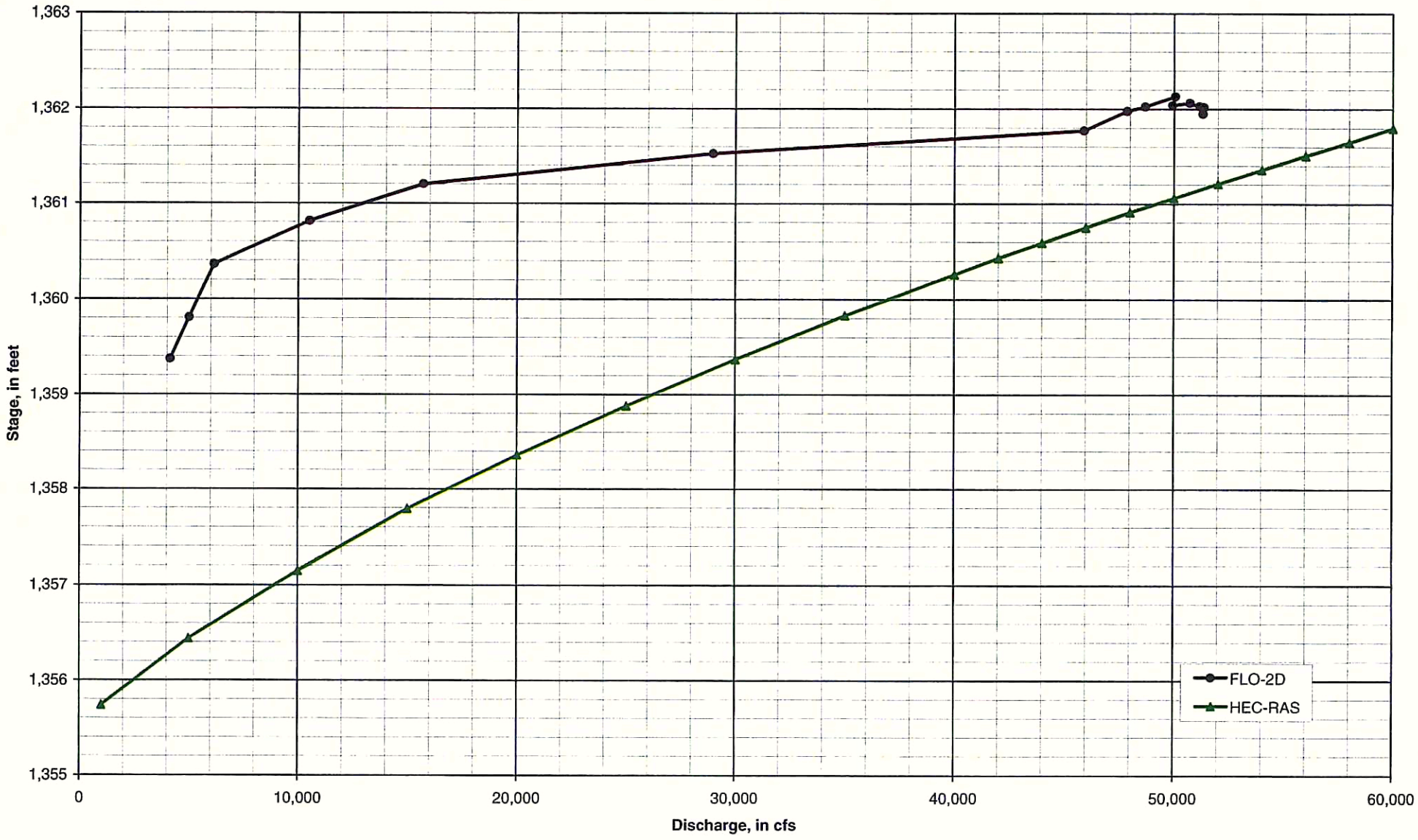
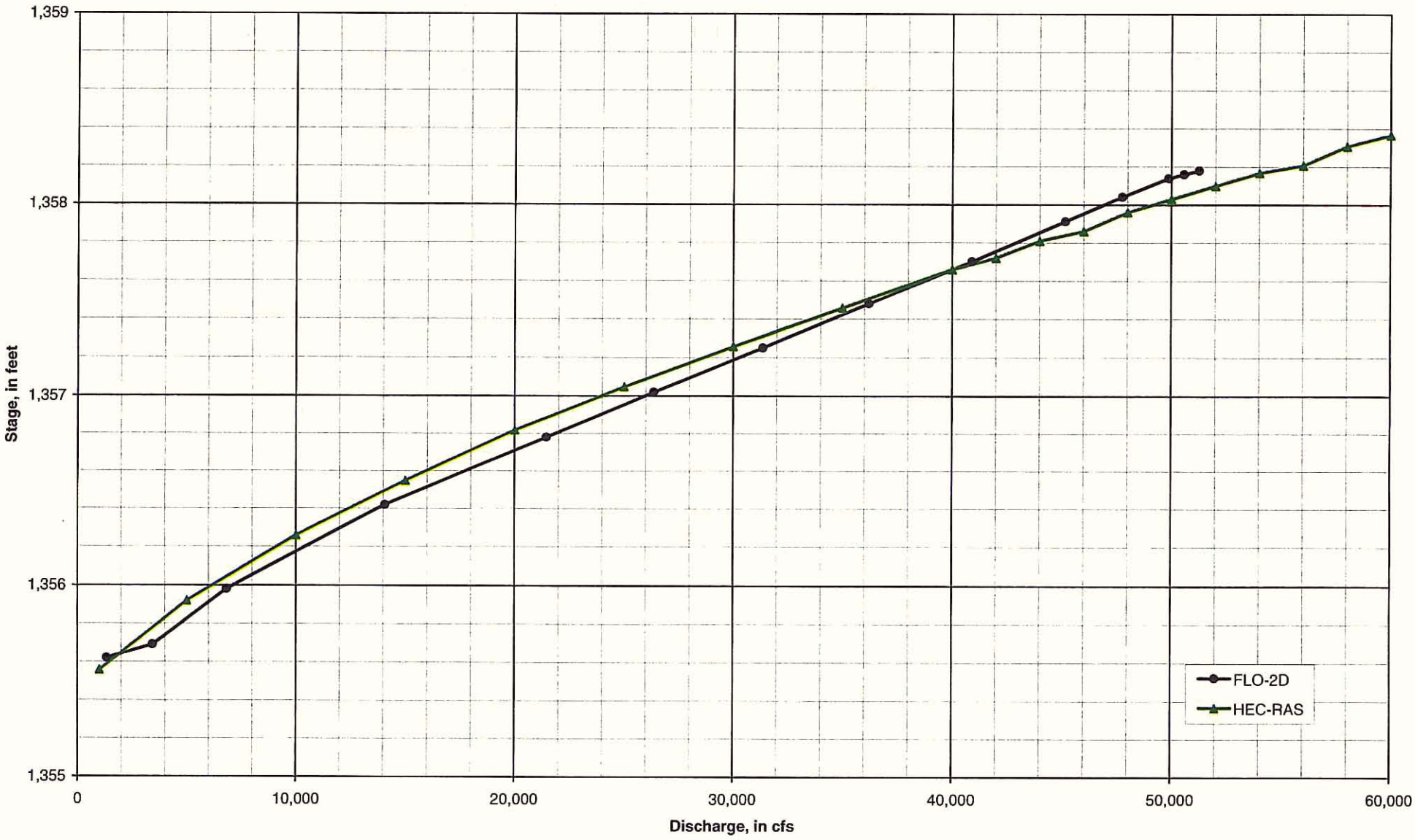


Figure MA-23
Comparison of stage-discharge relations at weir crest



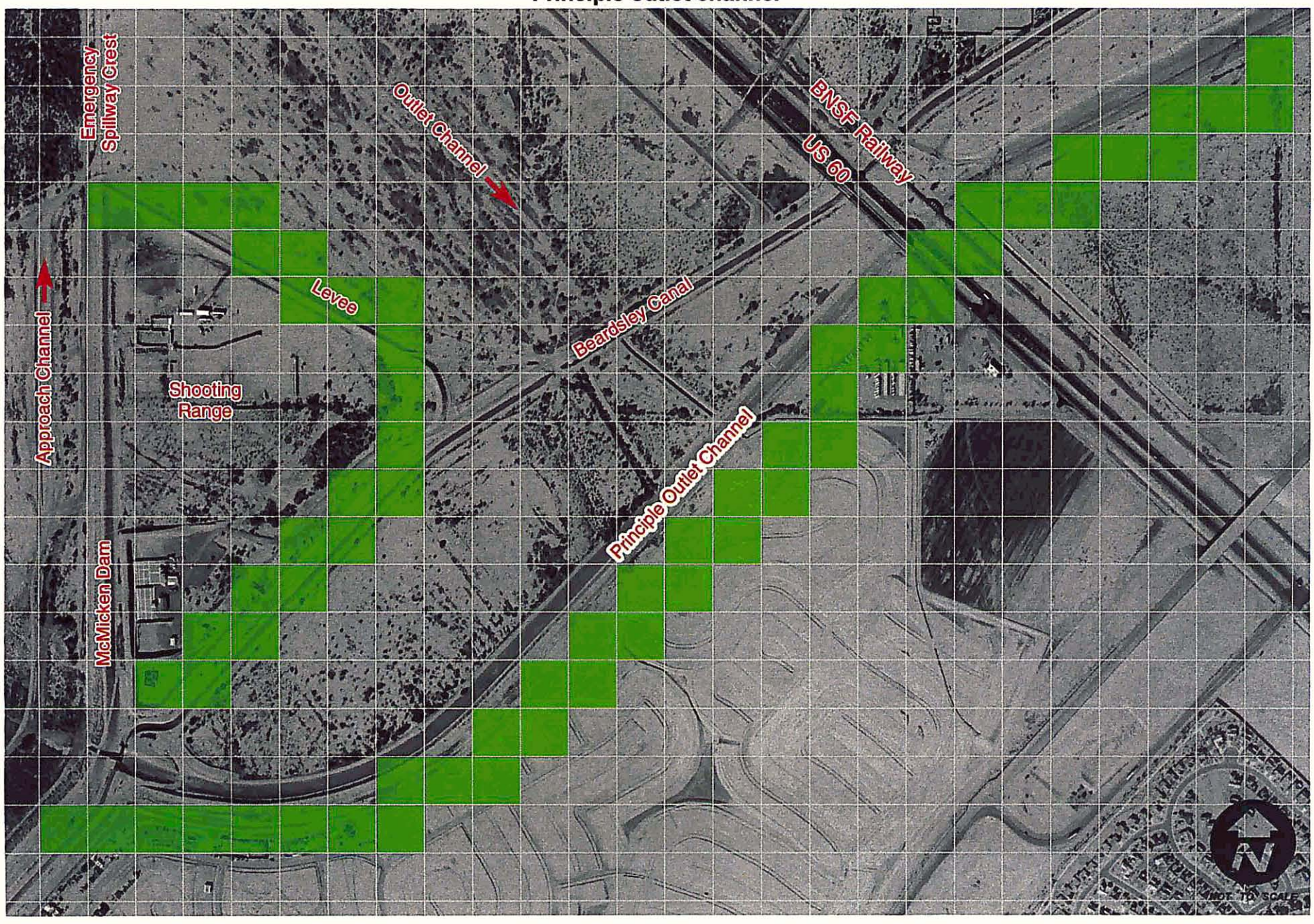
MA 3.3.5. Principal Outlet Channel

The principal outlet discharges to an unlined trapezoidal channel extending from the dam approximately 6 miles to a natural wash that is tributary to the Agua Fria River. The channel is below grade with a levee at the right bank. The longitudinal slope is approximately 0.00035 feet/feet (1.8 feet/mile) and the side slopes are typically 3H:1V. Bottom widths vary from approximately 50 feet at the principal outlet to approximately 80 feet at the limits of the study. The study limits are set approximately 2,200 feet downstream of the Burlington-Northern Santa Fe (BNSF) railroad bridge as shown in Figure MA-24. In addition to conveying discharges from the principal outlet, the channel intercepts discharge from the emergency spillway and from local runoff. The limits of the principal outlet channel were set in order to evaluate the impacts of discharge from the emergency spillway on the principal outlet channel.

The principal outlet channel was modeled in FLO-2D using the one-dimensional channel routine. Hydraulics for the channel are estimated for a trapezoidal cross section with a Manning's n-value of 0.035. Channel bottom widths and side slopes for each cross section are estimated using the circa 2002 topographic mapping. The model calculates the bed elevation by subtracting the channel depth input for each cross section from the associated floodplain elevation. The grid cells representing the channel are shown in Figure MA-24. The U.S. 60 highway and BNSF railroad bridges are not incorporated into the analysis.

The principal outlet channel levee is represented using 42 grid cells as shown in Figure MA-24. Crest elevations are coded for each levee grid cell for each potential overtopping direction and are based on recent survey data discussed in Section MA 2.1.2.

Figure MA-24
Principle outlet channel



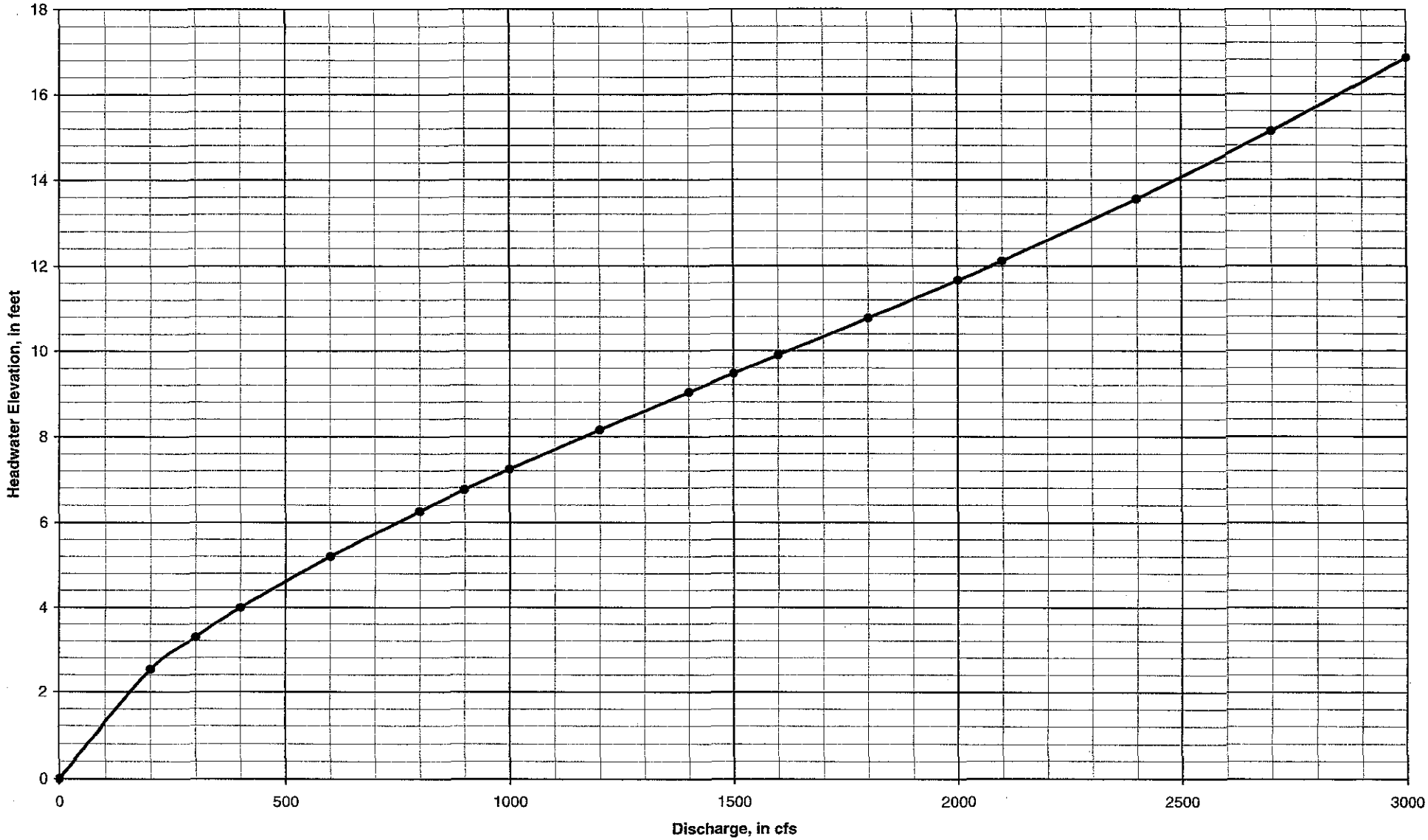
MA 3.5.6. Sun Valley Parkway

Sun Valley Parkway crosses the dam approximately midway along its length as shown in Figure MA-7. As part of the roadway project, a two-barrel 10-foot x 10-foot concrete box culvert was constructed at the low flow channel alignment. Figure MA-25 is a photograph of the culvert, looking south. The culvert was sized to provide sufficient conveyance such that the 100-year water surface elevation on either side of the roadway was not increased. In addition, the profile of the roadway was designed with a dip section. The minimum elevation of the dip section was set approximately equal to the crest of the emergency spillway. During the PMF, the culvert hydraulics have little impact on the maximum pool elevation. However, for the 100-, 200- and 500-year storms, the roadway essentially divides the impoundment area into two sections connected by the culvert. Therefore, the culvert is included in the model.

In general, the culvert functions to equalize both halves of the impoundment area. Modeling of the culvert in FLO-2D is accomplished using two rating curves. One rating curve represent flow that moves from north to south and the other for flow that moves from south to north. Both rating curves are identical and are based on an inlet control analysis of the culvert opening. The rating curve is shown in Figure MA-26 and is developed using the HY-8 computer program. A printout of the HY-8 output is provided in Appendix D. Invert elevations and other physical parameters are estimated from the circa 2002 topographic mapping and from a site visit. Tailwater conditions are accounted for at run time by specification of the tailwater option in the hydraulic structure routine. Specification of this option causes the model to compute the discharge through the structure using the supplied rating curve and the head differential between the inlet and outlet nodes.

Figure MA-25
Sun Valley Parkway culvert

Figure MA-26
Sun Valley Parkway culvert stage-discharge relation



MA 3.6. Control Parameters

Solution of the equations of motion using a central, finite difference scheme is limited to small time steps due to the stringent numerical stability criteria. Selection of the numerical stability criteria is the single most significant modeling issue for this analysis.

Control of the numerical stability criteria and thus the magnitude of the time step is accomplished by the selection of a floodplain and channel depth tolerance and three parameters related to the wave celerity of the floodwave, WAVECEL, WAVEMIN and WAVEMAX. Guidance for the selection of the minimum time step and the user controlled numerical stability criteria is provided in the *FLO-2D User's Manual.* For "difficult" simulations, a minimum time step of 0.01 seconds is recommended. The recommended value for both the floodplain and channel depth tolerances is 30 percent. The recommended values for WAVECEL, WAVEMIN and WAVEMAX are 0.2, 2 and 5, respectively.

Because of the extremely mild channel slopes and ponded conditions being modeled for this analysis, the key to a stable solution is a very small time step. Initially the model was run with the default values for the stability criteria. The stability criteria were then refined by first gradually reducing the WAVECEL, WAVEMIN and WAVEMAX parameters until further changes had no significant impact of the numerical stability. Next, the floodplain depth tolerance was reduced in the same fashion followed by the channel depth tolerance. The final stability criteria arrived at are 0.1, 0.1 and 1 for the WAVECEL, WAVEMIN and WAVEMAX parameters, 1 percent for the floodplain depth tolerance and 10 percent for the channel depth tolerance.

MA 3.7. Results

MA 3.7.1. General

Inflow to McMicken Dam is routed through the impoundment area to the outlet works. Routing is performed for four different storm events and two different hydrologic conditions for a total of seven models. All models are started with a dry pool area and without exclusion of volume for future sediment storage.

Simulation times for each model are set to a sufficient length to capture the maximum water surface elevations and velocities that occur anywhere within the limits of the grid.

The simulation time for the PMF is 70 hours. The simulation time for the 100-, 200- and 500-year models is 50 hours. The output time interval for all models is set to 15 minutes.

Model output includes outflow hydrographs for each hydraulic structure, maximum depth and velocity for every grid cell that occurs at any time during the simulation, and depth and velocity for every grid cell at the end of the simulation. In addition, the depth and velocity for every grid cell is reported for every output time interval. Input and output files for each model are provided digitally on CD as Appendix H. Model output is used to prepare an existing and future land use condition stage-flood magnitude relation as well as plots of the maximum water surface elevations. The hydraulic performance of the reservoir for each flood event is discussed in detail in the following sections.

FLO-2D is a volume conservation model. Conservation of volume is therefore a key indicator of a successful simulation. The volume conservation results for each model are checked and the inflow and outflow totals are reported in Table MA-6. As can be seen from that table, volume is conserved.

Table MA-6
Summary of volume conservation results

		Grid		
Model	**Inflow acre-ft**	**Outflow acre-ft**	**Storage acre-ft**	**Total acre-ft**
100-Year, Existing	16,557.89	8,497.65	8,060.15	16,557.90
100-Year, Future	20,461.02	10,272.52	10,188.49	20,461.01
200-Year, Existing	19,484.76	9,797.78	9,686.98	19,484.76
200-Year, Future	23,684.83	11,381.68	12,303.15	23,684.83
500-Year, Existing	23,080.15	11,100.16	11,979.99	23,080.15
500-Year, Future	27,624.88	13,343.32	14,281.56	27,624.88
PMF	106,121.65	85,611.88	20,509.78	106,121.66

3.7.2. Stage-Flood Magnitude Relations

Stage-flood magnitude relations are provided in Table MA-7 for both existing and future land use conditions. Interpretation of the stage-flood magnitude relations must consider that the water surface elevation in the reservoir varies with space and time due to the distribution in magnitude and timing of inflow, the linear configuration of the dam and storage volume and the resistance to the movement of the floodwave. To illustrate this,

maximum water surface elevations that occur at any point in time during the simulation for each model are plotted in profile along the low flow channel and are shown in Figure MA-27. Therefore, the stage shown in the tables for each storm frequency is the maximum water surface elevation that occurs at any time during the simulation at any location along the face of the dam. In addition to Table MA-6, the stage-flood magnitude relation for the 100-, 200- and 500-year storm frequencies is shown graphically in Figure MA-28. Since the PMF is the greatest flood magnitude for a watershed it does not have an associated exceedance probability. Therefore the maximum stage for the PMF is not shown graphically in the frequency relation shown in Figure MA-28.

Table MA-7
Stage-flood magnitude relations

Flood	Maximum Stage, in feet	
Magnitude	Existing	Future
100-Year	1,352.6	1,354.5
200-Year	1,354.0	1,356.0
500-Year	1,355,7	1,357.4
PMF	N/A	1,364.2

Figure MA-27
Maximum Water Surface Elevations

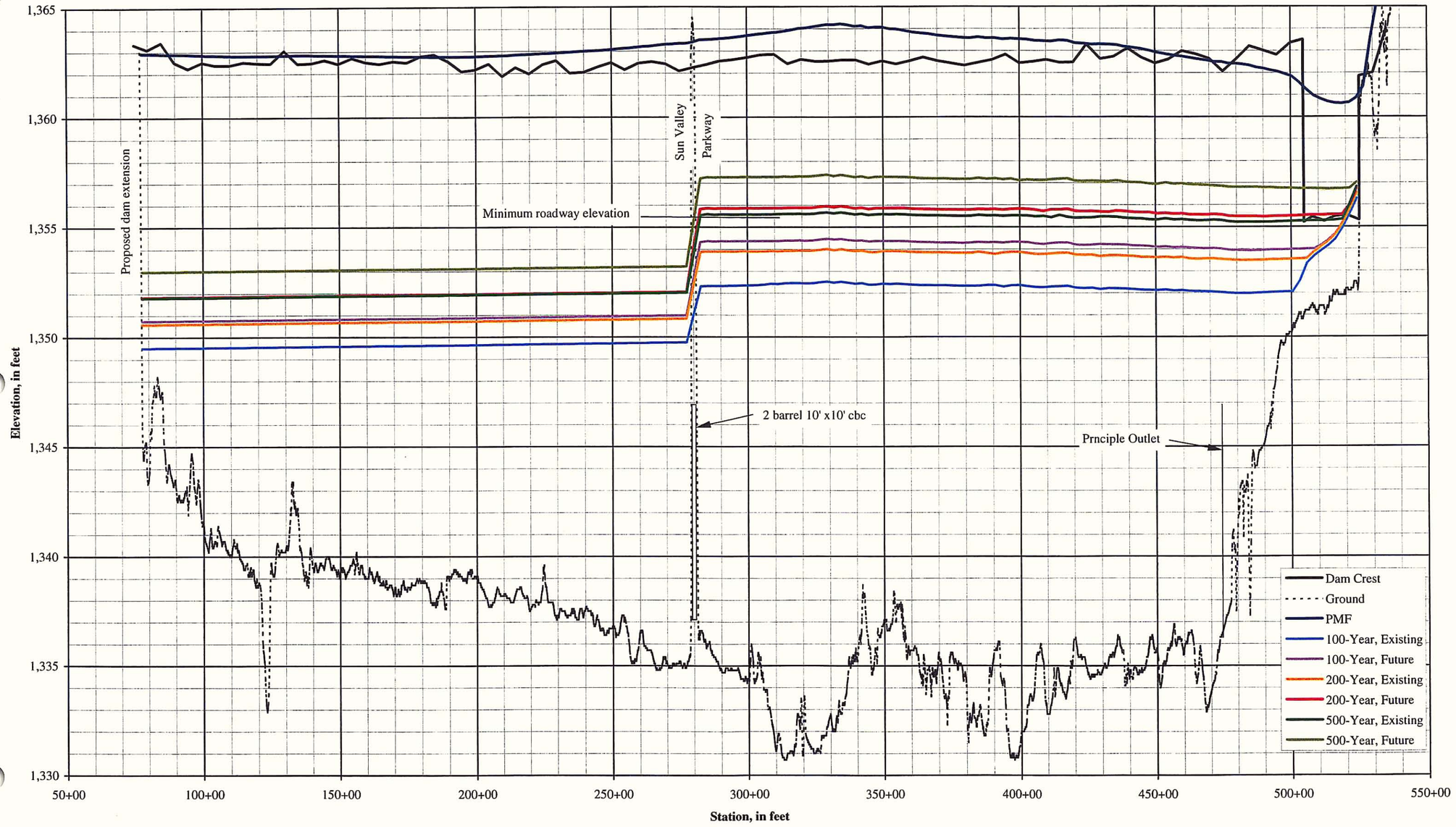
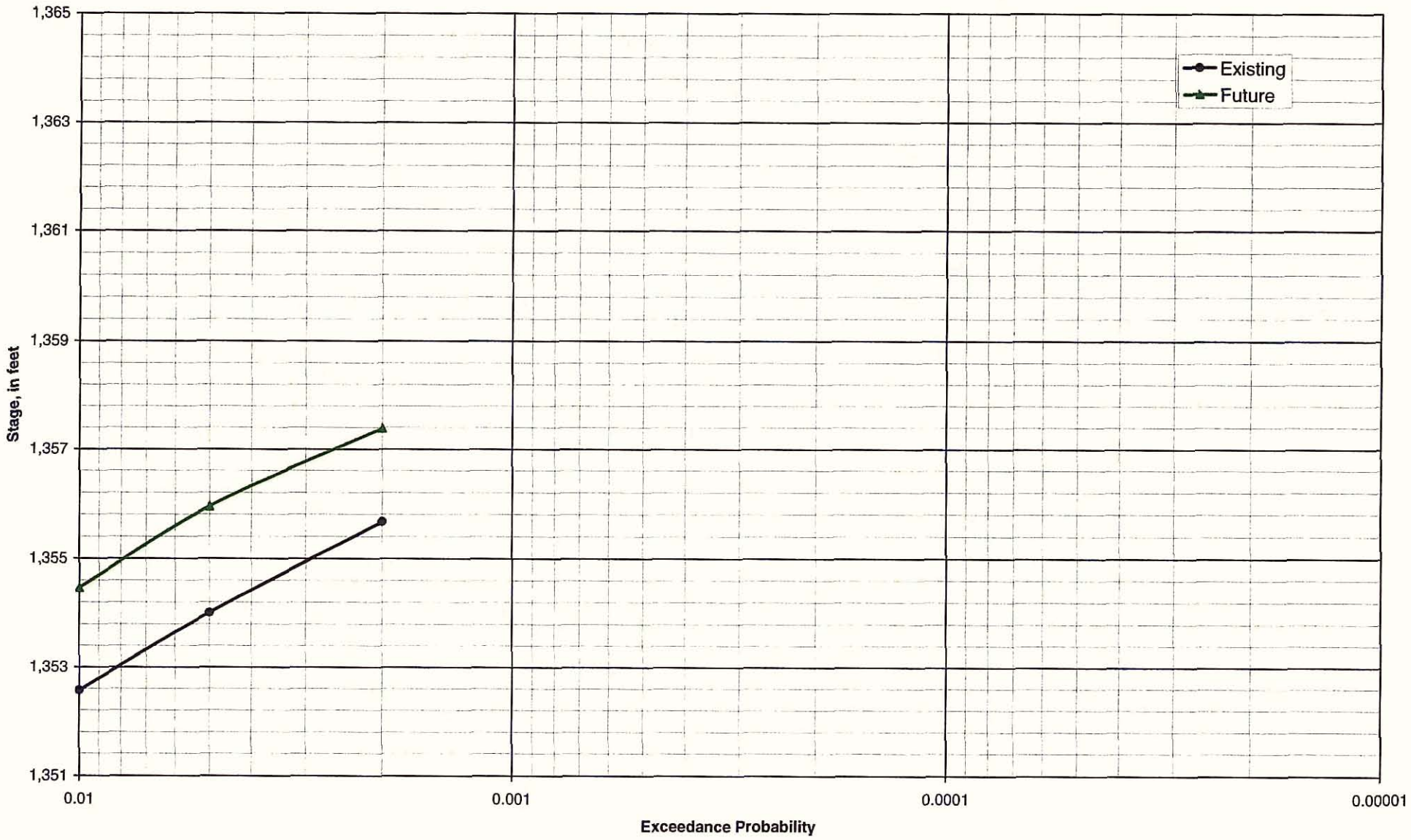


Figure MA-28
Stage-flood magnitude relation



MA 3.7.3. Reservoir Hydraulics

Movement of the floodwave through the reservoir can be illustrated through a series of water surface profiles taken along the low flow channel alignment at select points in time. The illustration is prepared to represent the differences in the hydraulics of the impoundment for two different events. The first set of illustrative profiles is for the PMF and is shown in Exhibit MA-2. The second illustrative set is for the 100-year, 24-hour storm for future land use conditions and is shown in Exhibit MA-3. Inflow and outflow hydrographs are shown on each exhibit to help correlate the water surface elevations to the hydrology of the watershed and the hydraulics of the outlet structures.

For the purposes of this discussion, the impoundment area is broken up into four reaches; White Tanks Reach, Trilby Wash Reach, Principal Outlet Reach and Emergency Spillway Reach. The White Tanks reach extends from the proposed FRZR dam extension to Sun Valley Parkway. Four sub-watersheds contribute runoff directly to this reach; 130, 120, WT110 and WT100. The Trilby Wash Reach extends from Sun Valley Parkway to dam station 425+00. Two sub-watersheds contribute runoff directly to this reach; 400 (Trilby Wash) and 510. These two sub-watersheds account for more than 60 percent of the total drainage area contributing to the dam. The Principal Outlet Reach extends from dam station 425+00 to the principal outlet. Runoff from sub-watershed 500.1 enters the impoundment area in this reach. The Emergency Spillway Reach extends from the principal outlet to the emergency spillway works. Runoff from sub-watershed 505 enters the impoundment area at the extreme northern end of this reach, in the emergency spillway approach channel.

Seven points in time are used to illustrate the movement of the PMF water surface profile along the low flow channel. The water surface profile is shown in relation to the ground elevation and the crest of the dam and emergency spillway in Exhibit MA-2. For comparison, a profile for the maximum water surface elevation along the low flow channel that occurs at any point in time is also shown in Exhibit MA-2.

In general, during the rising limb of the PMF inflow hydrograph, flow in the White Tanks reach travels north at velocities of approximately 1 fps. The flow proceeds up to the Sun Valley Parkway crossing. Inflow to the Trilby Wash Reach enters the low flow channel between stations 335+00 and 355+00 and spreads north and south. South of station

335+00, velocities range between 1 and 2 fps. North of station 355+00, velocities are generally less than 1 fps. Because of the significantly larger volume in this reach than the White Tanks Reach, flow through the Sun Valley Parkway culvert is from the north to the south. The maximum flow northward through the culvert is 175 cfs and occurs at the end of the simulation. The maximum flow southward through the culvert is approximately 325 cfs and occurs at hour 17. Inflow to the Principal Outlet Reach also spreads north and south. Flow to the south travels at velocities of approximately 1 fps and combines with flow traveling to the north from the Trilby Wash Reach. Flow traveling to the north towards the principal outlet moves at velocities less than 1 fps. Flow through the Emergency Spillway reach travels south with velocities near 2 fps toward the principal outlet.

Near the time of peak of the total inflow, flow velocities in the White Tanks Reach approach zero as the overwhelming volume of runoff in the Trilby Wash Reach begins to spread further south. In the Trilby Wash Reach, flow travels both to the north and south at fairly high velocities. South of station 335+00, velocities gradually decrease from approximately 6 to 2 fps. North of station 355+00, flow travels to the north at approximately 5 fps. At the boundary of the Trilby Wash and Principal Outlet Reach, velocities drop to approximately 2 fps as flow traveling north from the Trilby Wash Reach combines with flow traveling south from the Principal Outlet Reach. Flow traveling north in the Principal Outlet Reach moves at velocities of approximately 3 fps with velocities up to 6 fps near the entrance to the principal outlet. In the Emergency Spillway Reach, flow is moving to the north and east through the approach channel at velocities of 1 to 2 fps.

Starting around hour 40 of the simulation, the water surface elevation begins to stabilize along the length of the dam. Flow is generally from the south to the north with velocities increasing significantly north of Sun Valley Parkway. Near hour 70 of the simulation, Sun Valley Parkway becomes a significant obstruction to flow due to the limited conveyance capacity of the culvert.

For the 100-, 200- and 500-year flood frequencies, the conveyance capacities of the Sun Valley Parkway culvert and the principal outlet and the distribution in the magnitude and timing of the inflow to the dam have a much more significant impact on the reservoir hydraulics than during the PMF. To illustrate the general nature of the reservoir

hydraulics for these events, the movement of the water surface profile along the low flow channel at five points in time for the 100-year, future land use conditions are plotted in relation to the ground elevation (Exhibit MA-3). Also shown on Exhibit MA-3 is a profile for the maximum 100-year water surface elevation along the low flow channel that occurs at any point in time.

Initially the majority of the inflow enters the dam in the White Tanks Reach. This flow is concentrated in the low flow channel and travels north through the Sun Valley Parkway culvert before combining with inflow to the Trilby Wash Reach.

Near the time of peak of the total inflow to the dam, the majority of flow in the White Tanks Reach has ended and inflow to the Trilby Wash Reach begins to control the overall reservoir hydraulics. Because of the limited capacity of the principal outlet and Sun Valley Parkway culvert in comparison to the inflow, the water surface elevation in the northern half of the impoundment area rises relatively uniformly peaking near hour 26 of the simulation. It takes approximately 17 hours for the water surface elevations in the north and south halves of the dam to equalize.

MA 3.7.4. PMF

Inflow to the dam during the PMF is approximately 107,500 acre-feet. The limits of the maximum water surface elevation at any point in time, herein referred to as the inundation limits, are plotted on Exhibit MA-4. Routing of the flow through the reservoir results in overtopping of the dam. Overtopping begins at hour 18.5 of the simulation at station 335+00, which is essentially the location where Trilby Wash enters the impoundment area. The duration of overtopping is approximately 10 hours and the total discharge over the dam is 57,000 cfs. The volume of flow passing over the dam is approximately 16,500 acre-feet. The depth of overtopping varies along the length of the dam due to the movement of the floodwave through the reservoir, the distribution of the inflow along the length of the dam and the variability in the dam crest profile. The maximum depth occurs at station 335+00 and gradually decreases with increasing distance in both directions as can be seen from Figure MA-27. South of Trilby Wash at station 190+00, the overtopping depth drops to approximately 0.5 feet.

At station 90+00, the water surface elevation drops below the crest of the dam. North of Trilby Wash, at station 410+00, the overtopping depth is approximately 1 foot. North

from there, the water surface elevation begins to drop more rapidly due to the influence of flow being evacuated over the emergency spillway. At station 480+00 (just north of the principal outlet) the water surface elevation drops below the crest of the dam.

Peak inflow and outflow discharges are listed in Table MA-8. Inflow and outflow hydrographs are shown in Figure MA-29. Peak inflow and outflow is approximately 129,600 cfs and 113, 800 cfs, respectively. At the end of the 70-hour simulation approximately 86,300 acre-feet have passed the dam.

Flow through the principal outlet begins at hour 6 of the simulation. The peak flow is approximately 5,300 cfs occurring at hour 20.32 of the simulation. Over the 70-hour simulation, the principal outlet conveys approximately 22,400 acre-feet.

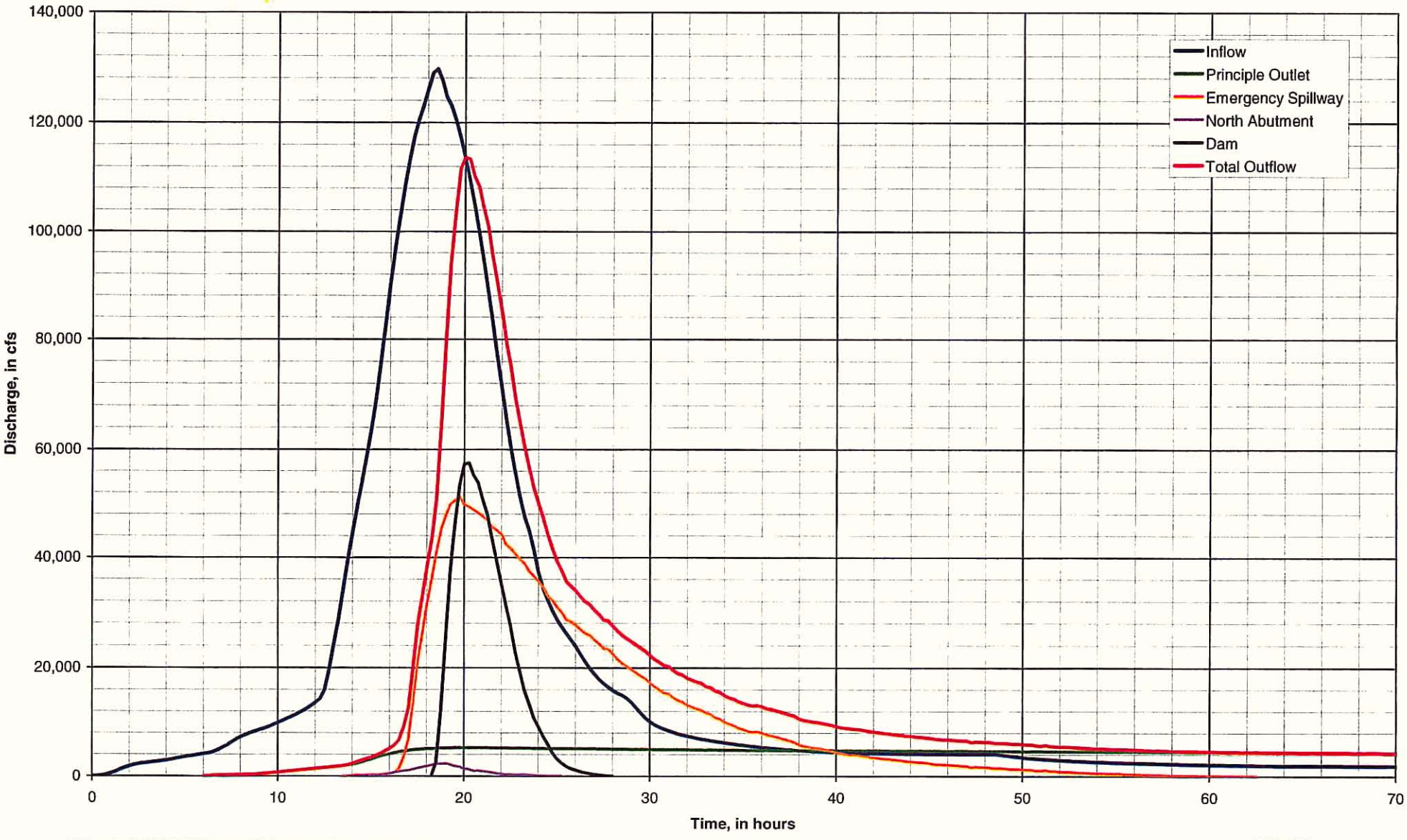
Flow over the emergency spillway begins at hour 13.5 of the simulation. Initially flow over the emergency spillway only occurs at the northern end due to the inflow from sub-watershed 505 entering the approach channel and is not due to ponding in the reservoir. Flow over the emergency spillway due to ponding in the reservoir occurs at approximately hour 16.5 of the simulation. The peak outflow over the emergency spillway is approximately 51,300 cfs occurring at hour 19.78 of the simulation. The duration of flow over the emergency spillway is just over 2 days (48.75 hours). The volume of flow passing over the emergency spillway is approximately 46,700 acre-feet. Outflow listed for the north abutment (see Figure MA-20) is flow that overtops the section of the dam north of the emergency spillway due to the limited capacity of the inflow channel for sub-watershed 505 that enters the emergency spillway approach channel, not due to ponding in the reservoir.

Table MA-8
Peak outflow for each flood magnitude for future land use conditions

		Outflow				
Flood Magnitude	**Inflow cfs**	**P.O.[1] cfs**	**E.S.[2] cfs**	**N. Abut.[3] Cfs**	**Dam cfs**	**Total cfs**
100-Year	28,790	4,253	55	20	0	4,253
200-Year	35,387	4,530	134	79	0	4,540
500-Year	43,187	4,712	1,985	173	0	6,685
PMF	129,636	5,293	51,250	2,315	57,511	113,775

Notes:
1. P.O. - Principal Outlet
2. E.S. - Emergency Spillway
3. N. Abut. - North Abutment

Figure MA-29
Inflow and outflow hydrographs for the PMF



MA 3.7.5. 100-Year, Future and Existing Land Use Conditions

Inflow to the dam for the 100-year future and existing land use conditions is approximately 20,500 and 16,600 acre-feet, respectively. Routing of the flow through the reservoir results in a maximum water surface elevation of 1,354.5 feet and 1,352.6 feet for future and existing land use conditions, respectively. Inundation limits for future land use conditions are plotted on Exhibit MA-5. Inundation limits for existing land use conditions provided digitally on CD as Exhibit MA-6.

Peak inflow and outflow discharges are listed in Table MA-8 and MA-9 for future and existing land use conditions, respectively. Inflow and outflow hydrographs are shown in Figure MA-30 and MA-31 for future and existing land use conditions, respectively. Flow through the principal outlet begins at hour 10.5 and 13.75 of the simulation for future and existing land use conditions, respectively. The peak flow for future conditions is approximately 4,300 cfs occurring at hour 25.8 of the simulation. The peak flow for existing land use conditions is approximately 3,800 cfs occurring at hour 25.24 of the simulation. Over the 50-hour simulation, the principal outlet conveys approximately 10,600 and 8,700 acre-feet for future and existing land use conditions, respectively.

For existing land use conditions, the maximum pool elevation is barely sufficient to inundate the emergency spillway approach channel. However, inflow from sub-watershed 505 results in water surface elevations that approach the emergency spillway crest due to the conveyance deficiencies of the emergency spillway approach channel. For future land use conditions, the maximum pool elevation in the emergency spillway approach channel is 1,354 feet, a little more than 1 foot below the spillway crest. However, beginning at hour 13.25 of the simulation, inflow to the dam from sub-watershed 505 overtops the emergency spillway and north abutment due to the conveyance deficiencies of the emergency spillway approach channel and the inlet channel to the approach channel.

Table MA-9
Peak outflow for each flood magnitude for existing land use conditions

		Outflow				
Flood Magnitude	**Inflow cfs**	**P.O.[1] cfs**	**E.S.[2] cfs**	**N. Abut.[3] cfs**	**Dam cfs**	**Total cfs**
100-Year	24,581	3,759	0	0	0	3,759
200-Year	31,009	4,157	66	15	0	4,157
500-Year	37,927	4,411	175	90	0	4,491
PMF	N/A	N/A	N/A	N/A	N/A	N/A

Notes:
1. P.O. - Principal Outlet
2. E.S. - Emergency Spillway
3. N. Abut. – North Abutment

Figure MA-30
Inflow and outflow hydrographs for the 100-year, 24-hour storm for future land use conditions

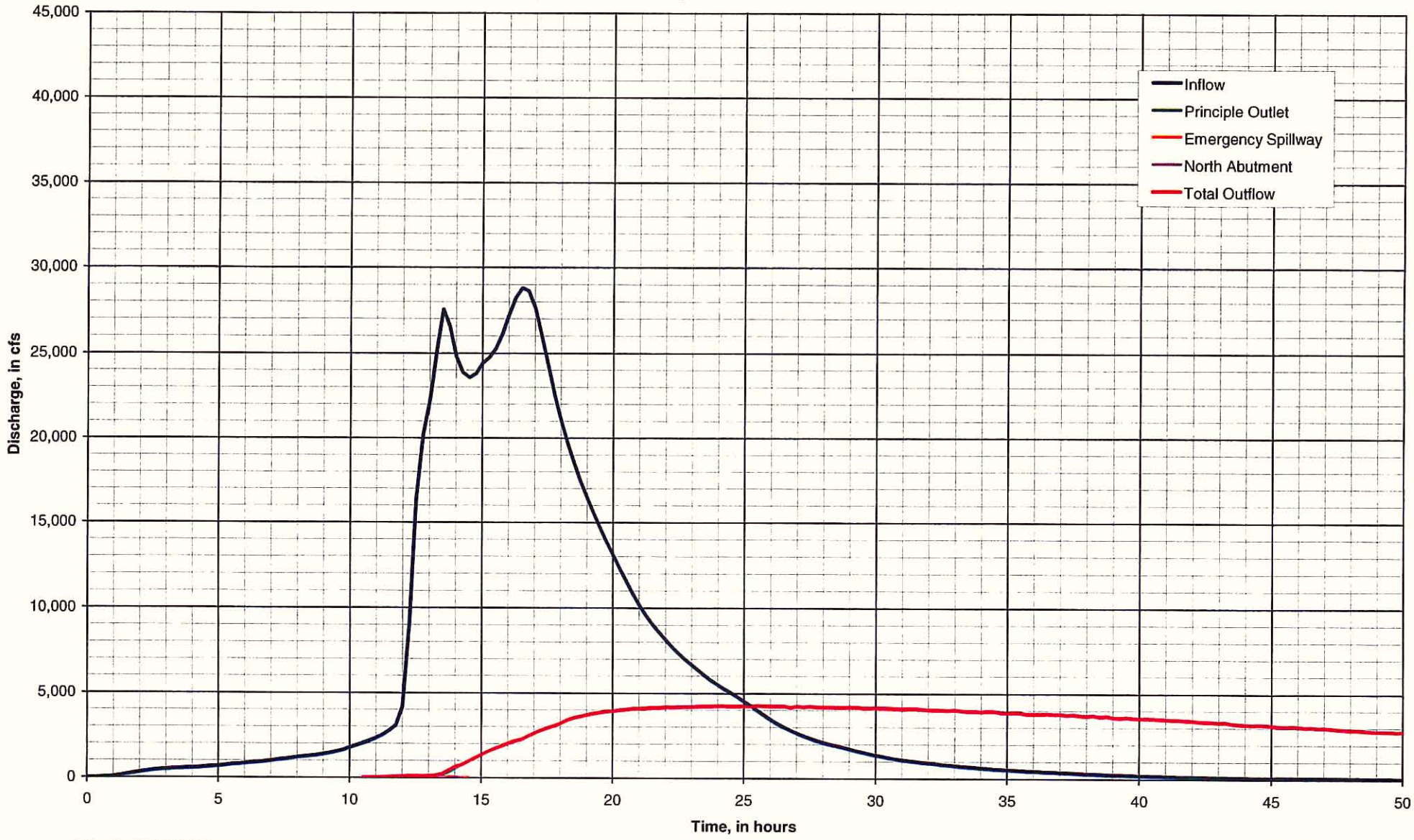
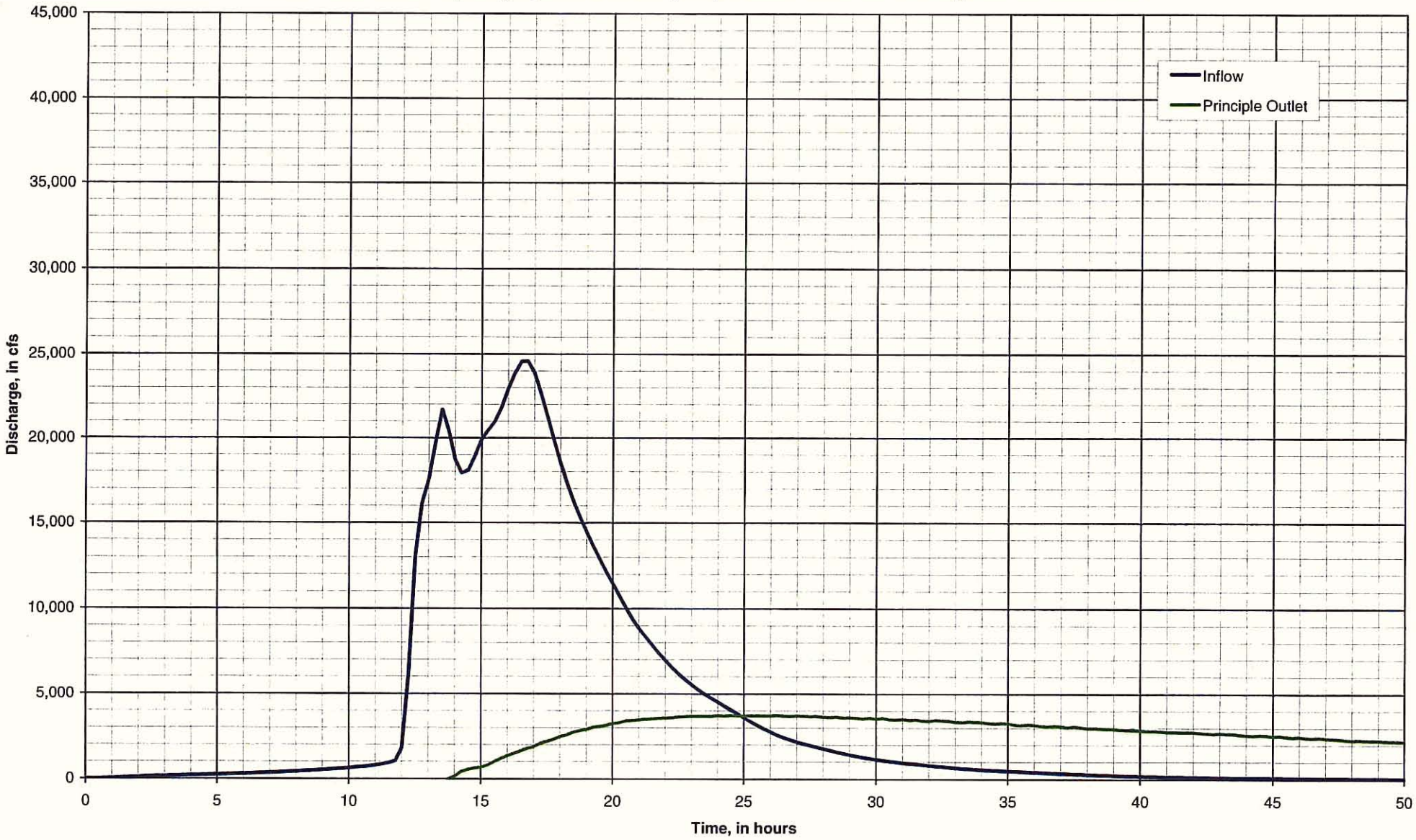


Figure MA-31
Inflow and outflow hydrographs for the 100-year, 24-hour storm for existing land use conditions



MA 3.7.6. 200-Year, Future and Existing Land Use Conditions

Inflow to the dam for the 200-year future and existing land use conditions is approximately 23,700 and 19,500 acre-feet, respectively. Routing of the flow through the reservoir results in a maximum water surface elevation of 1,356.0 feet and 1,354.0 feet for future and existing land use conditions, respectively. Inundation limits for both future and existing land use conditions provided digitally on CD as Exhibits MA-7 and MA-8, respectively.

Peak inflow and outflow discharges are listed in Table MA-8 and MA-9 for future and existing land use conditions, respectively. Inflow and outflow hydrographs are shown in Figure MA-32 and MA-33 for future and existing land use conditions, respectively. Flow through the principal outlet begins at hour 10.25 and 13.75 of the simulation for future and existing land use conditions, respectively. The peak flow for future conditions is approximately 4,500 cfs occurring at hour 25.52 of the simulation. The peak flow for existing land use conditions is approximately 4,200 cfs occurring at hour 25.56 of the simulation. Over the 50-hour simulation, the principal outlet conveys approximately 11,700 and 10,000 acre-feet for future and existing land use conditions, respectively.

For existing land use conditions, the maximum pool elevation in the emergency spillway approach channel is 1,353.6 feet. However, beginning at hour 13.25 of the simulation, inflow to the dam from sub-watershed 505 overtops the emergency spillway and north abutment due to the conveyance deficiencies of the emergency spillway approach channel and the inlet channel to the approach channel. For the future conditions, the emergency spillway and north abutment are overtopped due to the conveyance deficiencies of the approach channel beginning at hour 13.25 of the simulation. Then beginning at hour 22.75 of the simulation, the emergency spillway is overtopped due to ponding in the reservoir. Overtopping lasts for approximately 4.5 hours with a peak discharge of 18 cfs.

Figure MA-32
Inflow and outflow hydrographs for the 200-year, 24-hour storm for future land use conditions

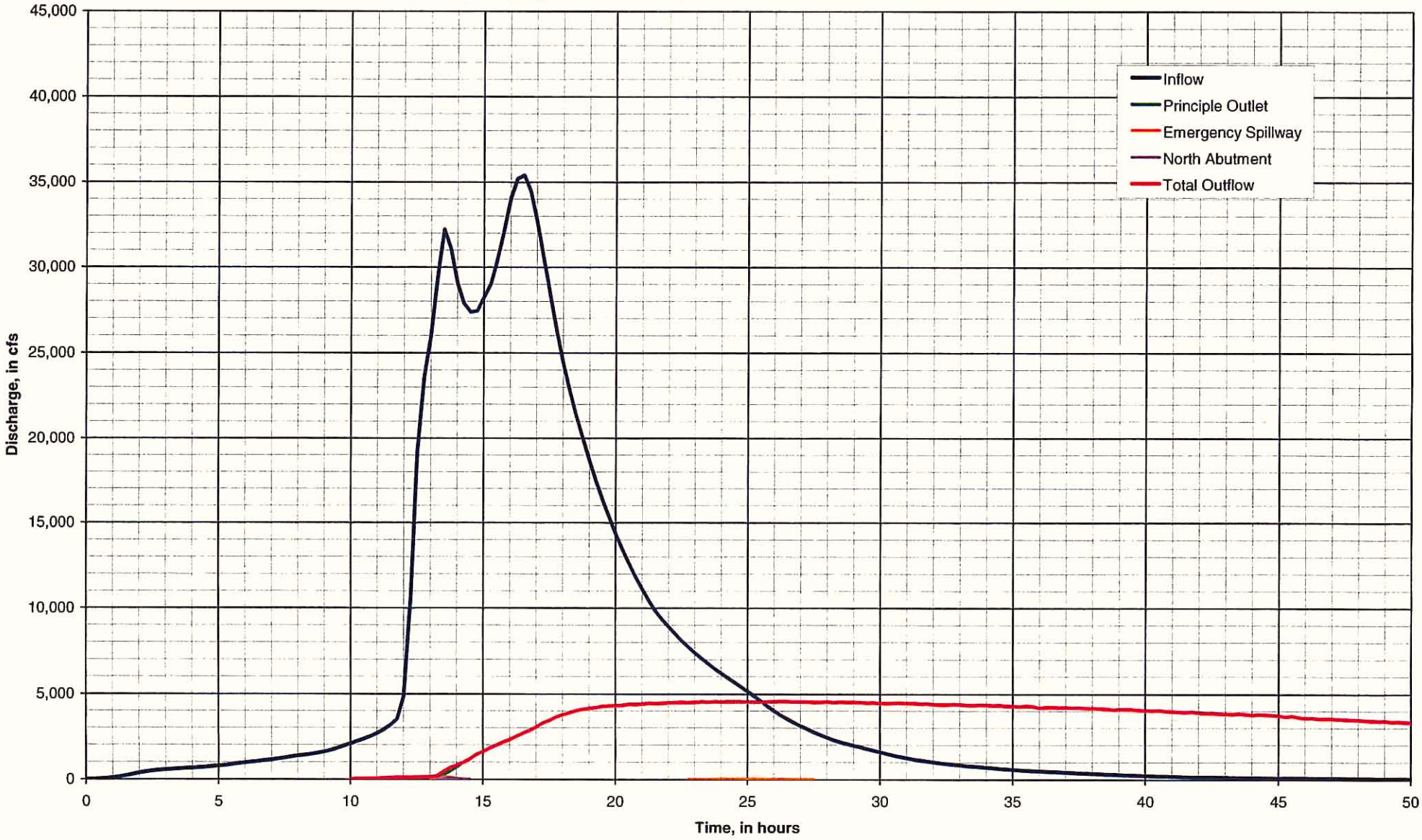
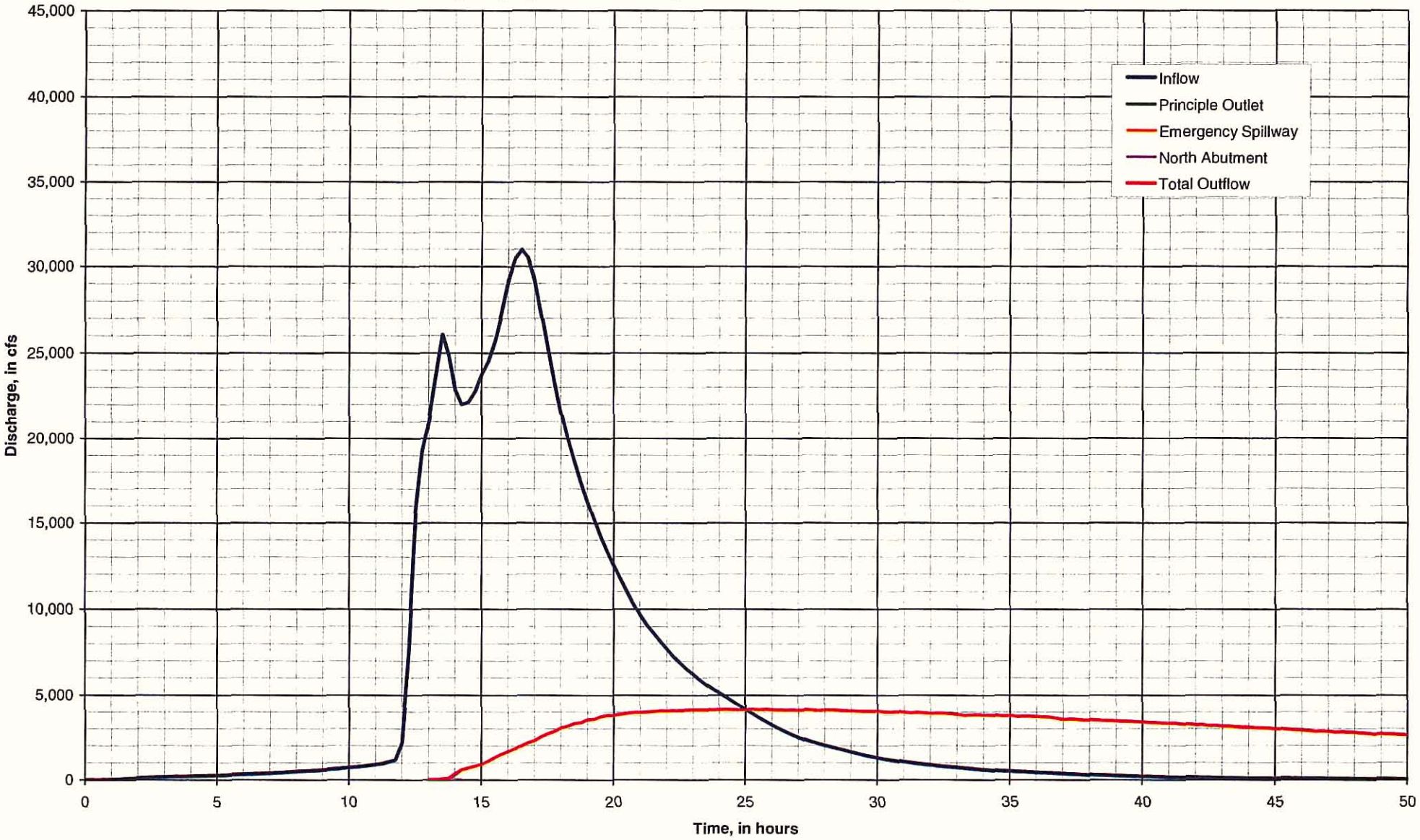


Figure MA-33
Inflow and outflow hydrographs for the 200-year, 24-hour storm for existing land use conditions



MA 3.7.7. 500-Year, Future and Existing Land Use Conditions

Inflow to the dam for the 500-year future and existing land use conditions is approximately 27,600 and 23,100 acre-feet, respectively. Routing of the flow through the reservoir results in a maximum water surface elevation of 1,357.4 feet and 1,355.7 feet for future and existing land use conditions, respectively. Inundation limits for both future and existing land use conditions provided digitally on CD as Exhibits MA-9 and MA-10, respectively.

Peak inflow and outflow discharges are listed in Table MA-8 and MA-9 for future and existing land use conditions, respectively. Inflow and outflow hydrographs are shown in Figure MA-34 and MA-35 for future and existing land use conditions, respectively. Flow through the principal outlet begins at hour 9.5 and 13. 5 of the simulation for future and existing land use conditions, respectively. The peak flow for future conditions is approximately 4,700 cfs occurring at hour 24.08 of the simulation. The peak flow for existing land use conditions is approximately 4,500 cfs occurring at hour 25.69 of the simulation. Over the 50-hour simulation, the principal outlet conveys approximately 12,600 and 11,500 acre-feet for future and existing land use conditions, respectively.

For existing land use conditions, the maximum pool elevation in the emergency spillway approach channel is right at the crest of the emergency spillway. However, beginning at hour 13.25 of the simulation, inflow to the dam from sub-watershed 505 overtops the emergency spillway and north abutment due to the conveyance deficiencies of the emergency spillway approach channel and the inlet channel to the approach channel. For the future conditions, the emergency spillway and north abutment are overtopped due to the conveyance deficiencies of the approach channel beginning at hour 13.25 of the simulation. Then beginning at hour 19.0 of the simulation, the emergency spillway is overtopped due to ponding in the reservoir. Overtopping lasts for approximately 15.25 hours with a peak discharge of 2,000 cfs.

Figure MA-34
Inflow and outflow hydrographs for the 500-year, 24-hour storm for future land use conditions

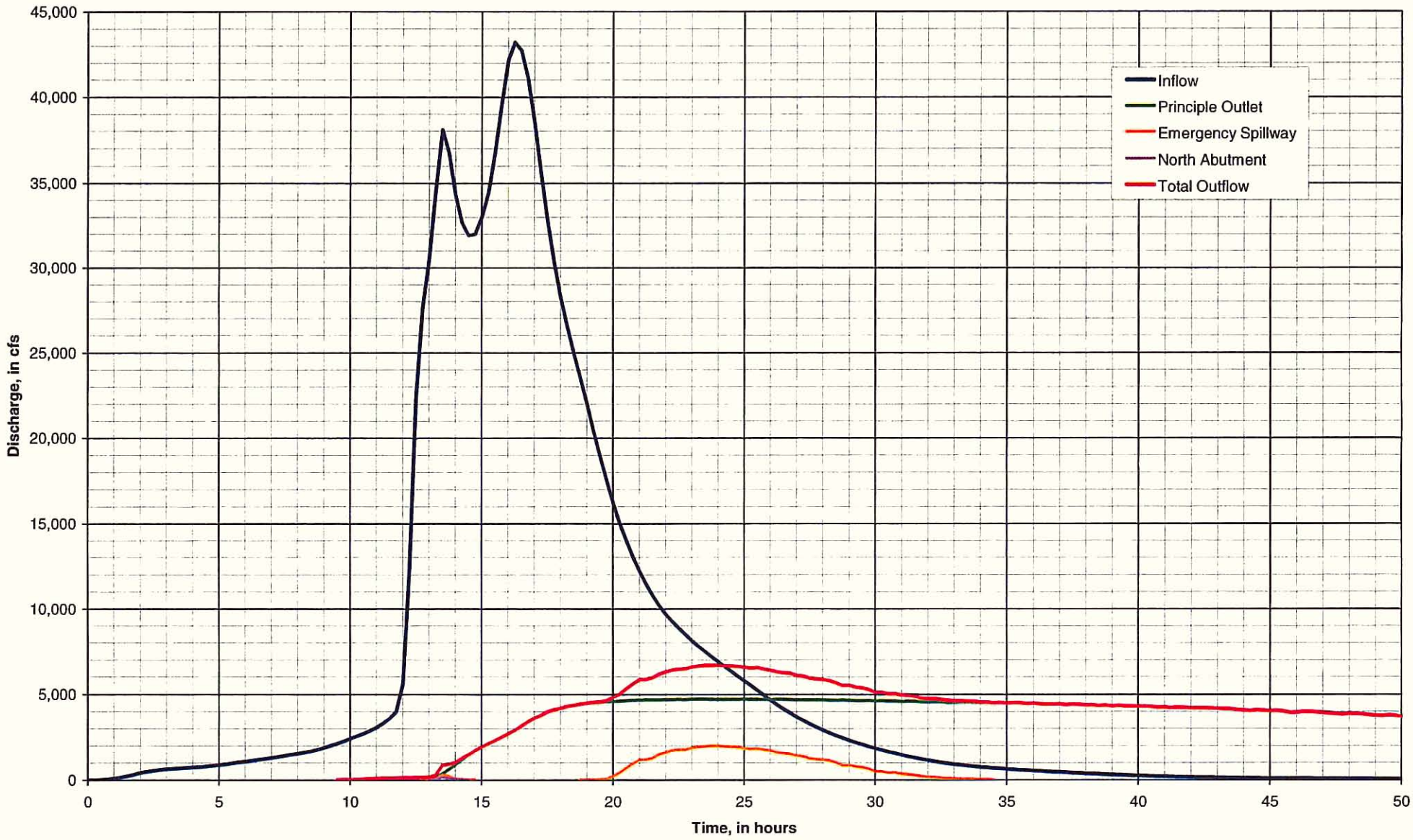
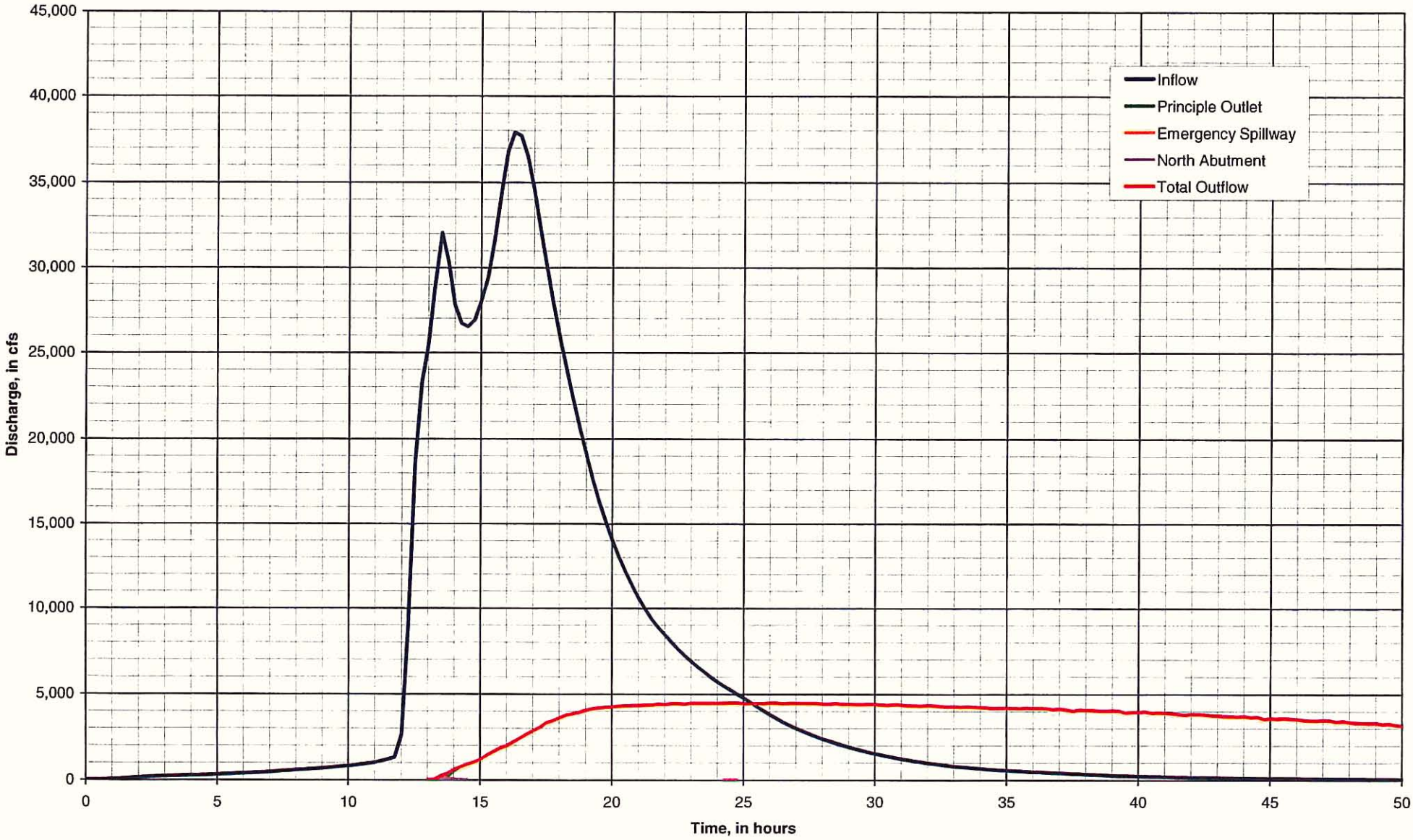


Figure MA-35
Inflow and outflow hydrographs for the 500-year, 24-hour storm for existing land use conditions



MA 3.7.8. Comparison of Results

Results of this study for the PMF are compared to the original design for the Maximum Probable Flood (MPF) as well as the results for the PMF from the SHB study (Section MA 2.4.2) and the PMF analyses conducted by the District (Sections MA 2.4.3 and 2.4.6). Inflow and outflow magnitudes and peak stage for each study along with the results of this study are listed in Table MA-10.

As can be seen from Table MA-10, the results of the various studies are remarkably similar in inflow and outflow magnitudes. Much of the differences among the previous studies are due to differences in the stage-storage-discharge relations used in the routing. Plots of the stage-storage and stage-discharge relations are provided on Figures MA-36 and MA-37, respectively. Inspection of those figures clearly shows the impact of subsidence (or possibly more detailed topography) and the vegetation in the approach channel. It is also important to note that the stage-storage relations of the previous studies exclude storage for future sediment. The volume of dead storage estimated by the USACE is 2,500 acre-feet.

Given the changes that have taken place since the dam was constructed, the recent studies performed by the District provide the most meaningful basis for comparison. Comparison of the results from these studies shows that the FLO-2D model predicts a lower peak discharge over the emergency spillway and a higher peak discharge over the dam. The corresponding maximum water surface elevation is also higher than what the HEC-1 models developed by the District predict. These differences are to be expected given the different modeling approaches. The previous District studies are based on a hydrologic routing technique that assumes a level pool and cannot account for losses associated with the movement of the floodwave through the impoundment. Furthermore, the rating curve used in HEC-1 to represent flow through the emergency spillway approach channel is based on a one-dimensional backwater model. A one-dimensional model cannot account for the losses associated with the inflow to the approach channel from sub-watershed 505 and underestimate the friction slope and thus overestimate the conveyance.

Table MA-10
Comparison of results from previous studies

	Inflow		Outflow				
Study	Discharge cfs	Volume acre-ft	P.O.[1] cfs	E.S.[2] cfs	Overtopping cfs	Total cfs	Stage[3] feet
USACE[4]	120,000	N/A	5,200	89,800	0	95,000	1362.0
SHB	155,800	96,700	5,300	118,500	0	123,800	1362.8
District, 1987	114,900	N/A	5,200	84,900	0	90,100	1,362.4
District, 2000	122,100	107,000	5,300	56,700	47,100	109,100	1,363.4
District, 2003	122,100	107,000	5,200	57,000	50,000	107,000	1,362.6
Wittmann ADMSU	129,600	107,500	5,300	51,300	58,700	113,800	1,364.2

Notes:
1. P.O. – Principal Outlet
2. E.S. – Emergency Spillway
3. Elevations reference to NAVD 88. Datum adjustment from NGVD 29 is + 2.015.
4. Results are not for the PMF. The data listed is an estimation of the maximum probable storm.

Figure MA-36
Comparison of stage-storage relations

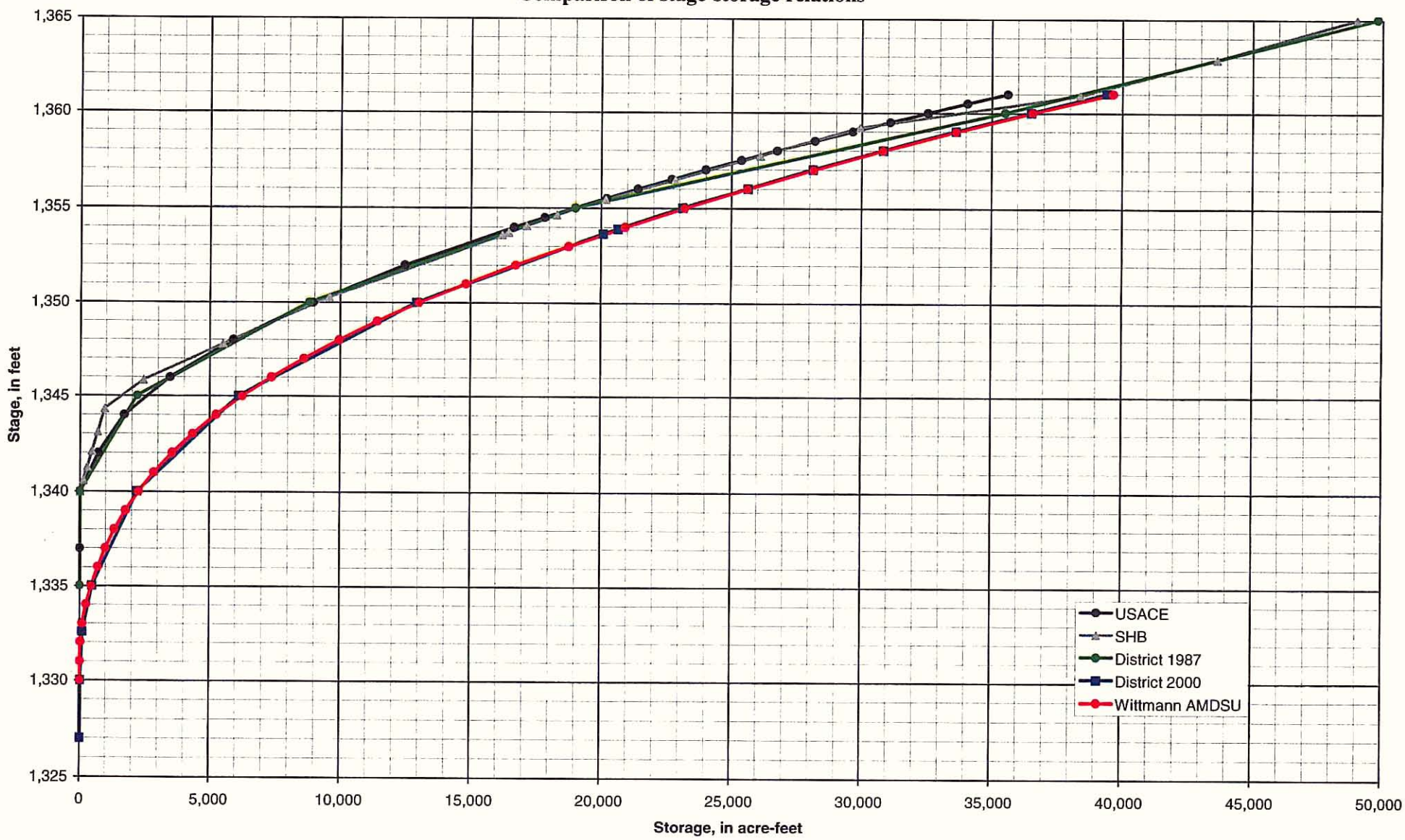
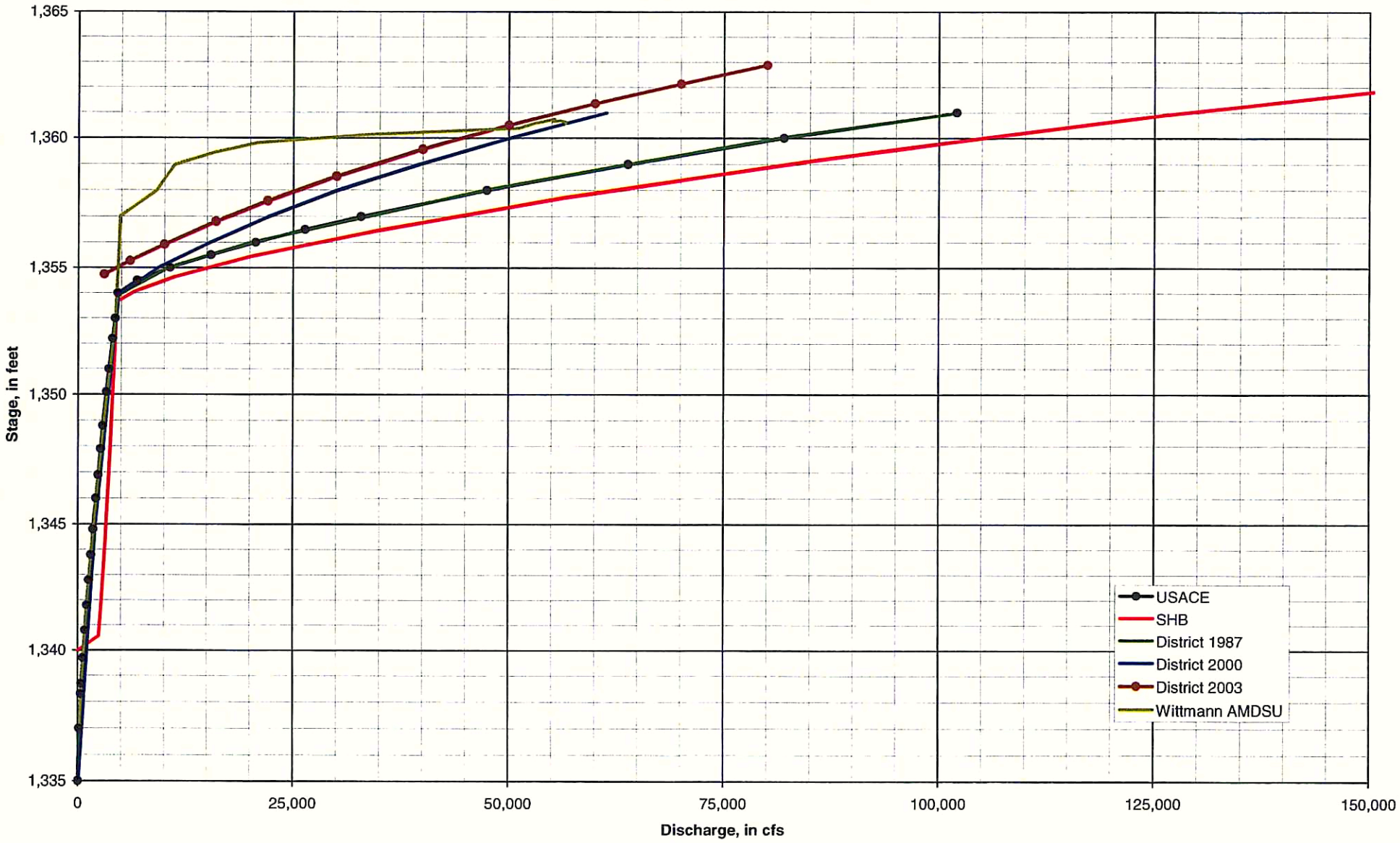


Figure MA-37
Comparison of stage-discharge relations



MA 3.8. Summary

Hydraulic routing of the inflow to McMicken Dam is accomplished using FLO-2D. Models are prepared for four storm events and two hydrologic conditions for a total of seven models. The key input parameter to achieve a successful simulation is the selection of the numerical stability criteria. Numerical stability criteria control the magnitude of the computational time interval. Because of the ponded flow conditions, very small computation time steps are required to achieve numerical stability.

The results of the models indicate that this dam is overtopped for a majority of its length during the PMF. The overtopping depth varies along the length of the dam with a maximum depth of 1.8 feet. During the 100-year event for future land use conditions as well as the 200- and 500-year events for both existing and future land use conditions, the north abutment of the dam (see Figure MA-20 for the relative location of those features) is overtopped due to insufficient conveyance capacity of the inlet channel that enters the dam at the emergency spillway approach channel. In addition, the presence of the vegetation in the approach channel reduces the conveyance capacity resulting in overtopping of the spillway due to the inflow that enters the approach channel. The model results also indicate that the spillway is overtopped due to ponding in the reservoir for the 200- and 500-year events for future land use conditions and that the water surface is at the crest of the spillway for the 500-year event with existing land use conditions.

For floods larger than about the 100-year event, Sun Valley Parkway presents a significant obstruction to the movement of the floodwave. The maximum water surface elevation differential across the roadway is as much as 4 feet and it takes nearly a full day for the water surface to equalize.

Comparison of the PMF results to previous studies shows that FLO-2D predicts a higher maximum water surface elevation and a higher peak discharge over the dam. Given the differences in the modeling techniques, a higher water surface elevation and corresponding overtopping discharge is to be expected. Yet the differences are remarkably similar providing a high degree of confidence in the reasonableness of the results. The refined accuracy of the two-dimension model results enhances the understanding of the reservoir hydraulics allowing for the identification of specific problem areas and thus the development of efficient and cost effective alternative solutions.

MA 4. Alternatives Analysis

MA4.1. General

An alternative analysis for McMicken Dam is prepared to provide a framework and baseline data for subsequent, more detailed alternative analyses and investigations. The main focus of this analysis is, therefore, to formulate and evaluate a list of viable and implementable solutions to the identified and potential safety deficiencies and failure modes.

Potential alternatives were formulated for two different options: dam rehabilitation and dam decommissioning. A concept level analysis of a selected alternative for each option was also performed to provide a benchmark for the general magnitude of the proposed improvements and the cost of those improvements.

MA 4.2. Alternative Formulation

Potential dam rehabilitation and decommissioning alternatives were developed through a series of meetings with stakeholders, District staff and key project team members. Each viable alternative considered is listed below along with a brief discussion. In addition, non-structural alternative elements that should be considered as an integral component of any structural measure were investigated by LTM Engineering Inc. and are presented in Section MA 5.

MA 4.2.1. Dam Rehabilitation Option

Descriptions of the dam rehabilitation alternatives identified during the formulation meetings are provided in the following sections. All viable dam rehabilitation alternatives must address the known and potential safety deficiencies and protect against potential failure modes. Potential failure modes were identified in the *McMicken Dam Individual Structures Assessment* (URS, 2002) and are summarized in Appendix E. Know and potential safety deficiencies with the dam are as follows:

- Embankment cracking due to desiccation and subsidence
- The embankment is founded on collapsible, unconsolidated Holocene soils
- Inadequate emergency spillway capacity
- Erosion of the north abutment of the dam

- Insufficient protection against internal erosion at the principal outlet
- Insufficient protection against internal erosion and structural integrity concerns of the corrugated metal pipes, herein referred to as low level outlets, located within the embankment

Raise Dam

The dam embankment would be raised to provide adequate freeboard. The dam would be raised to a height such that the IDF could be safely passed through the existing emergency spillway and principal outlet works without overtopping. Much of the construction required to raise the dam is already required to construct defenses against foundation and embankment cracking, erosion and against fissures. Material required to construct the new embankment could be obtained from the low flow channel or from the training dike northwest of the spillway. Borrow excavation from within the impoundment area would increase the amount of effective storage behind the dam. The existing non-functional low level pipes would be abandoned and the two functional pipes would be rehabilitated accordingly. The vegetation located in the emergency spillway approach channel would be cleared.

Increase the outlet capacity

Increasing the amount of flow that can be discharged from the dam will reduce the maximum water surface level in the reservoir. Increasing the discharge may also increase the risk of flooding during extreme flood events at locations downstream of the spillway. Three alternatives to increase the outlet capacity were identified. All three alternatives to improve the existing spillway also include the improvements to protect against foundation and embankment cracking and erosion and abandonment/rehabilitation of the low level outlets.

Widen emergency spillway - The existing emergency spillway would be lengthened to increase the capacity. The lengthened section would be constructed south of the existing spillway in the vicinity of the shooting range and the shooting range would be relocated. The berms around the range would be removed. The widened portion would be constructed with a Roller Compacted Concrete (RCC) dam/spillway section.

Fuse plug - The emergency spillway would be lengthened to increase the capacity. The lengthened section would be constructed south of the existing spillway in the vicinity of

the shooting range and the shooting range would be relocated. The berms around the range would be removed. The widened portion would be constructed with an RCC dam/spillway section. The crest elevation of the extension would be set at the same elevation as the existing spillway. The crest of the spillway would be backfilled with two feet of erodable fuse plug material to contain the 200-year. The fuse plug would be designed to begin eroding in a controlled manner once flow begins to pass over the spillway at a flood event larger than 200-year. This would dynamically increase the spillway capacity during passage of the IDF.

Additional spillway - A second spillway would be constructed at a separate location. The spillway would be constructed of RCC or Soil Cement and would be designed as an overtopping dam. The recommended location is north of Bell Road. This location provides a maximum length of about 7,500 feet of dam that could be reconstructed as a spillway. Providing a fuse plug fill on top of the RCC spillway maximizes the hydraulic capacity and flood protection and allows for aesthetic treatment of the spillway.

Other Methods

Other methods to rehabilitate the dam include a combination of the previous methods, segmentation and/or removal of a portion(s) of the dam, diversion of flow out of the dam, construction of a new dam or conversion of part of the dam to a channel with a levee, or reduction in the amount of flow into the dam. All of these alternatives will require protective measures for the existing embankment and low level outlets as previously described.

Raise Dam and Improve Emergency Spillway – This alternative optimizes the required raise for the dam embankment by improving the emergency spillway capacity. The dam embankment raise would be as previously described. Increasing the emergency spillway capacity could be accomplished by either modifying the existing emergency spillway or providing an additional or entirely new emergency spillway as previously described.

Reduce the inflow volume - The inflow volume can be reduce by diverting inflow, particularly the inflow from sub-watershed 505 that enters the impoundment at the north end of the emergency spillway approach channel. This flow could be diverted directly to the outlet channel. Alternatively, or in addition to diversion of inflow, it is anticipated that the use of a site-specific PMP would result in a reduction of 10 percent to more than

25 percent of the PMF. This may be a sufficient reduction in storm volume to demonstrate that the IDF is passed safely through the dam and the spillway without modifications to the height of the embankment or capacity of the spillway. Vegetation in the emergency spillway approach channel would be cleared.

Segment dam - Transverse dam segments would be constructed at locations between major inflow points. It is recommended that Trilby Wash be isolated from the rest of the watershed. Two new segments would be constructed; one along Bell Road, and a second about 1-½ miles north of Bell Road. Portions of the embankment south of Trilby Wash (south of Bell Road) could be lowered. A new spillway would be required for the dam segment at Trilby Wash. New low level outlet drains would be required at Bell Road and at the south end of the dam near Cactus Road. Other configurations could include the removal of the southern portion of the dam and construction of a collection system (channel/levee) upstream to divert flow into the existing impoundment area.

New dam on Trilby Wash - A new dam would be constructed on Trilby Wash farther upstream. The new dam could be located behind the CAP aqueduct. The existing dam would be rehabilitated and lowered as necessary.

MA 4.2.3. Dam Decommissioning Option

Descriptions of the dam decommissioning alternatives identified during the formulation meetings are provided in the following sections. The minimum design event for all decommissioning alternatives is the 100-year storm. All alternatives consider conveyance of runoff from the entire McMicken Dam and outlet channel watershed to the Agua Fria River.

Channel and Levee - The dam embankment would be lowered and portions removed such that it is no longer considered a jurisdictional dam. The outlet structure would be modified to pass the 100-year storm without impounding water. The outlet channel would be widened and the levee would be raised to convey the increased flow.

Detention/Retention - In addition to removing the dam and converting to a conveyance facility, detention / retention basin(s) would be constructed along the dam or outlet channel alignment or along major watersheds to divert flow out of the channel and to attenuate the peak flow rate.

New dam on Trilby Wash - A new dam would be constructed on Trilby Wash farther upstream. The new dam could be located behind the CAP aqueduct. The existing dam embankment would be lowered and portions removed such that it is no longer considered a jurisdictional dam. The outlet structure would be modified to pass the 100-year storm without impounding water. The outlet channel would be widened and the levee would be raised as necessary to convey the increased flow.

Utilize/Improve the CAP storage capacity - The CAP currently incorporates significant detention and retention storage behind the canal. These would be enlarged to provide 100-year minimum flood protection. This would serve to protect the CAP from larger floods as well as reduce the peak flow downstream. The existing dam embankment would be lowered and portions removed such that it is no longer considered a jurisdictional dam. The outlet structure would be modified to pass the 100-year storm without impounding water. The outlet channel would be widened and the levee would be raised as necessary to convey the increased flow.

MA 4.3. Alternative Evaluation

MA 4.3.1. Evaluation Criteria

Evaluation of the alternatives was accomplished by measuring the effectiveness at meeting a set of criteria. Evaluation criteria were identified during the alternative formulation process and were organized into seven major categories. A brief definition/description of each evaluation criterion is provided in the following sections.

Each category was assigned a weighting factor. The weighting factor represents the relative "importance" of each criterion in the evaluation process. Weighting factors for the major evaluation categories are listed in Table MA-11.

Table MA-11
Weighting factors for each evaluation category

Evaluation Category	Weighting Factor
Performance	10
Failure Consequences	10
Cost	7
Time and Schedule	4
Environmental	6
Additional Benefits	2
Landscape, Aesthetics and Multiuse	7

Evaluation of each alternative in regard to the criteria was accomplished during meetings with stakeholders, District staff and key project team members. The effectiveness of each alternative at meeting the evaluation criteria is represented numerically as a value between one and ten with one representing ineffectiveness and ten representing very effective. The values assigned for each alternative are shown in Tables MA-12 through MA-25. These tables are presented in pairs, one for the dam rehabilitation option alternatives and one for the dam decommissioning option alternatives. The seven pairs of tables correspond to the seven major evaluation categories and follow the definition/descriptions of the criterion for each category. Also shown in those tables are the "scores" for that category for each alternative. The score is calculated by multiplying the weighting factor by the average of the values assigned for each criterion. For example, there are 16 criterion in the Performance Category. The values assigned to each criterion for the dam raise alternative of the dam rehabilitation alternative range from 3 to 10 with an average value of 7. The weighting factor for that category is 10, therefore the effectiveness in terms of performance for the dam raise alternative is a value of 70.

Performance

Reduce risk - This criterion compares the probability of failure times the consequence of that failure (risk) of the project alternative with other alternatives. The risk is measured in several ways and includes risk for the District as well as the public.

Downstream and upstream flood protection - This criterion compares the level of flood protection, usually expressed as a measure of the recurrence interval for major floods, e.g.: 100-, 200-, 500-year or probable maximum flood. Upstream flood protection refers to the area upstream inundated by any impoundment. Downstream flood protection shall be a minimum 100-year storm for any alternative.

Safety - This measures a general perception of the level of safety provided by the design and provides another measure of the risk and the flood protection levels.

Regulatory and agency acceptance - The proposed improvements must meet the requirements of several agencies including Maricopa County, State of Arizona, USACE, EPA and possibly others.

Permanent solution (100-year life cycle) - The proposed improvement must be permanent and should have a 100-year design life, assuming regular inspection and maintenance is carried out.

Foundation and embankment failure modes - Foundation settlement, embankment cracking, erosion and piping are the basic failure modes and must be considered for all alternatives where a dam or levee embankment is to be constructed. Removal of the loose, unconsolidated Holocene soils, construction of effective cutoffs and filters and other methods should be used.

Subsidence - Subsidence is occurring at variable rates within the study area and the recommended alternative must account for an estimated 100 years of settlement at the estimated rates. Subsidence or differential settlement should not present a fatal flaw in the design.

Earth fissures - This is one of the failure modes for the dam and could cause a dam breach. It must be treated wherever a dam embankment is founded within a fissure risk zone. Channels, levees and basins within fissure risk zones should also have defensive mechanisms against uncontrolled release of water into a fissure.

Long term spillway requirements - Emergency spillways for dams must not be blocked. This is a dam safety regulation that must be met for any alternative.

Sediment deposition or transport - Dams and flood control basins should be able to accommodate sediment deposition. Sediment removal should be considered in the maintenance plan. Sediment deposits should not present a fatal flaw in the design for significant flood events. Channels and levees should be designed to handle scour and erosion and to prevent lateral migration and headcut.

Ability to monitor - Dams and levees should be designed such that embankment and foundation cracking due to subsidence or fissures can be readily detected.

Impacts on Loop 303 - Increase in discharge to the outlet channel may impact the proposed crossing at the freeway. Discharge of flow east from the dam may also cross the Loop 303 farther to the south and east. These flows must be safely conveyed to the outfall at the Agua Fria River.

Impacts on Luke Air Force Base - Reduction in the level of flood protection or increased flows directed towards the base could impact the cost of operations and maintenance at the base. These flows must be safely conveyed to the outfall at the Agua Fria River.

Table MA-12
Performance criteria ranking for the dam rehabilitation alternatives

Alternative	Reduce Risk	Downstream Flood Protection	Upstream Flood Protection	Safety	Regulatory and Agency Acceptance	Permanent Solution	Foundation Settlement	Embankment Piping	Impacts on Loop 303	Impacts on Luke Air Force Base	Erosion/Piping of Foundation Soils	Subsidence	Earth Fissures	Long Term Spillway Requirements	Sediment Deposition/Transport	Ability to Monitor	Total Score
Raise Dam	10	10	5	8	5	5	9	9	10	10	5	6	6	7	4	3	70
Widen Emergency Spillway	9	10	5	8	5	5	5	5	7	5	5	5	5	7	4	3	58
Fuse Plug	8	10	4	5	3	5	5	5	5	5	5	5	5	7	4	3	53
Additional Emergency Spillway	10	10	5	9	5	5	5	6	3	3	6	3	5	7	4	3	56
Raise Dam and Improve Emergency Spillway	10	10	5	8	5	5	9	9	10	10	5	6	6	10	4	3	72
Reduce Inflow	7	8	5	5	5	5	8	9	5	10	5	5	7	7	4	5	63
Segment Dam	9	8	5	7	5	5	9	9	3	3	5	6	6	7	4	5	60
New Dam on Trilby Wash	10	10	8	6	5	5	9	9	8	10	7	7	8	7	2	3	71

Table MA-13
Performance criteria ranking for the dam decommissioning alternatives

Alternative	Reduce Risk	Downstream Flood Protection	Upstream Flood Protection	Safety	Regulatory and Agency Acceptance	Permanent Solution	Foundation Settlement	Embankment Piping	Impacts on Loop 303	Impacts on Luke Air Force Base	Erosion/Piping of Foundation Soils	Subsidence	Earth Fissures	Long Term Spillway Requirements	Sediment Deposition/Transport	Ability to Monitor	Total Score
Channel and Levee	5	5	5	5	6	5	7	7	3	3	7	3	8	10	2	5	54
Retention/Detention	6	5	5	6	4	5	7	7	5	3	7	3	8	10	5	5	57
New Dam on Trilby Wash	7	6	7	6	4	5	6	6	5	3	6	7	8	10	7	3	60
Utilize/Improve CAP Storage Capacity	6	6	6	6	4	5	7	7	5	3	7	7	8	10	6	4	61

Failure Consequences

If the dam, channel, levee or basin fails for any reason, the consequences of the failure due to flooding and inundation should be estimated. The consequences include loss of life, damage to personal property and infrastructure and damage to the environment.

Table MA-14
Failure consequences criteria ranking for the dam rehabilitation alternatives

Alternative	Life	Property	Facility	Environmental	Total Score
Raise Dam	4	3	4	5	40
Widen Emergency Spillway	6	7	6	5	60
Fuse Plug	5	5	5	5	50
Additional Emergency Spillway	6	5	5	8	60
Raise Dam and Improve Emergency Spillway	7	8	7	6	70
Reduce Inflow	5	5	5	5	50
Segment Dam	8	8	8	8	80
New Dam on Trilby Wash	7	8	8	5	70

Table MA-15
Failure consequences criteria ranking for the dam decommissioning alternatives

Alternative	Life	Property	Facility	Environmental	Total Score
Channel and Levee	9	9	9	9	90
Retention/Detention	9	9	9	9	90
New Dam on Trilby Wash	7	8	8	5	70
Utilize/Improve CAP Storage Capacity	8	8	8	8	80

Cost

Capital cost - Capital cost includes the one time cost for construction of the improvements. Constructability should be considered in the capital cost.

Operations & Maintenance - Operations and maintenance should be estimated on an annual basis for a 100-year service life and should include inspection, monitoring, sediment removal and repairs.

Environmental Mitigation - This is the cost required to mitigate the permanent or temporary loss or damage to the environment caused by the construction or by on-going operations and maintenance. Mitigation for permanent loss of habitat may be required at an offsite location if it is not feasible to provide it within the project limits. This will usually be a requirement of the environmental permit(s).

Right of way - This is the cost to purchase additional right of way required by the proposed alternative. Alternatives should be designed within the existing right of way if at all possible.

BNSF railroad and other transportation infrastructure - Increase in discharge to the outlet channel will impact the crossings at US 60 and the railroad. Discharge of flow east from the dam may also cross other roads farther to the south and east. These flows must be safely conveyed to the outfall at the Agua Fria River.

Table MA-16
Cost criteria ranking for the dam rehabilitation alternatives

Alternative	Capital Cost	Operations and Maintenance	Landscaping	Environmental Mitigation	Right-of-Way	Transportation Infrastructure	BNSF	Total Score
Raise Dam	3	7	7	7	7	8	6	45
Widen Emergency Spillway	7	5	7	3	5	5	5	37
Fuse Plug	6	4	7	3	5	5	5	35
Additional Emergency Spillway	5	5	7	7	5	5	5	39
Raise Dam and Improve Emergency Spillway	5	7	8	7	8	8	8	51
Reduce Inflow	7	5	6	4	4	5	5	36
Segment Dam	3	5	3	3	6	6	5	31
New Dam on Trilby Wash	3	4	4	4	3	5	5	28

Table MA-17
Cost criteria ranking for the dam decommissioning alternatives

Alternative	Capital Cost	Operations and Maintenance	Landscaping	Environmental Mitigation	Right-of-Way	Transportation Infrastructure	BNSF	Total Score
Channel and Levee	5	5	4	5	6	3	3	31
Retention/Detention	4	3	4	4	3	4	4	26
New Dam on Trilby Wash	3	4	4	4	3	5	5	28
Utilize/Improve CAP Storage Capacity	3	3	4	5	3	5	5	28

Time and Schedule

Design and permitting for most projects will likely take about the same amount of time, however construction of a new dam and removal of the existing may take longer. Allowance should also be made for projects that will be constructed in phases.

Table MA-18
Time and schedule criteria ranking for the dam rehabilitation alternatives

Alternative	Design and Permitting	Construction	Total Score
Raise Dam	7	5	24
Widen Emergency Spillway	8	7	30
Fuse Plug	5	7	24
Additional Emergency Spillway	7	7	28
Raise Dam and Improve Emergency Spillway	7	7	28
Reduce Inflow	7	7	28
Segment Dam	3	3	12
New Dam on Trilby Wash	3	4	14

Table MA-19
Time and schedule criteria ranking for the dam decommissioning alternatives

Alternative	Design and Permitting	Construction	Total Score
Channel and Levee	5	4	18
Retention/Detention	3	3	12
New Dam on Trilby Wash	3	4	14
Utilize/Improve CAP Storage Capacity	3	4	14

Environmental

Restoration - The extent of permanent impacts to the environment and the ability to restore temporary impacts to a baseline condition should be considered.

Impacts to wildlife habitat, cultural resources and Waters of the US - The impacts should be quantified and must be mitigated to obtain permits for construction of the project. Schedule and cost of the project may also be affected by these issues.

Table MA-20
Environmental criteria ranking for the dam rehabilitation alternatives

Alternative	Restoration	Vegetation	Wildlife Habitat	Cultural Resources	Waters of the U.S.	Total Score
Raise Dam	7	4	4	7	8	36
Widen Emergency Spillway	7	3	4	7	5	31
Fuse Plug	7	3	3	7	5	30
Additional Emergency Spillway	7	6	6	5	5	35
Raise Dam and Improve Emergency Spillway	8	8	5	7	8	43
Reduce Inflow	3	4	4	7	4	26
Segment Dam	8	5	7	5	5	36
New Dam on Trilby Wash	6	6	5	5	5	32

Table MA-21
Environmental criteria ranking for the dam decommissioning alternatives

Alternative	Restoration	Vegetation	Wildlife Habitat	Cultural Resources	Waters of the U.S.	Total Score
Channel and Levee	1	5	6	5	4	25
Retention/Detention	1	5	6	5	4	25
New Dam on Trilby Wash	6	6	6	5	4	32
Utilize/Improve CAP Storage Capacity	6	5	5	5	4	30

Opportunities for Additional Benefits

Flood protection - The ability to increase the level of flood protection by raising the levee on the outlet channel, constructing a new dam upstream, or reducing the extent of the PMF flood pool should be considered as benefits. The ability of the project to provide a regional outfall for development occurring upstream is another benefit.

Mitigation Banking - Excess land generated by an alternative may provide a location to establish a mitigation site for other District, county or other municipal agency projects.

Excess land Revenue - Excess land generated by an alternative could be disposed and used to offset project costs. The value of excess land within the fissure risk zones should be discounted in value and only considered for appropriate land use types.

Excess material Revenue - Excavation to increase storage, remove the dam, remove the training dike or construct channels may be sold or donated for use as borrow material by local development or other construction needs. This can be used to offset project costs.

Table MA-22
Additional benefits criteria ranking for the dam rehabilitation alternatives

Alternative	Flood Protection	Mitigation Banking	Excess Land Revenue	Excess Material Revenue	Total Score
Raise Dam	9	6	4	6	13
Widen Emergency Spillway	7	6	4	5	11
Fuse Plug	6	6	4	5	11
Additional Emergency Spillway	5	6	4	6	11
Raise Dam and Improve Emergency Spillway	9	8	5	5	14
Reduce Inflow	6	5	3	4	9
Segment Dam	7	7	5	8	14
New Dam on Trilby Wash	8	7	6	7	14

Table MA-23
Additional benefits criteria ranking for the dam decommissioning alternatives

Alternative	Flood Protection	Mitigation Banking	Excess Land Revenue	Excess Material Revenue	Total Score
Channel and Levee	3	3	8	8	11
Retention/Detention	3	3	8	8	11
New Dam on Trilby Wash	5	4	7	8	12
Utilize/Improve CAP Storage Capacity	5	4	7	8	12

Landscaping, Aesthetics and Multiuse Opportunities

Landscape character - Certain types of structures conform more easily to the existing landscape character. Compatibility with the local environment is a goal for the project.

Recreation/multiuse - Potential uses include active and passive recreation, groundwater recharge, open space, mitigation sites, or other uses. A regional trail system is planned along the McMicken Dam corridor.

Table MA-24
Landscape, aesthetics and multiuse criteria ranking for the dam rehabilitation alternatives

Alternative	Recreational/Multiuse	Landscape Character	Regional Trail	Total Score
Raise Dam	5	6	4	35
Widen Emergency Spillway	6	2	5	30
Fuse Plug	6	5	4	35
Additional Emergency Spillway	4	6	4	33
Raise Dam and Improve Emergency Spillway	5	5	5	35
Reduce Inflow	2	2	2	14
Segment Dam	8	7	6	49
New Dam on Trilby Wash	6	5	6	40

Table MA-25
Landscape, aesthetics and multiuse criteria ranking for the dam decommissioning alternatives

Alternative	Recreational/Multiuse	Landscape Character	Regional Trail	Total Score
Channel and Levee	9	8	9	61
Retention/Detention	10	8	9	63
New Dam on Trilby Wash	6	5	6	40
Utilize/Improve CAP Storage Capacity	6	2	2	23

MA 4.3.1. Selected Alternative

The overall effectiveness of each alternative is summarized by the major categories for the dam rehabilitation option and the dam decommissioning option in Tables MA-26 and MA-27, respectively. The maximum score that could be achieved by any alternative is 460. As can be seen from Table MA-26, the alternative that received the highest score for the dam rehabilitation alternative is the dam raise and improved emergency spillway with a total score of 313. Table MA-27 shows that the alternative of converting the dam to a levee received the highest score of the dam decommissioning alternatives of 290. These are the selected alternatives for each option for which a concept level analysis and cost estimate is prepared.

Table MA-26
Dam rehabilitation option alternative rankings

Alternative	Performance	Failure Consequences	Cost	Time and Schedule	Environmental	Additional Benefits	Landscape, Aesthetics and Multiuse	Total Score
Raise Dam	70	40	45	24	36	13	35	263
Widen Emergency Spillway	58	60	67	30	31	11	30	258
Fuse Plug Emergency Spillway	53	50	35	24	30	11	35	237
Additional Emergency Spillway	56	60	39	28	35	11	33	261
Raise Dam and Improve Emergency Spillway	72	70	51	28	43	14	35	313
Reduce Inflow	63	50	36	28	26	9	14	226
Segment Dam	60	80	31	12	36	14	49	282
New Dam on Trilby Wash	71	70	28	14	32	14	40	269

Table MA-27
Dam decommissioning option alternative rankings

Alternative	Performance	Failure Consequences	Cost	Time and Schedule	Environmental	Additional Benefits	Landscape, Aesthetics and Multiuse	Total Score
Channel and Levee	54	90	31	18	25	11	61	290
Retention/Detention	57	90	26	12	25	11	63	284
New Dam on Trilby Wash	60	70	28	14	32	12	40	256
Utilize/Improve CAP Storage Capacity	61	80	28	14	30	12	23	248

MA 4.4. Engineering Analysis

MA 4.4.1. General

The selected alternative for the dam rehabilitation option is to raise the dam and increase the emergency spillway capacity. The selected alternative for the dam decommissioning option is to convert the dam to a channel and levee. Analysis of these alternatives is intended to provide a general order of magnitude of the dimensions of the proposed features and project cost. It is recognized that there are numerous possible configurations and alignments of the proposed features that could be investigated and optimized. However, for the purposes of this study, only one scenario is analyzed for each alternative. For the dam rehabilitation alternative, analysis is limited to modification of the FLO-2D model and existing HEC-RAS models of the outlet channel. For the dam decommissioning alternative, analysis is limited to normal depth calculations.

As stated previously, landscape, aesthetic and multiuse opportunities are a goal of this project. Initial identification of opportunities for enhancements of the existing landscape character and multiuse opportunities was performed as part of this study and are documented in a report entitled *McMicken Dam Final Landscape Character Compatibility Analysis Report* (Stantec, 2005, Volume LA). That report is intended to be used for future alternative investigations and assessments. Included in that report is an analysis of the compatibility of typical features associated with the selected alternative as well as unit costs for typical landscape enhancements.

MA 4.4.2. Dam Rehabilitation

This alternative optimizes the required dam embankment raise by increasing the emergency spillway capacity. The embankment would be raised to a height such that the Inflow Design Flood (IDF) could be safely passed through the emergency spillway and principal outlet without overtopping and would include adequate residual freeboard. The embankment raise would include modifications necessary to defend against foundation and embankment cracking, as well as erosion and earth fissures. Material required to construct the new embankment could be obtained from the low flow channel or from the training dike northwest of the emergency spillway. Borrow excavation from within the impoundment area would slightly increase the amount of effective storage behind the dam, but is not considered in the analysis. For the five low level outlets, the three non-functional outlets would be properly abandoned and the two functional outlets would be

rehabilitated and modified as necessary to conform to the proposed embankment dimensions including landscape aesthetic treatments.

Increasing the emergency spillway capacity could be accomplished by modifying the existing emergency spillway, providing an additional spillway or providing an entirely new emergency spillway or various combinations of these approaches. Utilization of the emergency spillway would involve removal of the vegetation within the approach channel. Long term maintenance would also be required to keep the approach channel free of vegetation and prevent further spreading. This level of maintenance may not be practical from both and economic and environmental perspective. Therefore, an entirely new spillway is proposed that includes the construction of a new end of dam segment across the entrance to the approach channel. The existing emergency spillway and approach channel would be abandoned. Inflow from sub-watershed 505 could either be rerouted into the impoundment area or allowed to bypass the dam. If the inflow is rerouted into the dam, it is recommended that a bifurcation structure be provided to allow frequent flows to continue feeding the vegetation in the existing approach channel. For this analysis, it is assumed that the inflow from sub-watershed 505 will bypass the dam. Bypassing the dam will require improvements to the Beardsley Canal overchute and the outlet channel levee. The location of the new emergency spillway, end of dam segment and other related facilities are shown on Exhibit MA-11. Construction of the new emergency spillway would require relocation of the shooting ranges and disposal of the lead contaminated soils. The new emergency spillway would be constructed of RCC. The spillway could be stepped for energy dissipation and an apron of sufficient size be provided.

Design Criteria

Analysis of the dam rehabilitation alternative is based on several key design criteria. Those criteria are as follows:

- One foot of residual freeboard for the earth fissure risk zone (Station 77+50 to 105+00)

- Two feet of residual freeboard for the embankment cracking zone (Station 105+00 to end of dam), 1 foot of long-term, residual freeboard and 1 foot for future subsidence

- Emergency spillway crest set at the 100-year flood pool elevation
- Routing of the IDF starting with a dry pool
- Sediment storage of 4,340 acre-feet

Sediment Storage

The volume of sediment to be stored is estimated to be 4,340 acre-feet. The estimate is based on a sediment yield analysis performed as part of the overall project (WEST 2004, Volume GR). A brief discussion of the sediment yield analysis as well as other data and interpretations used in the estimation of the sediment storage volume are provided in Appendix F.

Hydrology

Hydrologic data used in the analysis of the dam rehabilitation alternative is discussed in Section MA 3.4. For the PMF, inflow hydrographs to the dam are modified to account for sediment storage. Incorporation of the sediment storage volume into the FLO-2D modeling is accomplished by bulking the inflow volume by the 4,340 acre-feet of sediment. The 4,340 acre-feet of additional volume is distributed among the inflow hydrographs except sub-watershed 505 based on contributing drainage area. The volume of sediment is converted to a rate assuming a uniform distribution over a 24-hour period starting shortly after the onset of runoff (hour 5 of the simulation). The estimated inflow rate of sediment (bulked flow) for each inflow hydrograph is listed in Table MA-28. Use of a bulked flow approach simulates the distributive nature of how sediment is delivered to the dam as well as where the sediment is deposited within the impoundment.

Determination of potential impacts to the outlet channel due to the runoff from sub-watershed 505 bypassing the dam required modifications to the 100-year, 24-hour future conditions HEC-1 model discussed in Section MA 3.4. The purpose of the modifications is to estimate the peak discharge in the outlet channel in order to identify reaches that require raising the levee to contain the additional inflow. Because of hydrograph timing issues and aerial reduction of the design rainfall for Maricopa County, the model was run both with and without outflow from the dam. The modified HEC-1 models are provided digitally on CD as Appendix H. The 100-year, 24-hour peak discharges for future land use conditions along the outlet channel for both current and proposed conditions are listed in Table MA-29.

Table MA-28
Bulked inflow

Sub-watershed	Drainage Area sq. miles	Sediment Volume acre-ft	Sediment Discharge cfs
130	6.34	126	63
120	9.48	188	95
WT110	2.90	57	29
WT100	3.84	76	38
400	117.35	2,324	1,172
510	39.66	786	396
500.1	39.54	783	395

Table MA-29
100-year, 24-hour future land use condition peak discharges along the Outlet Channel

	With Dam Outflow			Without Dam Outflow		
HEC-1 Concentration Point	Drainage Area sq. miles	Without Bypass cfs	With Bypass cfs	Drainage Area[1] sq. miles	Without Bypass cfs	With Bypass cfs
600	30.2	7,850	7,850	30.2	7,850	7,850
600*	242.3	6,540	6,960	48.1	---	7,740
710*	283.5	8,940	9,580	89.3	9,890	10,150
700*	294.5	8,420	9,620	100.2	9,060	9,640

Notes:

1. The drainage areas include the 17.9 sq. mile area from sub-watershed 505.

Analysis

Analysis of the selected dam rehabilitation alternative includes two-dimensional reservoir routing and one-dimensional steady flow modeling of the outlet channel. Determination of the size of emergency spillway and required embankment raise to safely pass the PMF is accomplished by modifying the two-dimensional reservoir routing model prepared for the existing conditions analysis. The modifications to the model are listed below. The FLO-2D input and output files are provided digitally on CD as Appendix H.

- Levee crest elevations representing the dam are increased to prevent overtopping
- Inflow to the dam is bulked to account for sediment
- New levee data is added to represent the proposed north end of dam segment
- Rating curves representing the proposed emergency spillway are added

- Grid elevations downstream of the proposed emergency spillway are modified to reflect the proposed conditions

The proposed emergency spillway is 2,250 feet in length and is located approximately 500 feet north of the principal outlet as illustrated in Exhibit MA-11. The crest of the emergency spillway is set at an elevation of 1,355. 5 feet, slightly higher than the average elevation of the existing emergency spillway. This elevation is just above the 100-year pool elevation. The emergency spillway would be constructed of RCC. The downstream face could be stepped for energy dissipation and an apron of sufficient size be provided. A typical section of the proposed spillway with an apron is shown in Figure MA-38. The apron length shown in Figure MA-38 is the calculated length required to contain the hydraulic jump. Calculations for the apron length are provided in Appendix F. Flow over the proposed emergency spillway will pass through critical depth. A rating curve based on critical depth for a rectangular section is shown in Figure MA-39. Also shown in that figure are the USACE design and the existing condition stage-discharge curves. The proposed emergency spillway is represented with nine grid cells in the FLO-2D model. The proposed rating curve was divided uniformly across the nine grid cells.

Analysis of the outlet channel capacity is accomplished using existing HEC-RAS models. The outlet channel is divided into two reaches essentially at the U.S. 60 and BNSF railroad bridges. The HEC-RAS model for the upstream reach was prepared as part of the *McMicken Dam Outlet Channel Analysis* (Michael Baker Jr, 2003). The HEC-RAS model for the downstream reach was prepared as part of the *Emergency Action Plan Update for McMicken Dam Outlet Channel* (LTM/Kimley-Horn and Associates, 2004). Input and output files are provided digitally on CD as Appendix H. Modifications to those models made for the purposes of this study are listed below.

- Peak discharges are modified based on current hydrology and proposed conditions as discussed previously.

- The upstream reach HEC-RAS model boundary condition was set to a known water surface elevation based on the downstream reach model.

- Levee stations were added to the geometry to facilitate reporting.

Figure MA-38
Proposed emergency spillway typical section

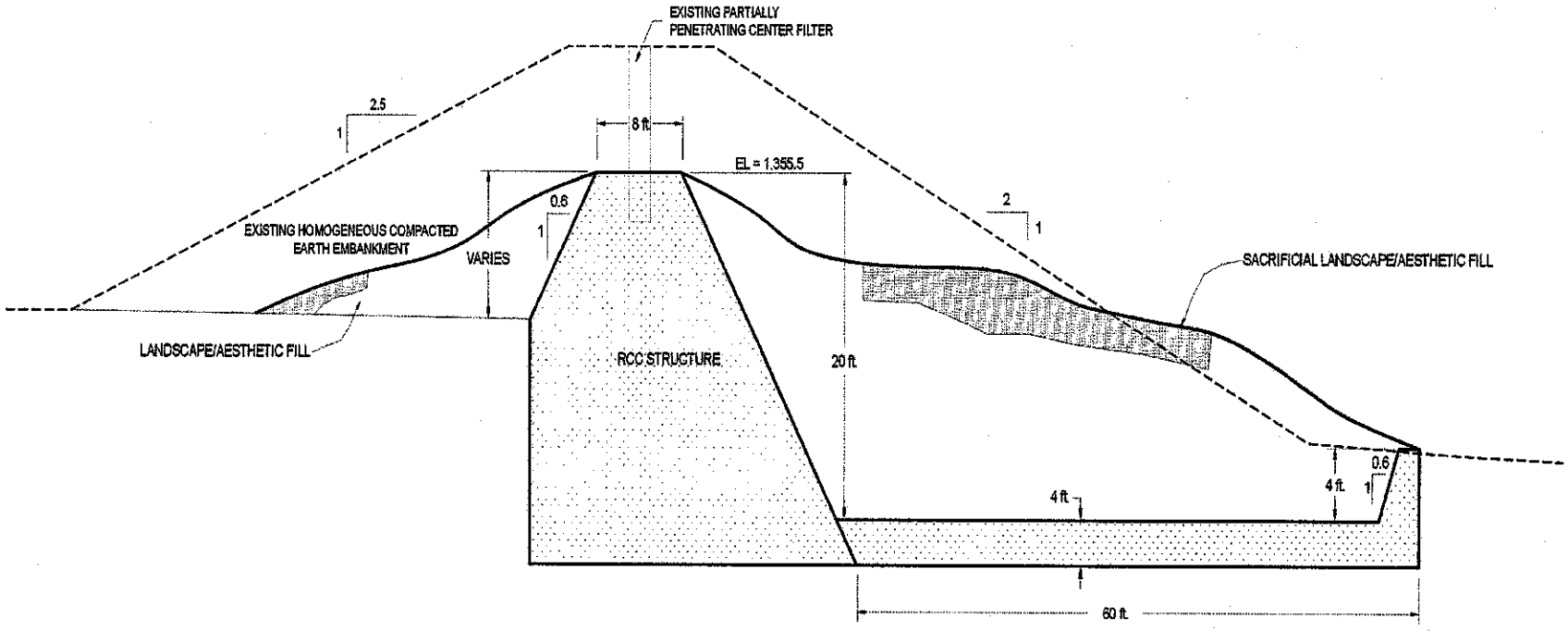
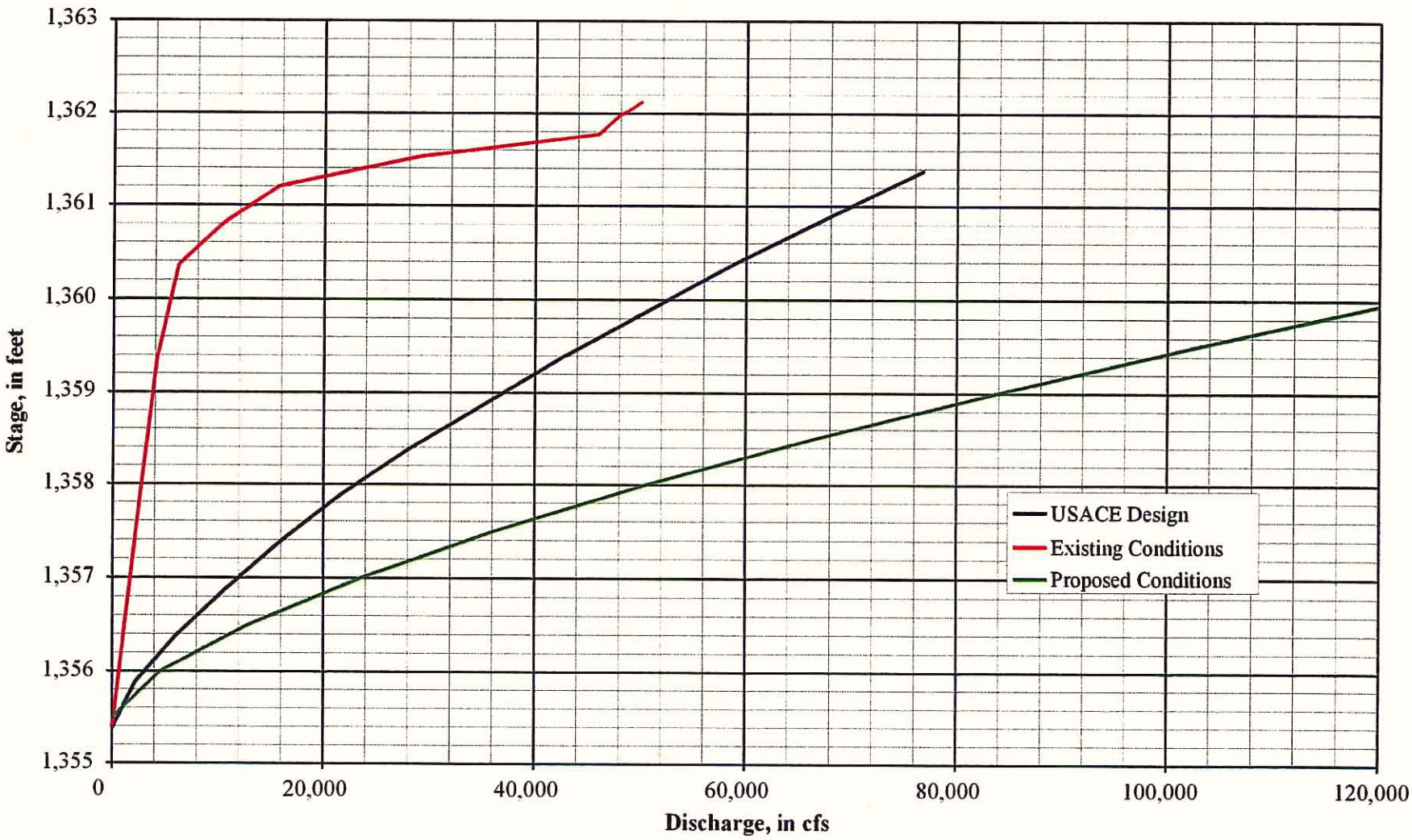


Figure MA-39
Comparison of stage-discharge relations



Results

The proposed emergency spillway is more efficient than the existing spillway. The peak discharge with the proposed spillway is 94,000 cfs compared to 51,000 cfs for the existing spillway. A comparison of the outflow hydrographs is provided in Figure MA-40. The efficiency of the existing emergency spillway is limited due to the presence of the vegetation in the approach channel and the effects of the inflow from sub-watershed 505 that enters at the northern end of the approach channel. In addition, tailwater conditions at the crest section of the emergency spillway may also reduce the efficiency.

The increased efficiency of the proposed emergency spillway and the additional length results in a maximum water surface elevation for the PMF of 1,363.1 feet, which occurs at the southern end of the dam. Profiles of the existing water surface elevation and the proposed water surface elevation are shown in Figure MA-41. As can be seen in that figure the proposed water surface elevation at the south end of the dam is very similar to the existing water surface elevation. For the southern half of the dam, the maximum water surface elevation is essentially level. North of Sun Valley Parkway, particularly starting station 350+00, the water surface elevation gradient begins to increase. From station 350+00 to 480+00 (the southern end of the proposed spillway) the water surface elevation drops approximately 2.5 feet and is below the existing top of dam.

The proposed embankment raise is illustrated in Figure MA-41. Between stations 77+50 and 105+00 (earth fissure risk zone) the required freeboard is 1 foot. For this reach of the dam the required embankment raise varies between 0.6 feet and 1.6 feet and averages 1.1 feet. Between station 105+00 and 280+00 (Sun Valley Parkway) the required freeboard is 2 feet. For this reach, the required embankment raise varies between 1.9 feet and 2.6 feet and averages 2.3 feet. Between stations 280+00 and 350+00 the required embankment raise varies between 1.6 and 2.3 with an average of 1.9. Near station 460+00, the water surface elevation is low enough that an embankment raise is not required, however, repairs to the embankment due to cracking and the presence of the Holocene soils are still required.

The HEC-RAS models for the outlet channel are run for both the existing condition discharges (100-year, future land use conditions) and the proposed conditions that include runoff from sub-watershed 505. Water surface profiles are provided in Exhibit MA-11

for both existing and proposed conditions. The existing condition results show that the majority of the levee does not meet current FEMA freeboard criteria. Adding the runoff from sub-watershed 505 has a relatively minor, incremental impact except for a short section upstream of U.S. 60 where the proposed water surface elevation is higher than the existing levee crest elevation. Both the existing and proposed levee crest elevations are shown in Exhibit MA-11. As can be seen in that exhibit, much of the lower reach of the outlet channel has more than the FEMA freeboard criteria of 3 feet.

Figure MA-40
Proposed emergency spillway discharge hydrograph for the PMF

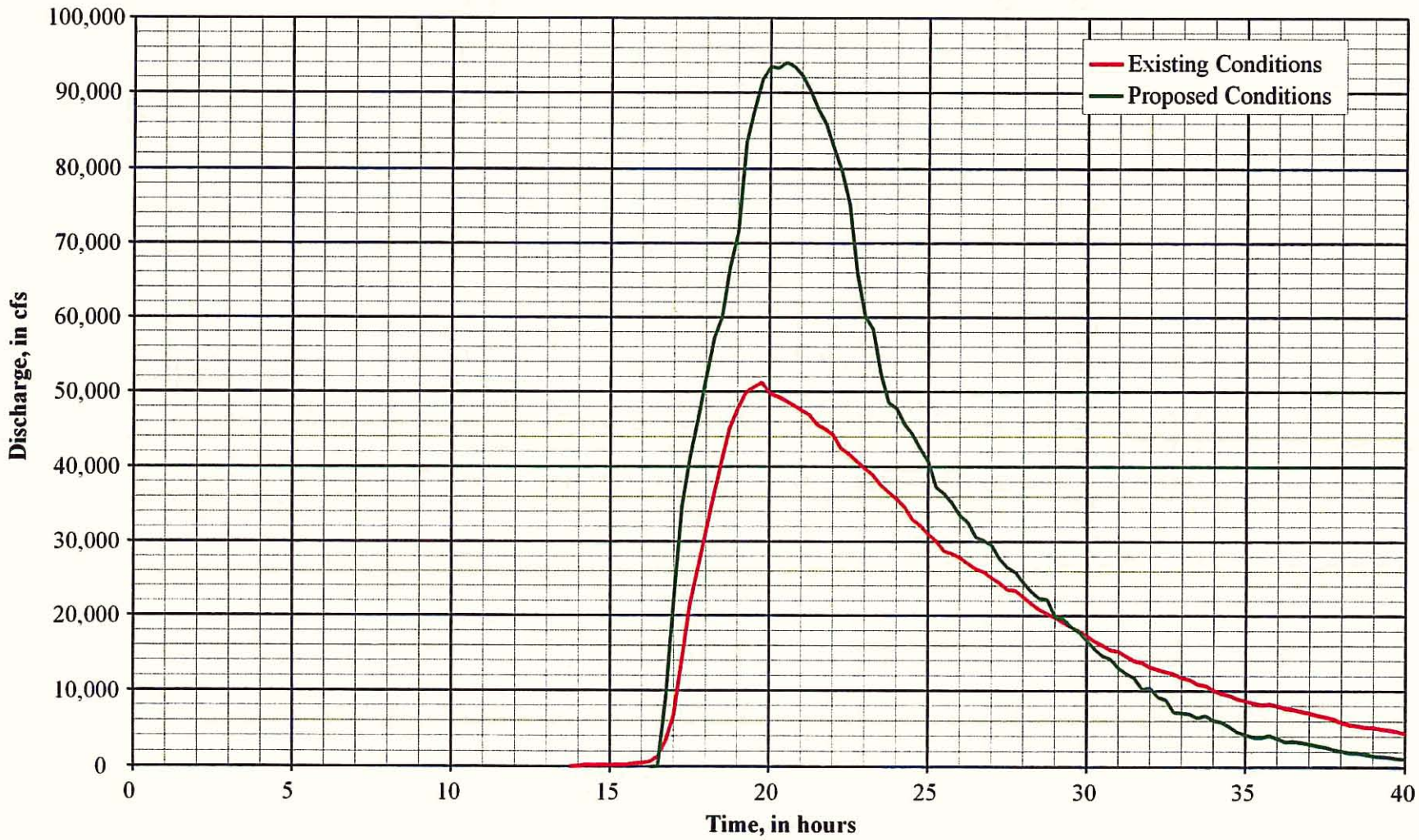
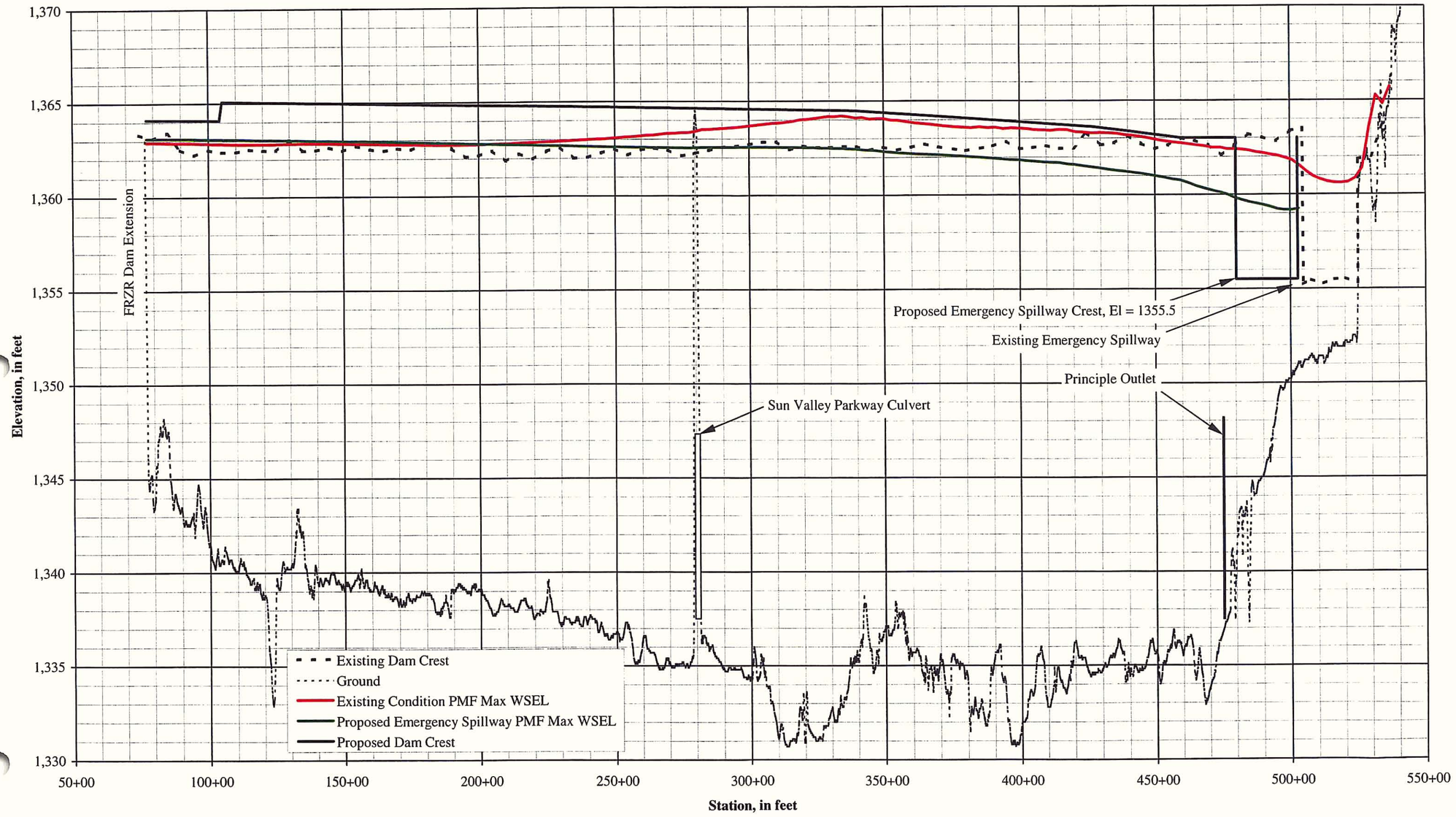


Figure MA-41
Maximum water surface elevation profiles along the low flow channel of the dam

Note:
Maximum water surface profiles represent the maximum water surface elevation for each grid cell along the face of the dam that occurred during the simulation.



MA 4.4.3. Dam Decommissioning

This alternative converts the dam to a channel. The channel and levee would extend from the southern end of the dam to the Agua Fria River and is designed for the 100-year event. The proposed channel alignment and general footprint is shown in Exhibit MA-12. Along the length of the dam, the embankment would be lowered to a height necessary to provide a minimum of 3 feet of freeboard per FEMA criteria. The excess material would be used to flatten the side slopes and vary the appearance to the extent reasonable to fit the form and function of the existing landscape character. The existing low flow channel would be widened and regraded to provide conveyance of the 100-year runoff from the watershed. Downstream of Trilby Wash (station 350+00) the slope of the channel would be increased to improve conveyance and to tie into the invert of the existing outlet channel. Drop/grade control structures would be required at the confluences with the major washes to prevent headcutting upstream. The proposed channel alignment would require relocation of the shooting ranges and disposal of the lead contaminated soil. The size of the proposed channel would also require new structures at the Sun Valley Parkway crossing of the impoundment and the U.S. 60 and BNSF railroad crossings of the outlet channel. In addition, the Beardsley Canal would need to be realigned and a siphon provided to cross the proposed channel.

Downstream of the dam, the outlet channel levee would be raised or lowered as necessary to provide the minimum 3 feet of freeboard. The shape of the levee would be varied to the extent reasonable to fit the form and function of the existing landscape character. The existing Outlet Channel dimensions would be increased to convey the 100-year flow. The alignment of the Outlet Channel would be extended more directly to the Agua Fria River instead of transitioning to the Outlet Wash. This alignment would cross Loop 303 and require construction of a new bridge. A bifurcation structure would be provided at the Outlet Wash to allow low flows to continue for environmental reasons and to allow high flows to spill into the Outlet Wash to reduce the design discharge in the Outlet Channel. There is a considerable elevation differential between the Outlet Channel at the confluence of the Outlet Wash and the Agua Fria River. This will require the construction of several energy dissipation structures.

A key element of this alternative is the opportunity to offset the cost of construction with the sale of excess right-of-way. Therefore, the channel footprint is minimized to a

reasonable extent to maximize opportunity for revenue generation without compromising the landscape aesthetics and multiuse opportunities.

Design Criteria

Analysis of the dam decommissioning alternative is based on several key design criteria. Those criteria are as follows:

- Minimum of 3 feet of freeboard for the levee. Additional freeboard should be considered to account for sediment deposition/transport.
- 100-year, 24-hour future land use condition peak discharges
- Earthen channel with maximum velocity of 5 fps
- Maximum channel side slopes of 6H:1V

Hydrology

Hydrologic data used in the analysis of the dam decommissioning alternative is discussed in Section MA 3.4. Modifications to the 100-year, 24-hour future land use condition model include the addition of hydrologic channel routing and hydrograph combine operations. HEC-1 Input and output files are provided digitally on CD as Appendix H. Peak discharges along the proposed channel are listed in Table MA-30.

Table MA-30
100-year, 24-hour future land use condition peak discharges along the proposed channel

HEC-1 Concentration Point	Drainage Area sq. miles	Peak Discharge cfs
130	6.3	2,560
120T	15.8	4,910
110T	18.7	4,370
WT	22.6	4,070
400T	139.9	21,800
510T	179.6	27,000
500.1T	212.1	28,000
505T	230.0	29,000
600T	260.2	29,100
710T	301.4	31,800
700T	312.3	31,700

Analysis and Results

The proposed channel dimensions and levee height are determined from normal depth calculations. Normal depth calculations are provided in Appendix G. The proposed channel invert, water surface elevation and levee crest elevation are shown in Exhibit MA-12. Three key points were used to set the profile. The first is near the east end of the proposed channel. This point is the start of the steep drop in elevation to the Agua Fria River. The second key point is at the confluence with the Outlet Wash. The third point is at the existing principal outlet of the dam. The channel footprint was initially set by the width of the existing District property along the Outlet Channel. This width is approximately 1,500 feet. The existing ground elevations at the proposed channel footprint were estimated from current topographic mapping and used in the determination of the channel dimensions.

The overall length of the proposed channel is divided into distinct reaches, which are shown on Exhibit MA-12. The first reach, identified as the White Tank Reach, extends downstream of the FRZR dam extension to the confluence with Trilby Wash (station 77+50 to 355+00). The Trilby Wash Reach extends downstream to the existing principal outlet (station 355+00 to 480+00). The third reach, identified as the Powerline Reach, extends downstream to station 750+00. At this point the proposed alignment leaves the existing District property limits in order to avoid an Arizona Public Service (APS) substation and start the transition to the Agua Fria River. The last reach is identified as the Outfall Reach and extends from station 750+00 to 870+00.

Each reach is described by one or more typical sections. Typical section identifiers are shown on Exhibit MA-12 and are illustrated in Figures MA-42 through MA-47. The analysis began at the downstream end essentially at the Loop 303 bridge. The existing landscape character of the Outfall Reach is impacted by the presence of the APS substation and the nature of the structures required to drop down to the Agua Fria River. The typical section utilized for this reach is trapezoidal with a 1,000-foot bottom width. The Manning's roughness coefficient is set to 0.04. From station 820+00 to 830+00 the proposed channel would be entirely below grade. The length of the side flow weir of the bifurcation structure is set to the FEMA floodway width of 350 feet. The crest of the weir is set to allow 3,000 cfs to pass over assuming a discharge coefficient of 2.4.

The Powerline Reach is described with two typical sections. Both sections are trapezoidal with a 1,065-foot bottom width and a low flow channel. The difference between the two sections is the width of the low flow channel. The alignment of the low flow channel would meander within the bottom width of the overall trapezoidal section. The low flow channel would be maintained free of vegetation and is modeled with a Manning's n-value of 0.035. The remainder of the channel bottom width would be disected with small channels connecting existing wash inflows to the low flow channel. It is assumed that this portion of the channel would be vegetated or allowed to establish vegetation and is modeled with a Manning's n-value of 0.06.

The typical section for the Trilby Wash Reach is similar to the Powerline Reach in the general configuration. The width of the low flow channel is significantly larger at 400 feet due to the relatively low elevation of the existing ground at the left bank in the upper portion of the reach.

Two typical sections are used to describe the White Tanks Reach. The conveyance capacity for this reach is significantly impacted by the backwater conditions at the confluence of Trilby Wash and the size of the proposed Sun Valley Parkway culvert. Downstream of Sun Valley Parkway, the existing low flow channel is modified slightly to generally contain the flow to a top width of approximately 600 feet. More extensive modifications would not have a significant impact on the top width due to the backwater conditions. The existing Sun Valley Parkway culvert is augmented with a 4-barrel, 10-foot x 10-foot box culvert. A printout of the culvert hydraulic calculations is provided in Appendix G. The capacity of the culvert is controlled by the tailwater conditions. The culvert capacity then controls the conveyance of the proposed channel upstream. Because of the backwater conditions and the relatively steep cross slope, channel improvements would not significantly reduce the channel top width. Therefore, the "channel limits" shown on Exhibit MA-12 upstream of Sun Valley Parkway represent the flood inundation limits.

Figure MA-42
Typical Section A-A

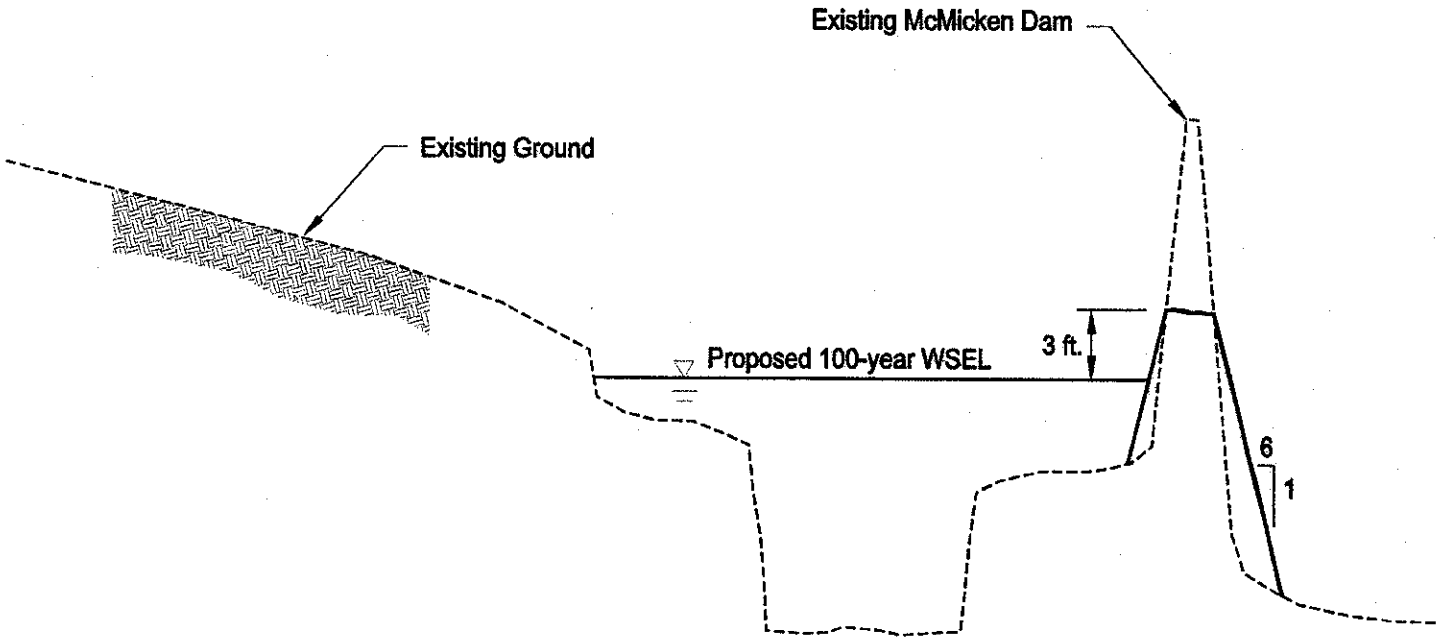


Figure MA-43
Typical Section B-B

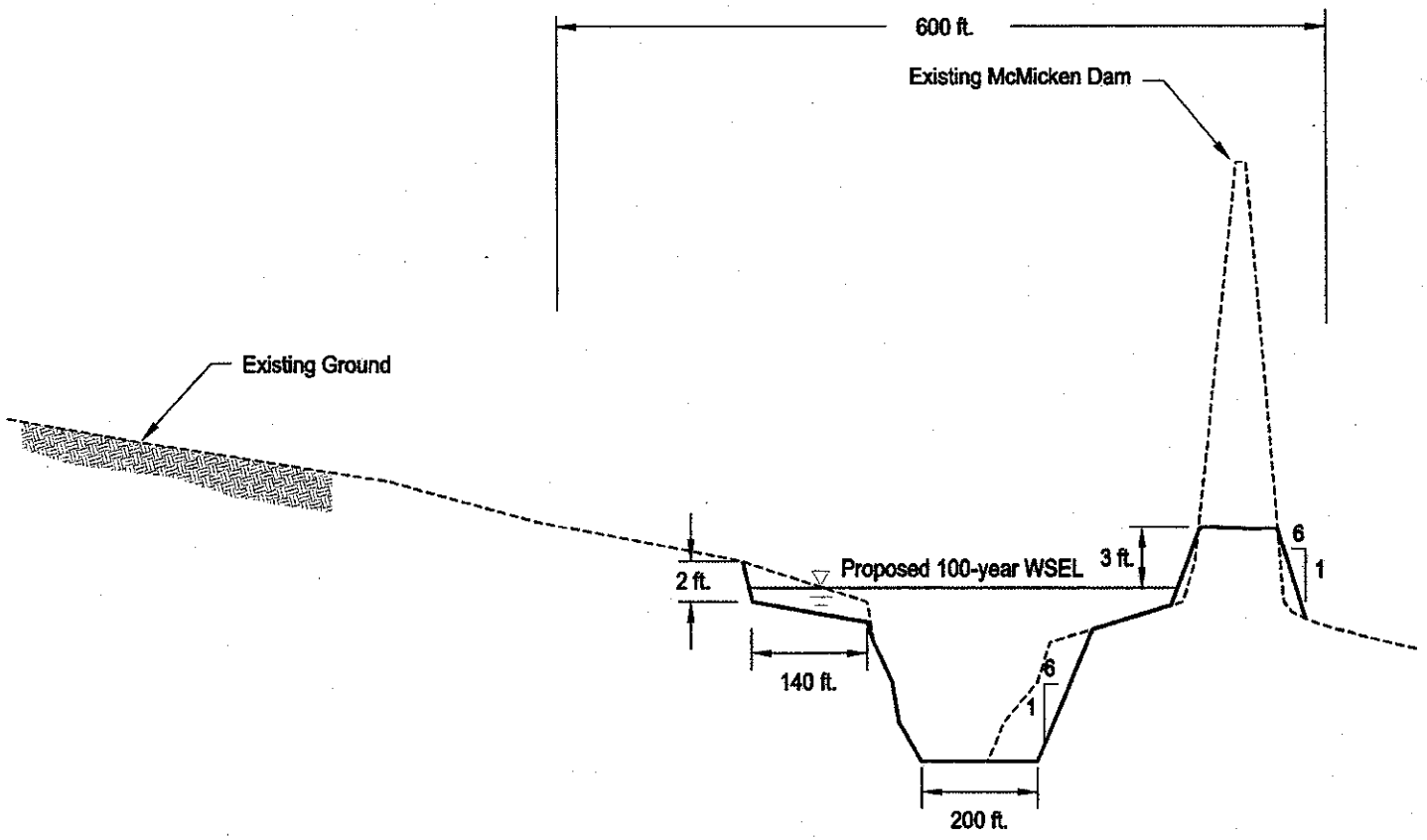


Figure MA-44
Typical Section C-C

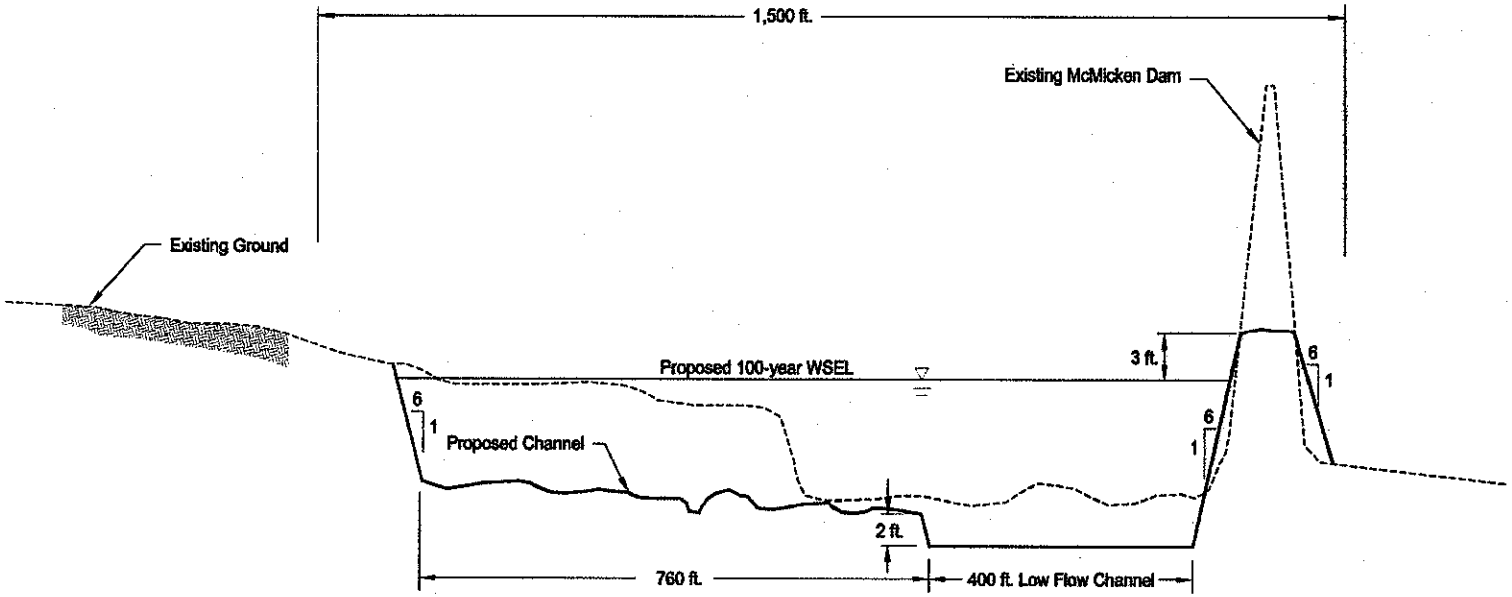


Figure MA-45
Typical Section D-D

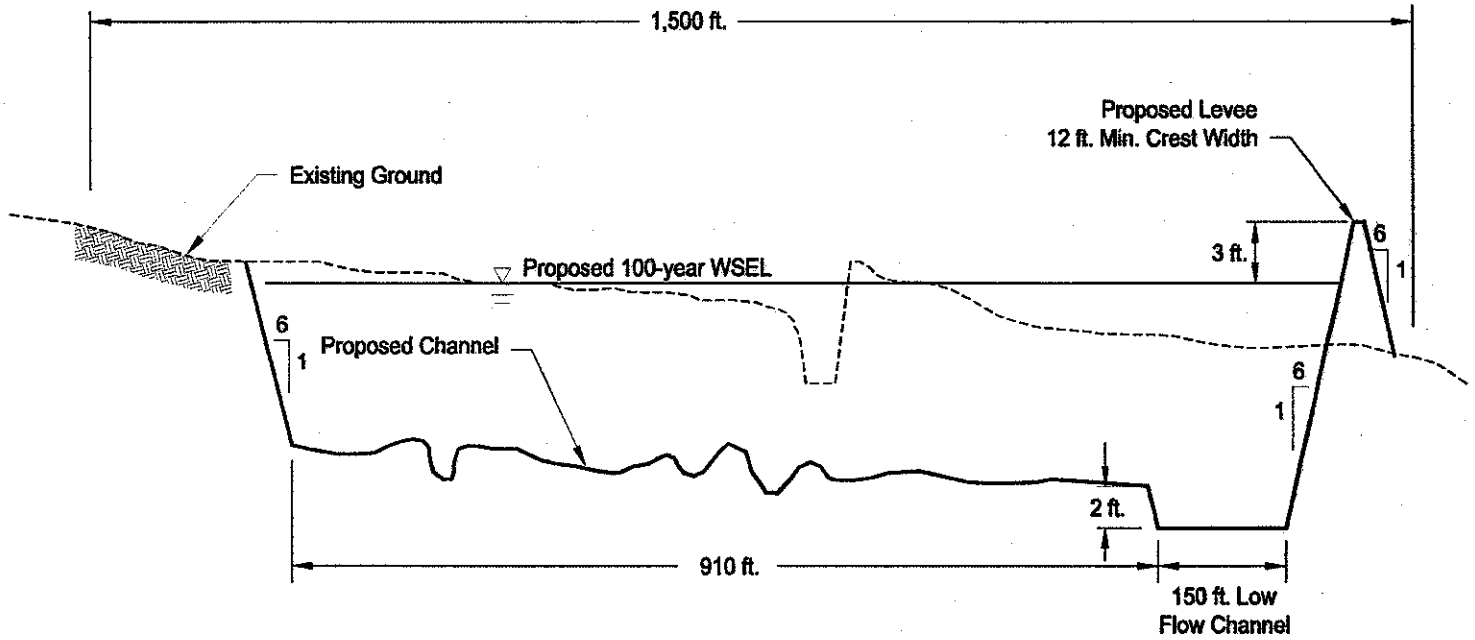


Figure MA-46
Typical Section E-E

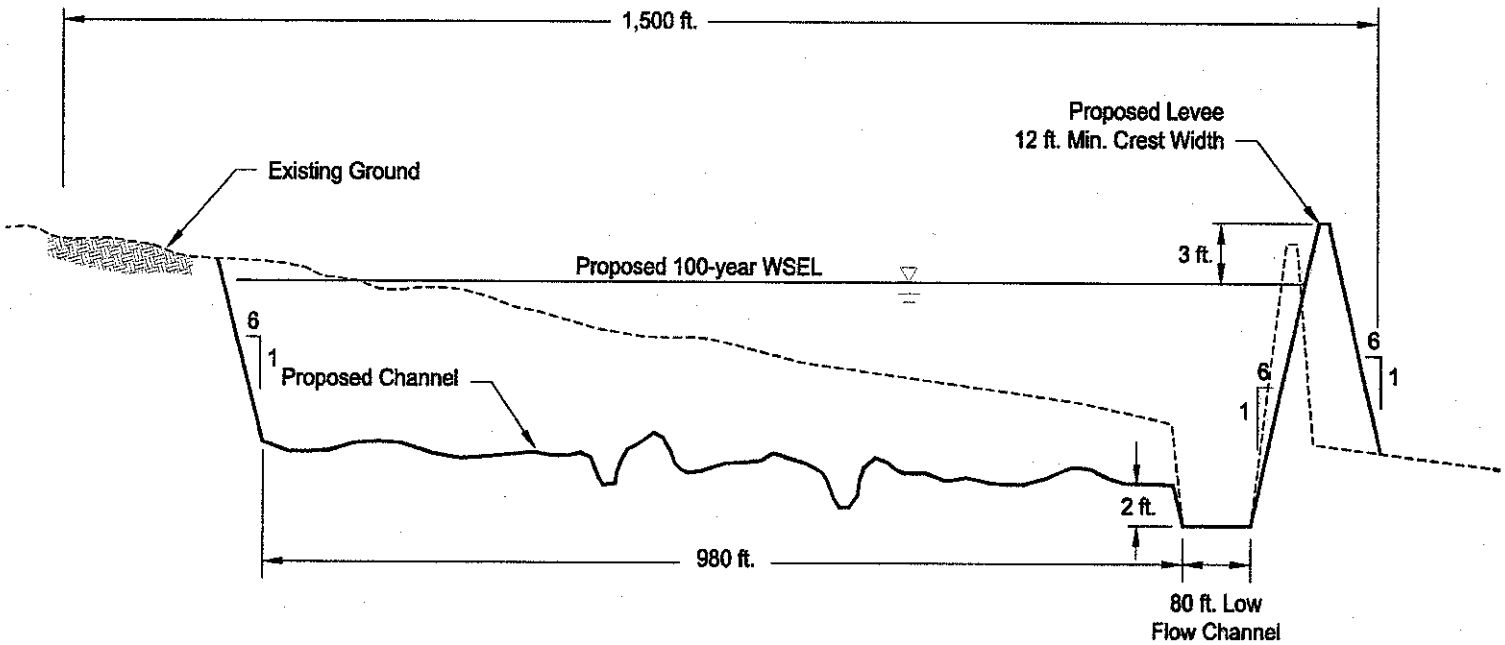
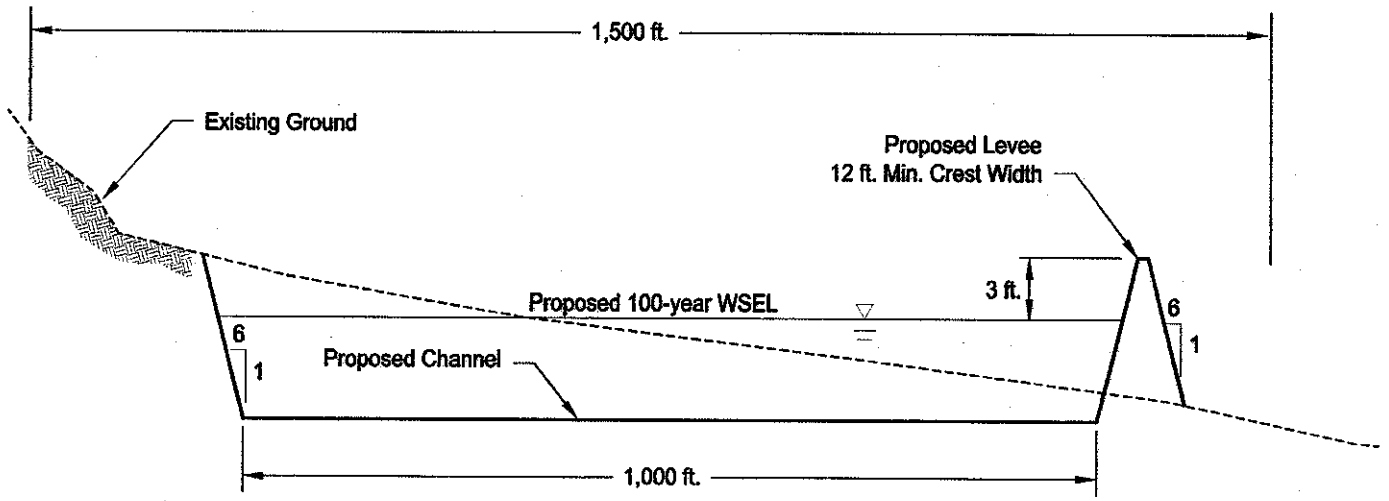


Figure MA-47
Typical Section F-F



MA 4.4.4. Cost Estimate

Cost estimates are developed for the selected alternative for both the dam rehabilitation and decommissioning options for planning purposes. Unit costs used in the estimate are based on the best available information including recent, similar projects and are listed in Tables MA-31. Any assumptions associated with specific unit costs are noted.

Material quantities are estimated based on the modeling results and the typical sections provided previously. Typical sections for the dam embankment raise are provided as Figures MA-48 and MA-49 for the earth fissure risk zone and the embankment cracking zone, respectively. Between station 355+00 and the principal outlet (embankment cracking zone), the existing embankment section incorporates and earlier structure such that a 12-foot bench is formed on the downstream face of the embankment. Since the proposed modifications are on the upstream side of the existing embankment, the change in typical section due to the earlier structure does not impact the quantity estimation of the engineering elements. Future, more detailed analyses should consider the different sections in regard to landscape aesthetic treatments. A typical section for raising the Outlet Channel levee is provided as Figure MA-50.

Summary information and some rough calculations of the material quantity estimations for each alternative are provided in Appendix F and G for the dam rehabilitation and decommissioning alternatives, respectively. Key assumptions used in the quantity estimation are as follows:

- An excavation depth of 6 inches is sufficient to remove the lead contaminated soil.
- Only a portion of the shooting range area contains lead contaminated soils. For this analysis, half of the site is assumed to contain lead. As a note, it is recommended that a detailed site assessment be performed to determine the areal extent of the lead contamination and the appropriate depth of excavation required to meet current standards.
- For the dam decommissioning alternative, it was assumed that 1 percent of the channel excavation material could be placed on site for landscape aesthetic purposes and would be in addition to the proposed geometry shown in the typical section, which incorporates certain landscape aesthetic elements.

The cost estimate is broken into several reaches for both alternatives. The extent of each reach is based on common physical features and conditions and considerations for phasing. The total cost is provided as a range to reflect and uncertainty in a local need for excess excavation and two options for the lead mitigation of the shooting range sites. The first option for lead mitigation is to excavate and dispose of the lead contaminated soil in a lead certified landfill. The second option is to separate the lead from the soil and dispose of the lead only. A range for landscape aesthetics is also provided to reflect the minimum and maximum reasonable landscape aesthetic enhancements that could be applied. For the planning purposes, the cost for the minimum landscape aesthetic enhancements is applied to the minimum construction cost range and the maximum cost for landscape aesthetic enhancements is applied to the maximum construction cost range.

The cost estimates for both alternatives are provided in Tables MA-32 and MA-33. The total construction cost for the dam rehabilitation alternative ranges from $26,581,800 to $36,031,600. The total cost, including environmental mitigation and landscape aesthetics ranges from $42,091,000 to $63,597,300. The total construction cost for the dam decommissioning alternative ranges from $149,440,300 to $231,745,300. The total cost including environmental mitigation, landscape aesthetics, additional right-of-way and less the revenue provided by the sale of excess right-of-way ranges from $54,027,500 to $237,471,000. Land prices used for right-of-way costs are provided by the District and are based on current appraisals. East of U.S. 60, right-of-way costs and revenue are based on a value of $22,500 per acre. West of U.S. 60, right-of-way costs are based on $75,000 per acre. For the White Tank Reach, the proposed plan would result in approximately 1,113 acres of excess District property and provide $83,475,000 in revenue. For the Powerline Reach, the proposed plan would yield approximately 819 acres of excess District property providing $61,425,000 in revenue. The Powerline Reach would require purchasing approximately 121 acres of land and yield approximately 45 acres of excess land for a net right-of-way cost of $1,710,000. The Outlet Reach would require purchasing approximately 376 acres of land and yield 134 acres of excess land for a net right-of-way cost of $5,445,000.

Table MA-31
Unit costs

DESCRIPTION	UNIT	UNIT PRICE	
CONSTRUCTION			
Clear and Grub	AC	$500.00	1
Excavation	CY	$3.00	2
Excavation of Lead Contaminated Soil	CY	$2.00	3
Mass Grading	CY	$2.00	4
Structural Fill	CY	$4.00	5
Roller Compacted Concrete	CY	$75.00	6
Soil Cement	CY	$42.00	7
Geomembrane	SF	$0.75	
Geotextile	SY	$2.50	
Structural Concrete	CY	$350.00	6
Disposal of Lead Contaminated Soil	Ton	$280.00	11
Cyclone Separation	CY	$3.00	15
Haul of Excess Material	CY	$5.00	12
Roadway Aggregate Base	Ton	$12.00	
Roadway Asphalt Paving	Ton	$35.00	
Beardsley Canal Siphon	LF	$280.00	8
Beardsley Canal Lining	LF	$125.00	9
Highway Bridge	LF	$10,000.00	
Railroad Bridge	LF	$2,500.00	10
Survey Monuments	Each	$300.00	
Abandon Low Level Outlet	LS	$100,000.00	
Rehabilitate Low Level Outlet	LS	$150,000.00	
Demolition and Removal of Existing Structures	LS	$200,000.00	
Demolition and Removal of Principle Outlet	LS	$100,000.00	
ENVIRONMENTAL MITIGATION			
Hydroseed	AC	$2,000.00	
GENERAL REQUIREMENTS (percentage of subtotal)			
Contingency	LS	25.00%	13
Engineer (Planning, Design and Geotech)	LS	10.00%	
Mobilization	LS	3.00%	
Supplemental General Conditions	LS	3.00%	14
Const. Management (CQA Testing, Inspection and Eng. Support)	LS	8.00%	
ADWR Permit Fee	LS	0.55%	16

Table MA-31
Unit costs

DESCRIPTION	UNIT	UNIT PRICE

FOOTNOTES

1. Doesn't include salvage of native plants
2. Assume material is placed on-site
3. Assume only the top 6 inches of soil are excavated and includes special environmental compliance issues
4. Regrading of dam embankment
5. Assume native material is acceptable for structural fill, with only minor processing
6. Includes furnishing approved aggregate, cement, mixing and placing, complete
7. Assume native material is acceptable and includes furnishing approved cement, mixing and placing
8. Includes excavation, furnishing of 84" diameter rgrcp and construction of headwalls
9. Assumes use of standard slip form
10. Assummed to be 25% of highway bridge
11. Haul to a facility capable of accepting lead contaminated soil. The closest site is located in Utah
12. Haul excess excavated material to an offsite location. Assumes no need locally for material.
13. Accounts for unknown conditions as well as general conditions, temporary facilities, insurance, performance bond, survey and as-builts
14. Includes partnering allowance, permitting, public information and notification allowance, public sign allowance and water management
15. Separation of lead material from soil, assumes maximum effectiveness of 90%
16. Estimate of ADWR permit for planning purposes.

Figure MA-48
Fissure risk zone typical section

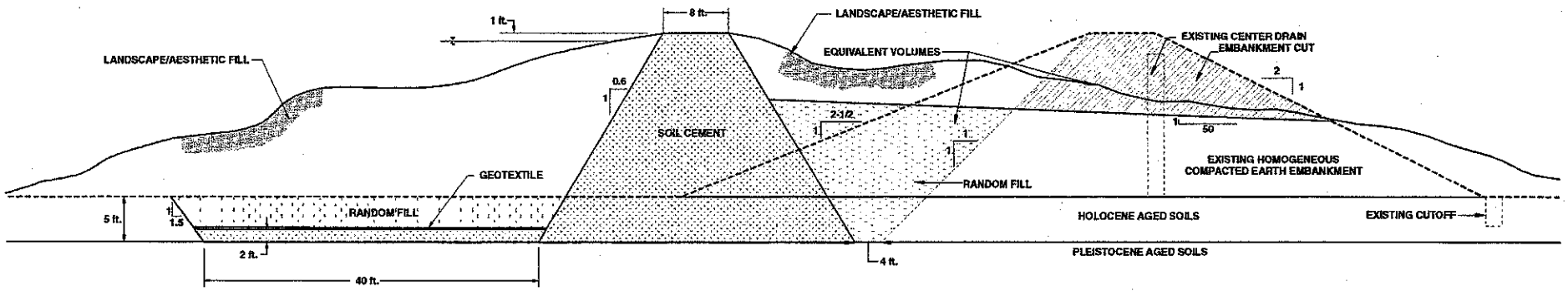


Figure MA-49
Embankment cracking zone typical section

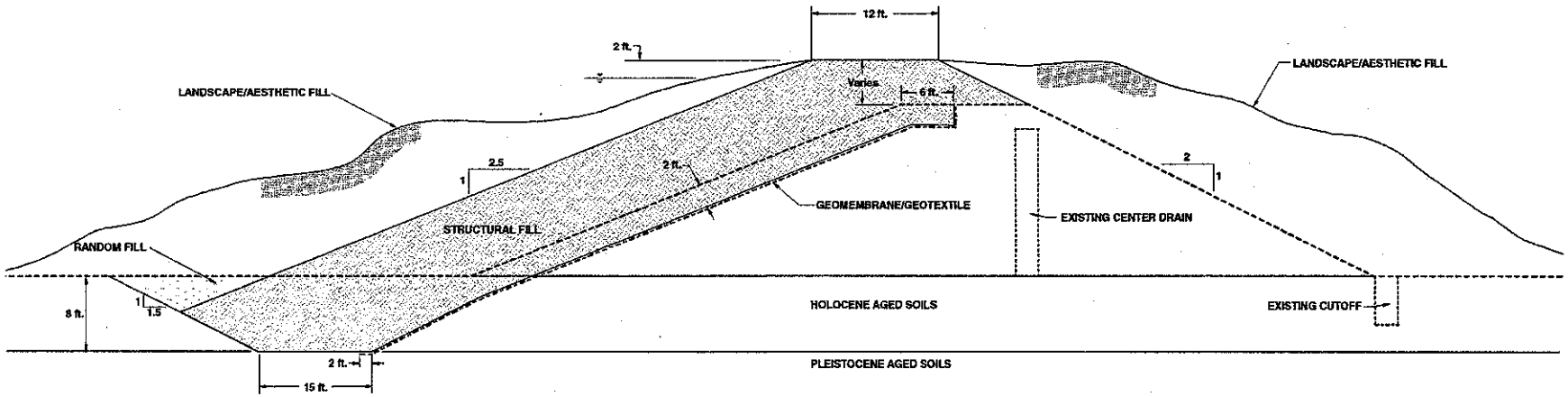
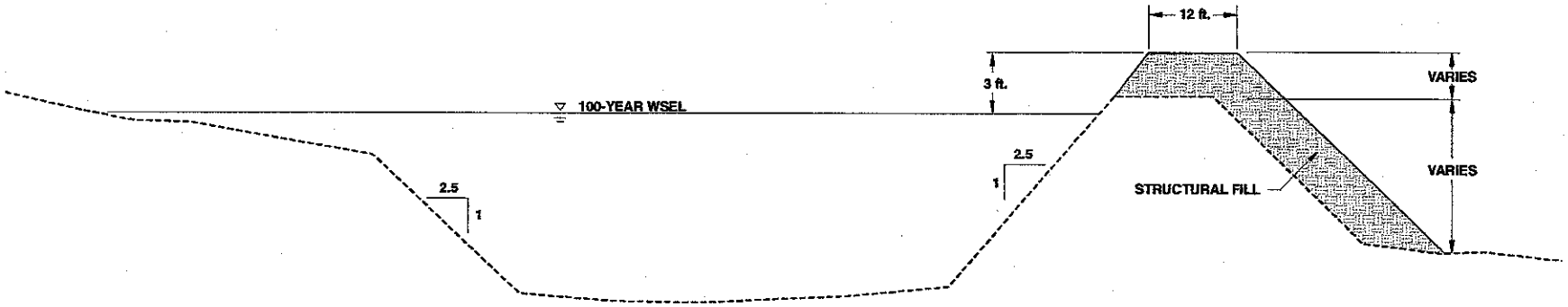


Figure MA-50
Outlet channel levee raise typical section



Ta[illegible]MA-32
Dam rehabilitation alternative cost estimate

by: mcg 04/28/05 chk: cvg 05/11/05

DESCRIPTION	AMOUNT	QTY	UNIT	UNIT PRICE	SUBTOTAL
Earth Fissure Risk Zone (Sta 77+50 to 105+00)	**$3,831,100**				
Clear and Grub		7	AC	$500.00	$3,400
Excavation of Existing Embankment		29,524	CY	$3.00	$88,600
Excavation of Holocene Soils		44,642	CY	$3.00	$133,900
Mass Grading		22,825	CY	$2.00	$45,700
Structural Fill		1,042	CY	$5.50	$5,700
Soil Cement		65,603	CY	$42.00	$2,755,300
Geotextile		12,925	SY	$2.50	$32,300
Contingency		1	LS	25.00%	$766,200
Embankment Cracking Zone (Sta 105+00 to 280+00)	**$5,471,900**				
Clear and Grub		43	AC	$500.00	$21,700
Excavation of Existing Embankment		93,333	CY	$3.00	$280,000
Excavation of Holocene Soils		160,741	CY	$3.00	$482,200
Structural Fill		370,417	CY	$5.50	$2,037,300
Mass Grading		82,963	CY	$2.00	$165,900
Geomembrane		1,352,750	SF	$0.75	$1,014,600
Geotextile		150,306	SY	$2.50	$375,800
Contingency		1	LS	25.00%	$1,094,400
Embankment Cracking Zone (Sta 280+00 to 350+00)	**$2,536,000**				
Clear and Grub		20	AC	$500.00	$9,900
Excavation of Existing Embankment		45,007	CY	$3.00	$135,000
Excavation of Holocene Soils		64,296	CY	$3.00	$192,900
Structural Fill		150,370	CY	$5.50	$827,000
Mass Grading		36,296	CY	$2.00	$72,600
Geomembrane		770,000	SF	$0.75	$577,500
Geotextile		85,556	SY	$2.50	$213,900
Contingency		1	LS	25.00%	$507,200

Ta[illegible]MA-32

Dam rehabilitation alternative cost estimate

by: mcg 04/28/05 chk: cvg 05/11/05

DESCRIPTION	AMOUNT	QTY	UNIT	UNIT PRICE	SUBTOTAL
Embankment Cracking Zone (Sta 350+00 to 460+00)	**$3,340,100**				
Clear and Grub		24	AC	$500.00	$11,800
Excavation of Existing Embankment		68,525	CY	$3.00	$205,600
Excavation of Holocene Soils		101,037	CY	$3.00	$303,100
Structural Fill		146,667	CY	$5.50	$806,700
Mass Grading		61,926	CY	$2.00	$123,900
Geomembrane		1,188,000	SF	$0.75	$891,000
Geotextile		132,000	SY	$2.50	$330,000
Contingency		1	LS	25.00%	$668,000
Embankment Cracking Zone (Sta 460+00 to 480+00)	**$534,800**				
Clear and Grub		5	AC	$500.00	$2,600
Excavation of Existing Embankment		12,000	CY	$3.00	$36,000
Excavation of Holocene Soils		18,370	CY	$3.00	$55,100
Structural Fill		15,259	CY	$5.50	$83,900
Mass Grading		17,185	CY	$2.00	$34,400
Geomembrane		210,000	SF	$0.75	$157,500
Geotextile		23,333	SY	$2.50	$58,300
Contingency		1	LS	25.00%	$107,000
Emergency Spillway and Outlet Channel	**$7,769,900**				
Clear and Grub		47	AC	$500.00	$23,500
Demolition and Removal of Existing Structures		1	LS	$200,000.00	$200,000
Excavation of Existing Embankment and Spillway Outlet		547,083	CY	$3.00	$1,641,200
Roller Compacted Concrete		56,292	CY	$75.00	$4,221,900
Beardsley Canal Siphon		160	LF	$280.00	$44,800
Drainage Channel Excavation		28,160	CY	$3.00	$84,500
Contingency		1	LS	25.00%	$1,554,000

Ta[illegible]IA-32

Dam rehabilitation alternative cost estimate

by: mcg 04/28/05 chk: cvg 05/11/05

DESCRIPTION	AMOUNT	QTY	UNIT	UNIT PRICE	SUBTOTAL
Shooting Range Lead Abatment (Range)	**$9,568,900 to $119,100**				
Option A					
Excavation of Lead Contaminated Soil		16,133	CY	$2.00	$32,300
Disposal of Lead Contaminated Soil (125lb/cf)		27,224	Ton	$280.00	$7,622,800
Contingency		1	LS	25.00%	$1,913,800
Option B					
Excavation of Lead Contaminated Soil		16,133	CY	$2.00	$32,300
Cyclone Separation		16,133	CY	$3.00	$48,400
Disposal of Lead Material (700lb/cf)		52	Ton	$280.00	$14,600
Contingency		1	LS	25.00%	$23,800
Outlet Channel Levee Improvement	**$363,900**				
Clear and Grub		10	AC	$500.00	$5,000
Structural Fill		52,015	CY	$5.50	$286,100
Contingency		1	LS	25.00%	$72,800
End of Dam Segment and Emergency Spillway Training Dike	**$1,825,600**				
Clear and Grub		5	AC	$500.00	$2,500
Excavation of Holocene Soils		65,778	CY	$3.00	$197,300
Structural Fill		195,956	CY	$5.50	$1,077,800
Geomembrane		178,000	SF	$0.75	$133,500
Geotextile		19,778	SY	$2.50	$49,400
Contingency		1	LS	25.00%	$365,100
Low Level Outlet Culverts	**$750,000**				
Abandon in Place		3	LS	$100,000.00	$300,000
Rehabilitation		2	LS	$150,000.00	$300,000
Contingency		1	LS	25.00%	$150,000
Survey Monuments	**$39,400**				
Survey Monuments		105	Each	$300	$31,500
Contingency		1	LS	25.00%	$7,900

Ta[illegible]IA-32
Dam rehabilitation alternative cost estimate

by: mcg 04/28/05 chk: cvg 05/11/05

DESCRIPTION	AMOUNT	QTY	UNIT	UNIT PRICE	SUBTOTAL
CONSTRUCTION SUBTOTAL (Range)	**$36,031,600 to**	**$26,581,800**			
Landscaping and Aesthetics (Range)	**$18,000,000 to**	**$8,263,300**			
Landscaping and Aesthetics (Option A)		1	LS	$18,000,000	$18,000,000
Landscaping and Aesthetics (Option B)		1	LS	$8,263,272	$8,263,300
Environmental Mitigation	**$720,000**				
Hydroseed		360	AC	$2,000	$720,000
General Costs (Range)	**$8,845,700 to**	**$6,525,900**			
Option A					
Engineer (Planning, Design and Geotech)		10%	LS	$36,031,600	$3,603,200
Mobilization		3%	LS	$36,031,600	$1,080,900
Supplemental General Conditions		3%	LS	$36,031,600	$1,080,900
Const. Management (CQA Testing, Inspection and Eng. Support)		8%	LS	$36,031,600	$2,882,500
ADWR Permit Fee		0.55%	LS	$36,031,600	$198,200
Option B					
Engineer (Planning, Design and Geotech)		10%	LS	$26,581,800	$2,658,200
Mobilization		3%	LS	$26,581,800	$797,500
Supplemental General Conditions		3%	LS	$26,581,800	$797,500
Const. Management (CQA Testing, Inspection and Eng. Support)		8%	LS	$26,581,800	$2,126,500
ADWR Permit Fee		0.55%	LS	$26,581,800	$146,200
PROJECT TOTAL (Range)	**$63,597,300 to**	**$42,091,000**			

Table MA-35
Dam decommissioning alternative cost estimate

by: mcg 05/08/05 chk: cvg 05/11/05 rev: mcg 06/28/05

DESCRIPTION	AMOUNT	QTY	UNIT	UNIT PRICE	SUBTOTAL
White Tank Reach (Sta 77+50 to 355+00)	**$3,524,900 to**	**$3,044,900**			
Clear and Grub		64	AC	$500.00	$32,000
Channel Excavation		106,666	CY	$3.00	$320,000
Haul Excess Material (Optional)		95,999	CY	$5.00	$480,000
Mass Grading		534,195	CY	$2.00	$1,068,400
4-10' x 10' concrete box culvert		250	LF	$3,120.00	$780,000
Roadway Aggregate Base (6 inches)		4,284	Ton	$12.00	$51,400
Roadway Asphalt Paving (3 inches)		2,516	Ton	$35.00	$88,100
Contingency		1	LS	25.00%	$705,000
Trilby Wash Reach (Sta 355+00 to 477+50)	**$31,906,400 to**	**$17,687,200**			
Clear and Grub		420	AC	$500.00	$210,000
Channel Excavation		3,159,819	CY	$3.00	$9,479,500
Haul Excess Material (Optional)		2,843,837	CY	$5.00	$14,219,200
Mass Grading		488,185	CY	$2.00	$976,400
RCC Drop Structures (3)		7,200	CY	$75.00	$540,000
Demolition of Principle Outlet		1	LS	$100,000.00	$100,000
Contingency		1	LS	25.00%	$6,381,300

Table MA-33
Dam decommissioning alternative cost estimate

by: mcg 05/08/05 chk: cvg 05/11/05 rev: mcg 06/28/05

DESCRIPTION	AMOUNT	QTY	UNIT	UNIT PRICE	SUBTOTAL
Power Line Reach (Sta 477+50 to 750+00)	**$105,188,600 to**	**$68,956,900**			
Clear and Grub		940	AC	$500.00	$470,000
Structural Fill		567,906	CY	$5.50	$3,123,500
Channel Excavation		8,051,479	CY	$3.00	$24,154,400
Haul Excess Material (Optional)		7,246,331	CY	$5.00	$36,231,700
RCC Drop Structure		2,400	CY	$75.00	$180,000
U.S. 60 Bridge		1,500	LF	$10,000.00	$15,000,000
BNSF Railroad Bridge		1,500	LF	$2,500.00	$3,750,000
Beardsley Canal Siphon		1,500	LF	$280.00	$420,000
Beardsley Canal Lining		4,970	LF	$125.00	$621,300
Demolition and Removal of Existing Structures		1	LS	$200,000.00	$200,000
Contingency		1	LS	25.00%	$21,037,700
Shooting Range Lead Abatment (Range)	**$9,568,900 to**	**$119,100**			
Option A					
Excavation of Lead Contaminated Soil		16,133	CY	$2.00	$32,300
Disposal of Lead Contaminated Soil (125lb/cf)		27,224	Ton	$280.00	$7,622,800
Contingency		1	LS	25.00%	$1,913,800
Option B					
Excavation of Lead Contaminated Soil		16,133	CY	$2.00	$32,300
Cyclone Separation		16,133	CY	$3.00	$48,400
Disposal of Lead Material (700lb/cf)		52	Ton	$280.00	$14,600
Contingency		1	LS	25.00%	$23,800

Table MA-33
Dam decommissioning alternative cost estimate

by: mcg 05/08/05 chk: cvg 05/11/05 rev: mcg 06/28/05

DESCRIPTION	AMOUNT		QTY	UNIT	UNIT PRICE	SUBTOTAL
Outfall Reach (750+00 to 880+00)	**$81,556,500**	**to**	**$59,632,200**			
Clear and Grub			447	AC	$500.00	$223,500
Structural Fill			226,366	CY	$5.50	$1,245,000
Channel Excavation			4,872,058	CY	$3.00	$14,616,200
Haul Excess Material (Optional)			4,384,852	CY	$5.00	$21,924,300
RCC Sideflow Weir			2,592	CY	$75.00	$194,400
Loop 303 Bridge			1,500	LF	$10,000.00	$15,000,000
Baffle Block Drop Structures (3)			34,405	CY	$350.00	$12,041,800
Contingency			1	LS	25.00%	$16,311,300
CONSTRUCTION SUBTOTAL	**$231,745,300**	**to**	**$149,440,300**			
Landscaping and Aesthetics (Range)	**$84,109,800**	**to**	**$2,724,600**			
Landscaping and Aesthetics (Option A)			1	LS	$84,109,812	$84,109,800
Landscaping and Aesthetics (Option B)			1	LS	$2,724,586	$2,724,600
Environmental Mitigation	**$3,742,000**					
Hydroseed			1871	AC	$2,000	$3,742,000
Right of Way	**($137,745,000)**					
Aquisition (497 acres)			1	LS	$11,182,500	$11,182,500
Excess (2,111 acres)			1	LS	$148,927,500	$148,927,500

Table MA-35
Dam decommissioning alternative cost estimate

by: mcg 05/08/05 chk: cvg 05/11/05 rev: mcg 06/28/05

DESCRIPTION	AMOUNT	QTY	UNIT	UNIT PRICE	SUBTOTAL
General Costs (Range)	**$55,618,900 to**	**$35,865,600**			
Option A					
Engineer (Planning, Design and Geotech)		10%	LS	$231,745,300	$23,174,500
Mobilization		3%	LS	$231,745,300	$6,952,400
Supplemental General Conditions		3%	LS	$231,745,300	$6,952,400
Const. Management (CQA Testing, Inspection and Eng. Support)		8%	LS	$231,745,300	$18,539,600
Option B					
Engineer (Planning, Design and Geotech)		10%	LS	$149,440,300	$14,944,000
Mobilization		3%	LS	$149,440,300	$4,483,200
Supplemental General Conditions		3%	LS	$149,440,300	$4,483,200
Const. Management (CQA Testing, Inspection and Eng. Support)		8%	LS	$149,440,300	$11,955,200
PROJECT TOTAL (Range)	**$237,471,000 to**	**$54,027,500**			

MA 4.4.5. Summary

The analyses of the selected alternatives consisted of modifications to existing models and basic hydraulic calculations of a possible alignment/configuration of proposed features. The analyses were conducted in order to provide a framework and baseline data for future more detailed analyses and investigations. Future analyses should consider various sub-alternatives of the two options to explore potential benefits of different alignments, construction materials, and configurations of the proposed features. In addition, a third option should be considered that combines elements of the rehabilitation and decommissioning option such as conversion of portions of the dam to a channel and levee conveyance structure, particularly the south end of the dam.

For the dam rehabilitation alternative, the proposed emergency spillway would have a peak discharge of approximately 93,000 cfs resulting in a maximum water surface elevation, in general, at the crest of the existing dam. However, the peak discharge is significantly more than the design discharge and the discharge used to map the downstream inundation area. Alternate spillway configurations, alignments and/or provision of an auxiliary spillway should be considered in future studies. Future studies should also consider the development of a more detailed hydraulic model of the Outlet Channel that includes the Outlet Wash. A more detailed floodplain delineation could be used to identify reaches along the Outlet Channel with excess right-of-way that could be used to offset the total cost for this alternative of approximately $64,000,000.

For the dam decommissioning alternative, the very mild longitudinal slope of the proposed alignment requires a very wide channel to convey the 100-year peak flows. Alternate alignments, particularly along the dam, should be considered that take advantage of the natural ground slope to reduce cost. Because of the magnitude of some of the proposed features, the cost is highly sensitive to small changes in unit prices, particularly clearing and grubbing, excavation, hauling of excess material and right-of-way. The extreme sensitivity of the cost estimate to unit prices makes viability of the decommissioning alternative difficult to evaluate. Another issue with the dam decommissioning alternative is the potential impacts to the Agua Fria River floodplain due to the increase in peak discharge of the proposed conditions.

MA 5. Non-Structural Alternatives

In addition to the development of structural alternatives, the District is interested in applying non-structural approaches to mitigate safety concerns relating to McMicken Dam. LTM Engineering, Inc. evaluated several non-structural alternatives to improve public safety conditions downstream of McMicken Dam. It is noted that the non-structural alternatives were developed to evaluate the need for and benefits of enhancing the effectiveness of structural solutions and are not proposed as independent alternatives. The non-structural elements analyzed include:

- Acquire Properties/Flowage Easements
- Upgrade Emergency Action Plans
- Protect Critical Facilities
- Mitigate through Flood Insurance
- Mass Notification for Flood Warning
- Public Education

MA 5.1. Acquire Properties/Flowage Easements

The current stage of development was reviewed with respect to acquiring properties or flowage easements. Upstream development is currently minimal. An APS substation is located upstream, but it is outside the PMF pool and the only potential public safety issues would be access/egress concerns and transmission lines in the vicinity. Additional uses include a shooting range near the north end of the dam and a model airplane club that operates within the reservoir near the Greenway Road alignment.

The downstream area is rapidly developing and includes several jurisdictions (Surprise, El Mirage, Youngtown, Luke AFB, Litchfield Park, Goodyear, and unincorporated Maricopa County). Sun City West is downstream of the Outlet Channel.

Within the reservoir pool, the District already owns the property up to the 100-year pool limits. Because the additional acreage needed to cover the reservoir pool up to the PMF is relatively low and the cost of acquiring a flowage easement is also low, acquiring additional easement in the reservoir pool may be worth pursuing if the dam is preserved. This would

reduce future upstream public safety concerns by pre-empting development in the reservoir. In addition, it would reduce future monitoring and response activities of the McMicken Dam EAP.

The McMicken Outlet Channel is a component of the McMicken Dam system and accepts releases from the principal outlet. It also acts as an interceptor channel for areas to the north. There is significant development downstream of the Outlet Channel, including Sun City West. The channel currently has the capacity to accept 100-year flows from the upstream areas in addition to releases from the principal outlet. However, if the dam is modified and flows to the Outlet Channel are increased, the channel may need to be widened. Additionally, a potential exists for localized land subsidence that could negatively impact the conveyance of the Outlet Channel in the future (Geological Consultants, Inc., 2004). In general, any land needed for constructed facilities would be purchased, whereas preservation of natural washes could be accomplished with flowage easements. For the Outlet Channel, because it is a constructed facility and development is either adjacent to the channel or impending, purchasing additional land would be relatively expensive.

The Outlet Wash is a natural wash that accepts runoff from the Outlet Channel and transports it to the Agua Fria River. The areas adjacent to the 100-year floodplain limits are heavily developed and portions of the existing developments would need to be displaced. Therefore, widening the Outlet Wash would be expensive and difficult to implement. In addition, any benefits to widening the Outlet Wash would be contingent on also widening the Outlet Channel.

MA 5.2. Upgrade Emergency Action Plans

The McMicken Dam Emergency Action Plan was recently updated to include an emergency spillway inundation scenario and Outlet Channel discharges, as well as dambreak scenarios (LTM Engineering, 2004). The EAP also will accommodate modifications currently underway at the southern end of the dam as part of the McMicken Dam Fissure Risk Zone Remediation (FRZR) Project. It was recommended that the EAP be further refined to include recent hydrologic analyses, (Entellus, 2004) performed as part of the Wittmann ADMSU to improve the current dambreak scenarios.

If additional operations are added to McMicken Dam, such as recreational activities, then the EAP would be affected and would need to be modified. In addition, if the operation of

McMicken Dam is modified as a result of implementing a structural alternative, the EAP would similarly need to be revised.

MA 5.3. Protect Critical Facilities

Critical facilities are described under the National Flood Insurance Program (NFIP) as facilities that may have special needs or require special attention during a flood. There is no universal agreement in the definition of the term "critical facilities"; they are selected according to the particular hazard and according to the perspective of the responder. The Federal Emergency Management Agency (FEMA) recommends identifying a structure as critical if flooding "would present an immediate threat to life, public health, and safety". In general, critical facilities typically include police and fire stations, hazardous materials storage, public utilities, transportation corridors, hospitals, nursing homes, and schools.

There are no critical facilities within the McMicken Dam reservoir pool, although an APS substation is in the vicinity. However, there are many candidate critical facilities downstream of the dam and outlet channel. Those identified in the McMicken Dam EAP include:

- Beardsley Canal
- Loop 303
- Interstate 10
- Luke Air Force Base
- Several elementary and high schools

These facilities are located within the corresponding inundation areas of three potential failure locations. The District conducted a dambreak analysis assuming three failure locations because of the long length of dam (Rumann & Sutko, 1987). The three scenarios are north of Trilby Wash near the emergency spillway, at Trilby Wash, and south of Trilby Wash near the south end of the dam. However, it is important to note that failure could occur at any point along the dam, not just at the locations analyzed in the original dambreak analysis. Therefore, additional critical facilities may be located downstream of McMicken Dam but outside of the identified inundation areas.

Maricopa County's draft multi-jurisdictional Hazard Mitigation Plan has been accepted by the County and the participating local jurisdictions and is currently under review by FEMA. During development of this plan, critical facilities were identified using FEMA's Hazards U.S. Multi-Hazard (HAZUS®MH) program, a GIS-based loss estimation tool. Facilities in unincorporated Maricopa County were then field-verified. In addition, the participating local jurisdictions provided similar information, although it is not known if all jurisdictions field-verified the data. When the plan is updated, field verification of all identified facilities will be performed. The data are sorted by category for the entire county and can be accessed through Maricopa County's GIS.

In order to protect critical facilities from a dam failure or emergency spillway discharge at McMicken Dam, the "critical facilities" designation must be defined and established for this specific purpose. Once the types of facilities to be protected are established, a subset database for the inundation area would need to be developed. It is noted that the areal extent of coverage should be expanded to cover all areas downstream of the dam, not just the inundation areas identified in the EAP, because if a break occurred in a location different from what was assumed in the original dambreak study, the corresponding inundation area would shift as well. Finally, procedures to protect the facilities would need to be developed.

Protection of critical facilities may be an attractive non-structural solution for selected facilities if they are easily identifiable, few in number, and in isolated locations. However, broad application of this technique downstream of McMicken Dam would be problematic for several reasons. First, given the large areal extent and heavy downstream development along the entire length of the McMicken Dam system (dam and outlet channel), there would be a significant number of critical facilities. Second, once the facilities are identified, protection must be designed and retrofitted. Retrofitting would be difficult in areas of concentrated development and may exacerbate flooding for adjacent structures. Third, retrofitting would likely be accomplished at significant cost not readily borne by the owners of the facilities.

As an example, Loop 303 has been identified as a critical facility because it is a major transportation corridor for the region. If the highway were to be protected, basic retrofitting scenarios to handle a dam failure would be to raise it (fill), provide upstream protection (berm), or allow pass-through drainage (culverts). Any of these options would be expensive to construct and would have negative impacts to adjacent development upstream and downstream of the highway.

It would be beneficial for the District to expand its current GIS capabilities by creating a subset database of critical facilities. The information could then be used in the future for better tracking and notification of critical facilities. In any event, care should be taken to restrict access to the database to maintain the security of the facilities.

MA 5.4. Mitigate through Flood Insurance

An option previously considered by the District at the Buckhorn-Mesa Structures was to encourage residents impacted by a dam to purchase voluntary flood insurance in southeastern Maricopa County. The analysis assumed that reduced premiums for $100,000 of structural coverage under a Preferred Risk Policy would be available at $221 per residence for structures outside the 100-year floodplain (Kimley-Horn and Associates, 2001). For the structures assumed to be located downstream of the Buckhorn-Mesa Structures at the time of the analysis, this equates to over $8.5 million in 2000 dollars for the first year. An annualized cost analysis was not performed for the study.

As shown in Table MA-34, updated Preferred Risk insurance costs were obtained from the NFIP (FEMA, 2004). Due to steady increases in new and used home values over the past several years, it was felt that an average policy of $125,000 of structural coverage would represent a typical residence under current (2004) conditions.

Table MA-34
Current Costs for Preferred Risk Flood Insurance Policies

Structure Coverage	Contents Coverage	Premium(without Basement)
$20,000	$5,000	$111
$30,000	$8,000	$137
$50,000	$12,000	$179
$75,000	$18,000	$206
$100,000	$25,000	$232
$125,000	$30,000	$248
$150,000	$38,000	$263
$200,000	$50,000	$295
$250,000	$60,000	$316

Notes:
- Available for residences in Zones B, C, or X that meet eligibility requirements
- Building deductible: $500
- Contents deductible: $500
- Deductibles applied separately
- Premium includes Federal Policy Fee and ICC Premium Rates

Encouraging the purchase of flood insurance has several benefits, including increased public awareness of flood hazards, minimal expenditure of public funds, and partial funding for recovery in the event of a flood. However, public participation in the purchase of voluntary flood insurance is expected to be very low. Because of the sparse rainfall in Maricopa County, flooding is often not perceived by the public as an imminent threat. As a result, individuals are reluctant to embrace flood insurance even if they are in a designated 100-year floodplain. Therefore, it would be unrealistic to expect residents to voluntary pay an additional annual premium of $250 to insure themselves against an event that is much less likely to occur. Finally, insurance does not increase public safety or reduce property damage; it only assists residents in recovering from flood damage once it occurs.

MA 5.5. Mass Notification

Maricopa County implemented a mass telephone notification system, the Community Emergency Notification System (CENS), in November 2003. The system was funded through a judgment against a privately–owned facility that had had a hazardous materials incident. Although it was originally intended to address hazardous materials incidents, the system is capable of handing many types of emergencies that would require mass notification and/or evacuation. The Maricopa County CENS system has been activated successfully a number of times over the past year, primarily for hazardous materials emergencies.

Navajo County implemented a similar system, the DCC Communications System, earlier this year as a result of the 2002 Rodeo-Chedeski wildfire. The system was partially funded through a FEMA mitigation grant following the wildfire. Navajo County has run a number of successful tests and plans to use the system in the future for a variety of hazards. Similarly, a number of counties in California have implemented or are evaluating mass telephone notification systems, primarily in response to recent wildfires. San Diego County has used an in-house notification system to call in first-response teams and is performing a test project using GIS and telephone databases to expand the system for external mass notification. Riverside County is also evaluating several systems for county-wide application.

Many options are available, including:

- Mass simultaneous telephone notification
- Spatial tracking of events

- Fax capable
- Bulletin Board features
- Hazardous materials capabilities

Advantages of a mass notification system include a greatly expanded range of notification capabilities, reduced time and labor requirements for notification, the ability to incorporate GIS data, multi-hazard coverage, and small-group mobilization options. Maintenance of a system can be internal or external.

Considerations of implementing the system include:

- Requires intensive and prolonged public education to be most effective
- In a flood emergency, the notification message may need to be segmented into relatively small areas in order to provide evacuation routes to the recipients
- Bilingual messages would be needed
- Computerized messages are sometimes ignored or unanswered by the recipient
- Cellular telephone numbers cannot currently be included
- System testing with blocked or unlisted numbers may be problematic
- Multi-jurisdictional use requires close coordination
- In addition to the initial setup purchase, there are ongoing maintenance costs.

The system could be readily adapted for use in spillway inundation or dam failure emergencies. It is not anticipated that the District would directly activate the CENS in the future. Rather, it is recommended that current notification procedures be followed. That is, the District would continue to provide Maricopa County Department of Emergency Management (MCDEM) with inundation maps showing the anticipated extent of flooding in the event of an emergency. The District would also continue to provide regular updates and technical support in the event of an impending or actual emergency. In turn, MCDEM would coordinate with local jurisdictions to notify the public using CENS or other appropriate means. In general, CENS could be used for immediate notification of an impending disaster.

If the disaster develops over several days, the system could be better used to direct the public to turn to more traditional and graphic means of communication such as television. This scenario is similar to how the Emergency Alert System (EAS) currently operates.

MA 5.6. Public Education

A number of tools could be implemented or expanded to improve public awareness of the existence and function of McMicken Dam, the benefits it provides, and the risks to downstream development. Additional general flood hazard information could also be included in an expanded public education effort. Elements of educational effort could include:

- Target downstream areas and any recreational users
- Educate real estate professionals
- Pursue property disclosure legislation
- Add a dam section to the District's website (background, function, benefits, and risks by geographic area)
- Upgrade the search capabilities of the District's website so that flooding information is more easily found
- Include an information station covering other past, current, and future flood control efforts within the area of interest at all of the District's other public meetings. The purpose would be to raise public awareness of flood hazards and present public benefits provided by the District on an ongoing basis.

MA 5.7. Summary of Non-Structural Alternatives Evaluation

Acquire Properties/Flowage Easements: May be worth pursuing within the reservoir pool up to the PMF level, but problematic for the Outlet Channel and Outfall due to high costs and the need to displace existing development.

Upgrade Emergency Action Plans: Necessary to modify EAP to match future configuration of McMicken Dam and incorporate any future recreational activities. Recommend

	future modification of EAP to incorporate recent hydrologic analysis performed for the Wittmann ADMSU as resources permit.
Protect Critical Facilities:	Could be pursued for selected facilities, but protection of all facilities would be impractical and could have negative impacts to surrounding structures. Recommend defining and identifying critical facilities using Maricopa County's existing database as resources permit.
Mitigate through Flood Insurance:	Includes beneficial public education component, but is unlikely to achieve significant acceptance from the public.
Mass Notification for Flood Warning:	Recommend the District cooperate with other County and local agencies to support their application of CENS for flood emergencies.
Public Education:	Recommend expanding the District's existing public education program on flood hazards and the benefits of the District's ongoing programs.

MA 6. References

Chow, V.T.; 1959; Open Channel Hydraulics

US Bureau of Reclamation; 1974; Design of Stilling Basins and Energy Dissipaters

O'Brien, J.; 2003; FLO-2D Users Manual

US Army Corps of Engineers; 1953; Design Memorandum No. 1, Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel

US Army Corps of Engineers; 1955; Design Memorandum No. 2, Design Analysis for Trilby Wash Detention Basin and Outlet Channel

Sergeant, Hauskins & Beckwith; 1983; Surface Water Hydrology Report, McMicken Dam Restoration Study, Maricopa County, Arizona

Flood Control District of Maricopa County; Rumann & Sutko; 1987; A Hydrologic Analysis of the McMicken Dam Watershed

Flood Control District of Maricopa County, Cruff; 2000, Hydrologic Analysis for McMicken Dam

Hoskins Engineering Consultants, Inc; 2001; McMicken Dam Spillway Delineation Study

Kimley-Horn and Associates, Inc.: 2001: Structures Assessment Program—Phase I alternatives Analysis Report. Prepared for the Flood Control District of Maricopa County

URS; 2002; McMicken Dam Individual Structures Assessment Report

Flood Control District of Maricopa County; Rumann; 2003; McMicken Spillway Analysis Memorandum

Michael Baker, Jr., Inc; 2003; McMicken Dam Outlet Channel Analysis

AMEC Earth & Environmental; 2003; Earth Fissures Investigation Report, McMicken Dam

AMEC Earth & Environmental; 2004; Design Report, McMicken Dam Fissure Risk Zone Remediation Project

AMEC Earth & Environmental; 2004; Design Report, McMicken Dam Fissure Risk Zone Remediation Project

Entellus; 2004; Wittmann ADMSU – Volume MD, McMicken Dam Hydrology Report

Geological Consultants Inc; 2004; Wittmann ADMSU – Volume SU, Land Subsidence and Earth Fissure Investigation Report

West Consultants Inc; 2004; Wittmann ADMSU – Volume GR, Geomorphology Report

LTM Engineering Inc; 2004; Emergency Action Plan Update for McMicken Dam Outlet Channel

APPENDIX A

SURVEY DATA

Dam Crest Elevations

Dam crest elevation data was not collected prior to year-2001. Previous survey activity was confined to collecting only the settlement monument elevations. The settlement monuments are located offset from dam centerline on the downstream face of the dam in a depression for protection and do not reflect the actual crest elevation. **Tables 1-A, B, & C** compare the 2002 crest elevation data at the lowest point adjacent to a settlement monument with the adjusted design crest elevation obtained from as-built construction plans. The design crest elevations must be adjusted because the design is referenced to NGVD 1929, while year-2002 survey data are referenced to a different vertical datum: NAVD 1988. Details of the adjustment calculation are outlined on page 16 of 16, **"Reference Marks."** **Figure 1-1** illustrates the comparison between the adjusted design crest elevations and the year-2002 survey data listed in **Table 1.** **Figure 1-2** displays the relative change in crest elevation obtained by subtracting the adjusted design crest elevation from the year-2002 survey elevations and plotting the relative elevation change at each station.

Elevation Station	Design Crest Elev	Adj Design Crest Elev	2002 Dam Crest Elev	2002 - Adj Dgn
44+90	1361.000	1363.015	1363.509	0.494
49+85	1361.000	1363.015	1363.147	0.132
55+07	1361.000	1363.015	1363.265	0.250
59+93	1361.000	1363.015	1363.673	0.658
64+94	1361.000	1363.015	1362.703	-0.312
69+85	1361.000	1363.015	1362.835	-0.180
74+90	1361.000	1363.015	1363.339	0.324
79+82	1361.000	1363.015	1363.110	0.095
84+95	1361.000	1363.015	1363.428	0.413
89+90	1361.000	1363.015	1362.527	-0.488
94+90	1361.000	1363.015	1362.237	-0.778
99+95	1361.000	1363.015	1362.516	-0.499
104+85	1361.000	1363.015	1362.390	-0.625
110+00	1361.000	1363.015	1362.402	-0.613
114+95	1361.000	1363.015	1362.530	-0.485
120+00	1361.000	1363.015	1362.482	-0.533
124+92	1361.000	1363.015	1362.467	-0.548
129+92	1361.000	1363.015	1363.042	0.027
134+87	1361.000	1363.015	1362.446	-0.569
139+96	1361.000	1363.015	1362.477	-0.538
144+90	1361.000	1363.015	1362.618	-0.397
149+84	1361.000	1363.015	1362.443	-0.572
154+93	1361.000	1363.015	1362.701	-0.314
159+95	1361.000	1363.015	1362.510	-0.505
165+08	1361.000	1363.015	1362.431	-0.584
169+92	1361.000	1363.015	1362.547	-0.468
174+93	1361.000	1363.015	1362.493	-0.522
179+91	1361.000	1363.015	1362.772	-0.243
184+88	1361.000	1363.015	1362.855	-0.160
189+93	1361.000	1363.015	1362.548	-0.467
		(Fig. 1-1 Plot Data)		(Fig. 1-2 Plot Data)

Elevation Station	Design Crest Elev	Adj Design Crest Elev	2002 Dam Crest Elev	2002 - Adj Dgn
194+97	1361.000	1363.015	1362.083	-0.932
199+93	1361.000	1363.015	1362.156	-0.859
204+96	1361.000	1363.015	1362.420	-0.595
210+01	1361.000	1363.015	1361.860	-1.155
214+94	1361.000	1363.015	1362.258	-0.757
219+96	1361.000	1363.015	1361.967	-1.048
225+00	1361.000	1363.015	1362.392	-0.623
229+98	1361.000	1363.015	1362.577	-0.438
234+92	1361.000	1363.015	1362.005	-1.010
239+97	1361.000	1363.015	1362.044	-0.971
245+00	1361.000	1363.015	1362.283	-0.732
249+97	1361.000	1363.015	1362.483	-0.532
254+94	1361.000	1363.015	1362.156	-0.859
259+94	1361.000	1363.015	1362.458	-0.557
264+92	1361.000	1363.015	1362.523	-0.492
269+95	1361.000	1363.015	1362.419	-0.596
275+05	1361.000	1363.015	1362.098	-0.917
280+03	1361.000	1363.015	1362.252	-0.763
285+00	1361.000	1363.015	1362.387	-0.628
289+90	1361.000	1363.015	1362.549	-0.466
294+96	1361.000	1363.015	1362.606	-0.409
299+92	1361.000	1363.015	1362.700	-0.315
304+90	1361.000	1363.015	1362.820	-0.195
309+99	1361.000	1363.015	1362.848	-0.167
314+94	1361.000	1363.015	1362.417	-0.598
319+90	1361.000	1363.015	1362.615	-0.400
325+03	1361.000	1363.015	1362.522	-0.493
329+92	1361.000	1363.015	1362.529	-0.486
335+00	1361.000	1363.015	1362.583	-0.432
340+00	1361.000	1363.015	1362.578	-0.437
344+94	1361.000	1363.015	1362.389	-0.626
		(Fig. 1-1 Plot Data)		(Fig. 1-2 Plot Data)

Station	Design Crest Elev	Adj Design Crest Elev	2002 Dam Crest Elev	2002 - Adj Dgn
349+89	1361.000	1363.015	1362.541	-0.474
354+98	1361.000	1363.015	1362.399	-0.616
359+95	1361.000	1363.015	1362.538	-0.477
364+97	1361.000	1363.015	1362.707	-0.308
369+92	1361.000	1363.015	1362.545	-0.470
379+95	1361.000	1363.015	1362.338	-0.677
389+95	1361.000	1363.015	1362.589	-0.426
395+04	1361.000	1363.015	1362.832	-0.183
400+00	1361.000	1363.015	1362.438	-0.577
404+95	1361.000	1363.015	1362.501	-0.514
410+02	1361.000	1363.015	1362.594	-0.421
415+00	1361.000	1363.015	1362.461	-0.554
420+04	1361.000	1363.015	1362.476	-0.539
424+94	1361.000	1363.015	1363.287	0.272
430+00	1361.000	1363.015	1362.634	-0.381
434+92	1361.000	1363.015	1362.728	-0.287
440+06	1361.000	1363.015	1363.099	0.084
444+94	1361.000	1363.015	1362.693	-0.322
450+04	1361.000	1363.015	1362.424	-0.591
454+95	1361.000	1363.015	1362.602	-0.413
459+93	1361.000	1363.015	1362.989	-0.026
464+95	1361.000	1363.015	1362.852	-0.163
470+07	1361.000	1363.015	1362.635	-0.380
475+03	1361.000	1363.015	1362.061	-0.954
479+80	1361.000	1363.015	1362.588	-0.427
484+93	1361.000	1363.015	1363.204	0.189
489+91	1361.000	1363.015	1363.015	0.000
495+00	1361.000	1363.015	1362.816	-0.199
500+07	1361.000	1363.015	1363.354	0.339
		(Fig. 1-1 Plot Data)		(Fig. 1-2 Plot Data)

Table 1
Dam Crest Elevations

Dam Crest Elevations

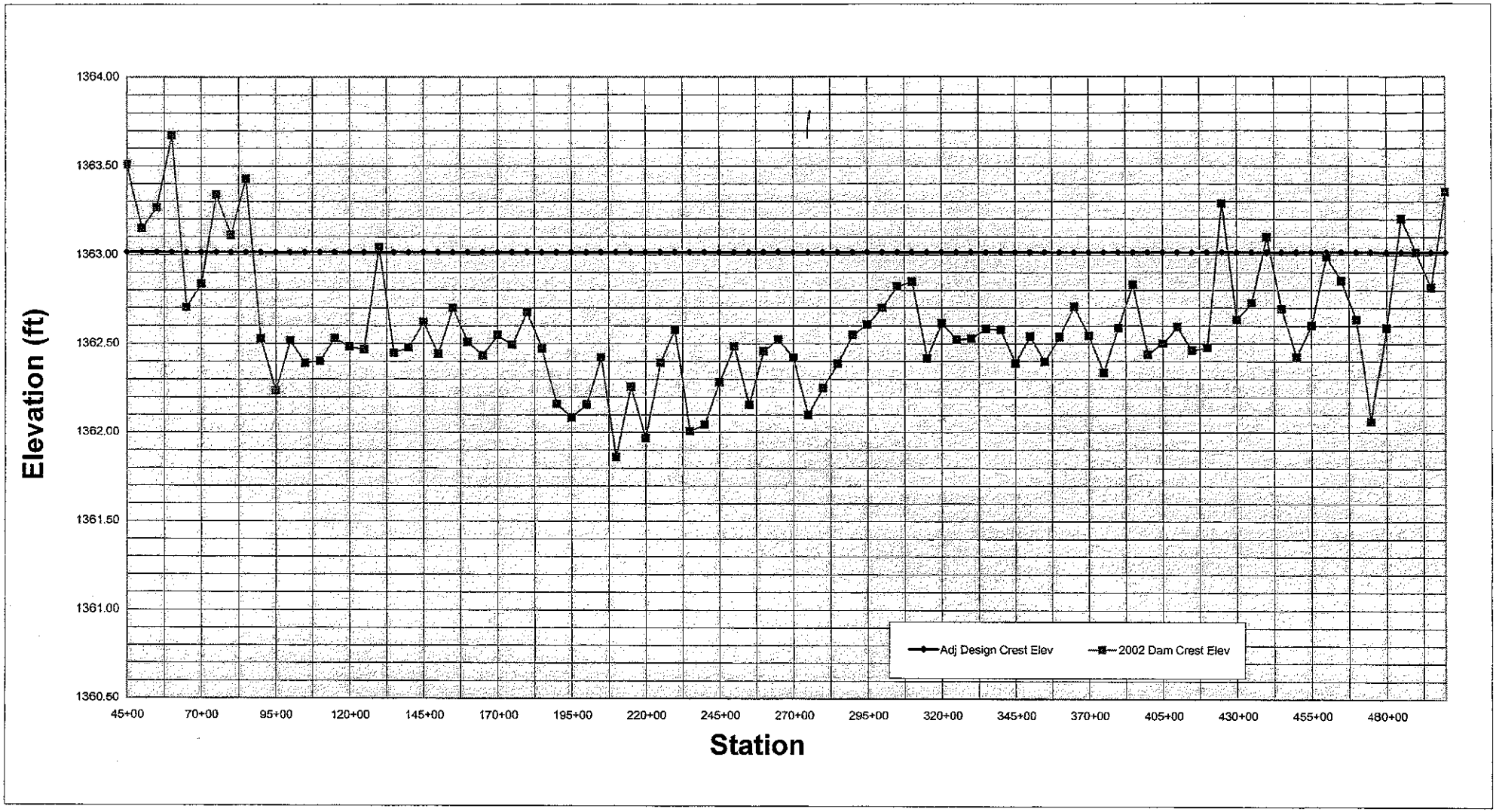


Figure 1-1
Dam Crest Elevation Comparison Chart

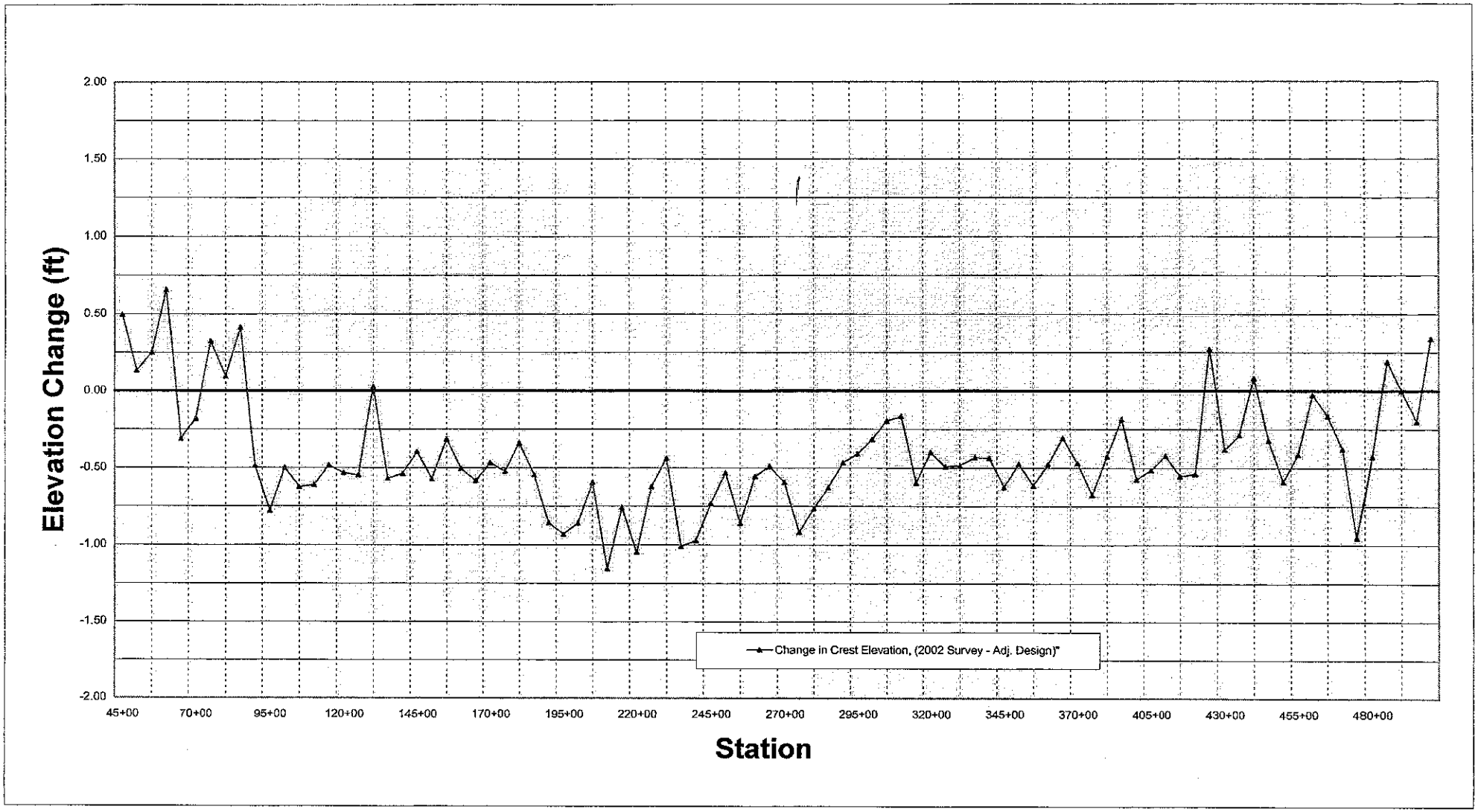


Figure 1-2
Change in Dam Crest Elevation Chart

Tables 2-A, B, & C summarize elevation data for crest settlement monuments. Elevation survey data collected prior to year-2001 is referenced to NGVD 1929, and has been adjusted for comparison with 2001 and 2002 elevations referenced to NAVD 1988. Adjustment details are outlined on page 16 of 16. **Figure 2-1** compares crest settlement nonument elevations for years 1986 through 2002.

		Crest Monument Survey Data							
Marker	**Station**	**1985**	**Adj 85**	**1991**	**Adj 91**	**1998**	**Adj 98**	**2001**	**2002**
40	40+00	1360.945	1362.960			1360.745	1362.760		
45	45+00	1361.719	1363.734	1361.490	1363.505	1361.495	1363.510	1363.434	1363.413
50	50+00	1361.537	1363.552	1361.311	1363.326	1361.325	1363.340	1363.226	1363.237
55	55+00	1361.428	1363.443	1361.179	1363.194	1361.185	1363.200	1363.105	1363.101
60	60+00	1362.027	1364.042	1361.768	1363.783	1361.765	1363.780	1363.644	1363.690
65	65+00	1361.362	1363.377	1361.038	1363.053	1360.965	1362.980	1362.874	1362.867
70	70+00	1361.253	1363.268	1360.910	1362.925	1360.865	1362.880	1362.754	1362.764
75	75+00	1361.767	1363.782	1361.430	1363.445	1361.385	1363.400	1363.286	1363.295
80	80+00	1361.665	1363.680	1361.310	1363.325	1361.265	1363.280	1363.183	1363.170
85	85+00	1362.033	1364.048	1361.660	1363.675	1361.605	1363.620	1363.511	1363.508
90	90+00	1361.271	1363.286	1360.865	1362.880	1360.805	1362.820	1362.695	1362.683
95	95+00	1361.164	1363.179	1360.716	1362.731	1360.635	1362.650	1362.511	1362.487
100	100+00	1361.375	1363.390	1360.880	1362.895	1360.785	1362.800	1362.680	1362.684
105	105+00	1361.269	1363.284	1360.756	1362.771	1360.635	1362.650	1362.547	1362.492
110	110+00	1361.164	1363.179	1360.624	1362.639	1360.505	1362.520	1362.370	1362.368
115	115+00	1361.380	1363.395	1360.872	1362.887	1360.745	1362.760	1362.606	1362.643
120	120+00	1361.303	1363.318	1360.798	1362.813	1360.685	1362.700	1362.569	1362.548
125	125+00	1361.225	1363.240	1360.756	1362.771	1360.655	1362.670	1362.532	1362.531
130	130+00	1361.662	1363.677	1361.201	1363.216	1361.095	1363.110	1362.952	1362.999
135	135+00	1361.153	1363.168	1360.728	1362.743	1360.630	1362.645	1362.474	1362.487
140	140+00	1361.341	1363.356	1360.902	1362.917	1360.805	1362.820	1362.683	1362.653
145	145+00	1361.266	1363.281	1360.854	1362.869	1360.765	1362.780	1362.681	1362.669
150	150+00	1361.273	1363.288	1360.859	1362.874	1360.775	1362.790	1362.701	1362.703
155	155+00	1361.156	1363.171	1360.742	1362.757	1360.655	1362.670	1362.566	1362.568
160	160+00	1361.226	1363.241	1360.823	1362.838	1360.745	1362.760	1362.649	1362.659
165	165+00	1361.273	1363.288	1360.868	1362.883	1360.775	1362.790	1362.668	1362.650
170	170+00	1361.397	1363.412	1360.994	1363.009	1360.905	1362.920	1362.784	1362.763
175	175+00	1361.333	1363.348			1360.835	1362.850	1362.708	1362.687

Table 2-A

STA 40+00 to 175+00 Crest Settlement Monument Elevations

Marker	Station	Crest Monument Survey Data							
		1985	Adj 85	1991	Adj 91	1998	Adj 98	2001	2002
180	180+00	1361.340	1363.355	1360.907	1362.922	1360.815	1362.830	1362.665	1362.696
185	185+00	1361.294	1363.309	1360.864	1362.879	1360.765	1362.780	1362.631	1362.643
190	190+00	1360.980	1362.995	1360.553	1362.568	1360.455	1362.470	1362.325	1362.318
195	195+00	1361.061	1363.076	1360.624	1362.639	1360.515	1362.530	1362.357	1362.416
200	200+00	1361.031	1363.046	1360.577	1362.592	1360.450	1362.465	1362.348	1362.330
205	205+00	1361.234	1363.249	1360.770	1362.785	1360.655	1362.670	1362.539	1362.561
210	210+00	1360.814	1362.829	1360.378	1362.393	1360.255	1362.270	1362.119	1362.131
215	215+00	1361.051	1363.066	1360.595	1362.610	1360.475	1362.490	1362.412	1362.333
220	220+00	1360.915	1362.930	1360.418	1362.433	1360.295	1362.310	1362.243	1362.218
225	225+00	1361.309	1363.324	1360.894	1362.909	1360.775	1362.790	1362.768	1362.645
230	230+00	1361.500	1363.515	1361.023	1363.038	1360.895	1362.910	1362.857	1362.817
235	235+00	1360.968	1362.983	1360.492	1362.507	1360.365	1362.380	1362.305	1362.267
240	240+00	1360.888	1362.903	1360.388	1362.403	1360.245	1362.260	1362.203	1362.154
245	245+00	1361.094	1363.109	1360.647	1362.662	1360.505	1362.520	1362.450	1362.402
250	250+00	1361.249	1363.264	1360.820	1362.835	1360.675	1362.690	1362.610	1362.558
255	255+00	1361.033	1363.048	1360.597	1362.612	1360.455	1362.470	1362.365	1362.357
260	260+00	1361.143	1363.158	1360.760	1362.775	1360.605	1362.620	1362.528	1362.496
265	265+00	1361.252	1363.267	1360.889	1362.904	1360.735	1362.750	1362.667	1362.653
270	270+00	1361.194	1363.209	1360.841	1362.856	1360.665	1362.680	1362.594	1362.580
275	275+00	1360.770	1362.785	1360.420	1362.435	1360.225	1362.240	1362.214	1362.180
280	280+00	1360.827	1362.842	1360.451	1362.466	1360.285	1362.300	1362.265	1362.146
285	285+00	1361.230	1363.245	1360.872	1362.887	1360.745	1362.760	1362.718	1362.597
290	290+00	1361.022	1363.037	1360.712	1362.727	1360.585	1362.600	1362.520	1362.493
295	295+00	1361.185	1363.200	1360.865	1362.880	1360.725	1362.740	1362.735	1362.631
300	300+00	1361.203	1363.218	1360.898	1362.913	1360.765	1362.780	1362.788	1362.669
305	305+00	1361.305	1363.320	1361.015	1363.030	1360.875	1362.890	1362.883	1362.755
310	310+00	1361.548	1363.563	1361.285	1363.300	1361.135	1363.150	1363.102	1362.983
315	315+00	1360.875	1362.890	1360.606	1362.621	1360.465	1362.480	1362.453	1362.344
320	320+00	1361.219	1363.234	1360.831	1362.846	1360.695	1362.710	1362.638	1362.578
325	325+00	1361.135	1363.150	1360.882	1362.897	1360.745	1362.760	1362.665	1362.645
330	330+00	1360.957	1362.972	1360.701	1362.716	1360.565	1362.580	1362.527	1362.461
335	335+00	1361.061	1363.076	1360.865	1362.880	1360.705	1362.720	1362.641	1362.653
340	340+00	1360.976	1362.991	1360.787	1362.802	1360.615	1362.630	1362.573	1362.522

Table 2-B

STA 180+00 to 340+00 Crest Settlement Monument Elevations

Marker	Station	Crest Monument Survey Data							
		1985	Adj 85	1991	Adj 91	1998	Adj 98	2001	2002
345	345+00	1360.911	1362.926	1360.706	1362.721	1360.555	1362.570	1362.506	1362.499
350	350+00	1360.928	1362.943	1360.714	1362.729	1360.545	1362.560	1362.529	1362.464
355	355+00	1361.001	1363.016	1360.813	1362.828	1360.655	1362.670	1362.648	1362.609
360	360+00	1361.139	1363.154	1360.905	1362.920	1360.725	1362.740	1362.694	1362.669
365	365+00	1361.085	1363.100	1360.848	1362.863	1360.665	1362.680	1362.640	1362.587
370	370+00	1361.061	1363.076	1360.872	1362.887	1360.675	1362.690	1362.652	1362.611
375	375+00	1360.899	1362.914	1360.693	1362.708	1360.445	1362.460		
380	380+00	1360.790	1362.805	1360.605	1362.620	1360.415	1362.430	1362.387	1362.370
385	385+00	1361.567	1363.582	1361.350	1363.365	1361.075	1363.090		
390	390+00	1360.833	1362.848	1360.687	1362.702	1360.505	1362.520	1362.492	1362.397
395	395+00	1361.462	1363.477	1361.241	1363.256	1361.055	1363.070	1363.046	1362.991
400	400+00	1361.135	1363.150	1360.863	1362.878	1360.705	1362.720	1362.717	1362.655
405	405+00	1361.129	1363.144	1360.932	1362.947	1360.745	1362.760	1362.727	1362.700
410	410+00	1360.777	1362.792	1360.558	1362.573	1360.385	1362.400	1362.372	1362.322
415	415+00	1361.159	1363.174	1360.900	1362.915	1360.725	1362.740	1362.707	1362.669
420	420+00	1361.062	1363.077	1360.852	1362.867	1360.665	1362.680	1362.660	1362.617
425	425+00	1361.727	1363.742	1361.471	1363.486	1361.245	1363.260	1363.245	1363.207
430	430+00	1361.226	1363.241	1361.034	1363.049	1360.805	1362.820	1362.807	1362.767
435	435+00	1361.054	1363.069	1360.869	1362.884	1360.665	1362.680	1362.683	1362.671
440	440+00	1361.569	1363.584	1361.382	1363.397	1361.185	1363.200	1363.191	1363.150
445	445+00	1361.115	1363.130	1360.893	1362.908	1360.705	1362.720	1362.724	1362.662
450	450+00	1361.041	1363.056	1360.847	1362.862	1360.665	1362.680	1362.665	1362.617
455	455+00	1360.868	1362.883	1360.702	1362.717	1360.495	1362.510	1362.509	1362.476
460	460+00	1361.258	1363.273	1361.140	1363.155	1360.975	1362.990	1363.009	1362.985
465	465+00	1361.254	1363.269	1361.071	1363.086	1360.865	1362.880	1362.869	1362.864
470	470+00	1361.170	1363.185	1360.972	1362.987	1360.775	1362.790	1362.786	1362.764
475	475+00	1360.664	1362.679	1360.453	1362.468	1360.225	1362.240	1362.296	1362.187
480	480+00	1360.745	1362.760	1360.550	1362.565	1360.325	1362.340	1362.373	1362.386
485	485+00	1361.419	1363.434	1361.294	1363.309	1361.105	1363.120	1363.168	1363.156
490	490+00	1361.209	1363.224	1361.116	1363.131	1360.925	1362.940	1363.029	1362.991
495	495+00	1360.984	1362.999	1360.940	1362.955	1360.775	1362.790	1362.890	1362.840
500	500+00	1361.455	1363.470	1361.415	1363.430	1361.255	1363.270	1363.315	1363.376

Table 2-C

STA 345+00 to 500+00 Crest Settlement Monument Elevations

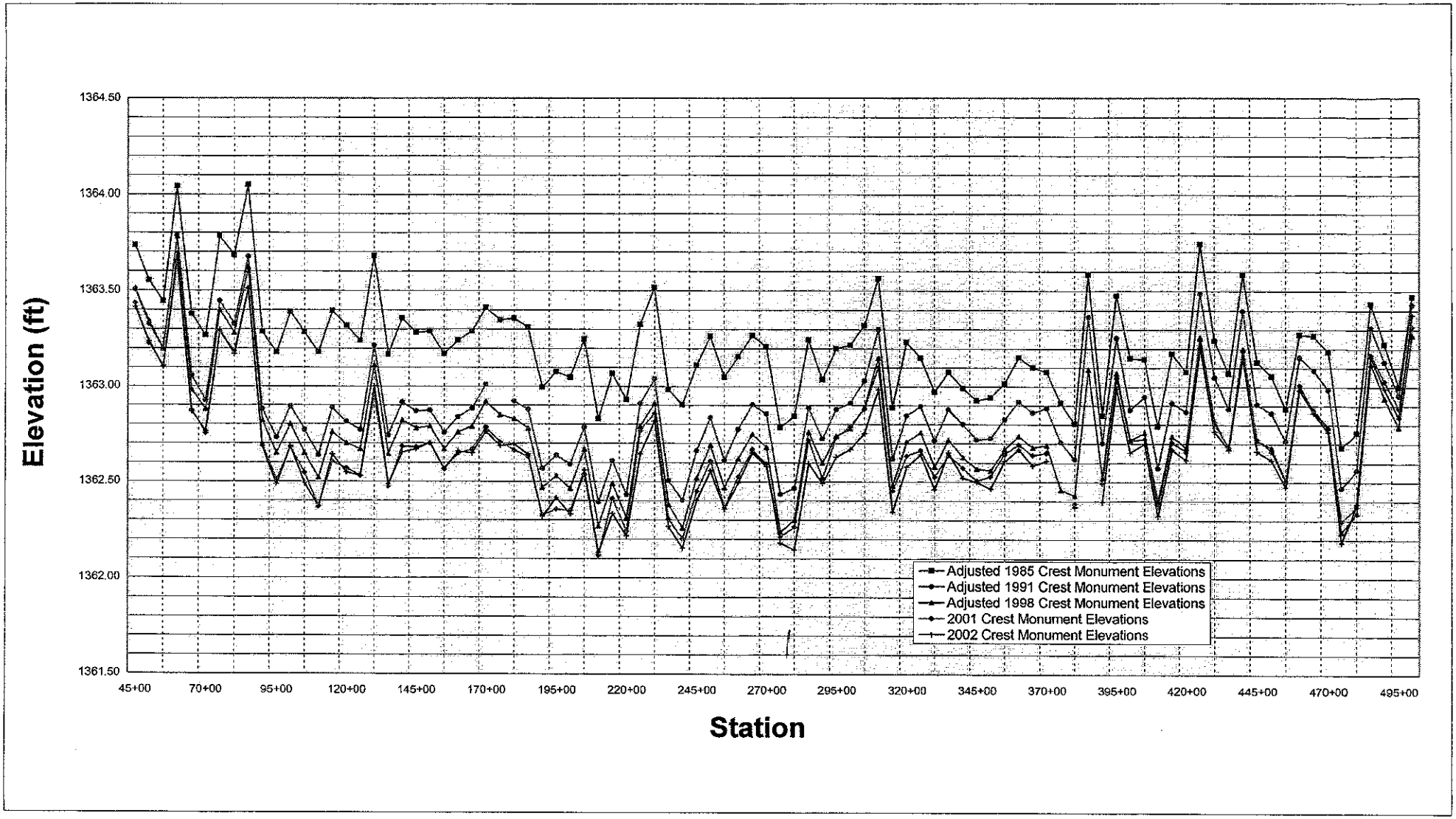


Figure 2-1
Elevation of Crest Settlement Monuments Chart

Tables 3-A, B, C below, summarize crest monument elevations, their adjustment as noted and the relative elevation change obtained by subtracting the adjusted 1985 elevation from the adjusted elevation surveyed in consecutive years (1991, 1998, 2001 and 2002). **Figure 3-1** illustrates the relative change in settlement monuments as calculated in **Tables 3-A, B, & C.** Adjusted elevation data obtained from the 1985 survey is used as a baseline, since the 1985 data set is the earliest available elevation reference.

		Crest Monument Survey Data							
Marker	Station	Adj 85	Adj 91	Adj 98	2001	2002	Adj 91 - Adj 85	Adj 98 - Adj 85	2001 - Adj 85	2002 - Adj 85
40	40+00	1362.960		1362.760				-0.200		
45	45+00	1363.734	1363.505	1363.510	1363.434	1363.413	-0.229	-0.224	-0.300	-0.321
50	50+00	1363.552	1363.326	1363.340	1363.226	1363.237	-0.226	-0.212	-0.326	-0.315
55	55+00	1363.443	1363.194	1363.200	1363.105	1363.101	-0.249	-0.243	-0.338	-0.342
60	60+00	1364.042	1363.783	1363.780	1363.644	1363.690	-0.259	-0.262	-0.398	-0.352
65	65+00	1363.377	1363.053	1362.980	1362.874	1362.867	-0.324	-0.397	-0.503	-0.510
70	70+00	1363.268	1362.925	1362.880	1362.754	1362.764	-0.343	-0.388	-0.514	-0.504
75	75+00	1363.782	1363.445	1363.400	1363.286	1363.295	-0.337	-0.382	-0.496	-0.487
80	80+00	1363.680	1363.325	1363.280	1363.183	1363.170	-0.355	-0.400	-0.497	-0.510
85	85+00	1364.048	1363.675	1363.620	1363.511	1363.508	-0.373	-0.428	-0.537	-0.540
90	90+00	1363.286	1362.880	1362.820	1362.695	1362.683	-0.406	-0.466	-0.591	-0.603
95	95+00	1363.179	1362.731	1362.650	1362.511	1362.487	-0.448	-0.529	-0.668	-0.692
100	100+00	1363.390	1362.895	1362.800	1362.680	1362.684	-0.495	-0.590	-0.710	-0.706
105	105+00	1363.284	1362.771	1362.650	1362.547	1362.492	-0.513	-0.634	-0.737	-0.792
110	110+00	1363.179	1362.639	1362.520	1362.370	1362.368	-0.540	-0.659	-0.809	-0.811
115	115+00	1363.395	1362.887	1362.760	1362.606	1362.643	-0.508	-0.635	-0.789	-0.752
120	120+00	1363.318	1362.813	1362.700	1362.569	1362.548	-0.505	-0.618	-0.749	-0.770
125	125+00	1363.240	1362.771	1362.670	1362.532	1362.531	-0.469	-0.570	-0.708	-0.709
130	130+00	1363.677	1363.216	1363.110	1362.952	1362.999	-0.461	-0.567	-0.725	-0.678
135	135+00	1363.168	1362.743	1362.645	1362.474	1362.487	-0.425	-0.523	-0.694	-0.681
140	140+00	1363.356	1362.917	1362.820	1362.683	1362.653	-0.439	-0.536	-0.673	-0.703
145	145+00	1363.281	1362.869	1362.780	1362.681	1362.669	-0.412	-0.501	-0.600	-0.612
150	150+00	1363.288	1362.874	1362.790	1362.701	1362.703	-0.414	-0.498	-0.587	-0.585
155	155+00	1363.171	1362.757	1362.670	1362.566	1362.568	-0.414	-0.501	-0.605	-0.603
160	160+00	1363.241	1362.838	1362.760	1362.649	1362.659	-0.403	-0.481	-0.592	-0.582
165	165+00	1363.288	1362.883	1362.790	1362.668	1362.650	-0.405	-0.498	-0.620	-0.638
170	170+00	1363.412	1363.009	1362.920	1362.784	1362.763	-0.403	-0.492	-0.628	-0.649
175	175+00	1363.348		1362.850	1362.708	1362.687		-0.498	-0.640	-0.661

(Fig. 3-1 Plot Data)

Table 3-A

Crest Settlement Monument Relative Elevation Change, with Adjusted 1985 Survey Data as Baseline

STA 40+00 to 175+00

Marker	Station	Crest Monument Survey Data Adj 85	Adj 91	Adj 98	2001	2002
180	180+00	1363.355	1362.922	1362.830	1362.665	1362.696
185	185+00	1363.309	1362.879	1362.780	1362.631	1362.643
190	190+00	1362.995	1362.568	1362.470	1362.325	1362.318
195	195+00	1363.076	1362.639	1362.530	1362.357	1362.416
200	200+00	1363.046	1362.592	1362.465	1362.348	1362.330
205	205+00	1363.249	1362.785	1362.670	1362.539	1362.561
210	210+00	1362.829	1362.393	1362.270	1362.119	1362.131
215	215+00	1363.066	1362.610	1362.490	1362.412	1362.333
220	220+00	1362.930	1362.433	1362.310	1362.243	1362.218
225	225+00	1363.324	1362.909	1362.790	1362.768	1362.645
230	230+00	1363.515	1363.038	1362.910	1362.857	1362.817
235	235+00	1362.983	1362.507	1362.380	1362.305	1362.267
240	240+00	1362.903	1362.403	1362.260	1362.203	1362.154
245	245+00	1363.109	1362.662	1362.520	1362.450	1362.402
250	250+00	1363.264	1362.835	1362.690	1362.610	1362.558
255	255+00	1363.048	1362.612	1362.470	1362.365	1362.357
260	260+00	1363.158	1362.775	1362.620	1362.528	1362.496
265	265+00	1363.267	1362.904	1362.760	1362.667	1362.653
270	270+00	1363.209	1362.856	1362.680	1362.594	1362.580
275	275+00	1362.785	1362.435	1362.240	1362.214	1362.180
280	280+00	1362.842	1362.466	1362.300	1362.265	1362.146
285	285+00	1363.245	1362.887	1362.760	1362.718	1362.597
290	290+00	1363.037	1362.727	1362.600	1362.520	1362.493
295	295+00	1363.200	1362.880	1362.740	1362.735	1362.631
300	300+00	1363.218	1362.913	1362.780	1362.788	1362.669
305	305+00	1363.320	1363.030	1362.890	1362.883	1362.755
310	310+00	1363.563	1363.300	1363.150	1363.102	1362.983
315	315+00	1362.890	1362.621	1362.480	1362.453	1362.344
320	320+00	1363.234	1362.846	1362.710	1362.638	1362.578
325	325+00	1363.150	1362.897	1362.760	1362.665	1362.645
330	330+00	1362.972	1362.716	1362.580	1362.527	1362.461
335	335+00	1363.076	1362.880	1362.720	1362.641	1362.653
340	340+00	1362.991	1362.802	1362.630	1362.573	1362.522

Adj 91 - Adj 85	Adj 98 - Adj 85	2001 - Adj 85	2002 - Adj 85
-0.433	-0.525	-0.690	-0.659
-0.430	-0.529	-0.678	-0.666
-0.427	-0.525	-0.670	-0.677
-0.437	-0.546	-0.719	-0.660
-0.454	-0.581	-0.698	-0.716
-0.464	-0.579	-0.710	-0.688
-0.436	-0.559	-0.710	-0.698
-0.456	-0.576	-0.654	-0.733
-0.497	-0.620	-0.687	-0.712
-0.415	-0.534	-0.556	-0.679
-0.477	-0.605	-0.658	-0.698
-0.476	-0.603	-0.678	-0.716
-0.500	-0.643	-0.700	-0.749
-0.447	-0.589	-0.659	-0.707
-0.429	-0.574	-0.654	-0.706
-0.436	-0.578	-0.683	-0.691
-0.383	-0.538	-0.630	-0.662
-0.363	-0.517	-0.600	-0.614
-0.353	-0.529	-0.615	-0.629
-0.350	-0.545	-0.571	-0.605
-0.376	-0.542	-0.577	-0.696
-0.358	-0.485	-0.527	-0.648
-0.310	-0.437	-0.517	-0.544
-0.320	-0.460	-0.465	-0.569
-0.305	-0.438	-0.430	-0.549
-0.290	-0.430	-0.437	-0.565
-0.263	-0.413	-0.461	-0.580
-0.269	-0.410	-0.437	-0.546
-0.388	-0.524	-0.596	-0.656
-0.253	-0.390	-0.485	-0.505
-0.256	-0.392	-0.445	-0.511
-0.196	-0.356	-0.435	-0.423
-0.189	-0.361	-0.418	-0.469

(Fig. 3-1 Plot Data)

Table 3-B

Crest Settlement Monument Relative Elevation Change, with Adjusted 1985 Survey Data as Baseline

STA 180+00 to 340+00

Marker	Station	Crest Monument Survey Data Adj 85	Adj 91	Adj 98	2001	2002
345	345+00	1362.926	1362.721	1362.570	1362.506	1362.499
350	350+00	1362.943	1362.729	1362.560	1362.529	1362.464
355	355+00	1363.016	1362.828	1362.670	1362.648	1362.609
360	360+00	1363.154	1362.920	1362.740	1362.694	1362.669
365	365+00	1363.100	1362.863	1362.680	1362.640	1362.587
370	370+00	1363.076	1362.887	1362.690	1362.652	1362.611
375	375+00	1362.914	1362.708	1362.460		
380	380+00	1362.805	1362.620	1362.430	1362.387	1362.370
385	385+00	1363.582	1363.365	1363.090		
390	390+00	1362.848	1362.702	1362.520	1362.492	1362.397
395	395+00	1363.477	1363.256	1363.070	1363.046	1362.991
400	400+00	1363.150	1362.878	1362.720	1362.717	1362.655
405	405+00	1363.144	1362.947	1362.760	1362.727	1362.700
410	410+00	1362.792	1362.573	1362.400	1362.372	1362.322
415	415+00	1363.174	1362.915	1362.740	1362.707	1362.669
420	420+00	1363.077	1362.867	1362.680	1362.660	1362.617
425	425+00	1363.742	1363.486	1363.260	1363.245	1363.207
430	430+00	1363.241	1363.049	1362.820	1362.807	1362.767
435	435+00	1363.069	1362.884	1362.680	1362.683	1362.671
440	440+00	1363.584	1363.397	1363.200	1363.191	1363.150
445	445+00	1363.130	1362.908	1362.720	1362.724	1362.662
450	450+00	1363.056	1362.862	1362.680	1362.665	1362.617
455	455+00	1362.883	1362.717	1362.510	1362.509	1362.476
460	460+00	1363.273	1363.155	1362.990	1363.009	1362.985
465	465+00	1363.269	1363.086	1362.880	1362.869	1362.864
470	470+00	1363.185	1362.987	1362.790	1362.786	1362.764
475	475+00	1362.679	1362.468	1362.240	1362.296	1362.187
480	480+00	1362.760	1362.565	1362.340	1362.373	1362.386
485	485+00	1363.434	1363.309	1363.120	1363.168	1363.156
490	490+00	1363.224	1363.131	1362.940	1363.029	1362.991
495	495+00	1362.999	1362.955	1362.790	1362.890	1362.840
500	500+00	1363.470	1363.430	1363.270	1363.315	1363.376

Adj 91 - Adj 85	Adj 98 - Adj 85	2001 - Adj 85	2002 - Adj 85
-0.205	-0.356	-0.420	-0.427
-0.214	-0.383	-0.414	-0.479
-0.188	-0.346	-0.368	-0.407
-0.234	-0.414	-0.460	-0.485
-0.237	-0.420	-0.460	-0.513
-0.189	-0.386	-0.424	-0.465
-0.206	-0.454		
-0.185	-0.375	-0.418	-0.435
-0.217	-0.492		
-0.146	-0.328	-0.356	-0.451
-0.221	-0.407	-0.431	-0.486
-0.272	-0.430	-0.433	-0.495
-0.197	-0.384	-0.417	-0.444
-0.219	-0.392	-0.420	-0.470
-0.259	-0.434	-0.467	-0.505
-0.210	-0.397	-0.417	-0.460
-0.256	-0.482	-0.497	-0.535
-0.192	-0.421	-0.434	-0.474
-0.185	-0.389	-0.386	-0.398
-0.187	-0.384	-0.393	-0.434
-0.222	-0.410	-0.406	-0.468
-0.194	-0.376	-0.391	-0.439
-0.166	-0.373	-0.374	-0.407
-0.118	-0.283	-0.264	-0.288
-0.183	-0.389	-0.400	-0.405
-0.198	-0.395	-0.399	-0.421
-0.211	-0.439	-0.383	-0.492
-0.195	-0.420	-0.387	-0.374
-0.125	-0.314	-0.266	-0.278
-0.093	-0.284	-0.195	-0.233
-0.044	-0.209	-0.109	-0.159
-0.040	-0.200	-0.155	-0.094

(Fig. 3-1 Plot Data)

Table 3-C

Crest Settlement Monument Relative Elevation Change, with Adjusted 1985 Survey Data as Baseline

STA 345+00 to 500+00

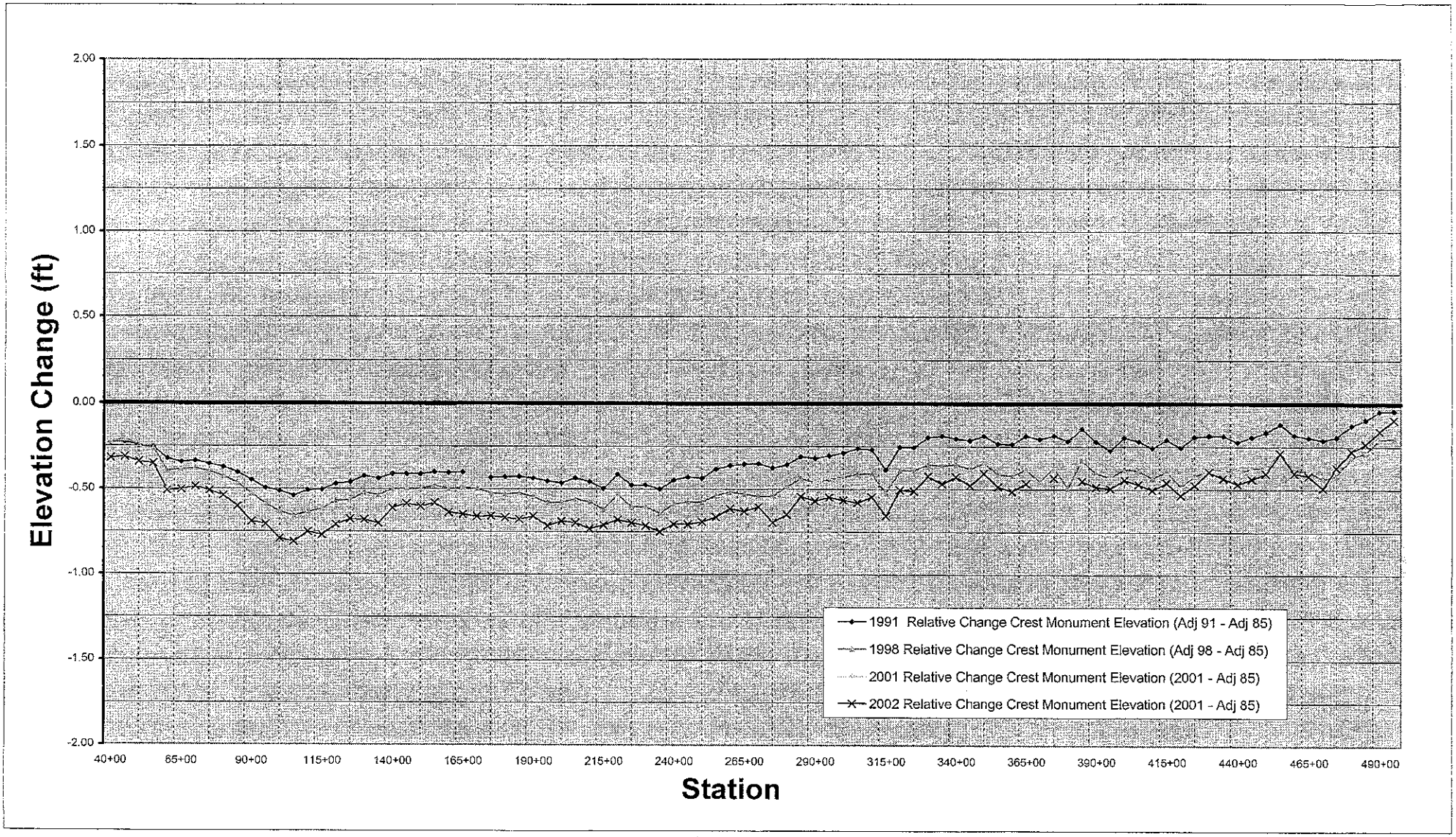


Figure 3-1

Relative Change in Crest Monument Elevation Chart, 1985 Survey Data Baseline Elevation Reference

Marker	Station	Northing	Easting	As-Built	Adj As-Built	2001	2001 - Adj As-Built	2002	2002 - Adj As-Built	Description
10200	504+73	977389.159	545924.949	Topo Varies		1353.846		1353.874		NORTH END ROCK SPILLWAY TOE
10201	504+73	977388.394	545920.727	1354.000	1356.015	1355.202	-0.813	1355.215	-0.800	NORTH END ROCK SPILLWAY TOP
10202	504+73	977387.829	545915.704	1354.000	1356.015	1355.103	-0.912	1355.131	-0.884	NORTH END ROCK SPILLWAY TOP
10203	504+73	977386.637	545909.537	Topo Varies		1352.927		1352.885		NORTH END ROCK SPILLWAY TOE
10204	507+74	977689.067	545902.570	Topo Varies		1352.427		1352.472		NORTH END ROCK SPILLWAY TOE
10205	507+74	977689.669	545912.878	1354.000	1356.015	1355.422	-0.593	1355.452	-0.563	NORTH END ROCK SPILLWAY TOP
10206	507+74	977689.103	545918.682	1354.000	1356.015	1355.239	-0.776	1355.232	-0.783	NORTH END ROCK SPILLWAY TOP
10207	507+74	977689.023	545918.777	1354.000	1356.015	1355.256	-0.759	1355.280	-0.735	NORTH END ROCK SPILLWAY TOP
10208	507+74	977688.720	545926.524	Topo Varies		1353.578		1353.592		NORTH END ROCK SPILLWAY TOE
10209	51+217	978130.889	545898.389	Topo Varies		1352.474		1352.510		NORTH END ROCK SPILLWAY TOE
10210	51+217	978131.518	545907.095	1354.000	1356.015	1355.317	-0.698	1355.257	-0.758	NORTH END ROCK SPILLWAY TOP
10211	51+217	978131.109	545913.345	1354.000	1356.015	1355.278	-0.737	1355.247	-0.768	NORTH END ROCK SPILLWAY TOP
10212	51+217	978131.013	545919.708	Topo Varies		1353.616		1353.598		NORTH END ROCK SPILLWAY TOE
10213	516+24	978537.968	545892.365	Topo Varies		1351.772		1351.755		NORTH END ROCK SPILLWAY TOE
10214	516+24	978538.301	545902.460	1354.000	1356.015	1355.505	-0.510	1355.480	-0.535	NORTH END ROCK SPILLWAY TOP
10215	516+24	978538.694	545908.305	1354.000	1356.015	1355.375	-0.640	1355.380	-0.635	NORTH END ROCK SPILLWAY TOP
10216	516+24	978538.511	545913.920	Topo Varies		1353.289		1353.405		NORTH END ROCK SPILLWAY TOE
10217	520+26	978940.462	545888.262	Topo Varies		1352.203		1352.089		NORTH END ROCK SPILLWAY TOE
10218	520+26	978940.827	545897.648	1354.000	1356.015	1355.377	-0.638	1355.418	-0.597	NORTH END ROCK SPILLWAY TOP
10219	520+26	978941.780	545903.433	1354.000	1356.015	1355.438	-0.577	1355.526	-0.489	NORTH END ROCK SPILLWAY TOP
10220	520+26	978941.428	545909.090	Topo Varies		1353.322		1353.379		NORTH END ROCK SPILLWAY TOE
10221	524+85	979332.213	545883.098	Topo Varies		1352.289		1352.290		NORTH END ROCK SPILLWAY TOE
10222	524+85	979332.922	545893.185	1354.000	1356.015	1355.301	-0.714	1355.304	-0.711	NORTH END ROCK SPILLWAY TOP
10223	524+85	979332.091	545900.073	1354.000	1356.015	1355.387	-0.628	1355.356	-0.659	NORTH END ROCK SPILLWAY TOP
10224	524+85	979329.431	545910.554	Topo Varies		1353.436		1353.408		NORTH END ROCK SPILLWAY TOE
10225	524+85	979354.522	545873.400	Topo Varies		1352.876		1353.135		NORTH END ROCK SPILLWAY TOE
10226	524+85	979354.009	545887.565	1354.000	1356.015	1355.526	-0.489	1355.583	-0.432	NORTH END ROCK SPILLWAY TOP
10227	524+85	979355.245	545899.640	1354.000	1356.015	1356.060	0.045	1356.123	0.108	NORTH END ROCK SPILLWAY TOP
10228	524+85	979355.866	545923.445	Topo Varies		1354.331		1354.370		NORTH END ROCK SPILLWAY TOE
10229	524+85	979355.745	545923.688	Topo Varies		1354.336		1354.359		NORTH END ROCK SPILLWAY TOE
10230	524+85	979379.898	545916.470	Topo Varies		1357.908		1357.968		NORTH END ROCK SPILLWAY TOE
10231	524+85	979379.733	545899.689	1354.000	1356.015	1361.781	5.766	1361.804	5.789	NORTH END ROCK SPILLWAY TOP
10232	524+85	979379.064	545891.340	1354.000	1356.015	1361.769	5.754	1361.844	5.829	NORTH END ROCK SPILLWAY TOP
10233	524+85	979380.214	545878.852	Topo Varies		1357.392		1357.395		NORTH END ROCK SPILLWAY TOE

Average Crest Elevation Markers **10201 - 10223 =**	**1355.323**	**1355.329**	**NAVD 88**
	1353.308	**1353.314**	**NGVD 29**

Table 4-A
Emergency Spillway Elevations

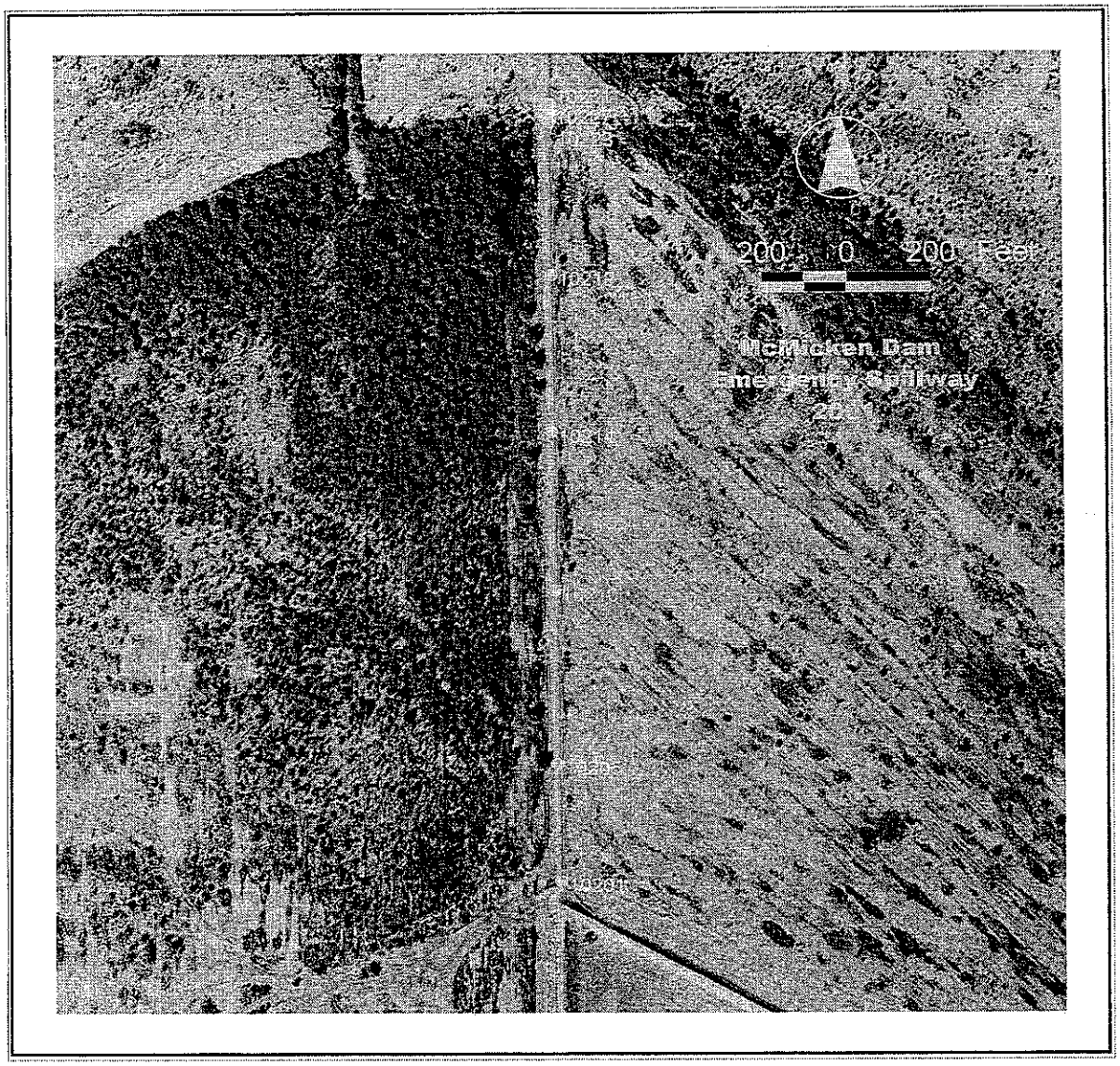
Marker	Station	Northing	Easting	As-Built	Adj As-Built	2001	2001- Adj As-Built	2002	2002- Adj As-Built	Description
10002	398+24	967947.913	541821.301	unavailable[1]		1335.819		1335.771		CHISELED "X" ON IRRIG. INLET STRUCTURE
10003	387+14	967376.792	540935.033	unavailable[1]		1335.459		1335.402		CHISELED "X" ON IRRIG. INLET STRUCTURE
10004	398+35	967821.599	541967.453	unavailable[1]		1332.764		1332.717		CHISELED "X" ON IRRIG. OUTLET INVERT
10005	387+50	967194.554	541020.636	unavailable[1]		1332.341		1332.280		CHISELED "X" ON IRRIG. OUTLET INVERT
10101	474+50	974390.445	545839.327	1335.000	1337.015	1335.779	-1.236	1336.116	-0.899	SCRIBE "X" ON SPILLWAY (Upper Apron, LT)
10102	474+50	974408.460	545846.494	1335.000	1337.015	1335.777	-1.238	1336.116	-0.899	SCRIBE "X" ON SPILLWAY (Upper Apron, RT)
10103	474+50	974376.552	545928.266	1333.800	1335.815	1334.636	-1.179	1334.962	-0.853	SCRIBE "X" ON SPILLWAY (Drop Structure Top of Slope,RT)
10104	474+50	974358.664	545921.143	1333.800	1335.815	1334.575	-1.240	1334.909	-0.906	SCRIBE "X" ON SPILLWAY (Drop Structure Top of Slope,LT)
10105	474+50	974365.444	545900.894	1361.000	1363.015	1361.699	-1.316	1362.026	-0.989	SCRIBE "X" ON SPILLWAY (Roadway Overpass, Top Corners)
10106	474+50	974385.392	545908.644	1361.000	1363.015	1361.737	-1.278	1362.066	-0.949	SCRIBE "X" ON SPILLWAY (Roadway Overpass, Top Corners)
10107	474+50	974361.379	545911.682	1361.000	1363.015	1361.672	-1.343	1362.116	-0.899	SCRIBE "X" ON SPILLWAY (Roadway Overpass, Top Corners)
10108	474+50	974381.037	545919.264	1361.000	1363.015	1361.736	-1.279	1362.174	-0.841	SCRIBE "X" ON SPILLWAY (Roadway Overpass, Top Corners)
10109	474+50	974341.108	545952.353	1320.000	1322.015	1320.689	-1.326	1321.154	-0.861	SCRIBE "X" ON SPILLWAY (Drop Structure Toe of Slope, LT)
10110	474+50	974368.374	545963.055	1320.000	1322.015	1320.708	-1.307	1321.169	-0.846	SCRIBE "X" ON SPILLWAY (Drop Structure Toe of Slope, RT)
10111	474+50	974345.613	546021.218	1320.000	1322.015	1320.707	-1.308	1321.175	-0.840	SCRIBE "X" ON SPILLWAY (Stilling Basin Threshold Bottom, RT)
10112	474+50	974345.402	546021.909	1321.500	1323.515	1322.170	-1.345	1322.638	-0.877	SCRIBE "X" ON SPILLWAY (Stilling Basin Threshold Top, RT)
10113	474+50	974318.354	546010.581	1320.000	1322.015	1320.751	-1.264	1321.220	-0.795	SCRIBE "X" ON SPILLWAY (Stilling Basin Threshold Bottom, LT)
10114	474+50	974318.078	546011.195	1321.500	1323.515	1322.212	-1.303	1322.681	-0.834	SCRIBE "X" ON SPILLWAY (Stilling Basin Threshold Top, LT)

Notes:

1: Irrigation pipes modified from construction plan details, elevation data for comparison with 2001 survey data unavailable

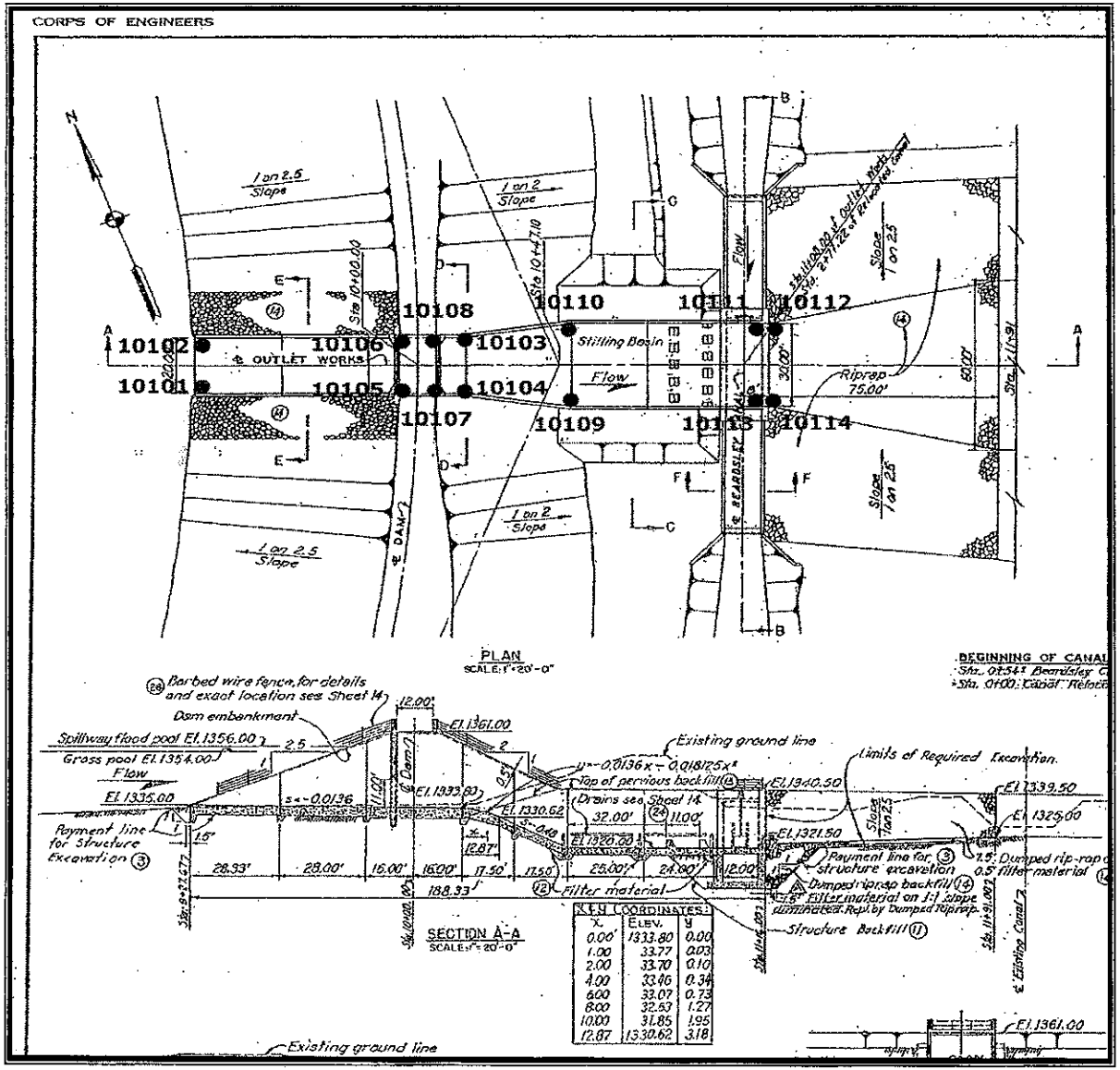
Table 4-B
Misc. Elevations

Spillway & Misc. Elevations



Marker	2001 - Adj As-Built	2002 - Adj As-Built	Description
10201	-0.813	-0.800	ROCK SPILLWAY TOP
10205	-0.593	-0.563	ROCK SPILLWAY TOP
10210	-0.698	-0.758	ROCK SPILLWAY TOP
10214	-0.510	-0.535	ROCK SPILLWAY TOP
10219	-0.577	-0.489	ROCK SPILLWAY TOP
10223	-0.628	-0.659	ROCK SPILLWAY TOP
10227	0.045	0.108	ROCK SPILLWAY TOP
10231	5.766	5.789	ROCK SPILLWAY TOP

Figure 4-1
2001 & 2002 Survey Point Locations, McMicken Dam



Marker	2001 - Adj As-Built	2002 - Adj As-Built	Description
10101	-1.236	-0.899	TOE OF SLOPE
10102	-1.238	-0.899	AVERAGE GROUND
10105	-1.316	-0.989	(Overpass, Top Corners)
10106	-1.278	-0.949	(Overpass, Top Corners)
10107	-1.343	-0.899	(Overpass, Top Corners)
10108	-1.279	-0.841	(Overpass, Top Corners)
10109	-1.326	-0.861	(Drop Str. Toe Slope, LT)
10110	-1.307	-0.846	(Drop Str. Toe Slope, RT)
10111	-1.308	-0.840	(Stil. Bas.Thrsh. Bot., RT)
10112	-1.345	-0.877	(Stil. Bas.Thrsh. Top, RT)
10113	-1.264	-0.795	(Stil. Bas. Thrsh. Bot., LT)
10114	-1.303	-0.834	(Stil. Bas. Thrsh. Top, LT)

Figure 4-2
2001 & 2002 Survey Point Locations,
McMicken Dam Principal Outlet Structure

The McMicken Dam Subsidence Surveys, 1985 through 1998, reference several vertical benchmarks: BM "Q 475", BM "N 475" and BM "J 265". The difference in benchmark "Q 475's" elevation from year-2002 to year-1985 is calculated in order to determine the Datum Shift adjustment between measurements referenced to NGVD 1929 and NAVD 1988.

Based on the Datum Shift at Benchmark "Q 475", NAVD 1988 Elevation equals NGVD 1929 Elevation plus 2.015 ft. The the highlighted elevation values in the "Adjusted" Column for each table reflects this calulation.

Bench	NGS Data Sheet			Settlement Survey Records					Datum Shift		Datum Shift	
Mark	NAVD 29	NAVD 88	Description	1985	1991	1998	2001	2002	2001-1991	2001-1998	2002-1991	20021-1998
FRI4	1598	1600 (VERT)	Brass Cap PID DV1860	-	-	-	1594.750	1594.750	-	-	-	-
BED1	-	1516.8	Brass Cap PID DV1277	-	-	-	1516.980	-	-	-	-	-
COT	1363	1365 (VERT)	Brass Cap PID DV1860	-	-	-	1361.774	-	-	-	-	-
H366	1339.92	1340.28	Brass Cap PID DV0094	-	-	-	1341.758	1341.702	-	-	-	-
J366	1336.57	1338.03	Brass Cap PID DV0096	-	-	-	1337.768	1337.729	-	-	-	-
K475	-	1328.13	Brass Cap	-	-	-	1329.036	1328.937	-	-	-	-
M265	1327.8	1326.73	Brass Cap	-	-	-	1327.582	1327.584	-	-	-	-
M475	-	1343.73	Metal Rod w/o Sleeve	-	-	-	1345.169	1345.227	-	-	-	-
N475	-	1474.52	Brass Cap	-	-	1474.154	1476.185	1476.168	-	2.031	-	2.014
Q475	-	1436.71	BC. El. 2001 WT#3 Surv.	-	1434.646	-	1436.744	1436.661	2.098	-	2.015	-
J265	1230.16	1231.05	-	-	1228.638	-	-		-	-	-	-

Table 5
Reference Marks

Dam Crest Elevations

Dam crest elevation data was not collected in the 2003 survey or surveys prior to year-2001. These survey activities were confined to collecting only the settlement monument elevations. The settlement monuments are located offset from the dam centerline on the downstream face of the dam in a depression for protection and do not reflect the actual crest elevation. Tables 1A and 1B compare the 2004 crest elevation data at the lowest point adjacent to a settlement monument with the adjusted design crest elevation obtained from as-built construction plans. The design crest elevations must be adjusted because the design is referenced to NGVD 1929, while year-2004 survey data are referenced to a different vertical datum: NAVD 1988. Details of the adjustment calculation are outlined on page 16, "**Reference Marks**."

Figure 1-1 illustrates the comparison between the adjusted design crest elevations and the year-2004 survey data listed in Table 1. Figure 1-2 displays the relative change in crest elevation obtained by subtracting the adjusted design crest elevation from the year-2004 survey elevations and plotting the relative elevation change at each approximate closest station.

Elevation Station	Design Crest Elev	Adj Design Crest Elev	2004 Dam Crest Elev	2004 - Adj Dgn
45+00	1361.000	1362.870	1363.539	0.669
47+50	1361.000	1362.870	1362.518	-0.352
50+00	1361.000	1362.870	1363.356	0.486
52+50	1361.000	1362.870	1363.231	0.361
55+00	1361.000	1362.870	1363.274	0.404
57+50	1361.000	1362.870	1363.425	0.555
60+00	1361.000	1362.870	1363.656	0.786
62+50	1361.000	1362.870	1363.190	0.320
65+00	1361.000	1362.870	1362.811	-0.059
67+50	1361.000	1362.870	1362.681	-0.189
70+00	1361.000	1362.870	1362.786	-0.084
72+50	1361.000	1362.870	1363.339	0.469
75+00	1361.000	1362.870	1363.219	0.349
77+50	1361.000	1362.870	1363.529	0.659
80+00	1361.000	1362.870	1363.052	0.182
82+50	1361.000	1362.870	1363.560	0.690
85+00	1361.000	1362.870	1363.568	0.698
87+50	1361.000	1362.870	1363.458	0.588
90+00	1361.000	1362.870	1362.704	-0.166
92+50	1361.000	1362.870	1362.822	-0.048
95+00	1361.000	1362.870	1362.483	-0.387
97+50	1361.000	1362.870	1362.632	-0.238
100+00	1361.000	1362.870	1362.681	-0.189
102+50	1361.000	1362.870	1362.626	-0.244
105+00	1361.000	1362.870	1362.473	-0.397
107+50	1361.000	1362.870	1362.575	-0.295
110+00	1361.000	1362.870	1362.443	-0.427
115+00	1361.000	1362.870	1362.608	-0.262
120+00	1361.000	1362.870	1362.640	-0.230
125+00	1361.000	1362.870	1362.570	-0.300
	(Figure 1-1 Plot Data)			(Fig. 1-2)

Elevation Station	Design Crest Elev	Adj Design Crest Elev	2004 Dam Crest Elev	2004 - Adj Dgn
130+00	1361.000	1362.870	1363.027	0.157
135+00	1361.000	1362.870	1362.525	-0.345
140+00	1361.000	1362.870	1362.730	-0.140
145+00	1361.000	1362.870	1362.729	-0.141
150+00	1361.000	1362.870	1362.689	-0.181
155+00	1361.000	1362.870	1362.477	-0.393
160+00	1361.000	1362.870	1362.628	-0.242
165+00	1361.000	1362.870	1362.739	-0.131
170+00	1361.000	1362.870	1362.876	0.006
175+00	1361.000	1362.870	1362.779	-0.091
180+00	1361.000	1362.870	1362.668	-0.202
185+00	1361.000	1362.870	1362.725	-0.145
190+00	1361.000	1362.870	1362.376	-0.494
195+00	1361.000	1362.870	1362.366	-0.504
200+00	1361.000	1362.870	1362.449	-0.421
205+00	1361.000	1362.870	1362.529	-0.341
210+00	1361.000	1362.870	1362.244	-0.626
215+00	1361.000	1362.870	1362.438	-0.432
217+50	1361.000	1362.870	1362.620	-0.250
220+00	1361.000	1362.870	1362.207	-0.663
222+50	1361.000	1362.870	1362.245	-0.625
225+00	1361.000	1362.870	1362.629	-0.241
230+00	1361.000	1362.870	1362.785	-0.085
235+00	1361.000	1362.870	1362.263	-0.607
240+00	1361.000	1362.870	1362.121	-0.749
245+00	1361.000	1362.870	1362.340	-0.530
250+00	1361.000	1362.870	1362.439	-0.431
255+00	1361.000	1362.870	1362.322	-0.548
260+00	1361.000	1362.870	1362.596	-0.274
265+00	1361.000	1362.870	1362.637	-0.233
	(Figure 1-1 Plot Data)			(Fig. 1-2)

Table 1A
STA. 45+00 through STA. 265+00
Dam Crest Elevations

Dam Crest Elevations

Elevation Station	Design Crest Elev	Adj Design Crest Elev	2004 Dam Crest Elev	2004 - Adj Dgn
270+00	1361.000	1362.870	1362.518	-0.352
275+00	1361.000	1362.870	1362.342	-0.528
280+00	1361.000	1362.870	1362.301	-0.569
285+00	1361.000	1362.870	1362.669	-0.201
290+00	1361.000	1362.870	1362.462	-0.408
295+00	1361.000	1362.870	1362.691	-0.179
300+00	1361.000	1362.870	1362.755	-0.115
302+50	1361.000	1362.870	1362.288	-0.582
305+00	1361.000	1362.870	1362.876	0.006
307+50	1361.000	1362.870	1362.714	-0.156
310+00	1361.000	1362.870	1362.999	0.129
312+50	1361.000	1362.870	1362.616	-0.254
315+00	1361.000	1362.870	1362.544	-0.326
317+50	1361.000	1362.870	1362.451	-0.419
320+00	1361.000	1362.870	1362.718	-0.152
322+50	1361.000	1362.870	1362.297	-0.573
325+00	1361.000	1362.870	1362.635	-0.235
330+00	1361.000	1362.870	1362.539	-0.331
335+00	1361.000	1362.870	1362.682	-0.188
340+00	1361.000	1362.870	1362.802	-0.068
345+00	1361.000	1362.870	1362.625	-0.245
350+00	1361.000	1362.870	1362.737	-0.133
355+00	1361.000	1362.870	1362.657	-0.213
360+00	1361.000	1362.870	1362.631	-0.239
365+00	1361.000	1362.870	1362.755	-0.115
370+00	1361.000	1362.870	1362.654	-0.216
380+00	1361.000	1362.870	1362.493	-0.377
390+00	1361.000	1362.870	1362.781	-0.089
395+00	1361.000	1362.870	1363.084	0.214
400+00	1361.000	1362.870	1362.663	-0.207

(Figure 1-1 Plot Data) (Fig. 1-2)

Elevation Station	Design Crest Elev	Adj Design Crest Elev	2004 Dam Crest Elev	2004 - Adj Dgn
405+00	1361.000	1362.870	1362.949	0.079
410+00	1361.000	1362.870	1362.682	-0.188
415+00	1361.000	1362.870	1362.606	-0.264
420+00	1361.000	1362.870	1362.679	-0.191
425+00	1361.000	1362.870	1363.321	0.451
430+00	1361.000	1362.870	1362.804	-0.066
435+00	1361.000	1362.870	1362.802	-0.068
440+00	1361.000	1362.870	1363.091	0.221
445+00	1361.000	1362.870	1362.739	-0.131
447+50	1361.000	1362.870	1363.382	0.512
450+00	1361.000	1362.870	1362.755	-0.115
452+50	1361.000	1362.870	1362.855	-0.015
455+00	1361.000	1362.870	1362.628	-0.242
457+50	1361.000	1362.870	1363.024	0.154
460+00	1361.000	1362.870	1363.026	0.156
462+50	1361.000	1362.870	1362.877	0.007
465+00	1361.000	1362.870	1362.969	0.099
467+50	1361.000	1362.870	1363.057	0.187
470+00	1361.000	1362.870	1362.866	-0.004
472+50	1361.000	1362.870	1362.638	-0.232
475+00	1361.000	1362.870	1362.199	-0.671
477+50	1361.000	1362.870	1362.413	-0.457
480+00	1361.000	1362.870	1362.665	-0.205
485+00	1361.000	1362.870	1363.216	0.346
490+00	1361.000	1362.870	1363.014	0.144
495+00	1361.000	1362.870	1362.831	-0.039
500+00	1361.000	1362.870	1363.288	0.418

(Figure 1-1 Plot Data) (Fig. 1-2)

Table 1B
STA. 270+00 through STA. 500+00
Dam Crest Elevations

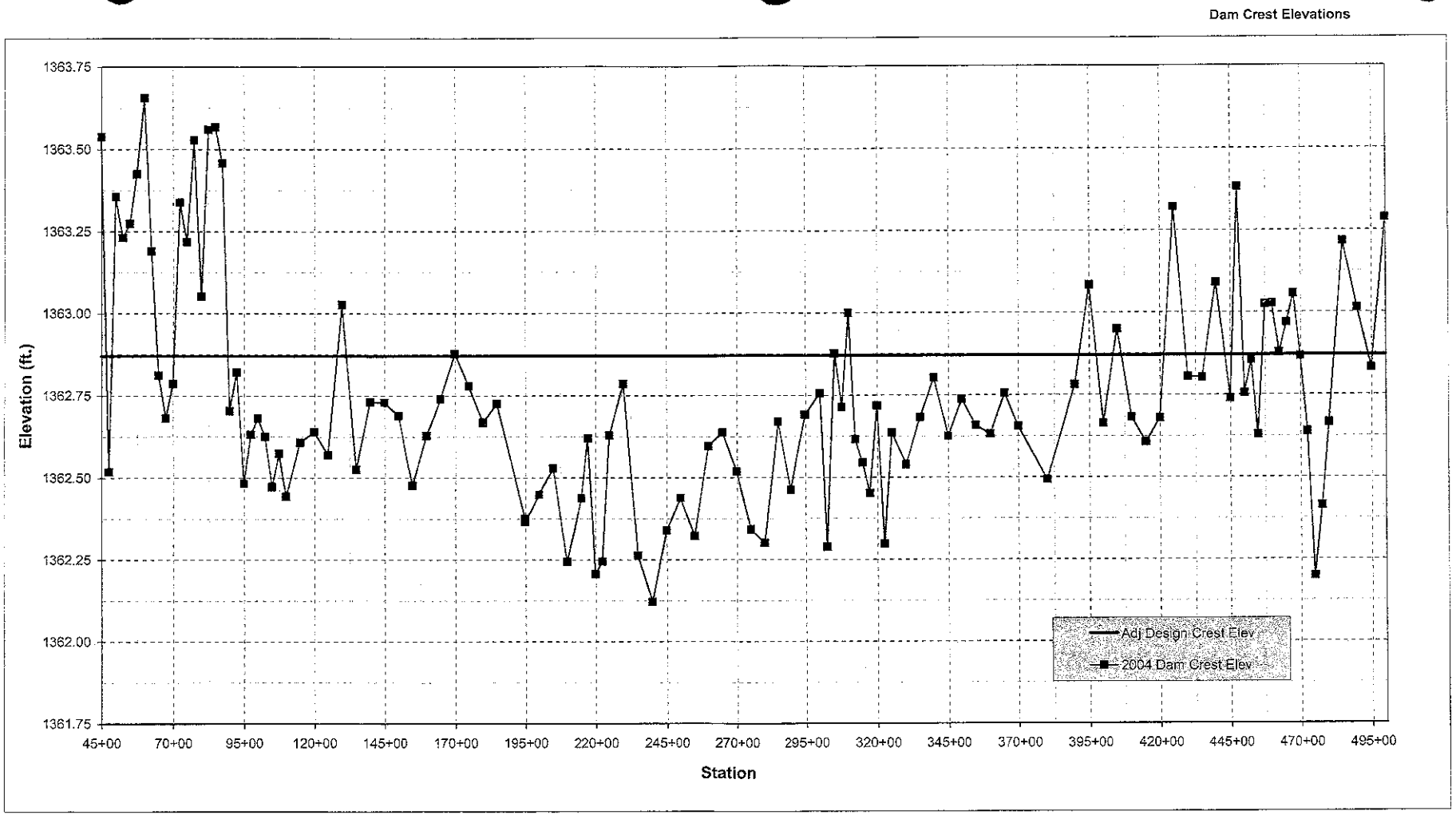


Figure 1-1
Dam Crest Elevation Comparison Chart

Dam Crest Elevations

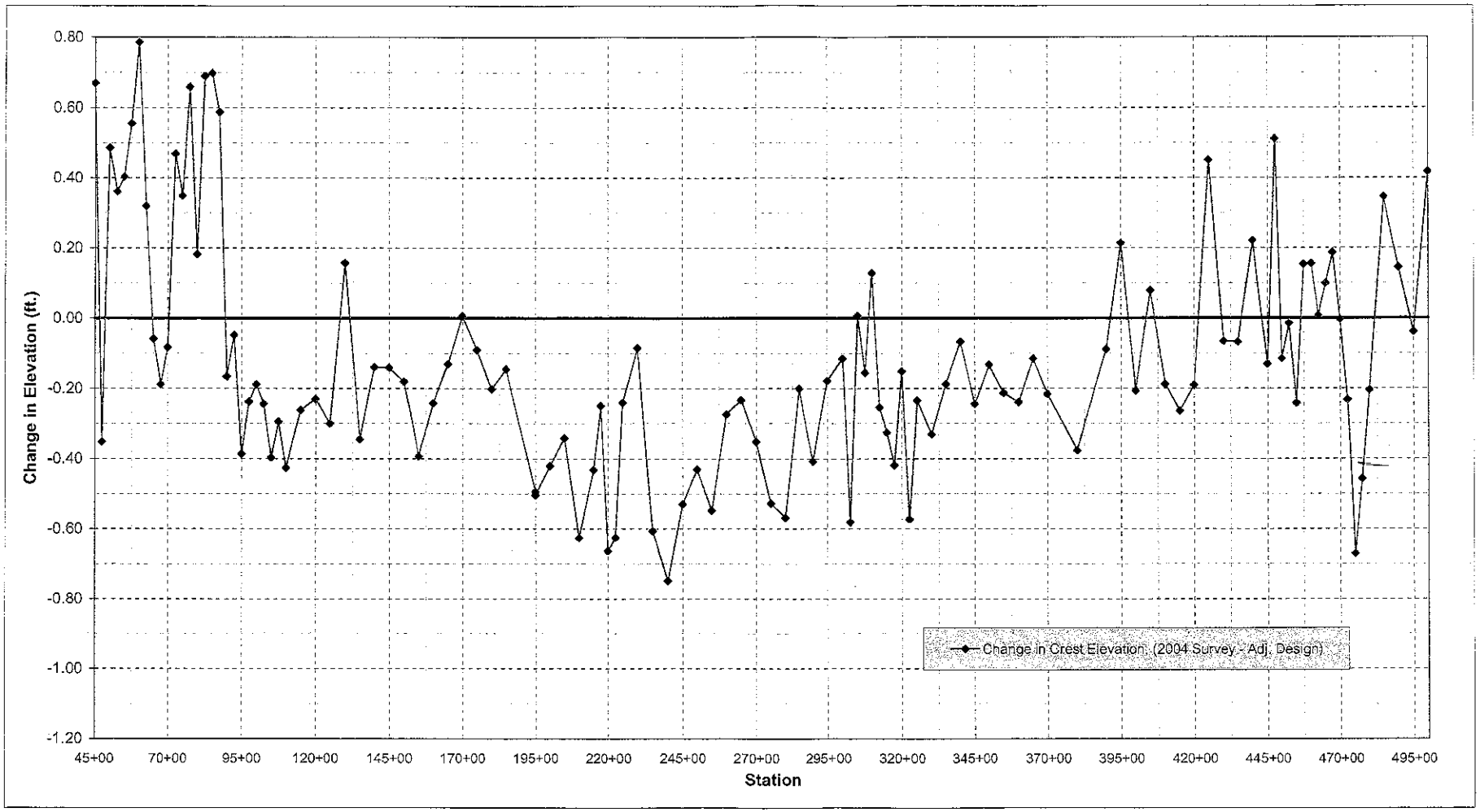


Figure 1-2
Change in Dam Crest Elevation Chart

Tables 2-A, B, & C summarize elevation data for crest settlement monuments. Elevation survey data collected prior to year-2001 is referenced to NGVD 1929, and has been adjusted for comparison with 2001 through 2004 elevations referenced to NAVD 1988. Adjustment calculation are outlined on page 16, **"Reference Marks."**
Figure 2-1 compares crest settlement monument elevations for years 1986 through 2004.

		Crest Monument Survey Data									
Marker	**Station**	**1985**	**Adj 85**	**1991**	**Adj 91**	**1998**	**Adj 98**	**2001**	**2002**	**2003**	**2004**
40	40+00	1360.945	1362.815	-	-	1360.745	1362.615	-	-	-	-
45	45+00	1361.719	1363.589	1361.490	1363.360	1361.495	1363.365	1363.434	1363.413	1363.291	1363.402
SM-2A	47+50	-	-	-	-	-	-	-	-	1362.449	1362.559
50	50+00	1361.537	1363.407	1361.311	1363.181	1361.325	1363.195	1363.226	1363.237	1363.113	1363.222
SM-3A	52+50	-	-	-	-	-	-	-	-	1363.212	1363.320
55	55+00	1361.428	1363.298	1361.179	1363.049	1361.185	1363.055	1363.105	1363.101	1362.976	1363.077
SM-4A	57+50	-	-	-	-	-	-	-	-	1363.247	1363.354
60	60+00	1362.027	1363.897	1361.768	1363.638	1361.765	1363.635	1363.644	1363.690	1363.550	1363.646
SM-5A	62+50	-	-	-	-	-	-	-	-	1363.102	1363.206
65	65+00	1361.362	1363.232	1361.038	1362.908	1360.965	1362.835	1362.874	1362.867	-	1362.833
SM-6A	67+50	-	-	-	-	-	-	-	-	1362.590	1362.692
70	70+00	1361.253	1363.123	1360.910	1362.780	1360.865	1362.735	1362.754	1362.764	1362.633	1362.722
SM-7A	72+50	-	-	-	-	-	-	-	-	1363.247	1363.344
75	75+00	1361.767	1363.637	1361.430	1363.300	1361.385	1363.255	1363.286	1363.295	1363.149	1363.235
SM-8A	77+50	-	-	-	-	-	-	-	-	1363.426	1363.522
80	80+00	1361.665	1363.535	1361.310	1363.180	1361.265	1363.135	1363.183	1363.170	1363.023	1363.118
SM-9A	82+50	-	-	-	-	-	-	-	-	1363.418	1363.511
85	85+00	1362.033	1363.903	1361.660	1363.530	1361.605	1363.475	1363.511	1363.508	1363.361	1363.457
SM-10A	87+50	-	-	-	-	-	-	-	-	1363.404	1363.495
90	90+00	1361.271	1363.141	1360.865	1362.735	1360.805	1362.675	1362.695	1362.683	1362.557	1362.649
SM-11A	92+50	-	-	-	-	-	-	-	-	1362.966	1363.055
95	95+00	1361.164	1363.034	1360.716	1362.586	1360.635	1362.505	1362.511	1362.487	1362.371	1362.463
SM-12A	97+50	-	-	-	-	-	-	-	-	1362.514	1362.604
100	100+00	1361.375	1363.245	1360.880	1362.750	1360.785	1362.655	1362.686	1362.684	1362.519	1362.609
SM-13A	102+50	-	-	-	-	-	-	-	-	1362.453	1362.542
105	105+00	1361.269	1363.139	1360.756	1362.626	1360.635	1362.505	1362.547	1362.492	1362.372	1362.462
SM-14A	107+50	-	-	-	-	-	-	-	-	1362.462	1362.552
110	110+00	1361.164	1363.034	1360.624	1362.494	1360.505	1362.375	1362.370	1362.368	1362.232	1362.324
115	115+00	1361.380	1363.250	1360.872	1362.742	1360.745	1362.615	1362.606	1362.643	1362.473	1362.630
120	120+00	1361.303	1363.173	1360.798	1362.668	1360.685	1362.555	1362.569	1362.548	1362.412	1362.561
125	125+00	1361.225	1363.095	1360.756	1362.626	1360.655	1362.525	1362.532	1362.531	1362.382	1362.553
130	130+00	1361.662	1363.532	1361.201	1363.071	1361.095	1362.965	1362.952	1362.999	1362.842	1363.045
135	135+00	1361.153	1363.023	1360.728	1362.598	1360.630	1362.500	1362.474	1362.487	1362.381	1362.560
140	140+00	1361.341	1363.211	1360.902	1362.772	1360.805	1362.830	1362.683	1362.653	1362.564	1362.706
145	145+00	1361.266	1363.136	1360.854	1362.724	1360.765	1362.790	1362.681	1362.669	1362.536	1362.701
150	150+00	1361.273	1363.143	1360.859	1362.729	1360.775	1362.800	1362.701	1362.703	1362.543	1362.708
			(Fig. 2-1)		**(Fig. 2-1)**				**(Figure 2-1 Plot Data)**		

Note: Leveling was conducted on caps located from Station 45+00 through 110+00.

Table 2-A
STA 40+00 to 150+00 - Crest Settlement Monument Elevations

Settlement Monuments - Crest

Marker	Station	Crest Monument Survey Data 1985	Adj 85	1991	Adj 91	1998	Adj 98	2001	2002	2003	2004
155	155+00	1361.156	1363.026	1360.742	1362.612	1360.655	1362.680	1362.566	1362.568	1362.419	1362.544
160	160+00	1361.226	1363.096	1360.823	1362.693	1360.745	1362.770	1362.649	1362.659	1362.516	1362.621
165	165+00	1361.273	1363.143	1360.868	1362.738	1360.775	1362.800	1362.668	1362.650	1362.536	1362.649
170	170+00	1361.397	1363.267	1360.994	1362.864	1360.905	1362.930	1362.784	1362.763	1362.662	1362.787
175	175+00	1361.333	1363.203	-	-	1360.835	1362.860	1362.708	1362.687	1362.574	1362.706
180	180+00	1361.340	1363.210	1360.907	1362.777	1360.815	1362.840	1362.665	1362.696	1362.549	1362.646
185	185+00	1361.294	1363.164	1360.864	1362.734	1360.765	1362.790	1362.631	1362.643	1362.499	1362.618
190	190+00	1360.980	1362.850	1360.553	1362.423	1360.455	1362.480	1362.325	1362.318	1362.185	1362.293
195	195+00	1361.061	1362.931	1360.624	1362.494	1360.515	1362.540	1362.367	1362.416	1362.233	1362.360
200	200+00	1361.031	1362.901	1360.577	1362.447	1360.450	1362.475	1362.348	1362.330	1362.191	1362.343
205	205+00	1361.234	1363.104	1360.770	1362.640	1360.655	1362.680	1362.539	1362.561	1362.379	1362.540
210	210+00	1360.814	1362.684	1360.378	1362.248	1360.255	1362.280	1362.119	1362.131	1361.981	1362.147
215	215+00	1361.051	1362.921	1360.595	1362.465	1360.475	1362.500	1362.412	1362.333	1362.191	1362.339
SM-36A	217+50	-	-	-	-	-	-	-	-	1362.472	1362.612
220	220+00	1360.915	1362.785	1360.418	1362.288	1360.295	1362.320	1362.243	1362.218	1362.024	1362.147
SM-37A	222+50	-	-	-	-	-	-	-	-	1362.080	1362.215
225	225+00	1361.309	1363.179	1360.894	1362.764	1360.775	1362.800	1362.768	1362.645	1362.497	1362.610
230	230+00	1361.500	1363.370	1361.023	1362.893	1360.895	1362.920	1362.657	1362.817	1362.617	1362.725
235	235+00	1360.968	1362.838	1360.492	1362.362	1360.365	1362.390	1362.305	1362.267	1362.080	1362.191
240	240+00	1360.888	1362.758	1360.388	1362.258	1360.245	1362.270	1362.203	1362.154	1361.961	1362.038
245	245+00	1361.094	1362.964	1360.647	1362.517	1360.505	1362.530	1362.450	1362.402	1362.221	1362.303
250	250+00	1361.249	1363.119	1360.820	1362.690	1360.675	1362.700	1362.610	1362.556	1362.365	1362.468
255	255+00	1361.033	1362.903	1360.597	1362.467	1360.455	1362.480	1362.365	1362.357	1362.171	1362.275
260	260+00	1361.143	1363.013	1360.760	1362.630	1360.605	1362.630	1362.528	1362.496	1362.323	1362.443
265	265+00	1361.252	1363.122	1360.889	1362.759	1360.735	1362.760	1362.667	1362.653	1362.461	1362.575
270	270+00	1361.194	1363.064	1360.841	1362.711	1360.665	1362.690	1362.594	1362.580	1362.397	1362.507
275	275+00	1360.770	1362.640	1360.420	1362.290	1360.225	1362.250	1362.214	1362.180	1361.994	1362.108
280	280+00	1360.827	1362.697	1360.451	1362.321	1360.285	1362.310	1362.265	1362.146	1362.021	1362.150
285	285+00	1361.230	1363.100	1360.872	1362.742	1360.745	1362.770	1362.718	1362.597	1362.470	1362.570
290	290+00	1361.022	1362.892	1360.712	1362.582	1360.585	1362.610	1362.520	1362.493	1362.317	1362.412
295	295+00	1361.185	1363.055	1360.865	1362.735	1360.725	1362.750	1362.735	1362.631	1362.473	1362.552
300	300+00	1361.203	1363.073	1360.898	1362.768	1360.765	1362.790	1362.788	1362.669	1362.507	1362.585
SM-53A	302+50	-	-	-	-	-	-	-	-	1362.240	1362.327
305	305+00	1361.305	1363.175	1361.015	1362.885	1360.875	1362.900	1362.883	1362.755	1362.630	1362.718
SM-54A	307+50	-	-	-	-	-	-	-	-	1362.642	1362.731
310	310+00	1361.548	1363.418	1361.285	1363.155	1361.135	1363.005	1363.102	1362.983	1362.862	1362.960
SM-55A	312+50	-	-	-	-	-	-	-	-	1362.536	1362.632
315	315+00	1360.875	1362.745	1360.606	1362.476	1360.465	1362.335	1362.453	1362.344	1362.218	1362.309
SM-56A	317+50	-	-	-	-	-	-	-	-	1362.331	1362.439
320	320+00	1361.219	1363.089	1360.831	1362.701	1360.695	1362.565	1362.638	1362.578	1362.434	1362.521
SM-57A	322+50	-	-	-	-	-	-	-	-	1362.208	1362.309
325	325+00	1361.135	1363.005	1360.882	1362.752	1360.745	1362.615	1362.665	1362.645	1362.494	1362.593
			(Fig. 2-1)		(Fig. 2-1)				(Figure 2-1 Plot Data)		

Table 2-B
STA 155+00 to 325+00 Crest Settlement Monument Elevations

Settlement Monuments - Crest

		Crest Monument Survey Data									
Marker	Station	1985	Adj 85	1991	Adj 91	1998	Adj 98	2001	2002	2003	2004
330	330+00	1360.957	1362.827	1360.701	1362.571	1360.565	1362.435	1362.527	1362.461	1362.316	1362.401
335	335+00	1361.061	1362.931	1360.865	1362.735	1360.705	1362.575	1362.641	1362.653	1362.459	1362.533
340	340+00	1360.976	1362.846	1360.787	1362.657	1360.615	1362.485	1362.573	1362.522	1362.373	1362.470
345	345+00	1360.911	1362.781	1360.706	1362.576	1360.555	1362.425	1362.506	1362.499	1362.336	1362.435
350	350+00	1360.928	1362.798	1360.714	1362.584	1360.545	1362.415	1362.528	1362.464	1362.331	1362.442
355	355+00	1361.001	1362.871	1360.813	1362.683	1360.655	1362.525	1362.648	1362.609	1362.452	1362.579
360	360+00	1361.139	1363.009	1360.905	1362.775	1360.725	1362.595	1362.694	1362.669	1362.501	1362.645
365	365+00	1361.085	1362.955	1360.848	1362.718	1360.665	1362.535	1362.640	1362.587	1362.448	1362.563
370	370+00	1361.061	1362.931	1360.872	1362.742	1360.675	1362.545	1362.652	1362.611	1362.439	1362.549
375	375+00	1360.899	1362.769	1360.693	1362.563	1360.445	1362.315	-	-		-
380	380+00	1360.790	1362.660	1360.605	1362.475	1360.415	1362.285	1362.387	1362.370	1362.184	1362.317
385	385+00	1361.567	1363.437	1361.350	1363.220	1361.075	1362.945	-	-		-
390	390+00	1360.833	1362.703	1360.687	1362.557	1360.505	1362.375	1362.492	1362.397	1362.265	1362.423
395	395+00	1361.462	1363.332	1361.241	1363.111	1361.055	1362.925	1363.046	1362.991	1362.822	1362.978
400	400+00	1361.135	1363.005	1360.863	1362.733	1360.705	1362.575	1362.717	1362.655	1362.490	1362.629
405	405+00	1361.129	1362.999	1360.932	1362.802	1360.745	1362.615	1362.727	1362.700	1362.527	1362.653
410	410+00	1360.777	1362.647	1360.558	1362.428	1360.385	1362.255	1362.372	1362.322	1362.174	1362.305
415	415+00	1361.159	1363.029	1360.900	1362.770	1360.725	1362.595	1362.707	1362.669	1362.511	1362.635
420	420+00	1361.062	1362.932	1360.852	1362.722	1360.665	1362.535	1362.660	1362.617	1362.454	1362.576
425	425+00	1361.727	1363.597	1361.471	1363.341	1361.245	1363.115	1363.245	1363.207	1363.039	1363.168
430	430+00	1361.226	1363.096	1361.034	1362.904	1360.805	1362.675	1362.807	1362.767	1362.594	1362.720
435	435+00	1361.054	1362.924	1360.869	1362.739	1360.665	1362.535	1362.683	1362.671	1362.465	1362.631
440	440+00	1361.569	1363.439	1361.382	1363.252	1361.185	1363.055	1363.191	1363.150	1362.976	1363.160
445	445+00	1361.115	1362.985	1360.893	1362.763	1360.705	1362.575	1362.724	1362.662	1362.500	1362.663
SM-82A	447+50	-	-	-	-	-	-	-	-	1363.277	1363.435
450	450+00	1361.041	1362.911	1360.847	1362.717	1360.665	1362.535	1362.665	1362.617	1362.480	1362.635
SM-83A	455+50	-	-	-	-	-	-	-	-	1362.731	1362.882
455	455+00	1360.868	1362.738	1360.702	1362.572	1360.495	1362.365	1362.509	1362.476	1362.295	1362.443
SM-84A	457+50	-	-	-	-	-	-	-	-	1362.838	1362.984
460	460+00	1361.258	1363.128	1361.140	1363.010	1360.975	1362.845	1363.009	1362.985	1362.805	1362.969
SM-85A	862+50	-	-	-	-	-	-	-	-	1362.8004	1362.946
465	465+00	1361.254	1363.124	1361.071	1362.941	1360.865	1362.735	1362.869	1362.864	1362.671	1362.837
SM-86A	467+50	-	-	-	-	-	-	-	-	1362.865	1363.039
470	470+00	1361.170	1363.040	1360.972	1362.842	1360.775	1362.645	1362.786	1362.764	1362.586	1362.733
SM-87A	472+50	-	-	-	-	-	-	-	-	1362.393	1362.569
475	475+00	1360.664	1362.534	1360.453	1362.323	1360.225	1362.095	1362.296	1362.187	1362.038	1362.153
SM-88A	477+50	-	-	-	-	-	-	-	-	1362.267	1362.429
480	480+00	1360.745	1362.615	1360.550	1362.420	1360.325	1362.195	1362.373	1362.386	1361.882	1362.303
485	485+00	1361.419	1363.289	1361.294	1363.164	1361.105	1362.975	1363.168	1363.156	1362.953	1363.105
490	490+00	1361.209	1363.079	1361.116	1362.986	1360.925	1362.795	1363.029	1362.991	1362.776	1362.911
495	495+00	1360.984	1362.854	1360.940	1362.810	1360.775	1362.645	1362.890	1362.840	1362.634	1362.768
500	500+00	1361.455	1363.325	1361.415	1363.285	1361.255	1363.125	1363.315	1363.376	1363.118	1363.273
			(Fig. 2-1)		(Fig. 2-1)				(Figure 2-1 Plot Data)		

Table 2-C
STA 330+00 to 500+00 Crest Settlement Monument Elevations

Settlement Monuments - Crest

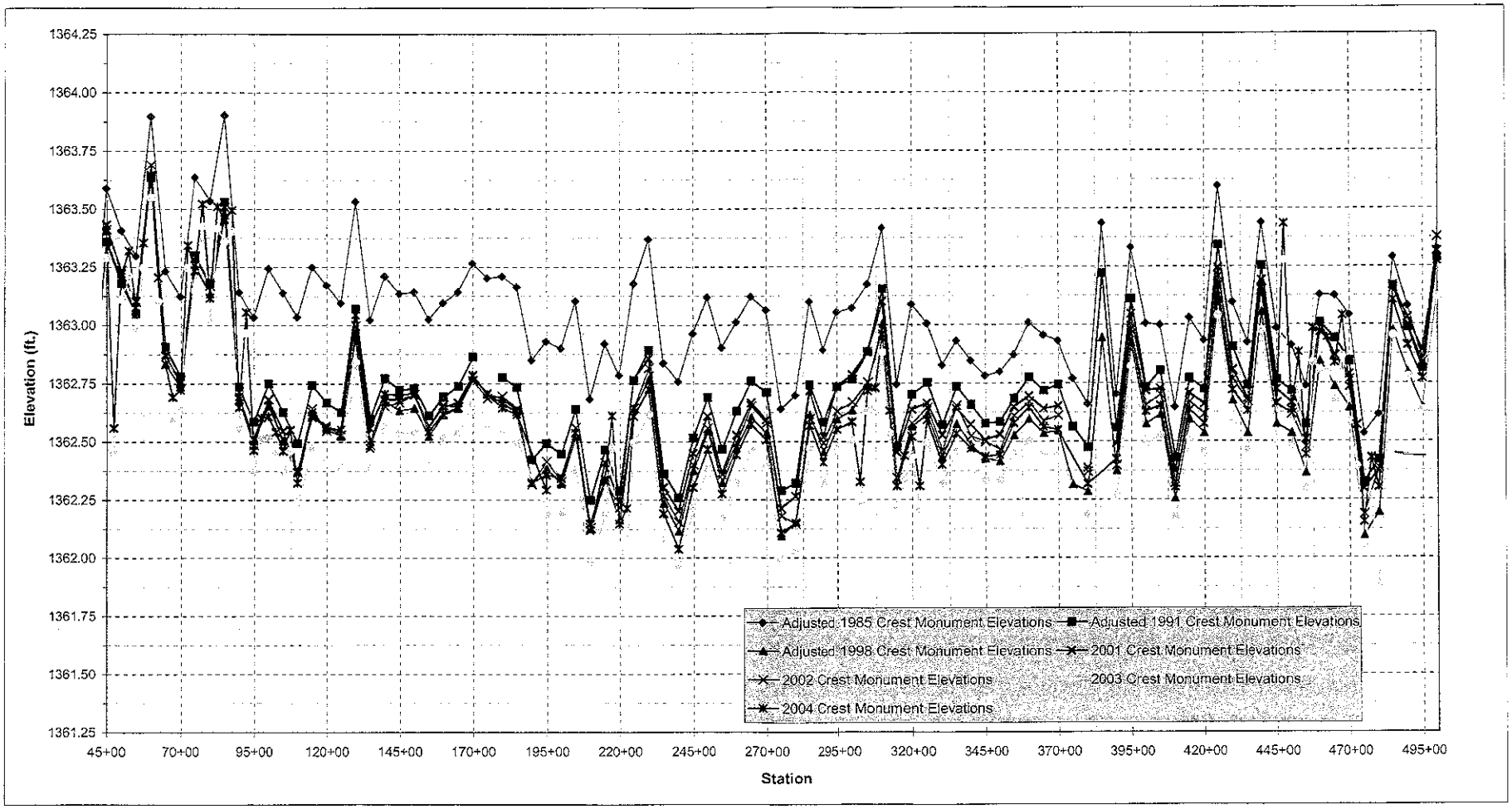


Figure 2-1
Elevation of Crest Settlement Monuments Chart

Tables 3-A, B, & C below, summarize crest monument elevations, their adjustment as noted, and the relative elevation change obtained by subtracting the adjusted 1985 elevation from the adjusted elevation surveyed in consecutive years (1991, 1998, 2001, 2002, 2003, and 2004).

Figure 3-1 illustrates the relative change in settlement monuments as calculated in Tables 3-A, B, & C. Adjusted elevation data obtained from the 1985 survey is used as a baseline, since the 1985 data set is the earliest available elevation reference.

		Crest Monument Survey Data						
Marker	Station	Adj 85	Adj 91	Adj 98	2001	2002	2003	2004
45	45+00	1363.589	1363.360	1363.365	1363.434	1363.413	1363.291	1363.402
50	50+00	1363.407	1363.181	1363.195	1363.226	1363.237	1363.113	1363.222
55	55+00	1363.298	1363.049	1363.055	1363.105	1363.101	1362.976	1363.077
60	60+00	1363.897	1363.638	1363.635	1363.644	1363.690	1363.550	1363.646
65	65+00	1363.232	1362.908	1362.835	1362.874	1362.867	-	1362.833
70	70+00	1363.123	1362.780	1362.735	1362.754	1362.764	1362.633	1362.722
75	75+00	1363.637	1363.300	1363.255	1363.286	1363.295	1363.149	1363.235
80	80+00	1363.535	1363.180	1363.135	1363.183	1363.170	1363.023	1363.118
85	85+00	1363.903	1363.530	1363.475	1363.511	1363.508	1363.361	1363.457
90	90+00	1363.141	1362.735	1362.675	1362.695	1362.683	1362.557	1362.649
95	95+00	1363.034	1362.586	1362.505	1362.511	1362.487	1362.371	1362.463
100	100+00	1363.245	1362.750	1362.655	1362.680	1362.684	1362.519	1362.609
105	105+00	1363.139	1362.626	1362.505	1362.547	1362.492	1362.372	1362.462
110	110+00	1363.034	1362.494	1362.375	1362.370	1362.368	1362.232	1362.324
115	115+00	1363.250	1362.742	1362.615	1362.606	1362.643	1362.473	1362.630
120	120+00	1363.173	1362.668	1362.555	1362.569	1362.548	1362.412	1362.561
125	125+00	1363.095	1362.626	1362.525	1362.532	1362.531	1362.382	1362.553
130	130+00	1363.532	1363.071	1362.965	1362.952	1362.999	1362.842	1363.045
135	135+00	1363.023	1362.598	1362.500	1362.474	1362.487	1362.381	1362.560
140	140+00	1363.211	1362.772	1362.675	1362.683	1362.653	1362.564	1362.706
145	145+00	1363.136	1362.724	1362.635	1362.681	1362.669	1362.536	1362.701
150	150+00	1363.143	1362.729	1362.645	1362.701	1362.703	1362.543	1362.708
155	155+00	1363.026	1362.612	1362.525	1362.566	1362.568	1362.419	1362.544
160	160+00	1363.096	1362.693	1362.615	1362.649	1362.659	1362.516	1362.621
165	165+00	1363.143	1362.738	1362.645	1362.668	1362.650	1362.536	1362.649
170	170+00	1363.267	1362.864	1362.775	1362.784	1362.763	1362.662	1362.787
175	175+00	1363.203		1362.705	1362.708	1362.687	1362.574	1362.706
180	180+00	1363.210	1362.777	1362.685	1362.665	1362.696	1362.549	1362.646
185	185+00	1363.164	1362.734	1362.635	1362.631	1362.643	1362.499	1362.618
190	190+00	1362.850	1362.423	1362.325	1362.325	1362.318	1362.185	1362.293
195	195+00	1362.931	1362.494	1362.385	1362.357	1362.416	1362.233	1362.360
200	200+00	1362.901	1362.447	1362.320	1362.348	1362.330	1362.191	1362.343

Adj 91 - Adj 85	Adj 98 - Adj 85	2001 - Adj 85	2002 - Adj 85	2003 - Adj 85	2004 - Adj 85
-0.229	-0.224	-0.155	-0.176	-0.298	-0.187
-0.226	-0.212	-0.181	-0.170	-0.294	-0.185
-0.249	-0.243	-0.193	-0.197	-0.322	-0.221
-0.259	-0.262	-0.253	-0.207	-0.347	-0.251
-0.324	-0.397	-0.358	-0.365		-0.399
-0.343	-0.388	-0.369	-0.359	-0.490	-0.401
-0.337	-0.382	-0.351	-0.342	-0.488	-0.402
-0.355	-0.400	-0.352	-0.366	-0.512	-0.417
-0.373	-0.428	-0.392	-0.395	-0.542	-0.446
-0.406	-0.456	-0.446	-0.458	-0.584	-0.492
-0.448	-0.529	-0.523	-0.547	-0.663	-0.571
-0.495	-0.590	-0.565	-0.561	-0.726	-0.636
-0.513	-0.634	-0.592	-0.647	-0.767	-0.677
-0.540	-0.659	-0.664	-0.666	-0.802	-0.710
-0.508	-0.635	-0.644	-0.607	-0.777	-0.620
-0.505	-0.618	-0.604	-0.625	-0.762	-0.612
-0.469	-0.570	-0.563	-0.564	-0.713	-0.542
-0.461	-0.567	-0.580	-0.533	-0.690	-0.487
-0.425	-0.523	-0.549	-0.536	-0.642	-0.463
-0.439	-0.536	-0.528	-0.558	-0.647	-0.612
-0.442	-0.501	-0.465	-0.467	-0.601	-0.487
-0.414	-0.498	-0.442	-0.440	-0.600	-0.435
-0.414	-0.501	-0.460	-0.458	-0.607	-0.482
-0.403	-0.481	-0.447	-0.437	-0.580	-0.475
-0.405	-0.498	-0.475	-0.493	-0.607	-0.494
-0.403	-0.492	-0.483	-0.504	-0.605	-0.480
	-0.498	-0.495	-0.516	-0.629	-0.497
-0.433	-0.525	-0.545	-0.514	-0.661	-0.564
-0.430	-0.529	-0.533	-0.521	-0.665	-0.546
-0.427	-0.525	-0.525	-0.532	-0.665	-0.557
-0.437	-0.546	-0.574	-0.515	-0.698	-0.571
-0.454	-0.581	-0.553	-0.571	-0.710	-0.568

(Fig. 3-1 Plot Data)

Table 3-A
Crest Settlement Monument Relative Elevation Change, with Adjusted 1985 Survey Data as Baseline
STA 45+00 to 200+00

Settlement Monuments - Crest

Marker	Station	Crest Monument Survey Data						
		Adj 85	Adj 91	Adj 98	2001	2002	2003	2004
205	205+00	1363.104	1362.640	1362.525	1362.539	1362.561	1362.379	1362.540
210	210+00	1362.684	1362.248	1362.125	1362.119	1362.131	1361.981	1362.147
215	215+00	1362.921	1362.465	1362.345	1362.412	1362.333	1362.191	1362.339
220	220+00	1362.785	1362.288	1362.165	1362.243	1362.218	1362.024	1362.147
225	225+00	1363.179	1362.764	1362.645	1362.768	1362.645	1362.497	1362.610
230	230+00	1363.370	1362.893	1362.765	1362.857	1362.817	1362.617	1362.725
235	235+00	1362.838	1362.362	1362.235	1362.305	1362.267	1362.080	1362.191
240	240+00	1362.758	1362.258	1362.115	1362.203	1362.154	1361.961	1362.038
245	245+00	1362.964	1362.517	1362.375	1362.450	1362.402	1362.221	1362.303
250	250+00	1363.119	1362.690	1362.545	1362.610	1362.558	1362.385	1362.468
255	255+00	1362.903	1362.467	1362.325	1362.365	1362.357	1362.171	1362.275
260	260+00	1363.013	1362.630	1362.475	1362.528	1362.496	1362.323	1362.443
265	265+00	1363.122	1362.759	1362.605	1362.667	1362.653	1362.461	1362.575
270	270+00	1363.064	1362.711	1362.535	1362.594	1362.580	1362.397	1362.507
275	275+00	1362.640	1362.290	1362.095	1362.214	1362.180	1361.994	1362.108
280	280+00	1362.697	1362.321	1362.155	1362.265	1362.146	1362.021	1362.150
285	285+00	1363.100	1362.742	1362.615	1362.718	1362.597	1362.470	1362.570
290	290+00	1362.892	1362.582	1362.455	1362.520	1362.493	1362.317	1362.412
295	295+00	1363.055	1362.735	1362.595	1362.735	1362.631	1362.473	1362.552
300	300+00	1363.073	1362.768	1362.635	1362.788	1362.669	1362.507	1362.585
305	305+00	1363.175	1362.885	1362.745	1362.883	1362.755	1362.630	1362.718
310	310+00	1363.418	1363.155	1363.005	1363.102	1362.983	1362.882	1362.960
315	315+00	1362.745	1362.476	1362.335	1362.453	1362.344	1362.218	1362.309
320	320+00	1363.089	1362.701	1362.565	1362.638	1362.578	1362.434	1362.521
325	325+00	1363.005	1362.752	1362.615	1362.665	1362.645	1362.494	1362.593
330	330+00	1362.827	1362.571	1362.435	1362.527	1362.461	1362.316	1362.401
335	335+00	1362.931	1362.735	1362.575	1362.641	1362.653	1362.459	1362.533
340	340+00	1362.846	1362.657	1362.485	1362.573	1362.522	1362.373	1362.470
345	345+00	1362.781	1362.576	1362.425	1362.506	1362.499	1362.336	1362.435
350	350+00	1362.798	1362.584	1362.415	1362.529	1362.464	1362.331	1362.442
355	355+00	1362.871	1362.683	1362.525	1362.648	1362.609	1362.452	1362.579
360	360+00	1363.009	1362.775	1362.595	1362.694	1362.669	1362.501	1362.645
365	365+00	1362.955	1362.718	1362.535	1362.640	1362.587	1362.448	1362.563
370	370+00	1362.931	1362.742	1362.545	1362.652	1362.611	1362.439	1362.549

Adj 91 - Adj 85	Adj 98 - Adj 85	2001 - Adj 85	2002 - Adj 85	2003 - Adj 85	2004 - Adj 85
-0.464	-0.579	-0.565	-0.543	-0.725	-0.564
-0.436	-0.559	-0.565	-0.553	-0.703	-0.537
-0.456	-0.576	-0.509	-0.588	-0.730	-0.582
-0.497	-0.620	-0.542	-0.567	-0.761	-0.638
-0.415	-0.534	-0.411	-0.534	-0.682	-0.569
-0.477	-0.605	-0.513	-0.553	-0.753	-0.645
-0.476	-0.603	-0.533	-0.571	-0.758	-0.647
-0.500	-0.643	-0.555	-0.604	-0.797	-0.720
-0.447	-0.589	-0.514	-0.562	-0.743	-0.661
-0.429	-0.574	-0.509	-0.561	-0.734	-0.651
-0.436	-0.578	-0.538	-0.546	-0.732	-0.628
-0.383	-0.538	-0.485	-0.517	-0.690	-0.570
-0.363	-0.517	-0.455	-0.469	-0.661	-0.547
-0.353	-0.529	-0.470	-0.484	-0.667	-0.557
-0.350	-0.546	-0.426	-0.460	-0.646	-0.532
-0.376	-0.542	-0.432	-0.551	-0.676	-0.547
-0.358	-0.485	-0.382	-0.503	-0.630	-0.530
-0.310	-0.437	-0.372	-0.399	-0.575	-0.480
-0.320	-0.460	-0.320	-0.424	-0.582	-0.503
-0.305	-0.438	-0.285	-0.404	-0.566	-0.488
-0.290	-0.430	-0.292	-0.420	-0.545	-0.457
-0.263	-0.413	-0.316	-0.436	-0.536	-0.458
-0.269	-0.410	-0.292	-0.401	-0.527	-0.436
-0.386	-0.524	-0.451	-0.511	-0.655	-0.568
-0.253	-0.390	-0.340	-0.360	-0.511	-0.412
-0.256	-0.392	-0.300	-0.366	-0.511	-0.426
-0.196	-0.356	-0.290	-0.278	-0.472	-0.398
-0.189	-0.361	-0.273	-0.324	-0.473	-0.376
-0.205	-0.356	-0.275	-0.282	-0.445	-0.346
-0.214	-0.383	-0.269	-0.334	-0.467	-0.356
-0.188	-0.346	-0.223	-0.262	-0.419	-0.292
-0.234	-0.414	-0.315	-0.340	-0.508	-0.364
-0.237	-0.420	-0.315	-0.368	-0.507	-0.392
-0.189	-0.386	-0.279	-0.320	-0.492	-0.382

(Fig. 3-1 Plot Data)

Table 3-B
Crest Settlement Monument Relative Elevation Change, with Adjusted 1985 Survey Data as Baseline
STA 205+00 to 370+00

Settlement Monuments - Crest

Marker	Station	Crest Monument Survey Data						
		Adj 85	Adj 91	Adj 98	2001	2002	2003	2004
375	375+00	1362.769	1362.563	1362.315				
380	380+00	1362.660	1362.475	1362.285	1362.387	1362.370	1362.184	1362.317
385	385+00	1363.437	1363.220	1362.945				
390	390+00	1362.703	1362.557	1362.375	1362.492	1362.397	1362.265	1362.423
395	395+00	1363.332	1363.111	1362.925	1363.046	1362.991	1362.822	1362.978
400	400+00	1363.005	1362.733	1362.575	1362.717	1362.655	1362.490	1362.629
405	405+00	1362.999	1362.802	1362.615	1362.727	1362.700	1362.527	1362.653
410	410+00	1362.647	1362.428	1362.255	1362.372	1362.322	1362.174	1362.305
415	415+00	1363.029	1362.770	1362.595	1362.707	1362.669	1362.511	1362.635
420	420+00	1362.932	1362.722	1362.535	1362.660	1362.617	1362.454	1362.576
425	425+00	1363.597	1363.341	1363.115	1363.245	1363.207	1363.039	1363.168
430	430+00	1363.096	1362.904	1362.675	1362.807	1362.767	1362.594	1362.720
435	435+00	1362.924	1362.739	1362.535	1362.683	1362.671	1362.465	1362.631
440	440+00	1363.439	1363.252	1363.055	1363.191	1363.150	1362.976	1363.160
445	445+00	1362.985	1362.763	1362.575	1362.724	1362.662	1362.500	1362.663
450	450+00	1362.911	1362.717	1362.535	1362.665	1362.617	1362.480	1362.635
455	455+00	1362.738	1362.572	1362.365	1362.509	1362.476	1362.295	1362.443
460	460+00	1363.128	1363.010	1362.845	1363.009	1362.985	1362.805	1362.969
465	465+00	1363.124	1362.941	1362.735	1362.869	1362.864	1362.671	1362.837
470	470+00	1363.040	1362.842	1362.645	1362.786	1362.764	1362.586	1362.733
475	475+00	1362.534	1362.323	1362.095	1362.296	1362.187	1362.038	1362.153
480	480+00	1362.615	1362.420	1362.195	1362.373	1362.386	1361.882	1362.303
485	485+00	1363.289	1363.164	1362.975	1363.168	1363.156	1362.953	1363.105
490	490+00	1363.079	1362.986	1362.795	1363.029	1362.991	1362.776	1362.911
495	495+00	1362.854	1362.810	1362.645	1362.890	1362.840	1362.634	1362.768
500	500+00	1363.325	1363.285	1363.125	1363.315	1363.376	1363.118	1363.273

Adj 91 - Adj 85	Adj 98 - Adj 85	2001 - Adj 85	2002 - Adj 85	2003 - Adj 85	2004 - Adj 85
-0.206	-0.454				
-0.185	-0.375	-0.273	-0.290	-0.476	-0.343
-0.217	-0.492				
-0.146	-0.328	-0.211	-0.306	-0.438	-0.280
-0.221	-0.407	-0.286	-0.341	-0.510	-0.354
-0.272	-0.430	-0.288	-0.350	-0.515	-0.376
-0.197	-0.384	-0.272	-0.299	-0.472	-0.346
-0.219	-0.392	-0.275	-0.325	-0.473	-0.342
-0.259	-0.434	-0.322	-0.360	-0.518	-0.394
-0.210	-0.397	-0.272	-0.315	-0.478	-0.356
-0.256	-0.482	-0.352	-0.390	-0.558	-0.429
-0.192	-0.421	-0.289	-0.329	-0.502	-0.376
-0.185	-0.389	-0.241	-0.253	-0.459	-0.293
-0.187	-0.384	-0.248	-0.289	-0.453	-0.279
-0.222	-0.410	-0.261	-0.323	-0.485	-0.322
-0.194	-0.376	-0.246	-0.294	-0.431	-0.276
-0.166	-0.373	-0.229	-0.262	-0.443	-0.295
-0.118	-0.283	-0.119	-0.143	-0.323	-0.159
-0.183	-0.389	-0.255	-0.260	-0.453	-0.287
-0.198	-0.395	-0.254	-0.276	-0.454	-0.307
-0.211	-0.439	-0.238	-0.347	-0.496	-0.381
-0.195	-0.420	-0.242	-0.229	-0.733	-0.312
-0.125	-0.311	-0.121	-0.133	-0.336	-0.184
-0.093	-0.284	-0.050	0.088	-0.303	-0.168
-0.044	-0.209	0.036	0.014	-0.220	-0.086
-0.040	-0.200	-0.010	-0.051	-0.207	-0.052

(Fig. 3-1 Plot Data)

Table 3-C
Crest Settlement Monument Relative Elevation Change, with Adjusted 1985 Survey Data as Baseline
STA 375+00 to 500+00

Settlement Monuments - Crest

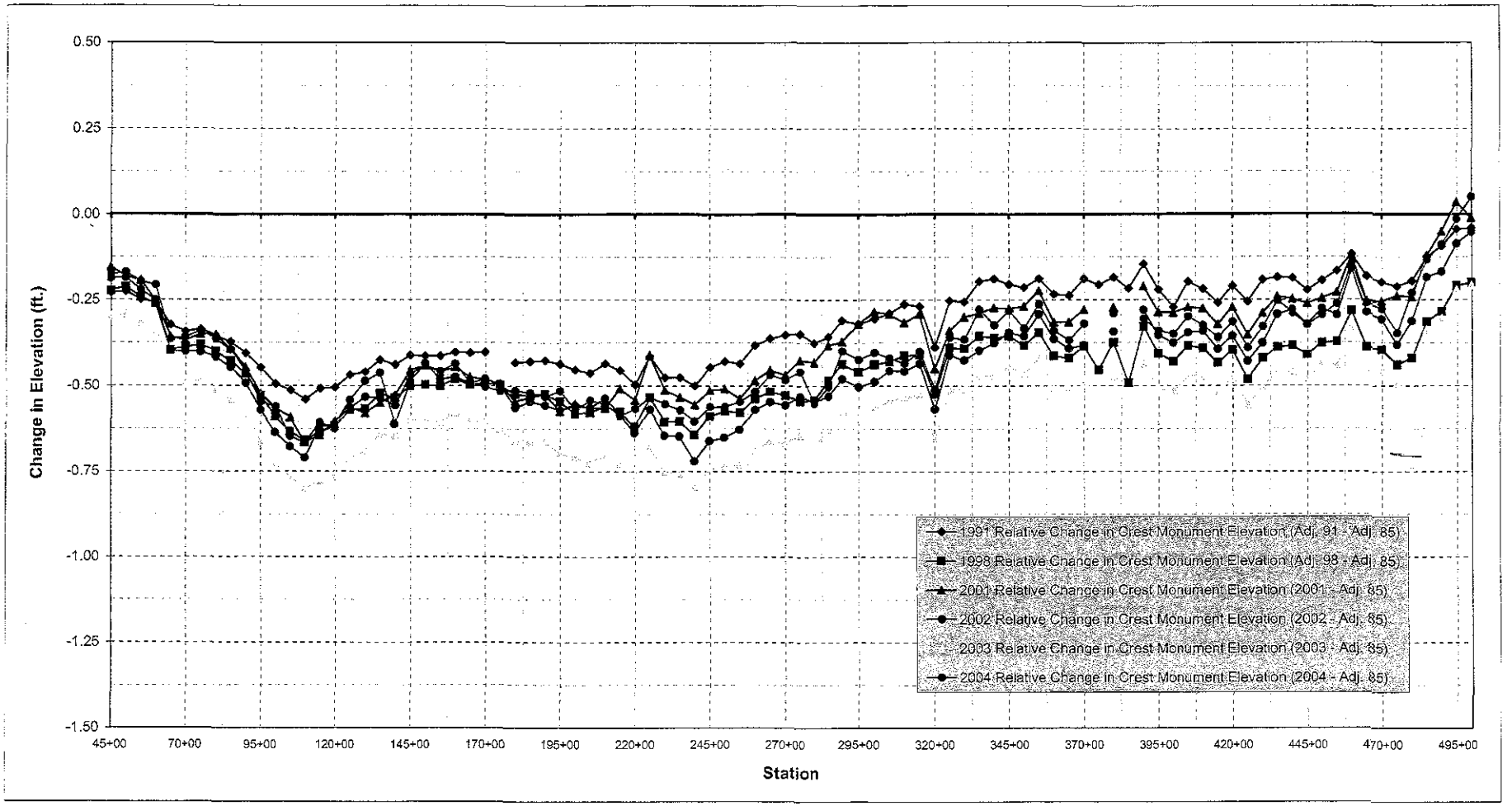


Figure 3-1
Relative Change in Crest Monument Elevation Chart, 1985 Survey Data Baseline Elevation Reference

Reference Marks

The McMicken Dam Subsidence Surveys, 1985 through 2004, referenced several vertical benchmarks. A Datum Shift must be applied to adjust measurements referenced in NGVD 1929 datum to an equivalent elevation in NAVD 1988 dat This Datum Shift was obtained from the 1991 NGS published elevations for benchmarks N475 and Bedrock 1 (bed1) in NAVD 1988 datum, and subtracting from it the corresponding 1991 published backward adjusted elevations in 1929 da columns in **Table 5-1** for benchmarks N475 and Bedrock 1 (BED1) are published data. The datum shift is applied to all 1991 and 1998 survey data.

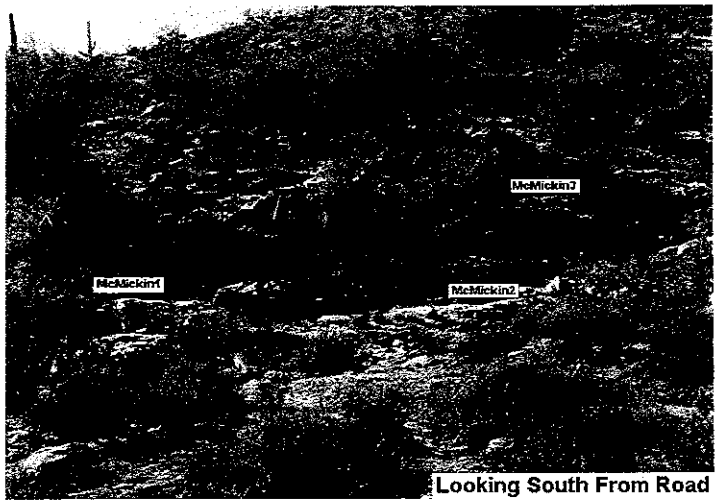
Based on the 1991 published Datum Shift at Benchmark "N 475", NAVD 1988 Elevation equals NGVD 1929 Elevation plus **1.870** ft. The highlighted elevation values in the "Adjusted" Column for each table reflects this calculation.

				Settlement Survey Records								Datum Shift				
Bench Mark	NGS Data Sheet NAVD 29	NAVD 88	Description	1985 (NGVD29)	1991 (NGVD29)	1991 (NAVD88)*	1998 (NGVD29)	2001 (NAVD88)	2002 (NAVD88)	2003 (NAVD88)	2004 (NAVD88)	1991 published	2001 - Adj. 1991	2002 - 1991	2003 - 1991	2004 - 1991
FRI4	1598	1600 (VERT)	Brass Cap PID DV1860	-	-	-	-	1594.750	1594.750	-	1594.747	-	-	-	-	-
BED1	-	1516.8	Brass Cap PID DV1277		1515.115	1516.985	-	1516.980	-	1516.942	1516.952	1.870	-0.005	-	-0.043	-0.033
COT	1363	1365 (VERT)	Brass Cap PID DV1860	-	-	-	-	1361.774	-	-	1361.650	-	-	-	-	-
H366	1339.92	1340.28	Brass Cap PID DV0094	-	-	-	-	1341.758	1341.702	-	1341.709	-	-	-	-	-
J366	1336.57	1338.03	Brass Cap PID DV0096	-	-	-	-	1337.768	1337.729	-	-	-	-	-	-	-
K475	-	1328.13	Brass Cap	-	-	-	-	1329.036	1328.937	-	-	-	-	-	-	-
M265	1327.8	1326.73	Brass Cap	-	-	-	-	1327.582	1327.584	-	-	-	-	-	-	-
M475	-	1343.73	Metal Rod w/o Sleeve	-	-	-	-	1345.169	1345.227	1345.162	-	-	-	-	-	-
N475	-	1474.52	Brass Cap	-	1474.354	1476.224	1474.154	1476.185	1476.168	1476.179	1476.189	1.870	-0.039	-0.056	-0.045	-0.035
Q475	-	1436.71	BC. El. 2001 WT3 Survey	-	1434.646	-	-	1436.744	1436.661	-	-	-	-	-	-	-
J265	1230.16	1231.05	-	-	1228.638	-	-	-	-	-	-	-	-	-	-	-
MCMC1	-	-	MCDOT Geodetic Ctrl Cap	-	-	-	-	-	-	-	1420.619	-	-	-	-	-
MCMC2	-	-	MCDOT Geodetic Ctrl Cap	-	-	-	-	-	-	-	1419.529	-	-	-	-	-
MCMC3	-	-	MCDOT Geodetic Ctrl Cap	-	-	-	-	-	-	-	1425.089	-	-	-	-	-

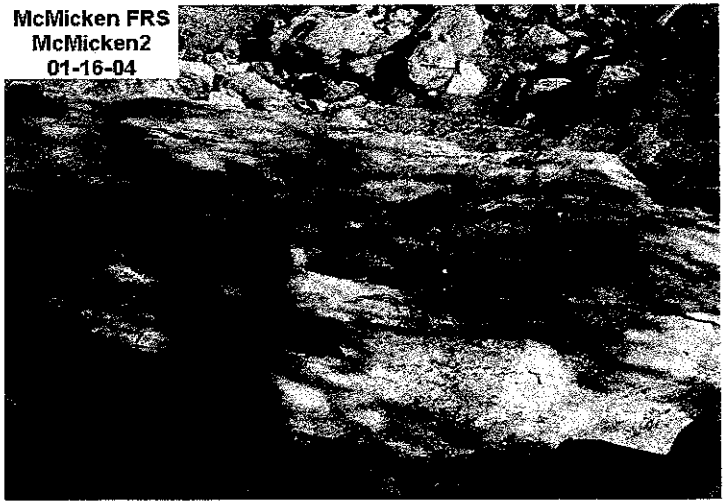
Notes: 1) N 475, P 475 and Q 475 benchmarks are set in a bedrock and have been evaluated as stable prime benchmarks.
2) The year-2003 survey was conducted in June 2003.
3) The year-2004 survey was conducted in February 2004.
4) In 2004, three new control monuments were set in bedrock: MICMICKEN 1 (MCMC1), MICKMICKEN 2 (MCMC2), and MICMICKEN 3, (MCMC3). MCMC1 was surveyed to NGS 'A' station precision.
*See **Figure 5-1** on page 17.

Table 5-1
Reference Marks

Miscellaneous Photos



Looking South From Road



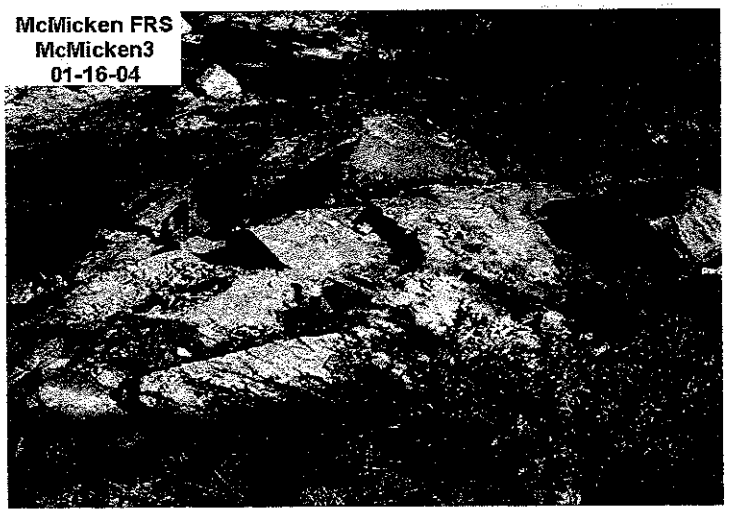


Figure 5-1
2004 New Control Point Locations

APPENDIX B

SENSITIVITY ANALYSIS

stantec.com

Memo

Stantec

To:	File Phoenix Office	From:	Mike Gerlach Phoenix Office
File:	82000267	Date:	July 22, 2004

Reference: McMicken Dam Hydraulic Routing Sensitivity Analysis

General

Selection of roughness coefficients is a relatively subjective process, complicated by the limitation that the coefficient input to the model is applied to the entire range of flow depths outside of the shallow flow depth range. This limitation combined with a theoretical limitation of the use of Manning's equation in the solution scheme for ponded flow conditions leads to a potential concern regarding the appropriateness of the use of FLO-2D for this study.

To address this concern, an analysis was performed to assess the sensitivity of the model to variability in roughness coefficients. Sensitivity to roughness coefficients was evaluated using the PMF model with a low range and high range of roughness coefficients. For the low range, the base values were reduced by 25 percent. For the high range, the base values were increased by 50 percent.

Base roughness coefficients were estimated assuming overland flow conditions that represent the general physical characteristics of the impoundment area. The primary physical characteristics considered were the bed/ground surface material and obstructions to flow, particularly obstructions due to vegetation. Base roughness coefficients range from 0.04 to 0.10. Increasing the base values by 50 percent results in a range of 0.06 to 0.15. Decreasing the values by 25 percent results in a range of 0.03 to 0.075.

Results

The results of each model are compared in terms of maximum water surface elevations, dam overtopping magnitudes and emergency spillway flows. In general, calculation of the maximum water surface elevations is not sensitive to the changes in roughness coefficients. This is illustrated in Figure 1 with a comparison of maximum water surface elevations profiles. The profiles shown in Figure 1 are the maximum water surface elevation that occurs along the low flow channel at any point in time. As can be seen in Figure 1, the only meaningful difference in water surface elevations occurs near the emergency spillway due to the change in efficiency of the spillway resulting from the increased and decreased roughness coefficients. For the high roughness coefficient condition, the maximum increase in the maximum water surface elevation is 0.65 feet with an average increase of 0.37 feet. For the low roughness coefficient condition, the

maximum decrease in the maximum water surface elevation is 0.43 feet with and average decrease of 0.22 feet. Although the average change in maximum water surface elevation for the high and low roughness coefficient conditions is small, it translates to a significant difference in overtopping discharges due to the length of the dam.

Overtopping hydrographs are shown in Figure 2 for each roughness coefficient condition. Peak discharges and overtopping volumes are listed in Table 1. Increasing the roughness coefficients by 50 percent results in a 13 percent increase in the peak overtopping discharge with a 21 percent increase in volume. Decreasing roughness coefficients by 25 percent results in a nine percent decrease in the peak overtopping discharge with 13 percent decrease in volume.

Table 1
Summary of sensitivity analysis results

Roughness Coefficient Condition	Emergency Spillway		Dam Overtopping	
	cfs	acre-ft	cfs	acre-ft
Base	51,300	46,700	57,500	16,500
50% Increase	42,800	41,900	65,000	19,900
25% Decrease	56,700	49,700	52,100	14,300

For the emergency spillway, open channel hydraulic conditions control the efficiency as opposed to the weir conditions for dam overtopping. Therefore, increases in maximum water surface elevations due to the high roughness coefficient conditions translates to a decrease in emergency spillway peak discharge of 17 percent with a corresponding decrease in volume of ten percent as can be seen in Figure 3 and Table 1. Conversely, decreasing the roughness coefficients results in an 11 percent increase in peak discharge with a six percent increase in volume.

Conclusion

The computation of water surface elevations in a ponded condition does not appear to be significantly sensitive to roughness coefficients. However, the minor differences in water surface elevations translate to potentially significant differences in the efficiency of the emergency spillway and the magnitude of dam overtopping. Because of the sensitivity in the magnitude of overtopping discharge to changes in water surface elevation and the lack of data or physical evidence to calibrate the model, the results of the sensitivity analysis in regard to dam overtopping do not provide any indication of the reasonableness of the roughness coefficients.

The reasonableness of roughness coefficients can be further evaluated by comparing the emergency spillway hydraulic results from FLO-2D with the results

from the HEC-RAS models. In general, the HEC-RAS models predict a much higher peak discharge than FLO-2D, which suggests that the low roughness coefficient condition yields more reasonable results. However, as discussed in Section 3.5.4, the HEC-RAS models cannot fully account for the losses associated with the radius of curvature and particularly the inflow from sub-watershed 505. Therefore, the HEC-RAS models over predict the capacity of the emergency spillway.

In an indirect way, the reasonableness of the roughness coefficients can be inspected in regard to the numerical stability of the models. Numerical stability of the models can be assessed by reviewing the total number of time step decrements required to achieve numerical stability. The total number of time step decrements required to achieve numerical stability for the base and high roughness coefficient conditions is nearly identical, around 2,400,000 times. For the low roughness coefficient condition, the time interval was decremented nearly twice the base condition, around 4,600,000 times. From a numerical stability perspective, this suggests that he base roughness coefficients represent a reasonable lower limit.

In general, the results of the sensitivity analysis suggest that the model is not sensitive to roughness coefficients in a ponded flow condition and thus there appears to be no reason to doubt the appropriateness of the use of FLO-2D for these conditions. However, because of the magnitude of the dimensions of the dam, the results of the sensitivity analysis did not provide conclusive evidence of the reasonableness of the selected roughness coefficients. Based on what little data is available to provide a meaningful comparison, the selected roughness coefficients, if anything, are slightly conservative.

STANTEC CONSULTING INC.

Mike Gerlach
Water Resources Engineer
mgerlach@stantec.com

mg w:\active\82000267\correspondence\memos\sensitivity analysis.doc

Figure 1
Maximum water surface profiles along the low flow channel of the dam during the PMF

Note:
Maximum water surface profiles represent the maximum water surface elevation for each grid cell along the face of the dam that occurred during the simulation.

Figure 2
Comparison of overtopping hydrographs

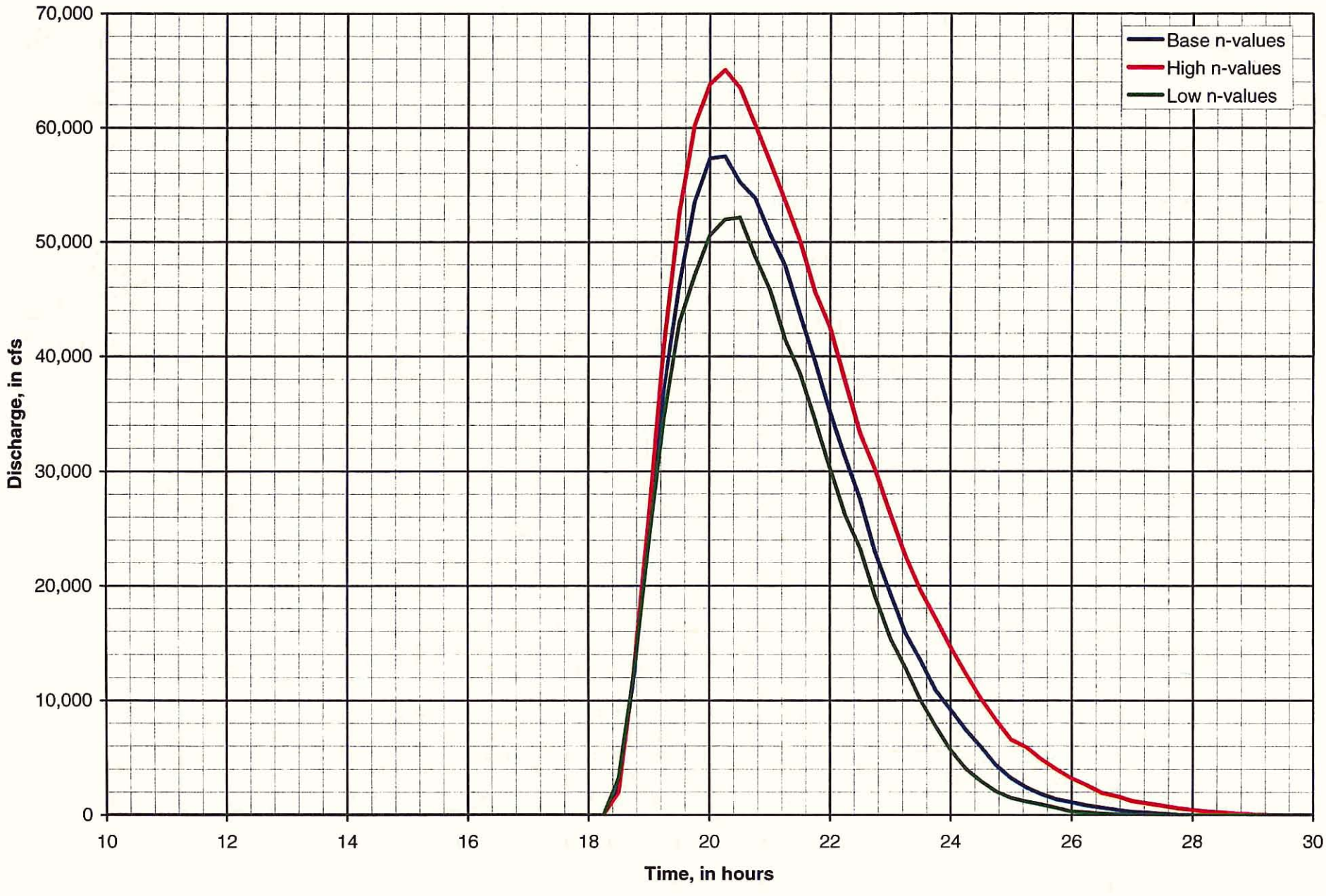
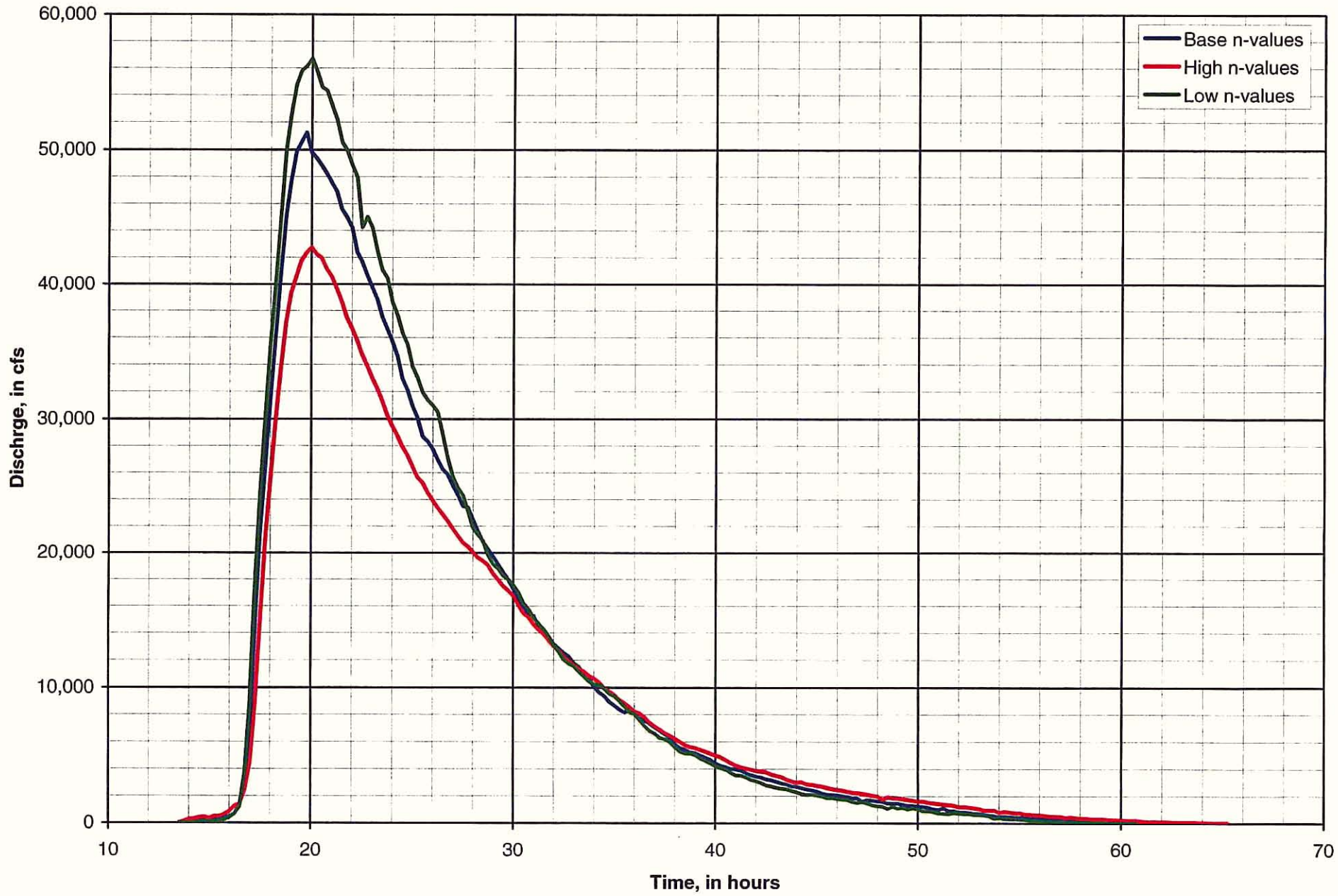


Figure 3
Comparison of emergency spillway flows



APPENDIX C

HYDROLOGY

Stantec Consulting Inc.
8211South 48th Street
Phoenix AZ 85044
Tel: (602) 438-2200 Fax: (602) 431-9562
stantec.com

Stantec

August 9, 2004
File: 82000267

Entellus
2255 N. 44th Street, Ste 125
Phoenix AZ, 85008

Attention: **Mr. Hernan Aristizabal, P.E.**

Reference: **Wittmann ADMSU - McMicken Dam Hydrology Review Comments**

Hydrology for McMicken Dam and outlet channel was prepared for the Probable Maximum Flood (PMF) for future land use conditions and for the 100-, 200- and 500-year flood frequencies for both existing and future land use conditions. Hydrologic input parameters are, in general, developed in accordance with the methodologies and procedures presented in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (FCDMC, 1995) as implemented in the Watershed Modeling System (WMS) software package. Those input parameters were reviewed and found to be reasonable for the flood magnitudes being considered. In addition, a select number of subbasin input parameters were calculated independently of WMS and those results were found to correlate with the parameters computed through WMS.

A comparison of the model results at the dam for the PMF to previous studies is provided in Table 1. As can be seen from Table 1, the results of the various studies are remarkably similar. For all other storm frequencies, only the 100-year existing land use condition results from the original area drainage master study (prepared by WLB) were provided for comparison. The peak discharge at the dam for that study is 20,400 cfs compared to 25,600 cfs estimated for this study. Although these peak discharges are relatively similar, it does not provide a sufficient amount of information to make a definitive statement regarding the reasonableness of the results. However, peak discharges for the 100-year models for both existing and future land use conditions were compared to indirect methods of verification and those comparisons indicate that the values are reasonable.

Although little discussion was provided in the *McMicken Dam Hydrology Report* regarding reasons for the differences in model results with previous studies, a table was provided that compared the general model methodologies. From the data provided in that table it can be inferred that the differences in model results are primarily due to differences in modeling

methodologies. Therefore, based on the review and inspection of input parameters as well as a review and comparison of model results, the modeling for the PMF and 100-year flood appear to be reasonable. As for the 200- and 500-year flood magnitudes, no discussion or measure of comparison for the reasonableness of the results was provided. Indirect comparisons could be made using the envelope curves discussed in Section 4.6.1 of the hydrology report. The envelope curves represent the maximum observed flood discharges and, therefore, are appropriate to provide some means of comparison for flood magnitudes greater than the 100-year. In addition, the model results for the 100-, 200- and 500-year can be plotted on flood frequency paper in order to draw some conclusions on the relative magnitude of the 200- and 500-year results to the 100-year.

Table 1
Comparison of PMF results from all known sources

	Inflow	
Study	**Discharge cfs**	**Volume acre-ft**
USACE[2]	120,000	N/A
SH&B	155,800	96,700
District, 1987	114,900	N/A
Wittmann ADMS	110,400	N/A
District, 2000	122,100	107,000
District, 2003	122,100	107,000
Wittmann ADMSU	128,000	107,500

While the results appear reasonable, I have a few comments regarding the PMF model in general. For the PMF model, the Probable Maximum Precipitation (PMP) data was developed for a previous study and provided by the District. The drainage area used in the development of the PMP data is 247 square miles. The drainage area estimated for this study to the dam is 245 square miles. Use of the PMP data prepared for the previous study for watershed modeling of the dam is appropriate. However, the PMF model also includes the watershed area contributing to the outlet channel downstream of the dam accounting for an additional 73 square miles of drainage area. Therefore, use of the PMP data developed for the previous study for the area downstream of the dam is not appropriate. Furthermore, the purpose of the PMF model is to develop inflow hydrographs to the dam. Facilities downstream of the dam are not designed for the PMF and it is not the intent of this study to evaluate the impacts of the PMF on those facilities. Also, in lieu of a reservoir routing operation hydrologic channel routing was used to route flow through the impoundment to the outlet works and through the outlet channel in order to tie the entire model (both the dam and outlet channel watersheds) together. The total inflow to the dam reported, includes the effects of the hydrologic channel routing. These hydrologic channel routing operations need to be removed and the individual inflow hydrographs should be combined in order to report the true inflow to McMicken Dam.

Reference: Wittmann ADMSU - McMicken Dam Hydrology Review Comments

Removal of the outlet channel watershed area operations and the hydrologic channel routing operations in the impoundment area of the dam also apply to the 100-, 200- and 500-year models as they relate to the inflow to the dam. However, as part of the alternative analysis, the outlet channel for these flood events is to be considered, particularly in regard to the dam decommissioning alternative. This suggests that two models are required, one for the inflow to the dam and one for alternative analyses purposes. Given that the exact configuration and components of the decommissioning alternative have yet to be developed, it is recommended that the 100-, 200- and 500-year models remain as is. The current state of the models provides an excellent set of base models that can easily be edited and tailored for modeling both the inflow to the dam and the decommissioning alternative features.

In conclusion, it is recommended that the PMF model be edited as discussed prior to acceptance as the current model for the dam. It is also recommended that model results for the 200- and 500-year flood frequencies be evaluated using indirect methods of verification. The 100-, 200- and 500-year models should be accepted as is, as base models for alternative analysis purposes. Appropriate qualification of the inflow magnitudes reported for the dam should be provided.

Sincerely,

STANTEC CONSULTING INC.

Mike Gerlach
Water Resources Engineer
Tel: 602.438.2200
Fax: 602.431.9562
mgerlach@stantec.com

c. Kelli Sertich, AICP; FCMCD
Tom Renckly, PE; FCDMC
Joe Rumann, PE; FCDMC
Michael Johnson, PhD, PE; ADWR

mg w:\active\82000267\correspondence\letters\mcg072104haltr.doc

Figure C-1
Inflow hydrographs for the 72-hour PMF with future condition land use

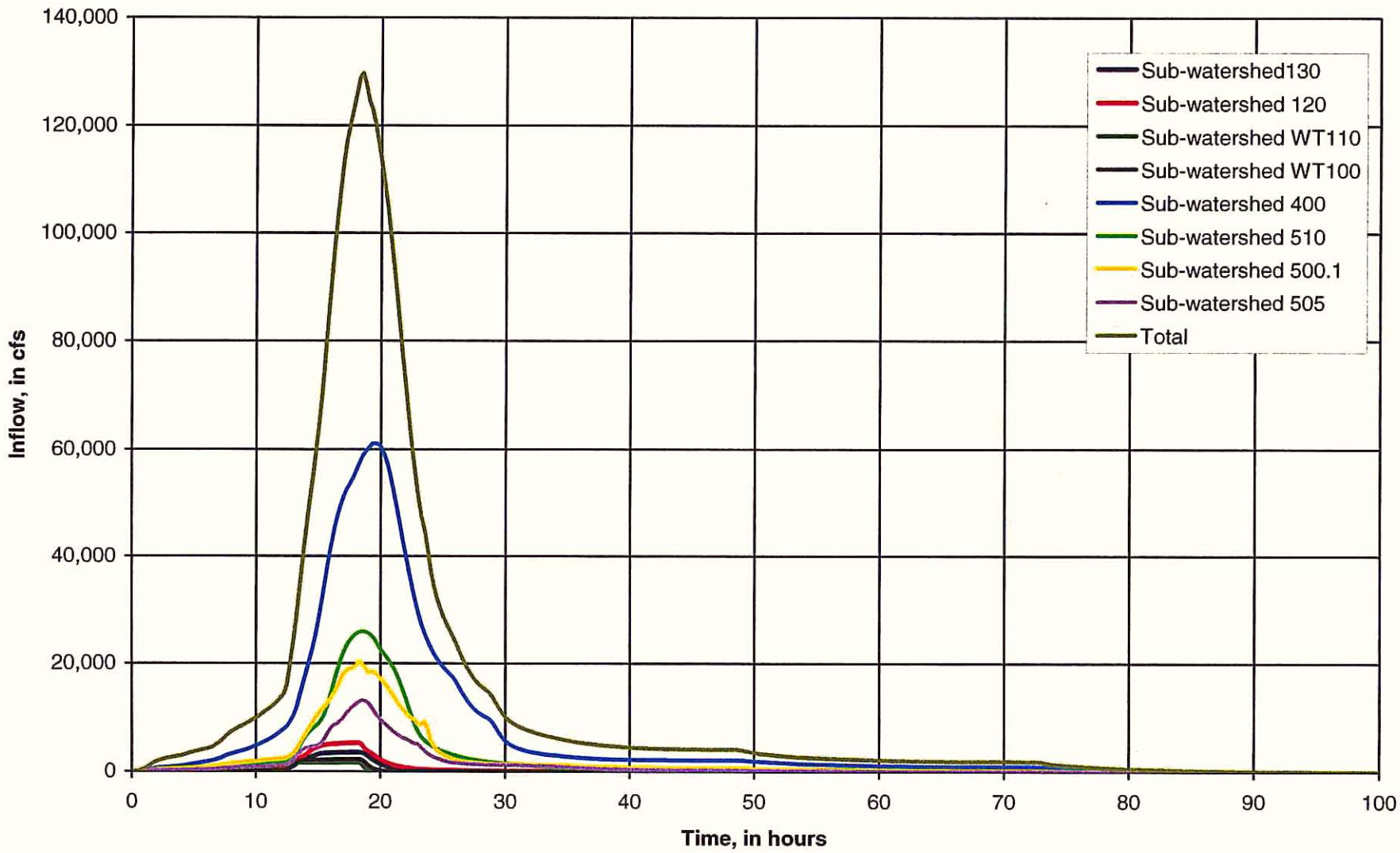


Figure C-2
Inflow hydrographs for the 500-year, 24-hour storm with future condition land use

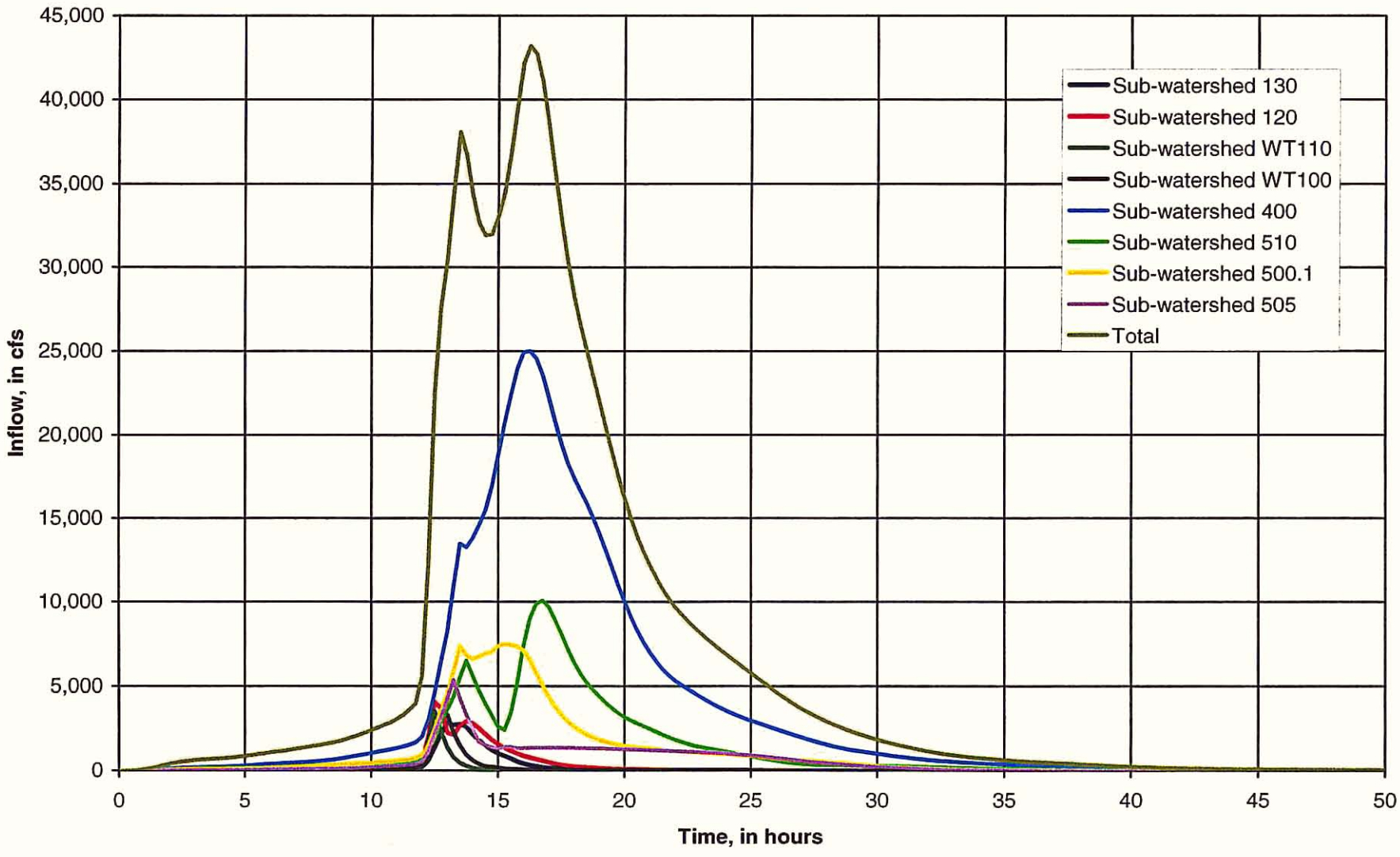


Figure C-3
Inflow hydrographs for the 500-year, 24-hour storm with existing condition land use

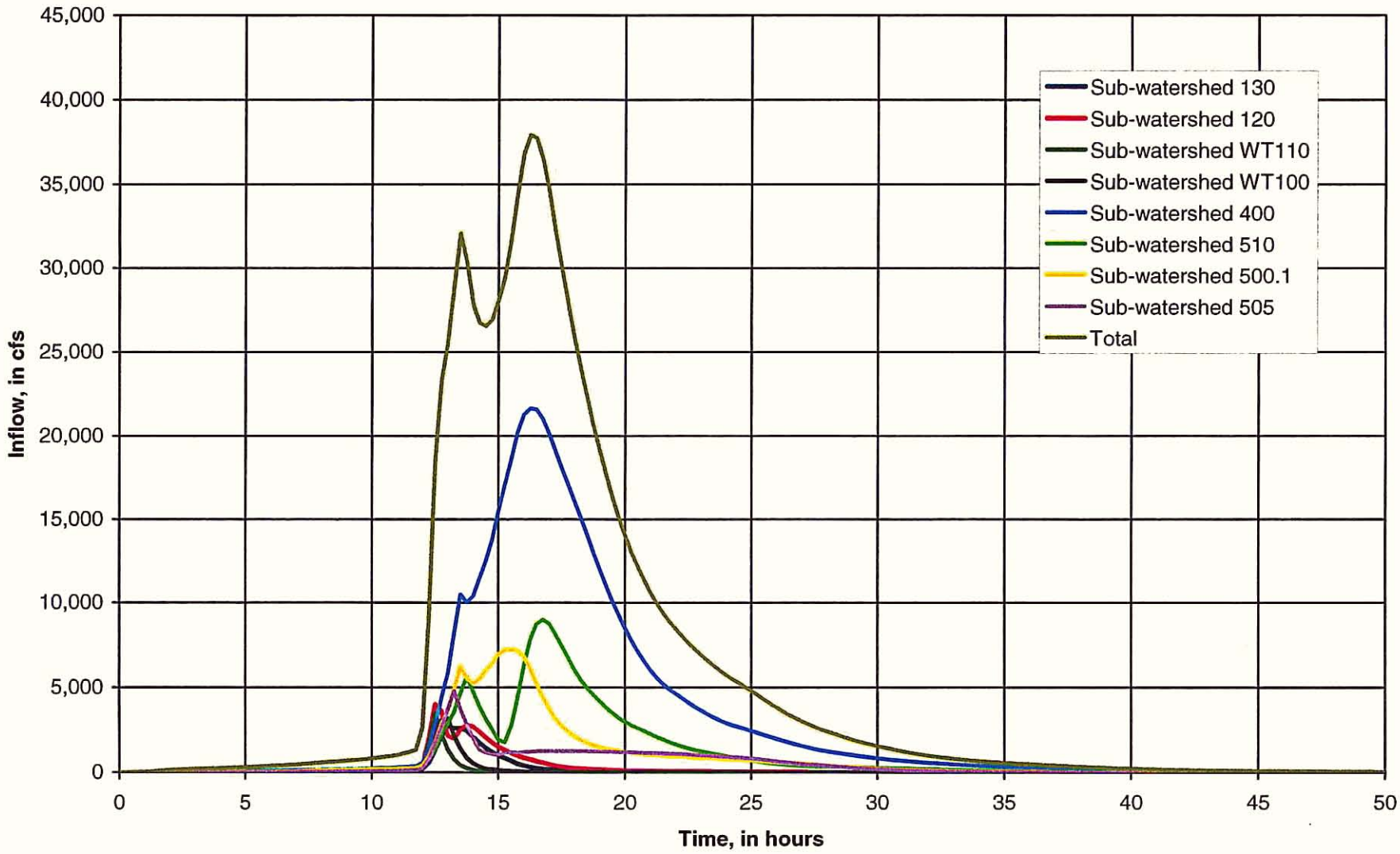


Figure C-4
Inflow hydrographs for the 200-year, 24-hour storm with future condition land use

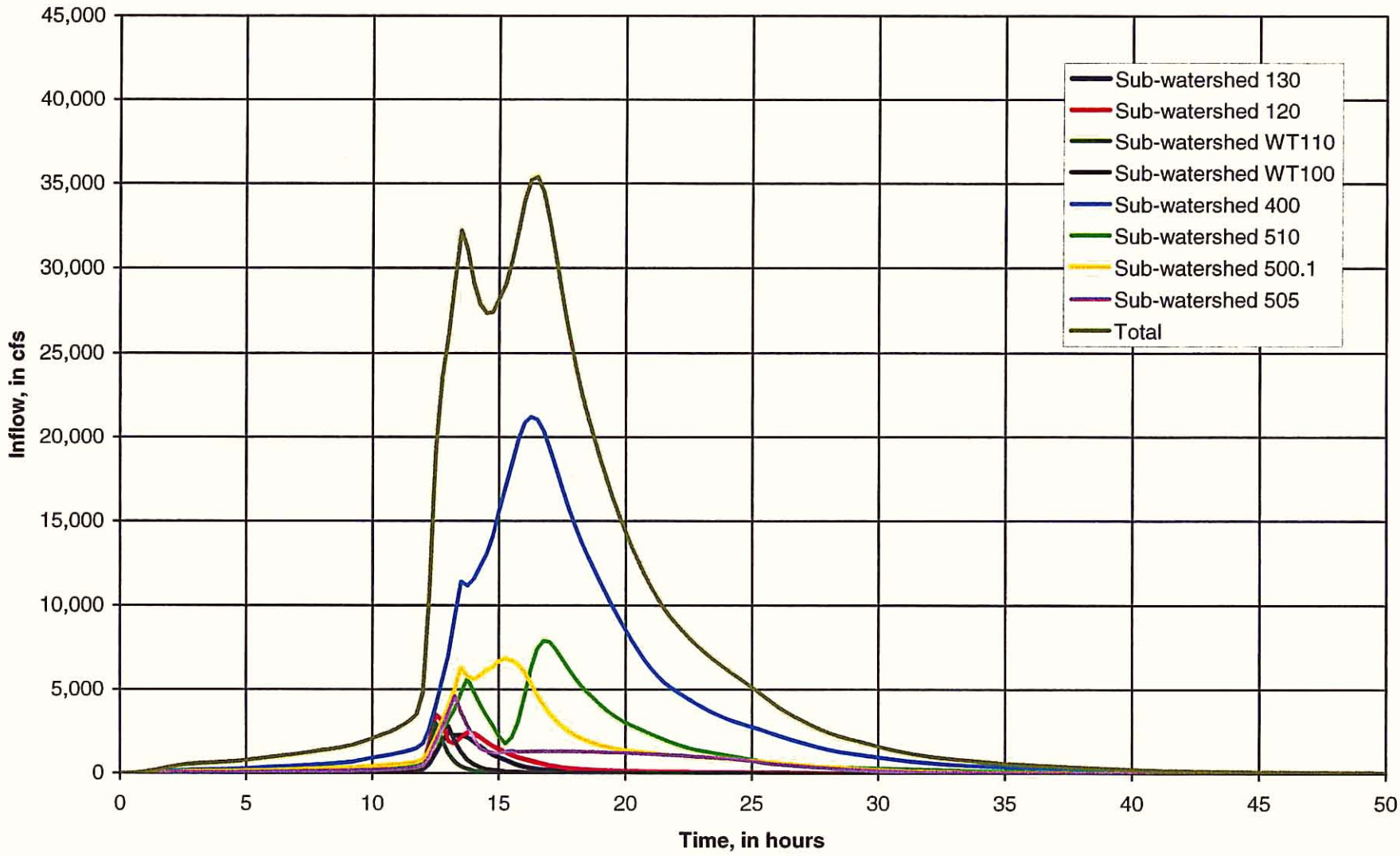


Figure C-5
Inflow hydrographs for the 200-year, 24-hour storm with existing condition land use

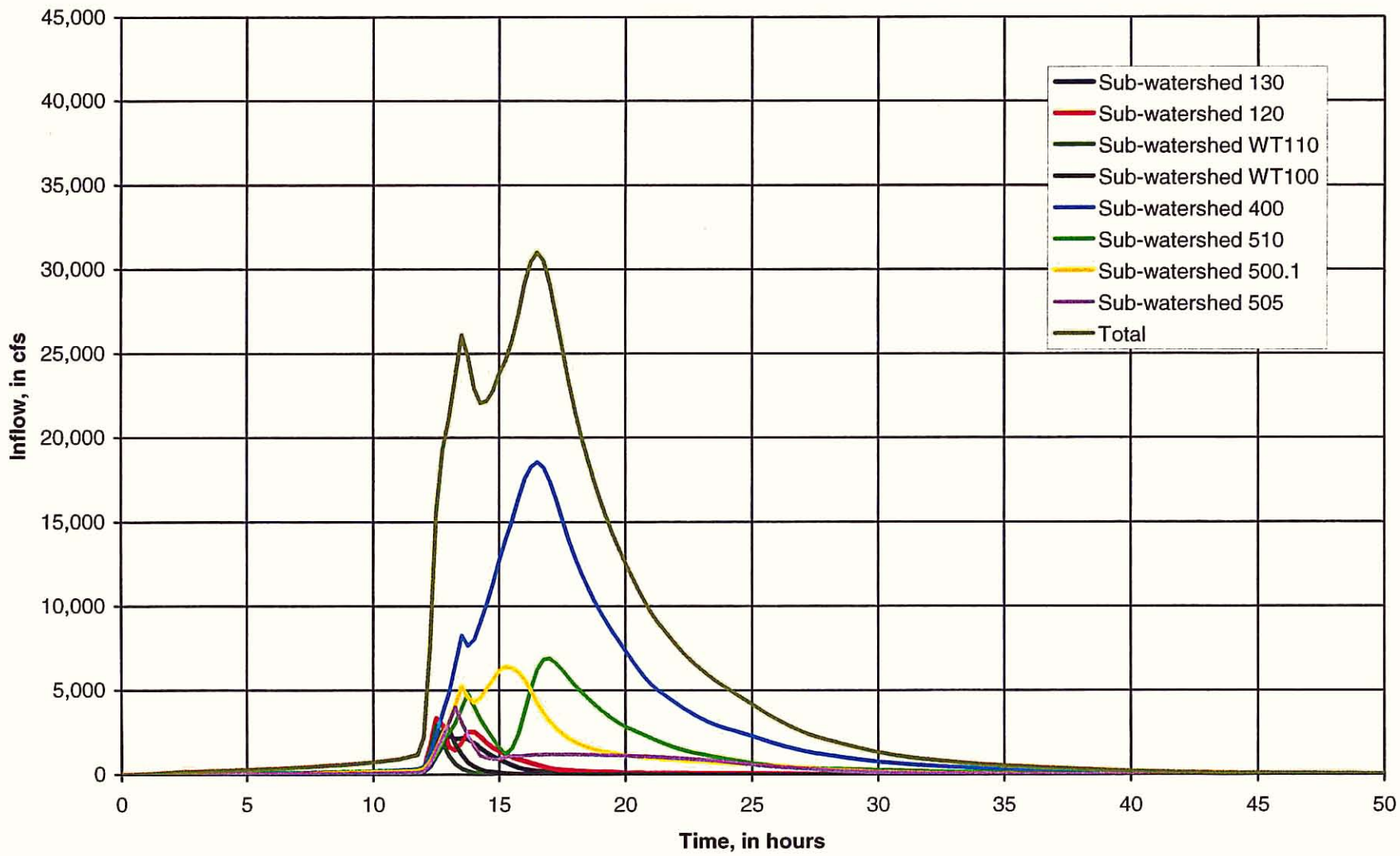


Figure C-7
Inflow hydrographs for the 100-year, 24-hour storm with existing condition land use

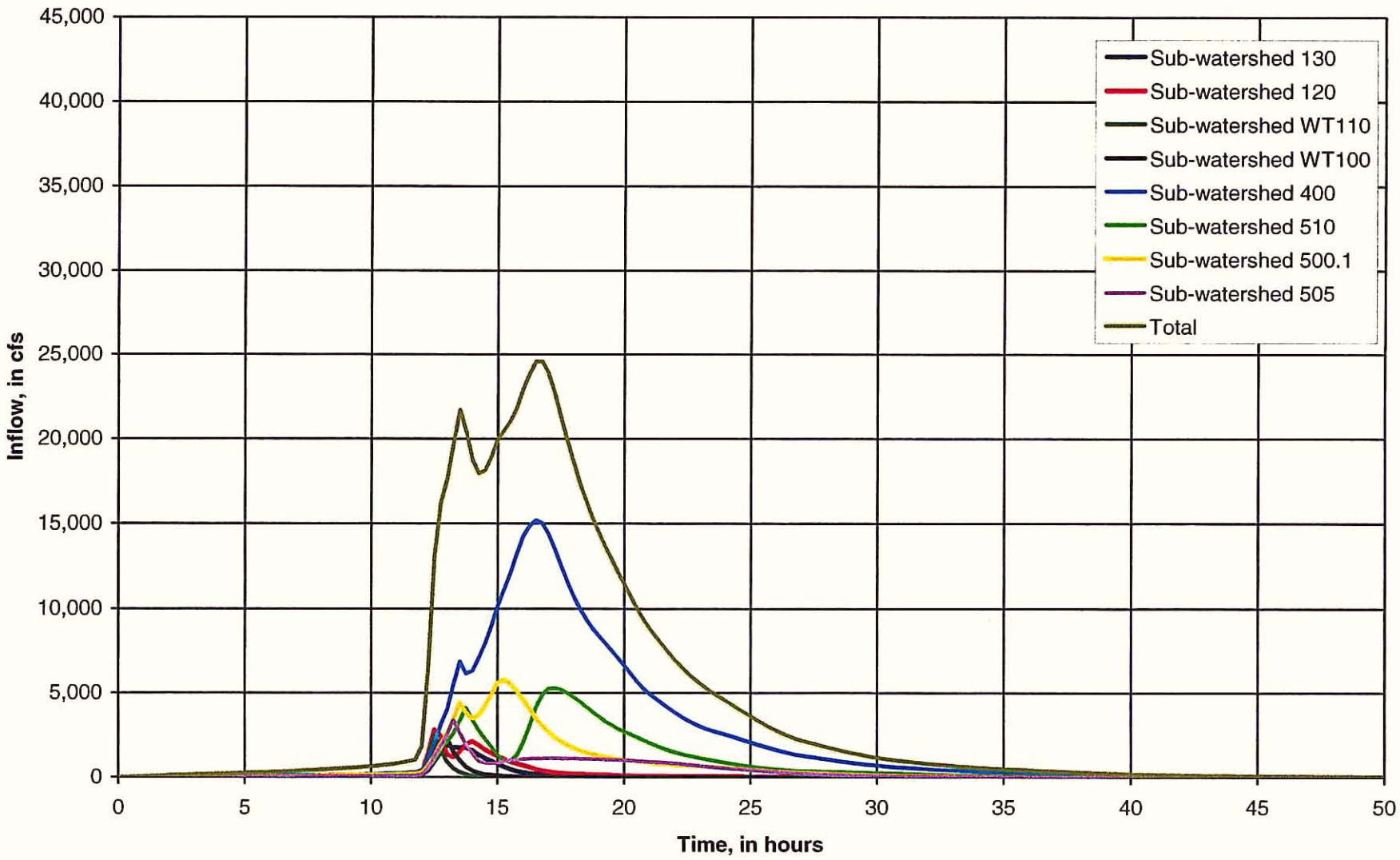
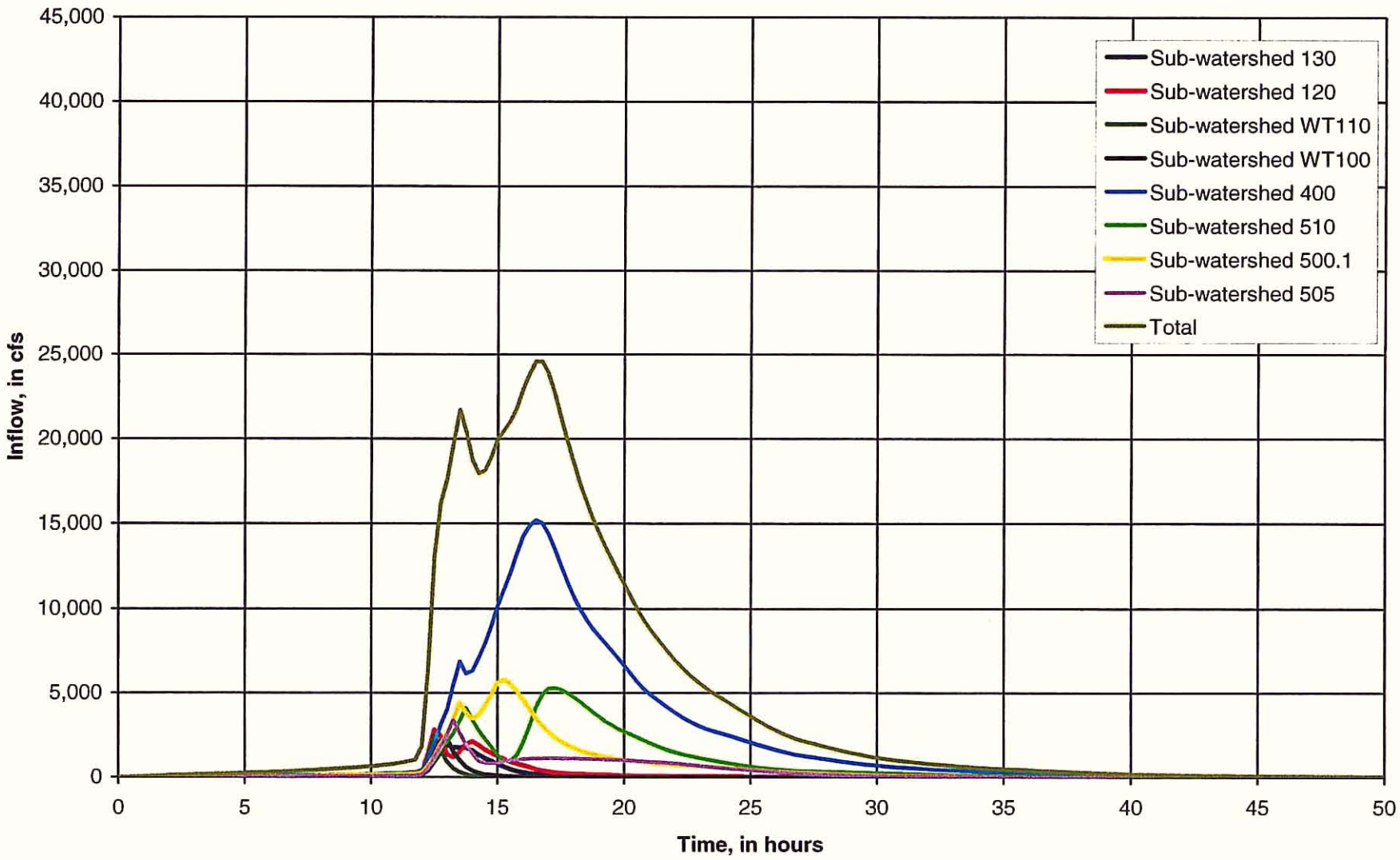


Figure C-7
Inflow hydrographs for the 100-year, 24-hour storm with existing condition land use



APPENDIX D

HYDRAULIC STRUCTURES

Memo

Stantec

To:	FILE Phoenix	From:	Mike Gerlach Phoenix
File:	82000267 (Task 102)	Date:	26 February 2004

Reference: Principle Outlet Hydraulic Model

The principle outlet for McMicken Dam is an ungated 20-foot wide, rectangular flume approximately 90 feet in length with a vertical breastwall located approximately 70 feet from the upstream end. The breastwall was designed to restrict outflow at the Standard Project Flood (SPF) pool stage (approximately 1355.4) to 4,450 cfs. The required opening height was determined from 1:18 scale physical model studies to be 11 feet. At the end of the flume is a 65-foot concrete stilling basin. The general features of the structure are shown in Figure 1.

The stage-discharge relation for the principle outlet is based on the results of the physical model studies performed by the USACE and is shown in Figure 2. The USACE design was based on elevations referenced to the National Geodetic Vertical Datum of 1929 (NGVD29). The design plans show the invert at the inlet to be at elevation 1,335.0 feet. New mapping and survey data is referenced to the North American Vertical Datum of 1988 (NAVD88). The elevation of the invert at the inlet based on the recent survey is 1,336.116 feet. For consistency, the elevations of the COE principle outlet rating curve are adjusted by 1.116 feet.

The hydraulics of the outlet are fairly complex. As the pool elevation increases, the location of the control section progresses downstream toward the breastwall. Below the lip of the breastwall, the outlet functions as an open channel in a supercritical flow regime. Above pool elevation 1,355 feet there is a shift in the hydraulic conditions at the control section. It is likely that this shift is due to the proximity of the control section to the breastwall. In order to the understand the nature of this shift in control, an HEC-RAS model representing the principle outlet was created. Printouts of the model input data and summary results are included at the back of this memo. The input and output files are also provided digitally on CD.

Geometric data for the structure was taken from as-built drawings and recent survey data. Contraction loss coefficients for the cross sections upstream of the breastwall were adjusted until the resulting pool elevation matched the physical model study results. The coefficients ranged from 0.1 just upstream of the breastwall to 0.3 at the upstream end of the flume. Three different geometric conditions were used to simulate and understand the impacts of the breastwall on the pool elevation. Each model was run using the mixed flow regime option. The results of each condition are shown in Figure 2 along with the results of the physical model studies.

For the first condition, the outlet was modeled without the breastwall. The purpose of this condition was to create a baseline representation of the flume. The next two conditions are different approaches for modeling the breastwall in HEC-RAS. The

first of these uses an inline structure with a gated outlet. The dimensions of the gate are set to the dimensions of the opening in the flume. The hydraulics through the structure are modeled as a sluice gate using the orifice equation. In the sluice gate option, head is measured from the invert of the opening. In addition to the geometric data, the program also requires input of a discharge coefficient, C_d. The discharge coefficient is primarily a function of the shape of the opening, area of the opening in relation to the upstream energy grade line, degree of contraction and the approach velocity. The breastwall forms a special case of an orifice, one that is suppressed on three sides. This configuration reduces the degree of contraction. In addition, the lip of the breastwall is beveled further reducing the degree of contraction. The approach velocity immediately upstream of the breastwall ranges from 9 to 19 fps. The USACE estimated a value for C_d of 0.878 based on the following relation.

$$C_d = \frac{1}{\sqrt{K_e + 1}}$$

Where: K_e = 0.3 accounting for entrance losses.

Based on the results of the physical model studies the discharge coefficient can be determined depending on an assumption of the head term. Table 1 shows the range of values for C_d for each stage of the rating curve above the lip of the breastwall. In column 3, C_d is calculated assuming free flow conditions with head measured from the invert of the opening. In column 4, C_d is measured from the lip of the breastwall which assumes a submerged condition where the tailwater elevation never exceeds the lip.

In HEC-RAS, head is measured to the energy grade line elevation from the invert of the opening for free flow conditions and from the tailwater elevation for submerged conditions. When the tailwater depth divided by the headwater energy is between 0.67 and 0.8, the program uses the following equation to transition from free flow to submerged flow conditions.

$$Q = C_d A \sqrt{2g3H}$$

In this equation, head is taken as the difference between the upstream energy grade line and the tailwater elevation. Once the submergence ratio exceeds 0.8, the program uses the standard orifice equation with head measured as the difference between the upstream grade line elevation and the tailwater elevation. A value for C_d must be input for both the free flow and submerged flow conditions. Based on the values in Table 1, a value of 0.58 and 0.878 was input for the free flow and submerged flow conditions, respectively. The resulting rating curve is shown in Figure 2. Inspection of the output shows that HEC-RAS reports a warning that the program cannot perform supercritical flow through an inline structure. In order to continue, the program sets the water surface elevation to critical depth at the downstream section. Despite this "limitation", the HEC-RAS results very accurately reproduce the results of the physical model studies.

Table 1
Discharge coefficients for the principle outlet

Discharge cfs (1)	Pool Elevation Feet[1] (2)	Free Flow (3)	Submerged Flow (4)
2,612	1,349.0	0.40	0.89
2,870	1,349.9	0.42	0.85
3,290	1,351.2	0.47	0.84
3,575	1,352.1	0.49	0.84
3,990	1,353.3	0.53	0.85
4,280	1,354.1	0.56	0.87
4,655	1,355.3	0.59	0.88
4,830	1,358.2	0.57	0.79
5,065	1,360.3	0.57	0.77
5,155	1,361.0	0.58	0.76
5,245	1,361.9	0.58	0.75

1. Pool elevations estimated by the USACE are adjusted from NGVD29 to NAVD 88 by +1.116 feet to reflect recent survey data.

The second approach was to model the breastwall as a very narrow bridge. For this approach the pressure flow option of the bridge routine was applied. Similarly to the inline structure, both free and submerged flow conditions can exist using the pressure flow option. For free flow conditions, discharge through the structure is estimated using the following equation.

$$Q = C_d A \sqrt{Y_3 - \frac{Z}{2} + \alpha_3 \frac{v_3^2}{2g}}$$

Where: Y_3 = Upstream hydraulic depth, in feet
Z = Height of the opening, in feet
$\alpha_3 \frac{v_3^2}{2g}$ = Approach velocity head, in feet

For the submerged condition, the discharge through the structure is estimated using the same equation as the inline gate under submerged conditions.

The value for C_d was varied to match the physical model study results. By trial and error, it was found that free flow conditions are not computed unless C_d was less than 0.7. Forcing free flow conditions to exist by setting C_d to a value much less than 0.7 (i.e. 0.58) yielded results that were not representative of the physical model studies. Therefore, C_d for free flow conditions was set to 0.7. The value of C_d for submerged

conditions that yielded the most representative results to the physical model study was 0.815. The resulting rating curve is shown in Figure 3.

As can be seen from Figure 2, the HEC-RAS results using the inline structure to simulate the breastwall very closely mach the results of the model study except at pool elevation 1,355.3 feet. Based on the results of the HEC-RAS models, the pronounced decrease in the performance shown by the physical model studies is likely due to the location of the control section and the transition from free flow to submerged flow conditions. Figure 3 is a plot of the water surface profiles for discharges starting at 3,990 cfs. For discharges less than 4,280 cfs, the water surface elevation is below the lip of the breastwall and the control section is more than 35 feet upstream of the breastwall. At 4,280 cfs, the water surface is in contact with the breastwall and the tailwater elevation is at the lip of the breastwall. At 4,655 cfs, the tailwater elevation is above the lip of the breastwall.

Figure 1
McMicken Dam principle outlet

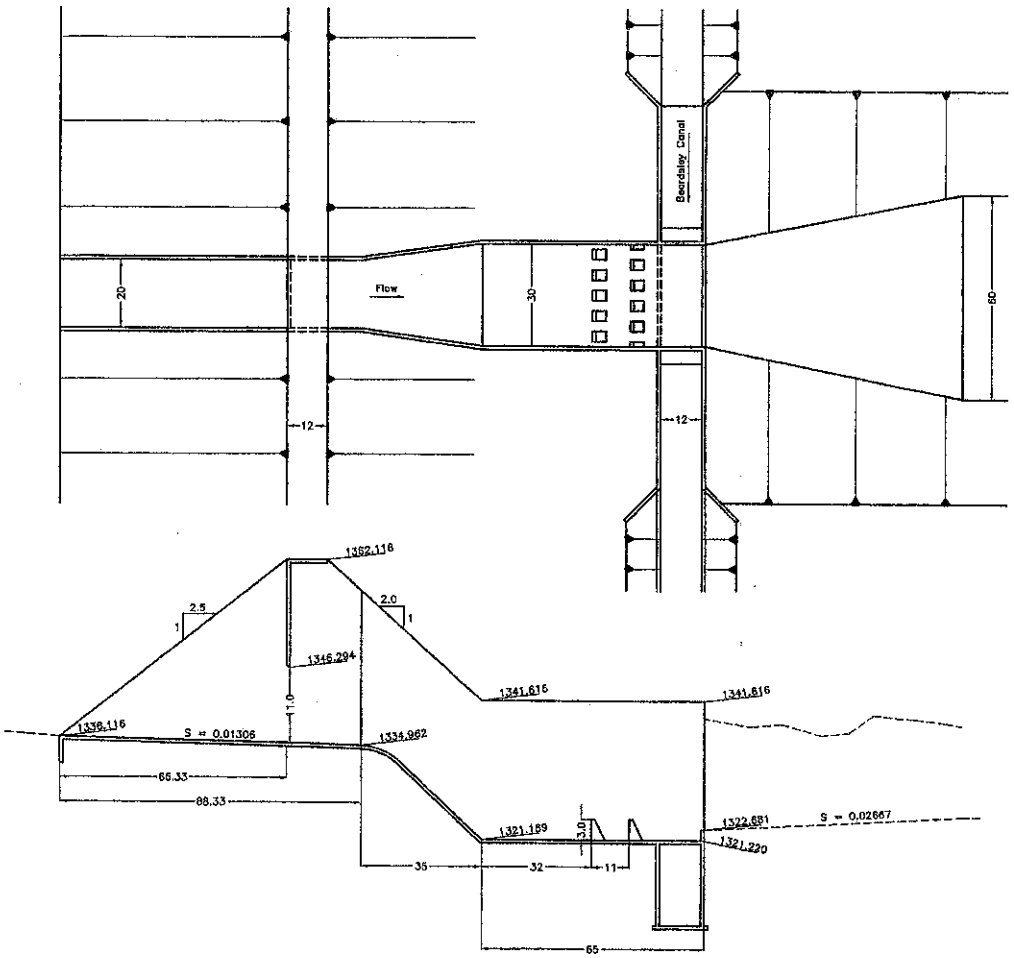
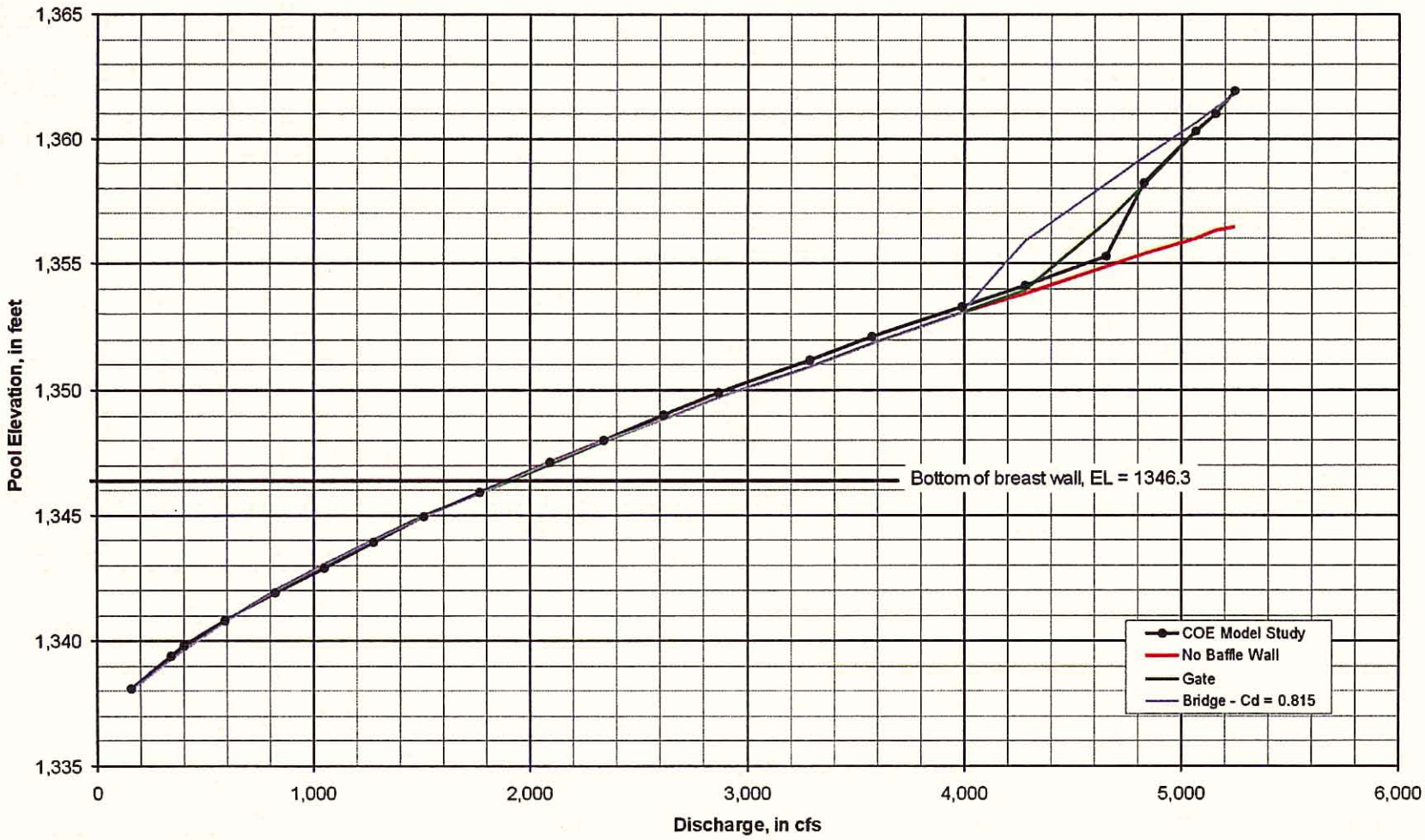
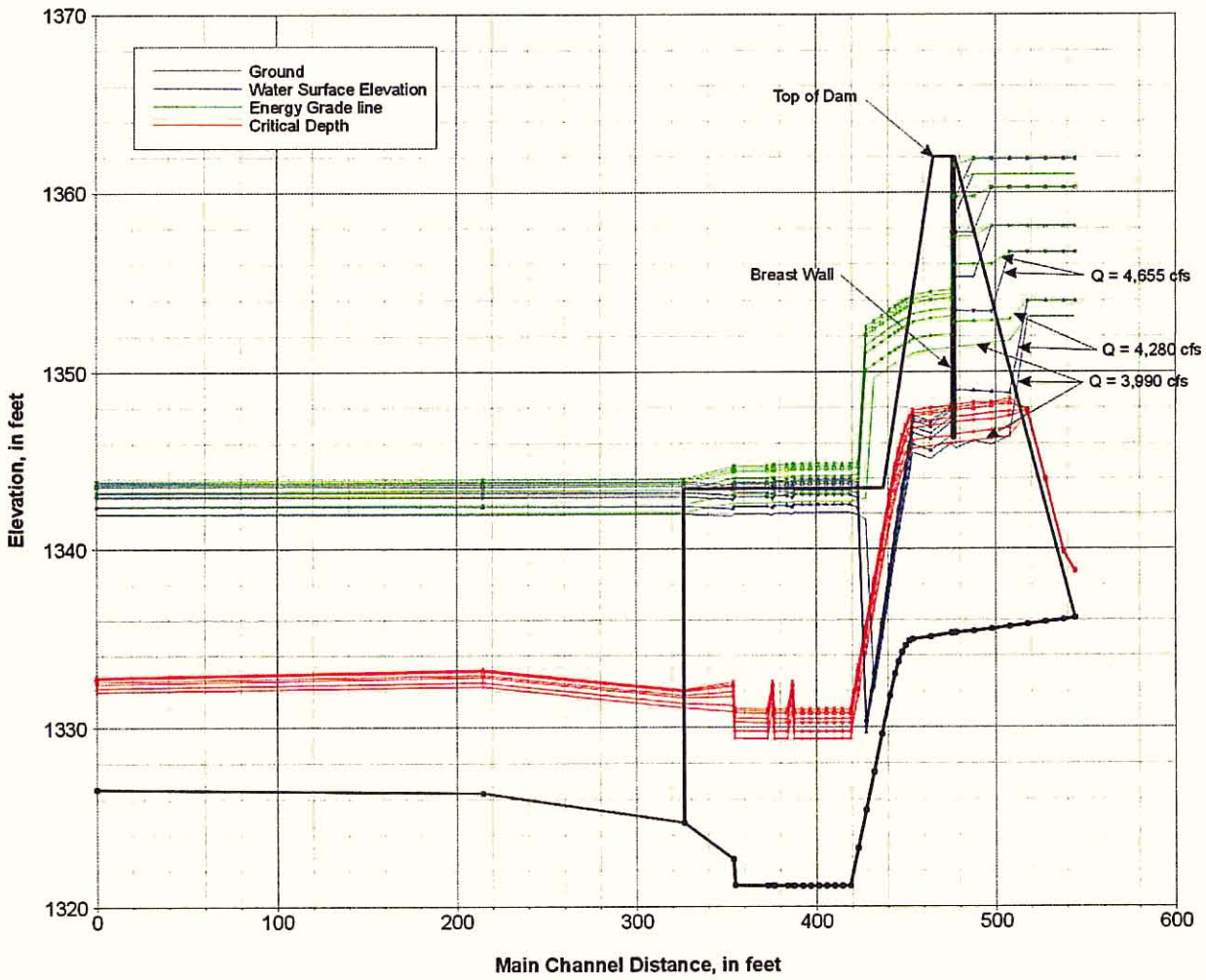


Figure 2
Comparison of stage-discharge relations for the principle outlet



Reference: Principle Outlet Hydraulic Model

Figure 3
Water surface profiles through the principle outlet



HEC-RAS Version 3.1.2 April 2004
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: McMicken Dam Principle Outlet
Project File : po.prj
Run Date and Time: 2/5/2004 5:10:22 PM

Project in English units

PLAN DATA

Plan Title: P.O. without Breast Wall
Plan File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.p01

Geometry Title: P.O. without Breast Wall
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.g01

Flow Title : P.O. Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.f01

Plan Summary Information:

Number of:	Cross Sections	= 39	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Program Selects Appropriate method
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: P.O. Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4	PF 5	PF 6	PF 7	PF 8
McMicken Dam Out	Principle Outlet	22	156	340	398	591	822	1047	1275	1509

River	Reach	RS	PF 9	PF 10	PF 11	PF 12	PF 13	PF 14	PF 15	PF 16
McMicken Dam Out	Principle Outlet	22	1765	2090	2337	2612	2870	3290	3575	3990

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
McMicken Dam Out	Principle Outlet	PF 1	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 2	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 3	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 4	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 5	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 6	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 7	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 8	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 9	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 10	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 11	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 12	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 13	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 14	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 15	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 16	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 17	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 18	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 19	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 20	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 21	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 22	Critical	Normal S = 0.0001

Inline Structure Gate Openings
River = McMicken Dam Out
Reach = Principle Outlet RS = 14.5
Gate = Gate #1

# Open	Open Ht	# Open	Open Ht	# Open	Open Ht	# Open	Open Ht	# Open	Open Ht
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1						

GEOMETRY DATA

Geometry Title: P.O. without Breast Wall
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.g01

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 22

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1362	11000	1337	110001336.116		110201336.116		11020	1337
21020	1362								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.02	11000	.012	11020	.02

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

```
        11000   11020              6.33    6.33    6.33             .3       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 21

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1338   110001336.061   110201336.008   11020    1338
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 20

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1342   11000 1335.93   110201335.877   11020    1342
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 19

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1346   110001335.799   110201335.746   11020    1346
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 18

INPUT
Description:
Station Elevation Data    num=       6
```

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1350   110001335.668   110201335.615   11020    1350
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 17

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1354   110001335.537   110201335.484   11020    1354
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 16

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1358   110001335.407   110201335.354   11020    1358
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10             .2       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 15

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362    10001335.276    10201335.276    1020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1020               2.5     2.5     2.5             .1       .3

CROSS SECTION
```

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 14

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1362	1000	1335.243	1020	1335.243	1020	1362

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1020	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1020	11.5	11.5	11.5	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 13

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1362	1000	1335.093	1020	1335.04	1020	1362

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1020	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1020	10	10	10	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 12

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1359	1000	1334.962	1020	1334.909	1020	1359

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1020	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1020	2	2	2	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 11

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1358	1000	1334.862	1020.57	1334.809	1020.57	1358

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1020.57	.012

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1020.57                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 10

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1357    10001334.618 1021.141334.565 1021.14    1357

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1021.14    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1021.14                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 9

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1356    10001334.228 1021.711334.175 1021.71    1356

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1021.71    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1021.71                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 8

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1355    10001333.693 1022.29 1333.64 1022.29    1355

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1022.29    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1022.29                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 7

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
    1000    1354    10001333.014 1022.861332.961 1022.86    1354

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1022.86    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1022.86              2.87    2.87    2.87             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 6

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1353    10001331.785 1023.671331.732 1023.67    1353

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1023.67    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1023.67              4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.8*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1350.8    1000 1329.66 1024.94 1329.62 1024.94  1350.8

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1024.94    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1024.94              4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.6*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1348.6    1000 1327.54  1026.2  1327.5  1026.2  1348.6

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012  1026.2    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000  1026.2              4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.4*
```

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1346.4	1000	1325.42	1027.47	1325.39	1027.47	1346.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1027.47	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1027.47	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 5.2*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1344.2	1000	1323.29	1028.73	1323.27	1028.73	1344.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1028.73	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1028.73	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 5

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.169	1030	1321.154	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.94285*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.88571*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.82857*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.77142*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.71428*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000   1030             4.43    4.43    4.43            .1        .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.65714*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000   1030             4.43    4.43    4.43            .1        .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.6

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000   1030               1       1       1            .1        .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.5

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169  1001.51321.169  1001.51324.169  1004.51324.169
  1004.51321.169  1007.51321.169  1007.51324.169  1010.51324.169  1010.51321.169
  1013.51321.169  1013.51324.169  1016.51324.169  1016.51321.169  1019.51321.169
  1019.51324.169  1022.51324.169  1022.51321.169  1025.51321.169  1025.51324.169
  1028.51324.169  1028.51321.154    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000   1030               3       3       3            .1        .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.4
```

```
INPUT
Description:
Station Elevation Data     num=       4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    1000     1342    10001321.169    10301321.154    1030     1342

Manning's n Values         num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
    1000     .012    1000     .012    1030     .012

Bank Sta: Left    Right    Lengths: Left Channel    Right      Coeff Contr.    Expan.
          1000    1030                 7       7       7              .1        .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet    RS: 4.3

INPUT
Description:
Station Elevation Data     num=       4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    1000     1342    10001321.169    10301321.154    1030     1342

Manning's n Values         num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
    1000     .012    1000     .012    1030     .012

Bank Sta: Left    Right    Lengths: Left Channel    Right      Coeff Contr.    Expan.
          1000    1030                 1       1       1              .1        .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet    RS: 4.2

INPUT
Description:
Station Elevation Data     num=      24
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    1000     1342    10001324.169  1001.51324.169  1001.51321.169  1004.51321.169
  1004.51324.169  1007.51324.169  1007.51321.169  1010.51321.169  1010.51324.169
  1013.51324.169  1013.51321.169  1016.51321.169  1016.51324.169  1019.51324.169
  1019.51321.169  1022.51321.169  1022.51324.169  1025.51324.169  1025.51321.169
  1028.51321.169  1028.51324.154    10301324.154    1030     1342

Manning's n Values         num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
    1000     .012    1000     .012    1030     .012

Bank Sta: Left    Right    Lengths: Left Channel    Right      Coeff Contr.    Expan.
          1000    1030                 3       3       3              .1        .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet    RS: 4.1

INPUT
Description:
Station Elevation Data     num=       4
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    1000     1342    10001321.169    10301321.154    1030     1342

Manning's n Values         num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
    1000     .012    1000     .012    1030     .012
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                18      18      18              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.175    1030 1321.22    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                 1       1       1              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 3

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001322.638    10301322.681    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030              27.4    27.4    27.4              .6       .8

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 2.5

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1341.2  1010.7  1341.2  1051.7  1325.2  1072.9  1324.7  1095.6  1326.4
  1129.4    1340    1130  1340.2    1133 1341.22 1134.91 1341.87 1146.91 1341.87

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045  1010.7    .035    1133    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1010.7    1133            111.78  111.78  111.78              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 2

INPUT
Description:
Station Elevation Data    num=      10
```

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1340.61	1010.6	1340.73	1024.9	1337.79	1032.9	1336.5	1059.1	1327.26
1089.2	1326.35	1107.6	1327.22	1140.2	1338.69	1149.46	1341.79	1161.46	1341.79

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1010.6	.035	1149.46	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1010.6	1149.46	214.63	214.63	214.63	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 1

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1340.3	1009	1338	1017	1336	1057	1333.69	1087.9	1327.86
1125.9	1326.57	1148.7	1328.05	1171.3	1333.29	1182	1333.98	1183.2	1334.06
1199.2	1339.27	1206.81	1341.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1009	.035	1206.81	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1009	1206.81	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:McMicken Dam Out

Reach	River Sta.	n1	n2	n3
Principle Outlet	22	.02	.012	.02
Principle Outlet	21	.02	.012	.02
Principle Outlet	20	.02	.012	.02
Principle Outlet	19	.02	.012	.02
Principle Outlet	18	.02	.012	.02
Principle Outlet	17	.02	.012	.02
Principle Outlet	16	.02	.012	.02
Principle Outlet	15	.012	.012	.012
Principle Outlet	14	.012	.012	.012
Principle Outlet	13	.012	.012	.012
Principle Outlet	12	.012	.012	.012
Principle Outlet	11	.012	.012	.012
Principle Outlet	10	.012	.012	.012
Principle Outlet	9	.012	.012	.012
Principle Outlet	8	.012	.012	.012
Principle Outlet	7	.012	.012	.012
Principle Outlet	6	.012	.012	.012
Principle Outlet	5.8*	.012	.012	.012
Principle Outlet	5.6*	.012	.012	.012
Principle Outlet	5.4*	.012	.012	.012
Principle Outlet	5.2*	.012	.012	.012
Principle Outlet	5	.012	.012	.012
Principle Outlet	4.94285*	.012	.012	.012
Principle Outlet	4.88571*	.012	.012	.012
Principle Outlet	4.82857*	.012	.012	.012
Principle Outlet	4.77142*	.012	.012	.012
Principle Outlet	4.71428*	.012	.012	.012
Principle Outlet	4.65714*	.012	.012	.012
Principle Outlet	4.6	.012	.012	.012
Principle Outlet	4.5	.012	.012	.012
Principle Outlet	4.4	.012	.012	.012

Principle Outlet	4.3	.012	.012	.012
Principle Outlet	4.2	.012	.012	.012
Principle Outlet	4.1	.012	.012	.012
Principle Outlet	4	.012	.012	.012
Principle Outlet	3	.012	.012	.012
Principle Outlet	2.5	.045	.035	.045
Principle Outlet	2	.045	.035	.045
Principle Outlet	1	.045	.035	.045

SUMMARY OF REACH LENGTHS

River: McMicken Dam Out

Reach	River Sta.	Left	Channel	Right
Principle Outlet	22	6.33	6.33	6.33
Principle Outlet	21	10	10	10
Principle Outlet	20	10	10	10
Principle Outlet	19	10	10	10
Principle Outlet	18	10	10	10
Principle Outlet	17	10	10	10
Principle Outlet	16	10	10	10
Principle Outlet	15	2.5	2.5	2.5
Principle Outlet	14	11.5	11.5	11.5
Principle Outlet	13	10	10	10
Principle Outlet	12	2	2	2
Principle Outlet	11	2	2	2
Principle Outlet	10	2	2	2
Principle Outlet	9	2	2	2
Principle Outlet	8	2	2	2
Principle Outlet	7	2.87	2.87	2.87
Principle Outlet	6	4.43	4.43	4.43
Principle Outlet	5.8*	4.43	4.43	4.43
Principle Outlet	5.6*	4.43	4.43	4.43
Principle Outlet	5.4*	4.43	4.43	4.43
Principle Outlet	5.2*	4.43	4.43	4.43
Principle Outlet	5	4.43	4.43	4.43
Principle Outlet	4.94285*	4.43	4.43	4.43
Principle Outlet	4.88571*	4.43	4.43	4.43
Principle Outlet	4.82857*	4.43	4.43	4.43
Principle Outlet	4.77142*	4.43	4.43	4.43
Principle Outlet	4.71428*	4.43	4.43	4.43
Principle Outlet	4.65714*	4.43	4.43	4.43
Principle Outlet	4.6	1	1	1
Principle Outlet	4.5	3	3	3
Principle Outlet	4.4	7	7	7
Principle Outlet	4.3	1	1	1
Principle Outlet	4.2	3	3	3
Principle Outlet	4.1	18	18	18
Principle Outlet	4	1	1	1
Principle Outlet	3	27.4	27.4	27.4
Principle Outlet	2.5	111.78	111.78	111.78
Principle Outlet	2	214.63	214.63	214.63
Principle Outlet	1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: McMicken Dam Out

Reach	River Sta.	Contr.	Expan.
Principle Outlet	22	.3	.3
Principle Outlet	21	.25	.3
Principle Outlet	20	.25	.3
Principle Outlet	19	.25	.3

Principle Outlet	18	.25	.3
Principle Outlet	17	.25	.3
Principle Outlet	16	.2	.3
Principle Outlet	15	.1	.3
Principle Outlet	14	.1	.3
Principle Outlet	13	.1	.3
Principle Outlet	12	.1	.3
Principle Outlet	11	.1	.3
Principle Outlet	10	.1	.3
Principle Outlet	9	.1	.3
Principle Outlet	8	.1	.3
Principle Outlet	7	.1	.3
Principle Outlet	6	.1	.3
Principle Outlet	5.8*	.1	.3
Principle Outlet	5.6*	.1	.3
Principle Outlet	5.4*	.1	.3
Principle Outlet	5.2*	.1	.3
Principle Outlet	5	.1	.3
Principle Outlet	4.94285*	.1	.3
Principle Outlet	4.88571*	.1	.3
Principle Outlet	4.82857*	.1	.3
Principle Outlet	4.77142*	.1	.3
Principle Outlet	4.71428*	.1	.3
Principle Outlet	4.65714*	.1	.3
Principle Outlet	4.6	.1	.3
Principle Outlet	4.5	.1	.3
Principle Outlet	4.4	.1	.3
Principle Outlet	4.3	.1	.3
Principle Outlet	4.2	.1	.3
Principle Outlet	4.1	.1	.3
Principle Outlet	4	.1	.3
Principle Outlet	3	.6	.8
Principle Outlet	2.5	.1	.3
Principle Outlet	2	.1	.3
Principle Outlet	1	.1	.3

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet

Reach	River Sta	Profile	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)	
Principle Outlet	22	PF 1	156.00	1336.12	1338.07	1337.43	1338.07	0.000028	0.97	496.67	875.66	0.12
Principle Outlet	22	PF 2	340.00	1336.12	1339.28	1337.67	1339.28	0.000003	0.46	2144.05	1844.61	0.05
Principle Outlet	22	PF 3	398.00	1336.12	1339.65	1337.72	1339.65	0.000002	0.40	2887.05	2142.75	0.04
Principle Outlet	22	PF 4	591.00	1336.12	1340.78	1337.84	1340.78	0.000001	0.28	5819.51	3046.86	0.02
Principle Outlet	22	PF 5	822.00	1336.12	1341.99	1337.95	1341.99	0.000000	0.22	10064.26	4009.36	0.02
Principle Outlet	22	PF 6	1047.00	1336.12	1343.05	1338.03	1343.05	0.000000	0.19	14771.61	4858.67	0.01
Principle Outlet	22	PF 7	1275.00	1336.12	1344.03	1338.12	1344.03	0.000000	0.17	19945.41	5646.66	0.01
Principle Outlet	22	PF 8	1509.00	1336.12	1344.93	1338.18	1344.93	0.000000	0.16	25302.62	6360.53	0.01
Principle Outlet	22	PF 9	1765.00	1336.12	1345.89	1338.25	1345.89	0.000000	0.15	31826.71	7134.06	0.01
Principle Outlet	22	PF 10	2090.00	1336.12	1347.10	1338.32	1347.10	0.000000	0.13	41030.41	8100.66	0.01
Principle Outlet	22	PF 11	2337.00	1336.12	1347.98	1338.38	1347.98	0.000000	0.13	48437.63	8801.84	0.01
Principle Outlet	22	PF 12	2612.00	1336.12	1348.85	1338.43	1348.85	0.000000	0.12	56407.21	9498.61	0.01
Principle Outlet	22	PF 13	2870.00	1336.12	1349.70	1338.48	1349.70	0.000000	0.12	64758.61	10177.71	0.01
Principle Outlet	22	PF 14	3290.00	1336.12	1350.95	1338.55	1350.95	0.000000	0.11	78137.13	11179.96	0.00
Principle Outlet	22	PF 15	3575.00	1336.12	1351.85	1338.60	1351.85	0.000000	0.10	88481.27	11897.15	0.00
Principle Outlet	22	PF 16	3990.00	1336.12	1353.07	1338.65	1353.07	0.000000	0.10	103692.90	12879.47	0.00
Principle Outlet	22	PF 17	4280.00	1336.12	1353.83	1338.71	1353.83	0.000000	0.10	113620.30	13482.01	0.00
Principle Outlet	22	PF 18	4655.00	1336.12	1354.87	1338.75	1354.87	0.000000	0.09	128101.00	14315.51	0.00
Principle Outlet	22	PF 19	4830.00	1336.12	1355.38	1338.78	1355.38	0.000000	0.09	135522.30	14724.39	0.00
Principle Outlet	22	PF 20	5065.00	1336.12	1356.01	1338.81	1356.01	0.000000	0.09	144985.40	15229.86	0.00
Principle Outlet	22	PF 21	5155.00	1336.12	1356.32	1338.81	1356.32	0.000000	0.09	149696.90	15475.37	0.00
Principle Outlet	22	PF 22	5245.00	1336.12	1356.46	1338.83	1356.46	0.000000	0.09	151867.70	15587.19	0.00
Principle Outlet	21	PF 1	156.00	1336.01	1337.27	1337.27	1337.89	0.002294	6.32	24.70	20.00	1.00
Principle Outlet	21	PF 2	340.00	1336.01	1339.27	1338.59	1339.28	0.000043	1.57	731.25	1074.08	0.15
Principle Outlet	21	PF 3	398.00	1336.01	1339.65	1338.66	1339.65	0.000018	1.11	1203.49	1393.09	0.10
Principle Outlet	21	PF 4	591.00	1336.01	1340.78	1338.84	1340.78	0.000003	0.56	3321.42	2338.93	0.05
Principle Outlet	21	PF 5	822.00	1336.01	1341.99	1338.98	1341.99	0.000001	0.36	6740.61	3342.04	0.03
Principle Outlet	21	PF 6	1047.00	1336.01	1343.05	1339.08	1343.05	0.000000	0.28	10758.82	4226.85	0.02
Principle Outlet	21	PF 7	1275.00	1336.01	1344.03	1339.18	1344.03	0.000000	0.23	15326.45	5047.67	0.01
Principle Outlet	21	PF 8	1509.00	1336.01	1344.93	1339.25	1344.93	0.000000	0.20	20163.14	5791.38	0.01
Principle Outlet	21	PF 9	1765.00	1336.01	1345.89	1339.33	1345.89	0.000000	0.18	26152.49	6597.15	0.01
Principle Outlet	21	PF 10	2090.00	1336.01	1347.10	1339.41	1347.10	0.000000	0.16	34731.79	7604.03	0.01
Principle Outlet	21	PF 11	2337.00	1336.01	1347.98	1339.46	1347.98	0.000000	0.15	41716.53	8334.41	0.01
Principle Outlet	21	PF 12	2612.00	1336.01	1348.85	1339.52	1348.85	0.000000	0.14	49291.64	9060.22	0.01
Principle Outlet	21	PF 13	2870.00	1336.01	1349.70	1339.58	1349.70	0.000000	0.13	57282.90	9767.62	0.01
Principle Outlet	21	PF 14	3290.00	1336.01	1350.95	1339.65	1350.95	0.000000	0.12	70173.82	10811.63	0.01
Principle Outlet	21	PF 15	3575.00	1336.01	1351.85	1339.69	1351.85	0.000000	0.11	80201.14	11558.70	0.01
Principle Outlet	21	PF 16	3990.00	1336.01	1353.07	1339.75	1353.07	0.000000	0.11	95022.36	12581.95	0.00

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	21	PF 17	4280.00	1336.01	1353.83	1339.80	1353.83	0.000000	0.10	104735.10	13209.59	0.00
Principle Outlet	21	PF 18	4655.00	1336.01	1354.87	1339.86	1354.87	0.000000	0.10	118950.10	14077.82	0.00
Principle Outlet	21	PF 19	4830.00	1336.01	1355.38	1339.87	1355.38	0.000000	0.10	126254.20	14503.75	0.00
Principle Outlet	21	PF 20	5065.00	1336.01	1356.01	1339.91	1356.01	0.000000	0.09	135584.60	15030.27	0.00
Principle Outlet	21	PF 21	5155.00	1336.01	1356.32	1339.92	1356.32	0.000000	0.09	140236.40	15286.01	0.00
Principle Outlet	21	PF 22	5245.00	1336.01	1356.46	1339.93	1356.46	0.000000	0.09	142381.00	15402.49	0.00
Principle Outlet	20	PF 1	156.00	1335.88	1336.96	1337.13	1337.81	0.003827	7.41	21.04	20.00	1.27
Principle Outlet	20	PF 2	340.00	1335.88	1337.98	1337.98	1339.02	0.002115	8.18	41.58	20.00	1.00
Principle Outlet	20	PF 3	398.00	1335.88	1338.22	1338.22	1339.37	0.002085	8.61	46.24	20.00	1.00
Principle Outlet	20	PF 4	591.00	1335.88	1338.92	1338.92	1340.41	0.002049	9.81	60.25	20.00	1.00
Principle Outlet	20	PF 5	822.00	1335.88	1339.65	1339.65	1341.52	0.002067	10.98	74.86	20.00	1.00
Principle Outlet	20	PF 6	1047.00	1335.88	1340.31	1340.31	1342.50	0.002067	11.87	88.21	20.00	1.00
Principle Outlet	20	PF 7	1275.00	1335.88	1342.38	1340.91	1343.70	0.000905	9.43	202.27	401.35	0.65
Principle Outlet	20	PF 8	1509.00	1335.88	1342.19	1341.54	1344.38	0.001505	11.91	143.92	210.67	0.84
Principle Outlet	20	PF 9	1765.00	1335.88	1345.89	1343.27	1345.89	0.000003	0.77	7769.18	3910.87	0.04
Principle Outlet	20	PF 10	2090.00	1335.88	1347.10	1343.39	1347.10	0.000001	0.50	13230.05	5120.22	0.03
Principle Outlet	20	PF 11	2337.00	1335.88	1347.98	1343.46	1347.98	0.000001	0.39	18103.31	5996.93	0.02
Principle Outlet	20	PF 12	2612.00	1335.88	1348.85	1343.54	1348.85	0.000000	0.32	23706.60	6868.02	0.02
Principle Outlet	20	PF 13	2870.00	1335.88	1349.70	1343.59	1349.70	0.000000	0.27	29897.94	7717.02	0.01
Principle Outlet	20	PF 14	3290.00	1335.88	1350.95	1343.70	1350.95	0.000000	0.22	40350.64	8969.83	0.01
Principle Outlet	20	PF 15	3575.00	1335.88	1351.85	1343.75	1351.85	0.000000	0.19	48793.80	9866.31	0.01
Principle Outlet	20	PF 16	3990.00	1335.88	1353.07	1343.82	1353.07	0.000000	0.17	61663.93	11094.34	0.01
Principle Outlet	20	PF 17	4280.00	1335.88	1353.83	1343.86	1353.83	0.000000	0.15	70303.53	11847.52	0.01
Principle Outlet	20	PF 18	4655.00	1335.88	1354.87	1343.93	1354.87	0.000000	0.14	83189.84	12889.38	0.01
Principle Outlet	20	PF 19	4830.00	1335.88	1355.38	1343.95	1355.38	0.000000	0.13	89908.34	13400.49	0.01
Principle Outlet	20	PF 20	5065.00	1335.88	1356.01	1343.99	1356.01	0.000000	0.13	98574.86	14032.33	0.00
Principle Outlet	20	PF 21	5155.00	1335.88	1356.32	1344.00	1356.32	0.000000	0.12	102928.30	14339.21	0.00
Principle Outlet	20	PF 22	5245.00	1335.88	1356.46	1344.01	1356.46	0.000000	0.12	104942.20	14478.98	0.00
Principle Outlet	19	PF 1	156.00	1335.75	1336.75	1337.00	1337.74	0.004870	7.99	19.52	20.00	1.43
Principle Outlet	19	PF 2	340.00	1335.75	1337.63	1337.84	1338.93	0.003018	9.17	37.09	20.00	1.19
Principle Outlet	19	PF 3	398.00	1335.75	1337.85	1338.09	1339.27	0.002890	9.56	41.61	20.00	1.17
Principle Outlet	19	PF 4	591.00	1335.75	1338.52	1338.79	1340.32	0.002696	10.74	55.04	20.00	1.14
Principle Outlet	19	PF 5	822.00	1335.75	1339.23	1339.53	1341.42	0.002614	11.88	69.19	20.00	1.13
Principle Outlet	19	PF 6	1047.00	1335.75	1339.89	1340.17	1342.40	0.002535	12.72	82.29	20.00	1.11
Principle Outlet	19	PF 7	1275.00	1335.75	1340.79	1340.79	1343.30	0.002111	12.71	100.29	20.00	1.00
Principle Outlet	19	PF 8	1509.00	1335.75	1341.39	1341.39	1344.19	0.002131	13.42	112.42	20.00	1.00
Principle Outlet	19	PF 9	1765.00	1335.75	1342.02	1342.02	1345.12	0.002159	14.12	124.98	20.00	1.00

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	19	PF 10	2090.00	1335.75	1342.76	1342.76	1346.23	0.002212	14.95	139.78	20.00	1.00
Principle Outlet	19	PF 11	2337.00	1335.75	1343.30	1343.30	1347.04	0.002252	15.52	150.53	20.00	1.00
Principle Outlet	19	PF 12	2612.00	1335.75	1344.38	1343.88	1347.96	0.001947	15.17	172.18	20.00	0.91
Principle Outlet	19	PF 13	2870.00	1335.75	1344.91	1344.41	1348.74	0.002003	15.71	182.68	20.00	0.92
Principle Outlet	19	PF 14	3290.00	1335.75	1346.21	1345.24	1350.00	0.001798	15.68	235.41	278.48	0.86
Principle Outlet	19	PF 15	3575.00	1335.75	1351.85	1347.61	1351.85	0.000001	0.52	21679.12	7327.13	0.02
Principle Outlet	19	PF 16	3990.00	1335.75	1353.07	1347.69	1353.07	0.000001	0.37	31622.81	8862.62	0.02
Principle Outlet	19	PF 17	4280.00	1335.75	1353.83	1347.75	1353.83	0.000000	0.31	38652.45	9804.09	0.01
Principle Outlet	19	PF 18	4655.00	1335.75	1354.87	1347.82	1354.87	0.000000	0.26	49546.82	11106.58	0.01
Principle Outlet	19	PF 19	4830.00	1335.75	1355.38	1347.84	1355.38	0.000000	0.23	55386.76	11745.46	0.01
Principle Outlet	19	PF 20	5065.00	1335.75	1356.01	1347.88	1356.01	0.000000	0.21	63057.47	12535.26	0.01
Principle Outlet	19	PF 21	5155.00	1335.75	1356.32	1347.88	1356.32	0.000000	0.20	66963.21	12918.86	0.01
Principle Outlet	19	PF 22	5245.00	1335.75	1356.46	1347.91	1356.46	0.000000	0.20	68781.10	13093.58	0.01
Principle Outlet	18	PF 1	156.00	1335.62	1336.57	1336.88	1337.66	0.005665	8.38	18.63	20.00	1.53
Principle Outlet	18	PF 2	340.00	1335.62	1337.40	1337.72	1338.85	0.003590	9.69	35.09	20.00	1.29
Principle Outlet	18	PF 3	398.00	1335.62	1337.61	1337.96	1339.20	0.003446	10.12	39.32	20.00	1.27
Principle Outlet	18	PF 4	591.00	1335.62	1338.25	1338.66	1340.24	0.003169	11.32	52.20	20.00	1.23
Principle Outlet	18	PF 5	822.00	1335.62	1338.95	1339.38	1341.35	0.003003	12.44	66.06	20.00	1.21
Principle Outlet	18	PF 6	1047.00	1335.62	1339.59	1340.04	1342.32	0.002860	13.25	79.00	20.00	1.18
Principle Outlet	18	PF 7	1275.00	1335.62	1340.36	1340.67	1343.20	0.002526	13.52	94.27	20.00	1.10
Principle Outlet	18	PF 8	1509.00	1335.62	1340.94	1341.27	1344.09	0.002520	14.23	106.02	20.00	1.09
Principle Outlet	18	PF 9	1765.00	1335.62	1341.57	1341.89	1345.01	0.002503	14.88	118.61	20.00	1.08
Principle Outlet	18	PF 10	2090.00	1335.62	1342.31	1342.62	1346.12	0.002526	15.68	133.29	20.00	1.07
Principle Outlet	18	PF 11	2337.00	1335.62	1342.84	1343.16	1346.93	0.002548	16.23	143.96	20.00	1.07
Principle Outlet	18	PF 12	2612.00	1335.62	1343.75	1343.75	1347.78	0.002295	16.11	162.12	20.00	1.00
Principle Outlet	18	PF 13	2870.00	1335.62	1344.28	1344.28	1348.57	0.002332	16.62	172.68	20.00	1.00
Principle Outlet	18	PF 14	3290.00	1335.62	1345.10	1345.10	1349.80	0.002398	17.40	189.11	20.00	1.00
Principle Outlet	18	PF 15	3575.00	1335.62	1345.63	1345.63	1350.60	0.002446	17.90	199.74	20.00	1.00
Principle Outlet	18	PF 16	3990.00	1335.62	1346.40	1346.40	1351.74	0.002501	18.55	215.15	20.00	1.00
Principle Outlet	18	PF 17	4280.00	1335.62	1347.42	1346.87	1352.55	0.002270	18.18	235.49	20.00	0.93
Principle Outlet	18	PF 18	4655.00	1335.62	1348.16	1347.56	1353.53	0.002288	18.59	250.42	20.00	0.93
Principle Outlet	18	PF 19	4830.00	1335.62	1348.18	1347.81	1353.94	0.002455	19.26	250.77	20.00	0.96
Principle Outlet	18	PF 20	5065.00	1335.62	1348.61	1348.25	1354.53	0.002475	19.53	259.30	20.00	0.96
Principle Outlet	18	PF 21	5155.00	1335.62	1348.41	1348.35	1354.74	0.002667	20.19	255.39	20.00	1.00
Principle Outlet	18	PF 22	5245.00	1335.62	1349.80	1348.52	1355.13	0.002119	18.53	283.11	20.00	0.87
Principle Outlet	17	PF 1	156.00	1335.48	1336.41	1336.75	1337.58	0.006348	8.68	17.98	20.00	1.61
Principle Outlet	17	PF 2	340.00	1335.48	1337.18	1337.60	1338.79	0.004166	10.16	33.46	20.00	1.38

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	17	PF 3	398.00	1335.48	1337.40	1337.82	1339.13	0.003926	10.55	37.71	20.00	1.35
Principle Outlet	17	PF 4	591.00	1335.48	1338.03	1338.53	1340.17	0.003553	11.75	50.29	20.00	1.31
Principle Outlet	17	PF 5	822.00	1335.48	1338.71	1339.27	1341.27	0.003311	12.85	63.95	20.00	1.27
Principle Outlet	17	PF 6	1047.00	1335.48	1339.34	1339.92	1342.24	0.003142	13.68	76.52	20.00	1.23
Principle Outlet	17	PF 7	1275.00	1335.48	1340.04	1340.54	1343.12	0.002830	14.06	90.66	20.00	1.16
Principle Outlet	17	PF 8	1509.00	1335.48	1340.63	1341.12	1344.00	0.002790	14.75	102.33	20.00	1.15
Principle Outlet	17	PF 9	1765.00	1335.48	1341.25	1341.70	1344.92	0.002750	15.38	114.74	20.00	1.13
Principle Outlet	17	PF 10	2090.00	1335.48	1341.98	1342.50	1346.03	0.002742	16.14	129.45	20.00	1.12
Principle Outlet	17	PF 11	2337.00	1335.48	1342.48	1343.04	1346.84	0.002785	16.76	139.43	20.00	1.12
Principle Outlet	17	PF 12	2612.00	1335.48	1343.28	1343.62	1347.67	0.002575	16.80	155.45	20.00	1.06
Principle Outlet	17	PF 13	2870.00	1335.48	1343.81	1344.15	1348.45	0.002601	17.30	165.90	20.00	1.06
Principle Outlet	17	PF 14	3290.00	1335.48	1344.62	1344.97	1349.68	0.002650	18.05	182.22	20.00	1.05
Principle Outlet	17	PF 15	3575.00	1335.48	1345.15	1345.50	1350.49	0.002687	18.54	192.82	20.00	1.05
Principle Outlet	17	PF 16	3990.00	1335.48	1345.91	1346.27	1351.62	0.002733	19.18	208.05	20.00	1.05
Principle Outlet	17	PF 17	4280.00	1335.48	1346.77	1346.74	1352.38	0.002550	19.00	225.26	20.00	1.00
Principle Outlet	17	PF 18	4655.00	1335.48	1347.35	1347.35	1353.35	0.002647	19.66	236.77	20.00	1.01
Principle Outlet	17	PF 19	4830.00	1335.48	1348.33	1347.72	1353.84	0.002320	18.84	256.31	20.00	0.93
Principle Outlet	17	PF 20	5065.00	1335.48	1348.75	1348.12	1354.43	0.002345	19.13	264.80	20.00	0.93
Principle Outlet	17	PF 21	5155.00	1335.48	1348.61	1348.26	1354.62	0.002499	19.68	261.89	20.00	0.96
Principle Outlet	17	PF 22	5245.00	1335.48	1348.46	1348.30	1354.83	0.002665	20.26	258.91	20.00	0.99
Principle Outlet	16	PF 1	156.00	1335.35	1336.25	1336.62	1337.49	0.006960	8.93	17.47	20.00	1.68
Principle Outlet	16	PF 2	340.00	1335.35	1337.00	1337.47	1338.72	0.004651	10.52	32.31	20.00	1.46
Principle Outlet	16	PF 3	398.00	1335.35	1337.20	1337.70	1339.06	0.004389	10.94	36.39	20.00	1.43
Principle Outlet	16	PF 4	591.00	1335.35	1337.82	1338.37	1340.10	0.003894	12.11	48.81	20.00	1.37
Principle Outlet	16	PF 5	822.00	1335.35	1338.49	1339.14	1341.20	0.003595	13.21	62.23	20.00	1.32
Principle Outlet	16	PF 6	1047.00	1335.35	1339.11	1339.79	1342.17	0.003392	14.04	74.58	20.00	1.28
Principle Outlet	16	PF 7	1275.00	1335.35	1339.78	1340.40	1343.04	0.003087	14.49	88.01	20.00	1.22
Principle Outlet	16	PF 8	1509.00	1335.35	1340.36	1341.00	1343.93	0.003021	15.16	99.56	20.00	1.20
Principle Outlet	16	PF 9	1765.00	1335.35	1341.63	1341.63	1344.73	0.002163	14.13	124.90	20.00	1.00
Principle Outlet	16	PF 10	2090.00	1335.35	1342.37	1342.37	1345.84	0.002213	14.95	139.76	20.00	1.00
Principle Outlet	16	PF 11	2337.00	1335.35	1342.84	1342.91	1346.65	0.002309	15.67	149.18	20.00	1.01
Principle Outlet	16	PF 12	2612.00	1335.35	1342.93	1343.49	1347.58	0.002792	17.30	150.95	20.00	1.11
Principle Outlet	16	PF 13	2870.00	1335.35	1343.45	1344.02	1348.36	0.002806	17.79	161.36	20.00	1.10
Principle Outlet	16	PF 14	3290.00	1335.35	1344.26	1344.84	1349.59	0.002842	18.53	177.57	20.00	1.10
Principle Outlet	16	PF 15	3575.00	1335.35	1344.79	1345.37	1350.40	0.002872	19.01	188.10	20.00	1.09
Principle Outlet	16	PF 16	3990.00	1335.35	1346.14	1346.14	1351.48	0.002501	18.55	215.14	20.00	1.00
Principle Outlet	16	PF 17	4280.00	1335.35	1346.95	1346.63	1352.26	0.002375	18.49	231.43	20.00	0.96
Principle Outlet	16	PF 18	4655.00	1335.35	1346.89	1347.30	1353.24	0.002850	20.22	230.19	20.00	1.05

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	16	PF 19	4830.00	1335.35	1347.59	1347.59	1353.67	0.002631	19.78	244.15	20.00	1.00
Principle Outlet	16	PF 20	5065.00	1335.35	1347.95	1347.95	1354.25	0.002685	20.16	251.29	20.00	1.00
Principle Outlet	16	PF 21	5155.00	1335.35	1348.76	1348.13	1354.52	0.002366	19.27	267.52	20.00	0.93
Principle Outlet	16	PF 22	5245.00	1335.35	1348.63	1348.29	1354.71	0.002511	19.80	264.95	20.00	0.96
Principle Outlet	15	PF 1	156.00	1335.28	1336.14	1336.51	1337.41	0.007296	9.06	17.22	20.00	1.72
Principle Outlet	15	PF 2	340.00	1335.28	1336.86	1337.35	1338.65	0.004963	10.74	31.65	20.00	1.50
Principle Outlet	15	PF 3	398.00	1335.28	1337.06	1337.59	1338.99	0.004677	11.16	35.66	20.00	1.47
Principle Outlet	15	PF 4	591.00	1335.28	1337.67	1338.28	1340.04	0.004125	12.34	47.90	20.00	1.40
Principle Outlet	15	PF 5	822.00	1335.28	1338.33	1339.02	1341.14	0.003803	13.46	61.08	20.00	1.36
Principle Outlet	15	PF 6	1047.00	1335.28	1338.93	1339.67	1342.12	0.003609	14.33	73.04	20.00	1.32
Principle Outlet	15	PF 7	1275.00	1335.28	1339.59	1340.29	1342.98	0.003271	14.78	86.28	20.00	1.25
Principle Outlet	15	PF 8	1509.00	1335.28	1340.16	1340.90	1343.87	0.003191	15.45	97.69	20.00	1.23
Principle Outlet	15	PF 9	1765.00	1335.28	1341.23	1341.52	1344.64	0.002476	14.82	119.06	20.00	1.07
Principle Outlet	15	PF 10	2090.00	1335.28	1341.96	1342.26	1345.76	0.002501	15.62	133.77	20.00	1.06
Principle Outlet	15	PF 11	2337.00	1335.28	1342.46	1342.80	1346.57	0.002561	16.26	143.71	20.00	1.07
Principle Outlet	15	PF 12	2612.00	1335.28	1342.68	1343.38	1347.51	0.002942	17.63	148.12	20.00	1.14
Principle Outlet	15	PF 13	2870.00	1335.28	1343.20	1343.91	1348.29	0.002951	18.12	158.42	20.00	1.13
Principle Outlet	15	PF 14	3290.00	1335.28	1344.00	1344.74	1349.52	0.002979	18.85	174.49	20.00	1.12
Principle Outlet	*15*	*PF 15*	*3575.00*	*1335.28*	*1344.52*	*1345.24*	*1350.33*	*0.003005*	*19.33*	*184.96*	*20.00*	*1.12*
Principle Outlet	15	PF 16	3990.00	1335.28	1345.70	1346.03	1351.39	0.002717	19.14	208.52	20.00	1.04
Principle Outlet	15	PF 17	4280.00	1335.28	1347.08	1346.52	1352.18	0.002255	18.13	236.08	20.00	0.93
Principle Outlet	15	PF 18	4655.00	1335.28	1347.05	1347.20	1353.12	0.002684	19.76	235.52	20.00	1.01
Principle Outlet	15	PF 19	4830.00	1335.28	1347.15	1347.49	1353.57	0.002829	20.34	237.43	20.00	1.04
Principle Outlet	15	PF 20	5065.00	1335.28	1347.52	1347.88	1354.16	0.002873	20.69	244.80	20.00	1.04
Principle Outlet	15	PF 21	5155.00	1335.28	1348.03	1348.03	1354.37	0.002677	20.21	255.03	20.00	1.00
Principle Outlet	15	PF 22	5245.00	1335.28	1348.73	1348.16	1354.63	0.002411	19.49	269.17	20.00	0.94
Principle Outlet	14	PF 1	156.00	1335.24	1336.10	1336.48	1337.39	0.007452	9.12	17.11	20.00	1.74
Principle Outlet	14	PF 2	340.00	1335.24	1336.81	1337.33	1338.63	0.005078	10.82	31.42	20.00	1.52
Principle Outlet	14	PF 3	398.00	1335.24	1337.01	1337.56	1338.98	0.004784	11.24	35.40	20.00	1.49
Principle Outlet	14	PF 4	591.00	1335.24	1337.62	1338.26	1340.02	0.004225	12.43	47.53	20.00	1.42
Principle Outlet	14	PF 5	822.00	1335.24	1338.28	1338.98	1341.13	0.003887	13.56	60.64	20.00	1.37
Principle Outlet	14	PF 6	1047.00	1335.24	1338.87	1339.65	1342.10	0.003674	14.42	72.60	20.00	1.33
Principle Outlet	14	PF 7	1275.00	1335.24	1339.52	1340.27	1342.97	0.003358	14.91	85.52	20.00	1.27
Principle Outlet	14	PF 8	1509.00	1335.24	1340.08	1340.87	1343.86	0.003286	15.60	96.71	20.00	1.25
Principle Outlet	14	PF 9	1765.00	1335.24	1341.28	1341.49	1344.60	0.002382	14.62	120.71	20.00	1.05
Principle Outlet	14	PF 10	2090.00	1335.24	1342.01	1342.23	1345.71	0.002418	15.44	135.39	20.00	1.05
Principle Outlet	14	PF 11	2337.00	1335.24	1342.51	1342.77	1346.53	0.002482	16.08	145.34	20.00	1.05

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	14	PF 12	2612.00	1335.24	1342.79	1343.35	1347.44	0.002791	17.30	150.96	20.00	1.11
Principle Outlet	14	PF 13	2870.00	1335.24	1343.30	1343.88	1348.23	0.002815	17.81	161.16	20.00	1.11
Principle Outlet	14	PF 14	3290.00	1335.24	1344.09	1344.71	1349.46	0.002867	18.59	176.99	20.00	1.10
Principle Outlet	14	PF 15	3575.00	1335.24	1344.61	1345.23	1350.27	0.002907	19.09	187.27	20.00	1.10
Principle Outlet	14	PF 16	3990.00	1335.24	1345.74	1346.00	1351.35	0.002670	19.01	209.90	20.00	1.03
Principle Outlet	14	PF 17	4280.00	1335.24	1346.40	1346.40	1352.11	0.002614	19.18	223.16	20.00	1.01
Principle Outlet	14	PF 18	4655.00	1335.24	1347.08	1347.16	1353.08	0.002650	19.67	236.69	20.00	1.01
Principle Outlet	14	PF 19	4830.00	1335.24	1347.18	1347.46	1353.54	0.002788	20.23	238.79	20.00	1.03
Principle Outlet	14	PF 20	5065.00	1335.24	1347.55	1347.84	1354.13	0.002832	20.58	246.16	20.00	1.03
Principle Outlet	14	PF 21	5155.00	1335.24	1347.72	1347.99	1354.35	0.002831	20.66	249.57	20.00	1.03
Principle Outlet	14	PF 22	5245.00	1335.24	1348.12	1348.12	1354.56	0.002700	20.36	257.61	20.00	1.00
Principle Outlet	13	PF 1	156.00	1335.04	1335.89	1336.31	1337.29	0.008489	9.49	16.43	20.00	1.85
Principle Outlet	13	PF 2	340.00	1335.04	1336.57	1337.15	1338.55	0.005796	11.28	30.13	20.00	1.62
Principle Outlet	13	PF 3	398.00	1335.04	1336.77	1337.38	1338.90	0.005441	11.71	33.98	20.00	1.58
Principle Outlet	13	PF 4	591.00	1335.04	1337.35	1338.07	1339.95	0.004781	12.94	45.66	20.00	1.51
Principle Outlet	13	PF 5	822.00	1335.04	1337.99	1338.78	1341.07	0.004364	14.08	58.37	20.00	1.45
Principle Outlet	13	PF 6	1047.00	1335.04	1338.57	1339.47	1342.03	0.004069	14.92	70.16	20.00	1.40
Principle Outlet	13	PF 7	1275.00	1335.04	1339.19	1340.09	1342.90	0.003736	15.46	82.47	20.00	1.34
Principle Outlet	13	PF 8	1509.00	1335.04	1339.74	1340.68	1343.79	0.003633	16.15	93.42	20.00	1.32
Principle Outlet	13	PF 9	1765.00	1335.04	1340.70	1341.31	1344.51	0.002903	15.68	112.58	20.00	1.16
Principle Outlet	13	PF 10	2090.00	1335.04	1341.40	1342.03	1345.63	0.002915	16.50	126.66	20.00	1.16
Principle Outlet	13	PF 11	2337.00	1335.04	1341.90	1342.59	1346.44	0.002941	17.09	136.73	20.00	1.15
Principle Outlet	13	PF 12	2612.00	1335.04	1342.30	1343.17	1347.36	0.003140	18.06	144.66	20.00	1.18
Principle Outlet	13	PF 13	2870.00	1335.04	1342.80	1343.67	1348.15	0.003151	18.55	154.69	20.00	1.18
Principle Outlet	13	PF 14	3290.00	1335.04	1344.53	1344.53	1349.22	0.002392	17.38	189.27	20.00	1.00
Principle Outlet	13	PF 15	3575.00	1335.04	1345.05	1345.05	1350.03	0.002447	17.90	199.69	20.00	1.00
Principle Outlet	13	PF 16	3990.00	1335.04	1345.04	1345.82	1351.25	0.003054	20.00	199.55	20.00	1.12
Principle Outlet	13	PF 17	4280.00	1335.04	1345.58	1346.32	1352.02	0.003061	20.36	210.18	20.00	1.11
Principle Outlet	13	PF 18	4655.00	1335.04	1346.22	1346.98	1352.98	0.003098	20.88	222.99	20.00	1.10
Principle Outlet	13	PF 19	4830.00	1335.04	1346.46	1347.28	1353.44	0.003152	21.20	227.84	20.00	1.11
Principle Outlet	13	PF 20	5065.00	1335.04	1346.83	1347.67	1354.03	0.003186	21.53	235.29	20.00	1.11
Principle Outlet	13	PF 21	5155.00	1335.04	1347.01	1347.78	1354.24	0.003173	21.58	238.86	20.00	1.10
Principle Outlet	13	PF 22	5245.00	1335.04	1347.23	1347.98	1354.45	0.003135	21.57	243.18	20.00	1.09
Principle Outlet	12	PF 1	156.00	1334.91	1335.74	1336.17	1337.19	0.008949	9.65	16.16	20.00	1.89
Principle Outlet	12	PF 2	340.00	1334.91	1336.41	1337.02	1338.48	0.006245	11.55	29.43	20.00	1.68
Principle Outlet	12	PF 3	398.00	1334.91	1336.60	1337.25	1338.82	0.005815	11.96	33.27	20.00	1.63
Principle Outlet	12	PF 4	591.00	1334.91	1337.17	1337.95	1339.89	0.005105	13.22	44.70	20.00	1.56

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	12	PF 5	822.00	1334.91	1337.80	1338.69	1341.00	0.004643	14.37	57.19	20.00	1.50
Principle Outlet	12	PF 6	1047.00	1334.91	1338.38	1339.33	1341.97	0.004318	15.22	68.78	20.00	1.45
Principle Outlet	12	PF 7	1275.00	1334.91	1338.97	1339.96	1342.84	0.003974	15.79	80.75	20.00	1.38
Principle Outlet	12	PF 8	1509.00	1334.91	1339.51	1340.55	1343.73	0.003857	16.49	91.52	20.00	1.36
Principle Outlet	12	PF 9	1765.00	1334.91	1340.39	1341.18	1344.46	0.003180	16.18	109.06	20.00	1.22
Principle Outlet	12	PF 10	2090.00	1334.91	1341.08	1341.92	1345.57	0.003169	17.00	122.96	20.00	1.21
Principle Outlet	12	PF 11	2337.00	1334.91	1341.58	1342.46	1346.38	0.003180	17.58	132.96	20.00	1.20
Principle Outlet	12	PF 12	2612.00	1334.91	1342.01	1343.04	1347.30	0.003345	18.47	141.41	20.00	1.22
Principle Outlet	12	PF 13	2870.00	1334.91	1342.50	1343.57	1348.09	0.003348	18.97	151.32	20.00	1.22
Principle Outlet	12	PF 14	3290.00	1334.91	1343.83	1344.40	1349.14	0.002830	18.50	177.83	20.00	1.09
Principle Outlet	12	PF 15	3575.00	1334.91	1344.38	1344.91	1349.94	0.002844	18.94	188.79	20.00	1.09
Principle Outlet	12	PF 16	3990.00	1334.91	1344.68	1345.69	1351.19	0.003251	20.47	194.93	20.00	1.16
Principle Outlet	12	PF 17	4280.00	1334.91	1345.94	1346.17	1351.81	0.002712	19.45	220.05	20.00	1.03
Principle Outlet	12	PF 18	4655.00	1334.91	1346.57	1346.85	1352.78	0.002769	20.00	232.73	20.00	1.03
Principle Outlet	12	PF 19	4830.00	1334.91	1346.08	1347.15	1353.37	0.003336	21.66	222.96	20.00	1.14
Principle Outlet	12	PF 20	5065.00	1334.91	1346.46	1347.54	1353.96	0.003366	21.98	230.39	20.00	1.14
Principle Outlet	12	PF 21	5155.00	1334.91	1347.37	1347.69	1354.04	0.002859	20.74	248.61	20.00	1.04
Principle Outlet	12	PF 22	5245.00	1334.91	1347.56	1347.84	1354.26	0.002844	20.77	252.49	20.00	1.03
Principle Outlet	11	PF 1	156.00	1334.81	1335.59	1336.04	1337.16	0.010528	10.05	15.53	20.57	2.04
Principle Outlet	11	PF 2	340.00	1334.81	1336.21	1336.88	1338.45	0.007246	12.00	28.33	20.57	1.80
Principle Outlet	11	PF 3	398.00	1334.81	1336.39	1337.09	1338.79	0.006709	12.41	32.07	20.57	1.75
Principle Outlet	11	PF 4	591.00	1334.81	1336.93	1337.80	1339.85	0.005851	13.71	43.11	20.57	1.67
Principle Outlet	11	PF 5	822.00	1334.81	1337.51	1338.52	1340.97	0.005327	14.93	55.05	20.57	1.61
Principle Outlet	11	PF 6	1047.00	1334.81	1338.06	1339.17	1341.94	0.004929	15.81	66.23	20.57	1.55
Principle Outlet	11	PF 7	1275.00	1334.81	1338.61	1339.78	1342.80	0.004558	16.44	77.54	20.57	1.49
Principle Outlet	11	PF 8	1509.00	1334.81	1339.11	1340.36	1343.69	0.004417	17.18	87.82	20.57	1.47
Principle Outlet	11	PF 9	1765.00	1334.81	1339.85	1340.96	1344.40	0.003785	17.12	103.09	20.57	1.35
Principle Outlet	11	PF 10	2090.00	1334.81	1340.48	1341.70	1345.51	0.003761	17.99	116.18	20.57	1.33
Principle Outlet	11	PF 11	2337.00	1334.81	1340.95	1342.22	1346.31	0.003755	18.59	125.73	20.57	1.32
Principle Outlet	11	PF 12	2612.00	1334.81	1341.36	1342.78	1347.24	0.003905	19.47	134.16	20.57	1.34
Principle Outlet	11	PF 13	2870.00	1334.81	1341.82	1343.30	1348.02	0.003892	19.98	143.65	20.57	1.33
Principle Outlet	11	PF 14	3290.00	1334.81	1342.84	1344.12	1349.04	0.003501	19.98	164.70	20.57	1.24
Principle Outlet	11	PF 15	3575.00	1334.81	1343.31	1344.61	1349.84	0.003540	20.51	174.29	20.57	1.24
Principle Outlet	11	PF 16	3990.00	1334.81	1343.77	1345.39	1351.09	0.003819	21.72	183.74	20.57	1.28
Principle Outlet	11	PF 17	4280.00	1334.81	1344.54	1345.88	1351.68	0.003510	21.43	199.68	20.57	1.21
Principle Outlet	11	PF 18	4655.00	1334.81	1345.11	1346.53	1352.64	0.003566	22.02	211.37	20.57	1.21
Principle Outlet	11	PF 19	4830.00	1334.81	1345.02	1346.81	1353.28	0.003933	23.06	209.46	20.57	1.27
Principle Outlet	11	PF 20	5065.00	1334.81	1345.37	1347.21	1353.85	0.003952	23.38	216.67	20.57	1.27

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	11	PF 21	5155.00	1334.81	1345.84	1347.35	1353.89	0.003648	22.78	226.31	20.57	1.21
Principle Outlet	11	PF 22	5245.00	1334.81	1345.98	1347.49	1354.11	0.003650	22.88	229.25	20.57	1.21
Principle Outlet	10	PF 1	156.00	1334.57	1335.27	1335.79	1337.10	0.014007	10.86	14.36	21.14	2.32
Principle Outlet	10	PF 2	340.00	1334.57	1335.85	1336.58	1338.40	0.009231	12.83	26.49	21.14	2.02
Principle Outlet	10	PF 3	398.00	1334.57	1336.01	1336.80	1338.74	0.008498	13.26	30.02	21.14	1.96
Principle Outlet	10	PF 4	591.00	1334.57	1336.51	1337.49	1339.80	0.007240	14.56	40.59	21.14	1.85
Principle Outlet	10	PF 5	822.00	1334.57	1337.05	1338.19	1340.93	0.006462	15.79	52.07	21.14	1.77
Principle Outlet	10	PF 6	1047.00	1334.57	1337.56	1338.82	1341.88	0.005919	16.68	62.75	21.14	1.71
Principle Outlet	10	PF 7	1275.00	1334.57	1338.07	1339.43	1342.75	0.005458	17.36	73.44	21.14	1.64
Principle Outlet	10	PF 8	1509.00	1334.57	1338.53	1340.01	1343.63	0.005246	18.11	83.30	21.14	1.61
Principle Outlet	10	PF 9	1765.00	1334.57	1339.17	1340.60	1344.33	0.004597	18.22	96.88	21.14	1.50
Principle Outlet	10	PF 10	2090.00	1334.57	1339.77	1341.32	1345.43	0.004525	19.11	109.39	21.14	1.48
Principle Outlet	10	PF 11	2337.00	1334.57	1340.20	1341.85	1346.24	0.004497	19.73	118.46	21.14	1.47
Principle Outlet	10	PF 12	2612.00	1334.57	1340.60	1342.40	1347.17	0.004609	20.58	126.94	21.14	1.48
Principle Outlet	10	PF 13	2870.00	1334.57	1341.02	1342.91	1347.95	0.004586	21.12	135.89	21.14	1.47
Principle Outlet	10	PF 14	3290.00	1334.57	1341.90	1343.70	1348.95	0.004209	21.31	154.41	21.14	1.39
Principle Outlet	10	PF 15	3575.00	1334.57	1342.33	1344.23	1349.74	0.004231	21.85	163.62	21.14	1.38
Principle Outlet	10	PF 16	3990.00	1334.57	1342.82	1344.94	1350.99	0.004458	22.95	173.85	21.14	1.41
Principle Outlet	10	PF 17	4280.00	1334.57	1343.44	1345.43	1351.57	0.004198	22.88	187.05	21.14	1.36
Principle Outlet	10	PF 18	4655.00	1334.57	1343.97	1346.08	1352.53	0.004241	23.48	198.23	21.14	1.35
Principle Outlet	10	PF 19	4830.00	1334.57	1343.98	1346.36	1353.17	0.004545	24.32	198.57	21.14	1.40
Principle Outlet	10	PF 20	5065.00	1334.57	1344.32	1346.74	1353.74	0.004553	24.64	205.55	21.14	1.39
Principle Outlet	10	PF 21	5155.00	1334.57	1344.65	1346.86	1353.78	0.004309	24.25	212.58	21.14	1.35
Principle Outlet	10	PF 22	5245.00	1334.57	1344.78	1347.01	1353.99	0.004311	24.36	215.30	21.14	1.35
Principle Outlet	9	PF 1	156.00	1334.18	1334.80	1335.38	1337.03	0.019848	11.97	13.03	21.71	2.72
Principle Outlet	9	PF 2	340.00	1334.18	1335.33	1336.17	1338.33	0.012264	13.90	24.46	21.71	2.31
Principle Outlet	9	PF 3	398.00	1334.18	1335.48	1336.39	1338.68	0.011226	14.35	27.74	21.71	2.24
Principle Outlet	9	PF 4	591.00	1334.18	1335.94	1337.06	1339.74	0.009272	15.63	37.81	21.71	2.09
Principle Outlet	9	PF 5	822.00	1334.18	1336.45	1337.76	1340.86	0.008099	16.86	48.76	21.71	1.98
Principle Outlet	9	PF 6	1047.00	1334.18	1336.92	1338.38	1341.82	0.007327	17.77	58.92	21.71	1.90
Principle Outlet	9	PF 7	1275.00	1334.18	1337.38	1338.95	1342.68	0.006705	18.47	69.02	21.71	1.83
Principle Outlet	9	PF 8	1509.00	1334.18	1337.82	1339.52	1343.55	0.006365	19.22	78.53	21.71	1.78
Principle Outlet	9	PF 9	1765.00	1334.18	1338.38	1340.12	1344.26	0.005657	19.45	90.75	21.71	1.68
Principle Outlet	9	PF 10	2090.00	1334.18	1338.94	1340.82	1345.35	0.005488	20.32	102.84	21.71	1.65
Principle Outlet	9	PF 11	2337.00	1334.18	1339.34	1341.32	1346.15	0.005405	20.94	111.60	21.71	1.63
Principle Outlet	9	PF 12	2612.00	1334.18	1339.73	1341.87	1347.09	0.005474	21.77	119.99	21.71	1.63
Principle Outlet	9	PF 13	2870.00	1334.18	1340.13	1342.37	1347.86	0.005412	22.31	128.64	21.71	1.62

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	9	PF 14	3290.00	1334.18	1340.91	1343.16	1348.84	0.005005	22.60	145.56	21.71	1.54
Principle Outlet	9	PF 15	3575.00	1334.18	1341.31	1343.66	1349.64	0.005008	23.16	154.37	21.71	1.53
Principle Outlet	9	PF 16	3990.00	1334.18	1341.79	1344.39	1350.89	0.005193	24.21	164.84	21.71	1.55
Principle Outlet	9	PF 17	4280.00	1334.18	1342.33	1344.85	1351.46	0.004938	24.24	176.57	21.71	1.50
Principle Outlet	9	PF 18	4655.00	1334.18	1342.83	1345.48	1352.42	0.004963	24.85	187.34	21.71	1.49
Principle Outlet	9	PF 19	4830.00	1334.18	1342.90	1345.75	1353.06	0.005228	25.58	188.83	21.71	1.53
Principle Outlet	9	PF 20	5065.00	1334.18	1343.20	1346.13	1353.63	0.005234	25.92	195.43	21.71	1.52
Principle Outlet	9	PF 21	5155.00	1334.18	1343.47	1346.28	1353.67	0.005012	25.63	201.14	21.71	1.48
Principle Outlet	9	PF 22	5245.00	1334.18	1343.59	1346.42	1353.88	0.005013	25.75	203.71	21.71	1.48
Principle Outlet	8	PF 1	156.00	1333.64	1334.19	1334.82	1336.94	0.028807	13.29	11.74	22.29	3.23
Principle Outlet	8	PF 2	340.00	1333.64	1334.67	1335.61	1338.24	0.016653	15.15	22.44	22.29	2.66
Principle Outlet	8	PF 3	398.00	1333.64	1334.81	1335.82	1338.59	0.015094	15.60	25.52	22.29	2.57
Principle Outlet	8	PF 4	591.00	1333.64	1335.24	1336.46	1339.65	0.012061	16.85	35.08	22.29	2.37
Principle Outlet	8	PF 5	822.00	1333.64	1335.71	1337.15	1340.77	0.010266	18.05	45.53	22.29	2.23
Principle Outlet	8	PF 6	1047.00	1333.64	1336.14	1337.76	1341.74	0.009179	18.99	55.15	22.29	2.13
Principle Outlet	8	PF 7	1275.00	1333.64	1336.57	1338.34	1342.60	0.008322	19.70	64.71	22.29	2.04
Principle Outlet	8	PF 8	1509.00	1333.64	1336.98	1338.90	1343.46	0.007802	20.44	73.84	22.29	1.98
Principle Outlet	8	PF 9	1765.00	1333.64	1337.48	1339.48	1344.17	0.006967	20.74	85.09	22.29	1.87
Principle Outlet	8	PF 10	2090.00	1333.64	1338.00	1340.17	1345.27	0.006687	21.63	96.64	22.29	1.83
Principle Outlet	8	PF 11	2337.00	1333.64	1338.38	1340.68	1346.05	0.006519	22.23	105.15	22.29	1.80
Principle Outlet	8	PF 12	2612.00	1333.64	1338.76	1341.20	1346.99	0.006520	23.02	113.45	22.29	1.80
Principle Outlet	8	PF 13	2870.00	1333.64	1339.13	1341.70	1347.76	0.006414	23.58	121.74	22.29	1.78
Principle Outlet	8	PF 14	3290.00	1333.64	1339.83	1342.47	1348.73	0.005950	23.94	137.40	22.29	1.70
Principle Outlet	8	PF 15	3575.00	1333.64	1340.21	1342.94	1349.53	0.005916	24.49	145.95	22.29	1.69
Principle Outlet	8	PF 16	3990.00	1333.64	1340.69	1343.66	1350.78	0.006045	25.49	156.54	22.29	1.70
Principle Outlet	8	PF 17	4280.00	1333.64	1341.16	1344.15	1351.35	0.005791	25.61	167.09	22.29	1.65
Principle Outlet	8	PF 18	4655.00	1333.64	1341.64	1344.73	1352.30	0.005778	26.21	177.61	22.29	1.64
Principle Outlet	8	PF 19	4830.00	1333.64	1341.73	1345.03	1352.94	0.006019	26.87	179.73	22.29	1.67
Principle Outlet	8	PF 20	5065.00	1333.64	1342.02	1345.37	1353.52	0.006009	27.21	186.12	22.29	1.66
Principle Outlet	8	PF 21	5155.00	1333.64	1342.24	1345.52	1353.54	0.005788	26.98	191.09	22.29	1.62
Principle Outlet	8	PF 22	5245.00	1333.64	1342.35	1345.65	1353.75	0.005786	27.10	193.54	22.29	1.62
Principle Outlet	7	PF 1	156.00	1332.96	1333.45	1334.11	1336.80	0.041236	14.69	10.62	22.86	3.80
Principle Outlet	7	PF 2	340.00	1332.96	1333.89	1334.90	1338.14	0.022765	16.55	20.55	22.86	3.08
Principle Outlet	7	PF 3	398.00	1332.96	1334.01	1335.11	1338.49	0.020368	16.97	23.45	22.86	2.95
Principle Outlet	7	PF 4	591.00	1332.96	1334.41	1335.74	1339.55	0.015793	18.19	32.49	22.86	2.69
Principle Outlet	7	PF 5	822.00	1332.96	1334.85	1336.42	1340.67	0.013088	19.36	42.46	22.86	2.50
Principle Outlet	7	PF 6	1047.00	1332.96	1335.25	1337.03	1341.64	0.011530	20.29	51.60	22.86	2.38

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	7	PF 7	1275.00	1332.96	1335.64	1337.59	1342.50	0.010345	21.01	60.69	22.86	2.27
Principle Outlet	7	PF 8	1509.00	1332.96	1336.02	1338.12	1343.37	0.009605	21.75	69.39	22.86	2.20
Principle Outlet	7	PF 9	1765.00	1332.96	1336.48	1338.70	1344.06	0.008566	22.09	79.89	22.86	2.08
Principle Outlet	7	PF 10	2090.00	1332.96	1336.97	1339.38	1345.16	0.008131	22.98	90.97	22.86	2.03
Principle Outlet	7	PF 11	2337.00	1332.96	1337.33	1339.87	1345.95	0.007856	23.56	99.19	22.86	1.99
Principle Outlet	7	PF 12	2612.00	1332.96	1337.69	1340.37	1346.87	0.007758	24.32	107.40	22.86	1.98
Principle Outlet	7	PF 13	2870.00	1332.96	1338.03	1340.89	1347.65	0.007596	24.88	115.35	22.86	1.95
Principle Outlet	7	PF 14	3290.00	1332.96	1338.67	1341.64	1348.62	0.007051	25.31	130.00	22.86	1.87
Principle Outlet	7	PF 15	3575.00	1332.96	1339.04	1342.13	1349.42	0.006969	25.85	138.28	22.86	1.85
Principle Outlet	7	PF 16	3990.00	1332.96	1339.50	1342.80	1350.66	0.007040	26.82	148.78	22.86	1.85
Principle Outlet	7	PF 17	4280.00	1332.96	1339.93	1343.29	1351.23	0.006752	26.98	158.63	22.86	1.80
Principle Outlet	7	PF 18	4655.00	1332.96	1340.37	1343.89	1352.18	0.006699	27.57	168.85	22.86	1.79
Principle Outlet	7	PF 19	4830.00	1332.96	1340.48	1344.16	1352.82	0.006918	28.19	171.37	22.86	1.81
Principle Outlet	7	PF 20	5065.00	1332.96	1340.76	1344.52	1353.39	0.006888	28.53	177.56	22.86	1.80
Principle Outlet	7	PF 21	5155.00	1332.96	1340.95	1344.65	1353.41	0.006665	28.33	181.95	22.86	1.77
Principle Outlet	7	PF 22	5245.00	1332.96	1341.05	1344.79	1353.62	0.006656	28.46	184.32	22.86	1.77
Principle Outlet	6	PF 1	156.00	1331.73	1332.15	1332.86	1336.54	0.067132	16.81	9.28	23.67	4.73
Principle Outlet	6	PF 2	340.00	1331.73	1332.53	1333.63	1337.94	0.035030	18.66	18.22	23.67	3.75
Principle Outlet	6	PF 3	398.00	1331.73	1332.64	1333.82	1338.29	0.030930	19.08	20.86	23.67	3.58
Principle Outlet	6	PF 4	591.00	1331.73	1332.99	1334.44	1339.37	0.023142	20.27	29.16	23.67	3.22
Principle Outlet	6	PF 5	822.00	1331.73	1333.38	1335.11	1340.49	0.018588	21.40	38.41	23.67	2.96
Principle Outlet	6	PF 6	1047.00	1331.73	1333.74	1335.70	1341.46	0.016001	22.30	46.95	23.67	2.79
Principle Outlet	6	PF 7	1275.00	1331.73	1334.10	1336.22	1342.32	0.014137	23.01	55.40	23.67	2.65
Principle Outlet	6	PF 8	1509.00	1331.73	1334.45	1336.75	1343.19	0.012925	23.73	63.58	23.67	2.55
Principle Outlet	6	PF 9	1765.00	1331.73	1334.85	1337.33	1343.89	0.011485	24.12	73.17	23.67	2.42
Principle Outlet	6	PF 10	2090.00	1331.73	1335.29	1337.99	1344.98	0.010710	24.98	83.67	23.67	2.34
Principle Outlet	6	PF 11	2337.00	1331.73	1335.62	1338.47	1345.76	0.010234	25.55	91.46	23.67	2.29
Principle Outlet	6	PF 12	2612.00	1331.73	1335.96	1338.98	1346.69	0.009981	26.29	99.35	23.67	2.26
Principle Outlet	6	PF 13	2870.00	1331.73	1336.28	1339.48	1347.46	0.009684	26.84	106.92	23.67	2.23
Principle Outlet	6	PF 14	3290.00	1331.73	1336.85	1340.19	1348.43	0.008956	27.31	120.45	23.67	2.13
Principle Outlet	6	PF 15	3575.00	1331.73	1337.18	1340.69	1349.23	0.008780	27.85	128.36	23.67	2.11
Principle Outlet	6	PF 16	3990.00	1331.73	1337.62	1341.35	1350.47	0.008736	28.77	138.69	23.67	2.09
Principle Outlet	6	PF 17	4280.00	1331.73	1338.00	1341.82	1351.03	0.008377	28.97	147.74	23.67	2.04
Principle Outlet	6	PF 18	4655.00	1331.73	1338.41	1342.40	1351.97	0.008247	29.55	157.53	23.67	2.02
Principle Outlet	6	PF 19	4830.00	1331.73	1338.53	1342.68	1352.62	0.008442	30.12	160.34	23.67	2.04
Principle Outlet	6	PF 20	5065.00	1331.73	1338.78	1343.02	1353.19	0.008374	30.46	166.26	23.67	2.03
Principle Outlet	6	PF 21	5155.00	1331.73	1338.94	1343.16	1353.21	0.008139	30.32	170.04	23.67	1.99
Principle Outlet	6	PF 22	5245.00	1331.73	1339.04	1343.27	1353.43	0.008117	30.44	172.30	23.67	1.99

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	5.8*	PF 1	156.00	1329.62	1329.96	1330.71	1335.96	0.120080	19.66	7.93	24.94	6.14
Principle Outlet	5.8*	PF 2	340.00	1329.62	1330.27	1331.44	1337.54	0.060347	21.63	15.72	24.94	4.80
Principle Outlet	5.8*	PF 3	398.00	1329.62	1330.36	1331.63	1337.91	0.052607	22.05	18.05	24.94	4.57
Principle Outlet	5.8*	PF 4	591.00	1329.62	1330.66	1332.24	1339.03	0.037953	23.21	25.46	24.94	4.05
Principle Outlet	5.8*	PF 5	822.00	1329.62	1331.00	1332.87	1340.18	0.029506	24.32	33.80	24.94	3.68
Principle Outlet	5.8*	PF 6	1047.00	1329.62	1331.31	1333.45	1341.16	0.024754	25.19	41.57	24.94	3.44
Principle Outlet	5.8*	PF 7	1275.00	1329.62	1331.62	1333.97	1342.02	0.021472	25.89	49.24	24.94	3.25
Principle Outlet	5.8*	PF 8	1509.00	1329.62	1331.92	1334.50	1342.89	0.019255	26.59	56.76	24.94	3.11
Principle Outlet	5.8*	PF 9	1765.00	1329.62	1332.26	1335.03	1343.59	0.016996	27.02	65.33	24.94	2.94
Principle Outlet	5.8*	PF 10	2090.00	1329.62	1332.65	1335.68	1344.69	0.015526	27.85	75.06	24.94	2.83
Principle Outlet	5.8*	PF 11	2337.00	1329.62	1332.94	1336.14	1345.47	0.014647	28.40	82.28	24.94	2.76
Principle Outlet	5.8*	PF 12	2612.00	1329.62	1333.24	1336.65	1346.39	0.014050	29.11	89.74	24.94	2.70
Principle Outlet	5.8*	PF 13	2870.00	1329.62	1333.52	1337.10	1347.17	0.013479	29.64	96.82	24.94	2.65
Principle Outlet	5.8*	PF 14	3290.00	1329.62	1334.02	1337.80	1348.13	0.012371	30.15	109.12	24.94	2.54
Principle Outlet	5.8*	PF 15	3575.00	1329.62	1334.31	1338.26	1348.92	0.012005	30.67	116.55	24.94	2.50
Principle Outlet	5.8*	PF 16	3990.00	1329.62	1334.71	1338.92	1350.16	0.011731	31.54	126.52	24.94	2.47
Principle Outlet	5.8*	PF 17	4280.00	1329.62	1335.04	1339.36	1350.72	0.011232	31.78	134.68	24.94	2.41
Principle Outlet	5.8*	PF 18	4655.00	1329.62	1335.41	1339.93	1351.66	0.010950	32.35	143.90	24.94	2.37
Principle Outlet	5.8*	PF 19	4830.00	1329.62	1335.53	1340.16	1352.31	0.011092	32.87	146.95	24.94	2.39
Principle Outlet	5.8*	PF 20	5065.00	1329.62	1335.76	1340.52	1352.88	0.010945	33.20	152.54	24.94	2.37
Principle Outlet	5.8*	PF 21	5155.00	1329.62	1335.89	1340.64	1352.89	0.010670	33.09	155.77	24.94	2.33
Principle Outlet	5.8*	PF 22	5245.00	1329.62	1335.97	1340.77	1353.10	0.010620	33.22	157.91	24.94	2.33
Principle Outlet	5.6*	PF 1	156.00	1327.50	1327.79	1328.55	1335.16	0.179376	21.79	7.16	26.20	7.34
Principle Outlet	5.6*	PF 2	340.00	1327.50	1331.74	1329.27	1331.89	0.000131	3.08	110.51	26.20	0.26
Principle Outlet	5.6*	PF 3	398.00	1327.50	1332.13	1329.45	1332.30	0.000138	3.29	120.89	26.20	0.27
Principle Outlet	5.6*	PF 4	591.00	1327.50	1333.28	1330.03	1333.52	0.000157	3.91	150.99	26.20	0.29
Principle Outlet	5.6*	PF 5	822.00	1327.50	1334.62	1330.66	1334.92	0.000166	4.42	186.04	26.20	0.29
Principle Outlet	5.6*	PF 6	1047.00	1327.50	1335.54	1331.19	1335.93	0.000191	4.98	210.17	26.20	0.31
Principle Outlet	5.6*	PF 7	1275.00	1327.50	1336.24	1331.72	1336.72	0.000224	5.58	228.44	26.20	0.33
Principle Outlet	5.6*	PF 8	1509.00	1327.50	1336.84	1332.22	1337.43	0.000260	6.18	244.15	26.20	0.36
Principle Outlet	5.6*	PF 9	1765.00	1327.50	1329.81	1332.74	1343.29	0.023299	29.47	59.90	26.20	3.43
Principle Outlet	5.6*	PF 10	2090.00	1327.50	1330.16	1333.36	1344.39	0.020975	30.28	69.03	26.20	3.29
Principle Outlet	5.6*	PF 11	2337.00	1327.50	1330.41	1333.78	1345.16	0.019595	30.82	75.83	26.20	3.19
Principle Outlet	5.6*	PF 12	2612.00	1327.50	1330.69	1334.30	1346.09	0.018574	31.49	82.94	26.20	3.12
Principle Outlet	5.6*	PF 13	2870.00	1327.50	1330.94	1334.74	1346.87	0.017687	32.03	89.61	26.20	3.05
Principle Outlet	5.6*	PF 14	3290.00	1327.50	1331.38	1335.36	1347.83	0.016117	32.55	101.06	26.20	2.92
Principle Outlet	5.6*	PF 15	3575.00	1327.50	1331.65	1335.87	1348.62	0.015520	33.07	108.12	26.20	2.87

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	5.6*	PF 16	3990.00	1327.50	1332.01	1336.50	1349.86	0.014979	33.90	117.70	26.20	2.82
Principle Outlet	5.6*	PF 17	4280.00	1327.50	1332.30	1336.93	1350.42	0.014301	34.16	125.30	26.20	2.75
Principle Outlet	5.6*	PF 18	4655.00	1327.50	1332.64	1337.47	1351.36	0.013840	34.72	134.07	26.20	2.70
Principle Outlet	5.6*	PF 19	4830.00	1327.50	1332.76	1337.71	1352.01	0.013923	35.21	137.18	26.20	2.71
Principle Outlet	5.6*	PF 20	5065.00	1327.50	1332.96	1338.03	1352.57	0.013681	35.54	142.52	26.20	2.69
Principle Outlet	5.6*	PF 21	5155.00	1327.50	1333.07	1338.18	1352.59	0.013360	35.45	145.41	26.20	2.65
Principle Outlet	5.6*	PF 22	5245.00	1327.50	1333.15	1338.29	1352.80	0.013278	35.57	147.44	26.20	2.64
Principle Outlet	5.4*	PF 1	156.00	1325.39	1330.21	1326.40	1330.23	0.000017	1.18	131.91	27.47	0.10
Principle Outlet	5.4*	PF 2	340.00	1325.39	1331.80	1327.09	1331.86	0.000034	1.94	175.66	27.47	0.13
Principle Outlet	5.4*	PF 3	398.00	1325.39	1332.20	1327.27	1332.27	0.000039	2.13	186.72	27.47	0.14
Principle Outlet	5.4*	PF 4	591.00	1325.39	1333.37	1327.85	1333.48	0.000055	2.70	218.79	27.47	0.17
Principle Outlet	5.4*	PF 5	822.00	1325.39	1334.72	1328.44	1334.88	0.000068	3.21	255.89	27.47	0.19
Principle Outlet	5.4*	PF 6	1047.00	1325.39	1335.66	1328.96	1335.88	0.000085	3.72	281.73	27.47	0.20
Principle Outlet	5.4*	PF 7	1275.00	1325.39	1336.38	1329.47	1336.66	0.000105	4.23	301.55	27.47	0.22
Principle Outlet	5.4*	PF 8	1509.00	1325.39	1337.01	1329.96	1337.36	0.000126	4.73	318.78	27.47	0.24
Principle Outlet	5.4*	PF 9	1765.00	1325.39	1337.64	1330.45	1338.07	0.000149	5.25	336.19	27.47	0.26
Principle Outlet	5.4*	PF 10	2090.00	1325.39	1338.36	1331.06	1338.89	0.000179	5.88	355.74	27.47	0.29
Principle Outlet	5.4*	PF 11	2337.00	1325.39	1338.85	1331.49	1339.47	0.000203	6.33	369.37	27.47	0.30
Principle Outlet	5.4*	PF 12	2612.00	1325.39	1339.37	1331.97	1340.09	0.000229	6.81	383.62	27.47	0.32
Principle Outlet	5.4*	PF 13	2870.00	1325.39	1339.84	1332.40	1340.65	0.000253	7.24	396.43	27.47	0.34
Principle Outlet	5.4*	PF 14	3290.00	1325.39	1340.56	1333.05	1341.53	0.000293	7.91	416.16	27.47	0.36
Principle Outlet	5.4*	PF 15	3575.00	1325.39	1341.02	1333.50	1342.10	0.000320	8.34	428.87	27.47	0.37
Principle Outlet	5.4*	PF 16	3990.00	1325.39	1341.65	1334.11	1342.89	0.000359	8.94	446.30	27.47	0.39
Principle Outlet	5.4*	PF 17	4280.00	1325.39	1329.70	1334.52	1350.12	0.017648	36.26	118.03	27.47	3.08
Principle Outlet	5.4*	PF 18	4655.00	1325.39	1330.01	1335.05	1351.05	0.016967	36.81	126.46	27.47	3.02
Principle Outlet	5.4*	PF 19	4830.00	1325.39	1330.12	1335.29	1351.70	0.016988	37.28	129.56	27.47	3.03
Principle Outlet	5.4*	PF 20	5065.00	1325.39	1330.31	1335.58	1352.27	0.016637	37.61	134.68	27.47	2.99
Principle Outlet	5.4*	PF 21	5155.00	1325.39	1330.40	1335.73	1352.28	0.016262	37.54	137.33	27.47	2.96
Principle Outlet	5.4*	PF 22	5245.00	1325.39	1330.48	1335.85	1352.50	0.016142	37.66	139.28	27.47	2.95
Principle Outlet	5.2*	PF 1	156.00	1323.27	1330.22	1324.25	1330.23	0.000005	0.78	199.26	28.73	0.05
Principle Outlet	5.2*	PF 2	340.00	1323.27	1331.82	1324.91	1331.85	0.000013	1.39	245.33	28.73	0.08
Principle Outlet	5.2*	PF 3	398.00	1323.27	1332.23	1325.09	1332.26	0.000016	1.55	257.00	28.73	0.09
Principle Outlet	5.2*	PF 4	591.00	1323.27	1333.40	1325.65	1333.47	0.000025	2.03	290.86	28.73	0.11
Principle Outlet	5.2*	PF 5	822.00	1323.27	1334.77	1326.21	1334.86	0.000034	2.49	329.96	28.73	0.13
Principle Outlet	5.2*	PF 6	1047.00	1323.27	1335.72	1326.74	1335.85	0.000045	2.93	357.32	28.73	0.15
Principle Outlet	5.2*	PF 7	1275.00	1323.27	1336.45	1327.23	1336.63	0.000057	3.37	378.46	28.73	0.16
Principle Outlet	5.2*	PF 8	1509.00	1323.27	1337.10	1327.70	1337.32	0.000070	3.80	396.92	28.73	0.18

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	5.2*	PF 9	1765.00	1323.27	1337.75	1328.18	1338.03	0.000084	4.25	415.61	28.73	0.20
Principle Outlet	5.2*	PF 10	2090.00	1323.27	1338.48	1328.77	1338.84	0.000104	4.79	436.70	28.73	0.22
Principle Outlet	5.2*	PF 11	2337.00	1323.27	1338.99	1329.17	1339.41	0.000119	5.18	451.46	28.73	0.23
Principle Outlet	5.2*	PF 12	2612.00	1323.27	1339.53	1329.66	1340.02	0.000136	5.59	466.95	28.73	0.24
Principle Outlet	5.2*	PF 13	2870.00	1323.27	1340.02	1330.06	1340.57	0.000152	5.97	480.88	28.73	0.26
Principle Outlet	5.2*	PF 14	3290.00	1323.27	1340.77	1330.71	1341.43	0.000178	6.55	502.40	28.73	0.28
Principle Outlet	5.2*	PF 15	3575.00	1323.27	1341.25	1331.13	1342.00	0.000196	6.92	516.29	28.73	0.29
Principle Outlet	5.2*	PF 16	3990.00	1323.27	1341.92	1331.73	1342.78	0.000222	7.45	535.40	28.73	0.30
Principle Outlet	5.2*	PF 17	4280.00	1323.27	1342.35	1332.13	1343.29	0.000241	7.81	547.72	28.73	0.32
Principle Outlet	5.2*	PF 18	4655.00	1323.27	1342.89	1332.64	1343.95	0.000265	8.26	563.38	28.73	0.33
Principle Outlet	5.2*	PF 19	4830.00	1323.27	1343.13	1332.83	1344.25	0.000277	8.47	570.37	28.73	0.33
Principle Outlet	5.2*	PF 20	5065.00	1323.27	1343.46	1333.18	1344.65	0.000292	8.74	579.81	28.73	0.34
Principle Outlet	5.2*	PF 21	5155.00	1323.27	1343.58	1333.31	1344.80	0.000298	8.84	583.35	28.73	0.35
Principle Outlet	5.2*	PF 22	5245.00	1323.27	1343.71	1333.42	1344.95	0.000303	8.94	586.85	28.73	0.35
Principle Outlet	5	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.71	30.00	0.03
Principle Outlet	5	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	319.99	30.00	0.06
Principle Outlet	5	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.23	30.00	0.06
Principle Outlet	5	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.77	30.00	0.08
Principle Outlet	5	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.80	30.00	0.10
Principle Outlet	5	PF 6	1047.00	1321.15	1335.75	1324.53	1335.84	0.000026	2.39	437.60	30.00	0.11
Principle Outlet	5	PF 7	1275.00	1321.15	1336.49	1325.00	1336.61	0.000034	2.77	459.93	30.00	0.12
Principle Outlet	5	PF 8	1509.00	1321.15	1337.15	1325.45	1337.30	0.000042	3.15	479.49	30.00	0.14
Principle Outlet	5	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.33	30.00	0.15
Principle Outlet	5	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.78	30.00	0.17
Principle Outlet	5	PF 11	2337.00	1321.15	1339.08	1326.90	1339.37	0.000075	4.35	537.53	30.00	0.18
Principle Outlet	5	PF 12	2612.00	1321.15	1339.63	1327.36	1339.98	0.000087	4.71	554.08	30.00	0.19
Principle Outlet	5	PF 13	2870.00	1321.15	1340.13	1327.75	1340.52	0.000098	5.04	568.99	30.00	0.20
Principle Outlet	5	PF 14	3290.00	1321.15	1340.90	1328.35	1341.38	0.000116	5.56	592.05	30.00	0.22
Principle Outlet	5	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.95	30.00	0.23
Principle Outlet	5	PF 16	3990.00	1321.15	1342.08	1329.35	1342.71	0.000147	6.36	627.51	30.00	0.25
Principle Outlet	5	PF 17	4280.00	1321.15	1342.52	1329.77	1343.22	0.000160	6.68	640.81	30.00	0.25
Principle Outlet	5	PF 18	4655.00	1321.15	1343.09	1330.24	1343.86	0.000177	7.08	657.72	30.00	0.27
Principle Outlet	5	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.29	30.00	0.27
Principle Outlet	5	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.49	30.00	0.28
Principle Outlet	5	PF 21	5155.00	1321.15	1343.81	1330.90	1344.70	0.000200	7.59	679.32	30.00	0.28
Principle Outlet	5	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.12	30.00	0.28
Principle Outlet	4.94285*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.94285*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.94285*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.94285*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.94285*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.84	30.00	0.10
Principle Outlet	4.94285*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.64	30.00	0.11
Principle Outlet	4.94285*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.97	30.00	0.12
Principle Outlet	4.94285*	PF 8	1509.00	1321.15	1337.15	1325.44	1337.30	0.000042	3.15	479.53	30.00	0.14
Principle Outlet	4.94285*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.37	30.00	0.15
Principle Outlet	4.94285*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.82	30.00	0.17
Principle Outlet	4.94285*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.56	30.00	0.18
Principle Outlet	4.94285*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.12	30.00	0.19
Principle Outlet	4.94285*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	569.02	30.00	0.20
Principle Outlet	4.94285*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.08	30.00	0.22
Principle Outlet	4.94285*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.98	30.00	0.23
Principle Outlet	4.94285*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.71	0.000147	6.36	627.54	30.00	0.24
Principle Outlet	4.94285*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.84	30.00	0.25
Principle Outlet	4.94285*	PF 18	4655.00	1321.15	1343.09	1330.25	1343.86	0.000177	7.08	657.74	30.00	0.27
Principle Outlet	4.94285*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.31	30.00	0.27
Principle Outlet	4.94285*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.51	30.00	0.28
Principle Outlet	4.94285*	PF 21	5155.00	1321.15	1343.81	1330.90	1344.70	0.000200	7.59	679.34	30.00	0.28
Principle Outlet	4.94285*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.13	30.00	0.28
Principle Outlet	4.88571*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.88571*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.88571*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.88571*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.88571*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.84	30.00	0.10
Principle Outlet	4.88571*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.64	30.00	0.11
Principle Outlet	4.88571*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.97	30.00	0.12
Principle Outlet	4.88571*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.53	30.00	0.14
Principle Outlet	4.88571*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.36	30.00	0.15
Principle Outlet	4.88571*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.81	30.00	0.17
Principle Outlet	4.88571*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.55	30.00	0.18
Principle Outlet	4.88571*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.11	30.00	0.19
Principle Outlet	4.88571*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	569.01	30.00	0.20
Principle Outlet	4.88571*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.06	30.00	0.22
Principle Outlet	4.88571*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.96	30.00	0.23
Principle Outlet	4.88571*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.71	0.000147	6.36	627.52	30.00	0.25
Principle Outlet	4.88571*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.81	30.00	0.25

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.88571*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.71	30.00	0.27
Principle Outlet	4.88571*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.28	30.00	0.27
Principle Outlet	4.88571*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.48	30.00	0.28
Principle Outlet	4.88571*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.31	30.00	0.28
Principle Outlet	4.88571*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.10	30.00	0.28
Principle Outlet	4.82857*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.82857*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.82857*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.82857*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.82857*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.82857*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.82857*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.82857*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.52	30.00	0.14
Principle Outlet	4.82857*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.35	30.00	0.15
Principle Outlet	4.82857*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.81	30.00	0.17
Principle Outlet	4.82857*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.54	30.00	0.18
Principle Outlet	4.82857*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.10	30.00	0.19
Principle Outlet	4.82857*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.99	30.00	0.20
Principle Outlet	4.82857*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.05	30.00	0.22
Principle Outlet	4.82857*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.94	30.00	0.23
Principle Outlet	4.82857*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.50	30.00	0.25
Principle Outlet	4.82857*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.79	30.00	0.25
Principle Outlet	4.82857*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.69	30.00	0.27
Principle Outlet	4.82857*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.15	0.000185	7.26	665.26	30.00	0.27
Principle Outlet	4.82857*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.45	30.00	0.28
Principle Outlet	4.82857*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.28	30.00	0.28
Principle Outlet	4.82857*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.08	30.00	0.28
Principle Outlet	4.77142*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.77142*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.77142*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.77142*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.77142*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.77142*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.77142*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.77142*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.51	30.00	0.14
Principle Outlet	4.77142*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.35	30.00	0.15
Principle Outlet	4.77142*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.80	30.00	0.17

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.77142*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.53	30.00	0.18
Principle Outlet	4.77142*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.08	30.00	0.19
Principle Outlet	4.77142*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.98	30.00	0.20
Principle Outlet	4.77142*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.37	0.000116	5.56	592.03	30.00	0.22
Principle Outlet	4.77142*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.93	30.00	0.23
Principle Outlet	4.77142*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.47	30.00	0.25
Principle Outlet	4.77142*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.77	30.00	0.25
Principle Outlet	4.77142*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.66	30.00	0.27
Principle Outlet	4.77142*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.23	30.00	0.27
Principle Outlet	4.77142*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.42	30.00	0.28
Principle Outlet	4.77142*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.25	30.00	0.28
Principle Outlet	4.77142*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	683.05	30.00	0.28
Principle Outlet	4.71428*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.71428*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.71428*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.71428*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.71428*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.71428*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.71428*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.71428*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.51	30.00	0.14
Principle Outlet	4.71428*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.34	30.00	0.15
Principle Outlet	4.71428*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.79	30.00	0.17
Principle Outlet	4.71428*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.52	30.00	0.18
Principle Outlet	4.71428*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.97	0.000087	4.71	554.07	30.00	0.19
Principle Outlet	4.71428*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.96	30.00	0.20
Principle Outlet	4.71428*	PF 14	3290.00	1321.15	1340.89	1328.38	1341.37	0.000116	5.56	592.02	30.00	0.22
Principle Outlet	4.71428*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.91	30.00	0.23
Principle Outlet	4.71428*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.45	30.00	0.25
Principle Outlet	4.71428*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.75	30.00	0.25
Principle Outlet	4.71428*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.64	30.00	0.27
Principle Outlet	4.71428*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.20	30.00	0.27
Principle Outlet	4.71428*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.40	30.00	0.28
Principle Outlet	4.71428*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.22	30.00	0.28
Principle Outlet	4.71428*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	683.02	30.00	0.28
Principle Outlet	4.65714*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.65714*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.65714*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.65714*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.65714*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.82	30.00	0.10
Principle Outlet	4.65714*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.62	30.00	0.11
Principle Outlet	4.65714*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.95	30.00	0.12
Principle Outlet	4.65714*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.50	30.00	0.14
Principle Outlet	4.65714*	PF 9	1765.00	1321.15	1337.80	1325.91	1338.00	0.000052	3.53	499.33	30.00	0.15
Principle Outlet	4.65714*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.78	30.00	0.17
Principle Outlet	4.65714*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.51	30.00	0.18
Principle Outlet	4.65714*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.97	0.000087	4.71	554.06	30.00	0.19
Principle Outlet	4.65714*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.95	30.00	0.20
Principle Outlet	4.65714*	PF 14	3290.00	1321.15	1340.89	1328.38	1341.37	0.000116	5.56	592.01	30.00	0.22
Principle Outlet	4.65714*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.89	30.00	0.23
Principle Outlet	4.65714*	PF 16	3990.00	1321.15	1342.07	1329.36	1342.70	0.000147	6.36	627.43	30.00	0.25
Principle Outlet	4.65714*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.73	30.00	0.25
Principle Outlet	4.65714*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.61	30.00	0.27
Principle Outlet	4.65714*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.18	30.00	0.27
Principle Outlet	4.65714*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.37	30.00	0.28
Principle Outlet	4.65714*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.69	0.000200	7.59	679.19	30.00	0.28
Principle Outlet	4.65714*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	682.99	30.00	0.28
Principle Outlet	4.6	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.71	30.00	0.03
Principle Outlet	4.6	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	319.99	30.00	0.06
Principle Outlet	4.6	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.23	30.00	0.06
Principle Outlet	4.6	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.77	30.00	0.08
Principle Outlet	4.6	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.78	30.00	0.10
Principle Outlet	4.6	PF 6	1047.00	1321.15	1335.75	1324.53	1335.84	0.000026	2.39	437.57	30.00	0.11
Principle Outlet	4.6	PF 7	1275.00	1321.15	1336.49	1325.00	1336.61	0.000034	2.77	459.91	30.00	0.12
Principle Outlet	4.6	PF 8	1509.00	1321.15	1337.14	1325.45	1337.30	0.000042	3.15	479.45	30.00	0.14
Principle Outlet	4.6	PF 9	1765.00	1321.15	1337.80	1325.91	1338.00	0.000052	3.54	499.28	30.00	0.15
Principle Outlet	4.6	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.73	30.00	0.17
Principle Outlet	4.6	PF 11	2337.00	1321.15	1339.08	1326.90	1339.37	0.000075	4.35	537.45	30.00	0.18
Principle Outlet	4.6	PF 12	2612.00	1321.15	1339.63	1327.36	1339.97	0.000087	4.71	554.00	30.00	0.19
Principle Outlet	4.6	PF 13	2870.00	1321.15	1340.13	1327.75	1340.52	0.000098	5.04	568.89	30.00	0.20
Principle Outlet	4.6	PF 14	3290.00	1321.15	1340.89	1328.35	1341.37	0.000116	5.56	591.94	30.00	0.22
Principle Outlet	4.6	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.82	30.00	0.23
Principle Outlet	4.6	PF 16	3990.00	1321.15	1342.07	1329.35	1342.70	0.000147	6.36	627.36	30.00	0.25
Principle Outlet	4.6	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.66	30.00	0.25
Principle Outlet	4.6	PF 18	4655.00	1321.15	1343.08	1330.24	1343.86	0.000177	7.08	657.54	30.00	0.27
Principle Outlet	4.6	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.11	30.00	0.27

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.6	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.29	30.00	0.28
Principle Outlet	4.6	PF 21	5155.00	1321.15	1343.80	1330.90	1344.69	0.000200	7.59	679.11	30.00	0.28
Principle Outlet	4.6	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	682.91	30.00	0.28
Principle Outlet	4.5	PF 1	156.00	1321.15	1330.22	1322.67	1330.22	0.000007	0.69	226.44	30.00	0.04
Principle Outlet	4.5	PF 2	340.00	1321.15	1331.82	1323.69	1331.85	0.000020	1.24	274.58	30.00	0.07
Principle Outlet	4.5	PF 3	398.00	1321.15	1332.23	1324.44	1332.26	0.000024	1.39	286.77	30.00	0.08
Principle Outlet	4.5	PF 4	591.00	1321.15	1333.41	1324.96	1333.46	0.000037	1.83	322.17	30.00	0.10
Principle Outlet	4.5	PF 5	822.00	1321.15	1334.77	1325.52	1334.85	0.000050	2.26	363.02	30.00	0.11
Principle Outlet	4.5	PF 6	1047.00	1321.15	1335.72	1326.04	1335.83	0.000065	2.67	391.64	30.00	0.13
Principle Outlet	4.5	PF 7	1275.00	1321.15	1336.46	1326.51	1336.61	0.000082	3.08	413.77	30.00	0.15
Principle Outlet	4.5	PF 8	1509.00	1321.15	1337.11	1326.97	1337.29	0.000100	3.48	433.10	30.00	0.16
Principle Outlet	4.5	PF 9	1765.00	1321.15	1337.76	1327.44	1337.99	0.000121	3.90	452.69	30.00	0.18
Principle Outlet	4.5	PF 10	2090.00	1321.15	1338.50	1328.00	1338.80	0.000147	4.40	474.82	30.00	0.19
Principle Outlet	4.5	PF 11	2337.00	1321.15	1339.01	1328.40	1339.36	0.000168	4.77	490.29	30.00	0.21
Principle Outlet	4.5	PF 12	2612.00	1321.15	1339.55	1328.86	1339.97	0.000191	5.16	506.57	30.00	0.22
Principle Outlet	4.5	PF 13	2870.00	1321.15	1340.04	1329.25	1340.51	0.000212	5.51	521.19	30.00	0.23
Principle Outlet	4.5	PF 14	3290.00	1321.15	1340.80	1329.89	1341.36	0.000247	6.05	543.81	30.00	0.25
Principle Outlet	4.5	PF 15	3575.00	1321.15	1341.28	1330.29	1341.92	0.000271	6.40	558.40	30.00	0.26
Principle Outlet	4.5	PF 16	3990.00	1321.15	1341.95	1330.86	1342.69	0.000305	6.90	578.50	30.00	0.28
Principle Outlet	4.5	PF 17	4280.00	1321.15	1342.39	1331.25	1343.20	0.000330	7.24	591.49	30.00	0.29
Principle Outlet	4.5	PF 18	4655.00	1321.15	1342.93	1331.77	1343.84	0.000361	7.66	607.97	30.00	0.30
Principle Outlet	4.5	PF 19	4830.00	1321.15	1343.18	1331.99	1344.14	0.000376	7.85	615.35	30.00	0.31
Principle Outlet	4.5	PF 20	5065.00	1321.15	1343.51	1332.29	1344.53	0.000395	8.10	625.28	30.00	0.31
Principle Outlet	4.5	PF 21	5155.00	1321.15	1343.64	1332.41	1344.68	0.000402	8.20	629.01	30.00	0.32
Principle Outlet	4.5	PF 22	5245.00	1321.15	1343.76	1332.51	1344.83	0.000410	8.29	632.71	30.00	0.32
Principle Outlet	4.4	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.69	30.00	0.03
Principle Outlet	4.4	PF 2	340.00	1321.15	1331.83	1322.75	1331.84	0.000006	1.06	319.91	30.00	0.06
Principle Outlet	4.4	PF 3	398.00	1321.15	1332.23	1322.93	1332.26	0.000008	1.20	332.13	30.00	0.06
Principle Outlet	4.4	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.62	30.00	0.08
Principle Outlet	4.4	PF 5	822.00	1321.15	1334.78	1324.03	1334.84	0.000019	2.01	408.57	30.00	0.10
Principle Outlet	4.4	PF 6	1047.00	1321.15	1335.74	1324.53	1335.83	0.000026	2.39	437.30	30.00	0.11
Principle Outlet	4.4	PF 7	1275.00	1321.15	1336.48	1325.00	1336.60	0.000034	2.77	459.55	30.00	0.12
Principle Outlet	4.4	PF 8	1509.00	1321.15	1337.13	1325.45	1337.28	0.000042	3.15	479.01	30.00	0.14
Principle Outlet	4.4	PF 9	1765.00	1321.15	1337.79	1325.91	1337.98	0.000052	3.54	498.75	30.00	0.15
Principle Outlet	4.4	PF 10	2090.00	1321.15	1338.53	1326.49	1338.78	0.000065	4.01	521.09	30.00	0.17
Principle Outlet	4.4	PF 11	2337.00	1321.15	1339.05	1326.90	1339.35	0.000075	4.35	536.71	30.00	0.18
Principle Outlet	4.4	PF 12	2612.00	1321.15	1339.60	1327.36	1339.95	0.000087	4.72	553.15	30.00	0.19

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.4	PF 13	2870.00	1321.15	1340.09	1327.75	1340.49	0.000098	5.05	567.93	30.00	0.20
Principle Outlet	4.4	PF 14	3290.00	1321.15	1340.86	1328.35	1341.34	0.000116	5.57	590.82	30.00	0.22
Principle Outlet	4.4	PF 15	3575.00	1321.15	1341.35	1328.78	1341.89	0.000129	5.90	605.58	30.00	0.23
Principle Outlet	4.4	PF 16	3990.00	1321.15	1342.03	1329.35	1342.66	0.000148	6.37	625.95	30.00	0.25
Principle Outlet	4.4	PF 17	4280.00	1321.15	1342.47	1329.77	1343.16	0.000161	6.70	639.12	30.00	0.26
Principle Outlet	4.4	PF 18	4655.00	1321.15	1343.02	1330.24	1343.81	0.000178	7.10	655.84	30.00	0.27
Principle Outlet	4.4	PF 19	4830.00	1321.15	1343.27	1330.48	1344.10	0.000186	7.28	663.33	30.00	0.27
Principle Outlet	4.4	PF 20	5065.00	1321.15	1343.61	1330.78	1344.49	0.000197	7.52	673.41	30.00	0.28
Principle Outlet	4.4	PF 21	5155.00	1321.15	1343.73	1330.90	1344.63	0.000202	7.61	677.19	30.00	0.28
Principle Outlet	4.4	PF 22	5245.00	1321.15	1343.86	1331.00	1344.78	0.000206	7.70	680.95	30.00	0.28
Principle Outlet	4.3	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.69	30.00	0.03
Principle Outlet	4.3	PF 2	340.00	1321.15	1331.83	1322.75	1331.84	0.000006	1.06	319.91	30.00	0.06
Principle Outlet	4.3	PF 3	398.00	1321.15	1332.23	1322.93	1332.26	0.000008	1.20	332.13	30.00	0.06
Principle Outlet	4.3	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.62	30.00	0.08
Principle Outlet	4.3	PF 5	822.00	1321.15	1334.78	1324.03	1334.84	0.000019	2.01	408.56	30.00	0.10
Principle Outlet	4.3	PF 6	1047.00	1321.15	1335.74	1324.53	1335.83	0.000026	2.39	437.29	30.00	0.11
Principle Outlet	4.3	PF 7	1275.00	1321.15	1336.48	1325.00	1336.60	0.000034	2.77	459.55	30.00	0.12
Principle Outlet	4.3	PF 8	1509.00	1321.15	1337.13	1325.45	1337.28	0.000042	3.15	479.00	30.00	0.14
Principle Outlet	4.3	PF 9	1765.00	1321.15	1337.79	1325.91	1337.98	0.000052	3.54	498.74	30.00	0.15
Principle Outlet	4.3	PF 10	2090.00	1321.15	1338.53	1326.49	1338.78	0.000065	4.01	521.07	30.00	0.17
Principle Outlet	4.3	PF 11	2337.00	1321.15	1339.05	1326.90	1339.35	0.000075	4.35	536.69	30.00	0.18
Principle Outlet	4.3	PF 12	2612.00	1321.15	1339.60	1327.36	1339.95	0.000087	4.72	553.14	30.00	0.19
Principle Outlet	4.3	PF 13	2870.00	1321.15	1340.09	1327.75	1340.49	0.000098	5.05	567.91	30.00	0.20
Principle Outlet	4.3	PF 14	3290.00	1321.15	1340.86	1328.35	1341.34	0.000116	5.57	590.79	30.00	0.22
Principle Outlet	4.3	PF 15	3575.00	1321.15	1341.35	1328.78	1341.89	0.000129	5.90	605.56	30.00	0.23
Principle Outlet	4.3	PF 16	3990.00	1321.15	1342.03	1329.35	1342.66	0.000148	6.37	625.91	30.00	0.25
Principle Outlet	4.3	PF 17	4280.00	1321.15	1342.46	1329.77	1343.16	0.000161	6.70	639.08	30.00	0.26
Principle Outlet	4.3	PF 18	4655.00	1321.15	1343.02	1330.24	1343.80	0.000178	7.10	655.80	30.00	0.27
Principle Outlet	4.3	PF 19	4830.00	1321.15	1343.27	1330.48	1344.09	0.000186	7.28	663.28	30.00	0.27
Principle Outlet	4.3	PF 20	5065.00	1321.15	1343.61	1330.78	1344.49	0.000197	7.52	673.36	30.00	0.28
Principle Outlet	4.3	PF 21	5155.00	1321.15	1343.73	1330.90	1344.63	0.000202	7.61	677.14	30.00	0.28
Principle Outlet	4.3	PF 22	5245.00	1321.15	1343.86	1331.00	1344.78	0.000206	7.70	680.90	30.00	0.28
Principle Outlet	4.2	PF 1	156.00	1321.17	1330.22	1322.67	1330.22	0.000007	0.69	226.41	30.00	0.04
Principle Outlet	4.2	PF 2	340.00	1321.17	1331.82	1323.68	1331.84	0.000018	1.24	274.50	30.00	0.07
Principle Outlet	4.2	PF 3	398.00	1321.17	1332.22	1324.44	1332.25	0.000021	1.39	286.68	30.00	0.08
Principle Outlet	4.2	PF 4	591.00	1321.17	1333.40	1324.97	1333.45	0.000033	1.84	322.01	30.00	0.10
Principle Outlet	4.2	PF 5	822.00	1321.17	1334.76	1325.52	1334.84	0.000045	2.27	362.81	30.00	0.11

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.2	PF 6	1047.00	1321.17	1335.71	1326.03	1335.83	0.000059	2.68	391.36	30.00	0.13
Principle Outlet	4.2	PF 7	1275.00	1321.17	1336.45	1326.51	1336.60	0.000075	3.08	413.42	30.00	0.15
Principle Outlet	4.2	PF 8	1509.00	1321.17	1337.09	1326.95	1337.28	0.000092	3.49	432.65	30.00	0.16
Principle Outlet	4.2	PF 9	1765.00	1321.17	1337.74	1327.43	1337.98	0.000111	3.90	452.15	30.00	0.18
Principle Outlet	4.2	PF 10	2090.00	1321.17	1338.47	1327.99	1338.78	0.000135	4.41	474.16	30.00	0.20
Principle Outlet	4.2	PF 11	2337.00	1321.17	1338.99	1328.41	1339.34	0.000155	4.77	489.53	30.00	0.21
Principle Outlet	4.2	PF 12	2612.00	1321.17	1339.52	1328.86	1339.94	0.000176	5.17	505.69	30.00	0.22
Principle Outlet	4.2	PF 13	2870.00	1321.17	1340.01	1329.25	1340.48	0.000196	5.52	520.20	30.00	0.23
Principle Outlet	4.2	PF 14	3290.00	1321.17	1340.76	1329.89	1341.33	0.000229	6.06	542.64	30.00	0.25
Principle Outlet	4.2	PF 15	3575.00	1321.17	1341.24	1330.26	1341.88	0.000251	6.42	557.11	30.00	0.26
Principle Outlet	4.2	PF 16	3990.00	1321.17	1341.90	1330.87	1342.65	0.000283	6.91	577.03	30.00	0.28
Principle Outlet	4.2	PF 17	4280.00	1321.17	1342.33	1331.26	1343.15	0.000306	7.26	589.88	30.00	0.29
Principle Outlet	4.2	PF 18	4655.00	1321.17	1342.88	1331.77	1343.79	0.000336	7.68	606.19	30.00	0.30
Principle Outlet	4.2	PF 19	4830.00	1321.17	1343.12	1332.00	1344.08	0.000350	7.87	613.48	30.00	0.31
Principle Outlet	4.2	PF 20	5065.00	1321.17	1343.45	1332.29	1344.47	0.000368	8.13	623.31	30.00	0.31
Principle Outlet	4.2	PF 21	5155.00	1321.17	1343.57	1332.41	1344.62	0.000375	8.22	626.99	30.00	0.32
Principle Outlet	4.2	PF 22	5245.00	1321.17	1343.69	1332.51	1344.76	0.000382	8.32	630.66	30.00	0.32
Principle Outlet	4.1	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.66	30.00	0.03
Principle Outlet	4.1	PF 2	340.00	1321.15	1331.82	1322.75	1331.84	0.000006	1.06	319.84	30.00	0.06
Principle Outlet	4.1	PF 3	398.00	1321.15	1332.23	1322.93	1332.25	0.000008	1.20	332.04	30.00	0.06
Principle Outlet	4.1	PF 4	591.00	1321.15	1333.41	1323.46	1333.45	0.000013	1.61	367.47	30.00	0.08
Principle Outlet	4.1	PF 5	822.00	1321.15	1334.77	1324.03	1334.84	0.000019	2.01	408.35	30.00	0.10
Principle Outlet	4.1	PF 6	1047.00	1321.15	1335.73	1324.53	1335.82	0.000026	2.40	437.02	30.00	0.11
Principle Outlet	4.1	PF 7	1275.00	1321.15	1336.47	1325.00	1336.59	0.000034	2.78	459.20	30.00	0.13
Principle Outlet	4.1	PF 8	1509.00	1321.15	1337.11	1325.45	1337.27	0.000042	3.15	478.57	30.00	0.14
Principle Outlet	4.1	PF 9	1765.00	1321.15	1337.77	1325.91	1337.96	0.000052	3.54	498.22	30.00	0.15
Principle Outlet	4.1	PF 10	2090.00	1321.15	1338.51	1326.49	1338.76	0.000065	4.02	520.42	30.00	0.17
Principle Outlet	4.1	PF 11	2337.00	1321.15	1339.03	1326.90	1339.32	0.000076	4.36	535.95	30.00	0.18
Principle Outlet	4.1	PF 12	2612.00	1321.15	1339.57	1327.36	1339.92	0.000087	4.73	552.28	30.00	0.19
Principle Outlet	4.1	PF 13	2870.00	1321.15	1340.06	1327.75	1340.46	0.000098	5.06	566.95	30.00	0.21
Principle Outlet	4.1	PF 14	3290.00	1321.15	1340.82	1328.35	1341.30	0.000117	5.58	589.66	30.00	0.22
Principle Outlet	4.1	PF 15	3575.00	1321.15	1341.31	1328.78	1341.85	0.000130	5.92	604.31	30.00	0.23
Principle Outlet	4.1	PF 16	3990.00	1321.15	1341.98	1329.35	1342.61	0.000148	6.39	624.49	30.00	0.25
Principle Outlet	4.1	PF 17	4280.00	1321.15	1342.41	1329.77	1343.11	0.000162	6.71	637.53	30.00	0.26
Principle Outlet	4.1	PF 18	4655.00	1321.15	1342.96	1330.24	1343.75	0.000179	7.12	654.08	30.00	0.27
Principle Outlet	4.1	PF 19	4830.00	1321.15	1343.21	1330.48	1344.04	0.000188	7.30	661.48	30.00	0.27
Principle Outlet	4.1	PF 20	5065.00	1321.15	1343.54	1330.78	1344.43	0.000199	7.54	671.46	30.00	0.28
Principle Outlet	4.1	PF 21	5155.00	1321.15	1343.67	1330.90	1344.57	0.000203	7.63	675.21	30.00	0.28

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.1	PF 22	5245.00	1321.15	1343.79	1331.00	1344.72	0.000207	7.73	678.92	30.00	0.29
Principle Outlet	4	PF 1	156.00	1321.18	1330.22	1322.14	1330.22	0.000002	0.58	270.58	30.00	0.03
Principle Outlet	4	PF 2	340.00	1321.18	1331.82	1322.79	1331.84	0.000006	1.07	318.75	30.00	0.06
Principle Outlet	4	PF 3	398.00	1321.18	1332.23	1322.96	1332.25	0.000008	1.20	330.95	30.00	0.06
Principle Outlet	4	PF 4	591.00	1321.18	1333.41	1323.49	1333.45	0.000013	1.61	366.37	30.00	0.08
Principle Outlet	4	PF 5	822.00	1321.18	1334.77	1324.07	1334.84	0.000019	2.02	407.25	30.00	0.10
Principle Outlet	4	PF 6	1047.00	1321.18	1335.73	1324.56	1335.82	0.000026	2.40	435.91	30.00	0.11
Principle Outlet	4	PF 7	1275.00	1321.18	1336.47	1325.04	1336.59	0.000034	2.78	458.08	30.00	0.13
Principle Outlet	4	PF 8	1509.00	1321.18	1337.11	1325.49	1337.27	0.000043	3.16	477.44	30.00	0.14
Principle Outlet	4	PF 9	1765.00	1321.18	1337.77	1325.97	1337.96	0.000053	3.55	497.08	30.00	0.15
Principle Outlet	4	PF 10	2090.00	1321.18	1338.51	1326.53	1338.76	0.000066	4.02	519.27	30.00	0.17
Principle Outlet	4	PF 11	2337.00	1321.18	1339.02	1326.94	1339.32	0.000076	4.37	534.79	30.00	0.18
Principle Outlet	4	PF 12	2612.00	1321.18	1339.57	1327.39	1339.92	0.000088	4.74	551.11	30.00	0.19
Principle Outlet	4	PF 13	2870.00	1321.18	1340.06	1327.76	1340.46	0.000099	5.07	565.77	30.00	0.21
Principle Outlet	4	PF 14	3290.00	1321.18	1340.81	1328.42	1341.30	0.000118	5.59	588.46	30.00	0.22
Principle Outlet	4	PF 15	3575.00	1321.18	1341.30	1328.82	1341.85	0.000130	5.93	603.09	30.00	0.23
Principle Outlet	4	PF 16	3990.00	1321.18	1341.97	1329.40	1342.61	0.000149	6.40	623.25	30.00	0.25
Principle Outlet	4	PF 17	4280.00	1321.18	1342.41	1329.80	1343.11	0.000163	6.73	636.28	30.00	0.26
Principle Outlet	4	PF 18	4655.00	1321.18	1342.96	1330.29	1343.75	0.000180	7.13	652.81	30.00	0.27
Principle Outlet	4	PF 19	4830.00	1321.18	1343.20	1330.52	1344.04	0.000189	7.32	660.20	30.00	0.27
Principle Outlet	4	PF 20	5065.00	1321.18	1343.54	1330.81	1344.42	0.000200	7.56	670.17	30.00	0.28
Principle Outlet	4	PF 21	5155.00	1321.18	1343.66	1330.93	1344.57	0.000204	7.65	673.91	30.00	0.28
Principle Outlet	4	PF 22	5245.00	1321.18	1343.79	1331.04	1344.72	0.000208	7.74	677.62	30.00	0.29
Principle Outlet	3	PF 1	156.00	1322.64	1330.21	1323.60	1330.22	0.000004	0.69	226.65	30.00	0.04
Principle Outlet	3	PF 2	340.00	1322.64	1331.82	1324.25	1331.84	0.000010	1.24	274.69	30.00	0.07
Principle Outlet	3	PF 3	398.00	1322.64	1332.22	1324.43	1332.25	0.000012	1.39	286.84	30.00	0.08
Principle Outlet	3	PF 4	591.00	1322.64	1333.40	1324.96	1333.45	0.000019	1.83	322.12	30.00	0.10
Principle Outlet	3	PF 5	822.00	1322.64	1334.76	1325.49	1334.83	0.000027	2.27	362.85	30.00	0.11
Principle Outlet	3	PF 6	1047.00	1322.64	1335.70	1326.02	1335.82	0.000035	2.68	391.33	30.00	0.13
Principle Outlet	3	PF 7	1275.00	1322.64	1336.44	1326.48	1336.58	0.000045	3.08	413.31	30.00	0.15
Principle Outlet	3	PF 8	1509.00	1322.64	1337.08	1326.94	1337.26	0.000056	3.49	432.46	30.00	0.16
Principle Outlet	3	PF 9	1765.00	1322.64	1337.72	1327.42	1337.96	0.000068	3.91	451.86	30.00	0.18
Principle Outlet	3	PF 10	2090.00	1322.64	1338.45	1327.99	1338.75	0.000084	4.41	473.74	30.00	0.20
Principle Outlet	3	PF 11	2337.00	1322.64	1338.96	1328.41	1339.31	0.000096	4.78	489.01	30.00	0.21
Principle Outlet	3	PF 12	2612.00	1322.64	1339.50	1328.84	1339.91	0.000110	5.17	505.05	30.00	0.22
Principle Outlet	3	PF 13	2870.00	1322.64	1339.97	1329.25	1340.45	0.000124	5.53	519.45	30.00	0.23
Principle Outlet	3	PF 14	3290.00	1322.64	1340.72	1329.87	1341.29	0.000146	6.07	541.71	30.00	0.25

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	3	PF 15	3575.00	1322.64	1341.19	1330.29	1341.84	0.000161	6.43	556.05	30.00	0.26
Principle Outlet	3	PF 16	3990.00	1322.64	1341.85	1330.87	1342.60	0.000183	6.93	575.78	30.00	0.28
Principle Outlet	3	PF 17	4280.00	1322.64	1342.28	1331.22	1343.10	0.000199	7.27	588.50	30.00	0.29
Principle Outlet	3	PF 18	4655.00	1322.64	1342.81	1331.72	1343.73	0.000219	7.70	604.63	30.00	0.30
Principle Outlet	3	PF 19	4830.00	1322.64	1343.05	1331.96	1344.02	0.000229	7.89	611.83	30.00	0.31
Principle Outlet	3	PF 20	5065.00	1322.64	1343.38	1332.28	1344.41	0.000242	8.15	621.54	30.00	0.32
Principle Outlet	3	PF 21	5155.00	1322.64	1343.50	1332.38	1344.56	0.000247	8.25	625.19	30.00	0.32
Principle Outlet	3	PF 22	5245.00	1322.64	1343.62	1332.51	1344.70	0.000252	8.34	628.80	30.00	0.32
Principle Outlet	2.5	PF 1	156.00	1324.70	1330.22	1325.91	1330.22	0.000030	0.58	267.80	66.23	0.05
Principle Outlet	2.5	PF 2	340.00	1324.70	1331.82	1326.48	1331.83	0.000052	0.89	380.45	74.32	0.07
Principle Outlet	2.5	PF 3	398.00	1324.70	1332.22	1326.61	1332.24	0.000058	0.97	411.04	76.37	0.07
Principle Outlet	2.5	PF 4	591.00	1324.70	1333.40	1327.02	1333.42	0.000071	1.17	504.56	82.32	0.08
Principle Outlet	2.5	PF 5	822.00	1324.70	1334.76	1327.43	1334.79	0.000077	1.32	621.34	89.19	0.09
Principle Outlet	2.5	PF 6	1047.00	1324.70	1335.72	1327.81	1335.75	0.000086	1.48	708.74	94.01	0.09
Principle Outlet	2.5	PF 7	1275.00	1324.70	1336.46	1328.13	1336.50	0.000098	1.64	779.50	97.74	0.10
Principle Outlet	2.5	PF 8	1509.00	1324.70	1337.10	1328.47	1337.15	0.000111	1.79	843.55	100.99	0.11
Principle Outlet	2.5	PF 9	1765.00	1324.70	1337.76	1328.80	1337.81	0.000123	1.94	910.69	104.29	0.12
Principle Outlet	2.5	PF 10	2090.00	1324.70	1338.50	1329.20	1338.56	0.000137	2.11	989.21	108.03	0.12
Principle Outlet	2.5	PF 11	2337.00	1324.70	1339.01	1329.48	1339.09	0.000147	2.23	1045.79	110.64	0.13
Principle Outlet	2.5	PF 12	2612.00	1324.70	1339.56	1329.77	1339.64	0.000157	2.36	1106.81	113.39	0.13
Principle Outlet	2.5	PF 13	2870.00	1324.70	1340.05	1330.04	1340.14	0.000166	2.47	1162.93	115.88	0.14
Principle Outlet	2.5	PF 14	3290.00	1324.70	1340.81	1330.45	1340.91	0.000179	2.63	1252.45	120.07	0.14
Principle Outlet	2.5	PF 15	3575.00	1324.70	1341.30	1330.71	1341.41	0.000185	2.72	1312.94	133.22	0.15
Principle Outlet	2.5	PF 16	3990.00	1324.70	1341.97	1331.09	1342.10	0.000188	2.86	1404.83	146.91	0.15
Principle Outlet	2.5	PF 17	4280.00	1324.70	1342.41	1331.34	1342.54	0.000191	2.95	1469.07	146.91	0.15
Principle Outlet	2.5	PF 18	4655.00	1324.70	1342.96	1331.65	1343.11	0.000193	3.06	1550.63	146.91	0.15
Principle Outlet	2.5	PF 19	4830.00	1324.70	1343.21	1331.77	1343.36	0.000194	3.11	1587.13	146.91	0.15
Principle Outlet	2.5	PF 20	5065.00	1324.70	1343.55	1331.97	1343.70	0.000195	3.17	1636.35	146.91	0.16
Principle Outlet	2.5	PF 21	5155.00	1324.70	1343.67	1332.04	1343.83	0.000195	3.19	1654.84	146.91	0.16
Principle Outlet	2.5	PF 22	5245.00	1324.70	1343.80	1332.10	1343.96	0.000195	3.22	1673.21	146.91	0.16
Principle Outlet	2	PF 1	156.00	1326.35	1330.20	1327.48	1330.21	0.000092	0.82	190.15	65.33	0.08
Principle Outlet	2	PF 2	340.00	1326.35	1331.80	1327.95	1331.82	0.000112	1.13	301.78	74.40	0.10
Principle Outlet	2	PF 3	398.00	1326.35	1332.21	1328.08	1332.23	0.000116	1.20	332.36	76.70	0.10
Principle Outlet	2	PF 4	591.00	1326.35	1333.38	1328.45	1333.41	0.000125	1.39	426.52	83.38	0.11
Principle Outlet	2	PF 5	822.00	1326.35	1334.75	1328.84	1334.78	0.000120	1.51	545.31	91.11	0.11
Principle Outlet	2	PF 6	1047.00	1326.35	1335.70	1329.18	1335.74	0.000128	1.65	634.71	96.52	0.11
Principle Outlet	2	PF 7	1275.00	1326.35	1336.43	1329.50	1336.48	0.000140	1.80	707.30	100.70	0.12

HEC-RAS Plan: No Wall River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	2	PF 8	1509.00	1326.35	1337.08	1329.82	1337.14	0.000156	1.95	773.72	106.28	0.13
Principle Outlet	2	PF 9	1765.00	1326.35	1337.73	1330.13	1337.80	0.000171	2.09	845.02	112.19	0.13
Principle Outlet	2	PF 10	2090.00	1326.35	1338.47	1330.48	1338.55	0.000186	2.25	930.00	117.96	0.14
Principle Outlet	2	PF 11	2337.00	1326.35	1338.98	1330.74	1339.07	0.000196	2.36	992.00	121.98	0.15
Principle Outlet	2	PF 12	2612.00	1326.35	1339.53	1331.02	1339.62	0.000206	2.47	1059.58	126.26	0.15
Principle Outlet	2	PF 13	2870.00	1326.35	1340.02	1331.29	1340.12	0.000214	2.56	1122.35	130.10	0.15
Principle Outlet	2	PF 14	3290.00	1326.35	1340.78	1331.67	1340.89	0.000223	2.69	1224.57	146.44	0.16
Principle Outlet	2	PF 15	3575.00	1326.35	1341.27	1331.92	1341.39	0.000224	2.77	1296.84	147.90	0.16
Principle Outlet	2	PF 16	3990.00	1326.35	1341.95	1332.27	1342.08	0.000223	2.88	1399.64	161.46	0.16
Principle Outlet	2	PF 17	4280.00	1326.35	1342.39	1332.50	1342.52	0.000222	2.95	1470.46	161.46	0.16
Principle Outlet	2	PF 18	4655.00	1326.35	1342.94	1332.79	1343.08	0.000220	3.04	1560.29	161.46	0.16
Principle Outlet	2	PF 19	4830.00	1326.35	1343.19	1332.91	1343.34	0.000219	3.08	1600.50	161.46	0.16
Principle Outlet	2	PF 20	5065.00	1326.35	1343.53	1333.10	1343.68	0.000218	3.13	1654.72	161.46	0.16
Principle Outlet	2	PF 21	5155.00	1326.35	1343.65	1333.18	1343.81	0.000217	3.15	1675.08	161.46	0.16
Principle Outlet	2	PF 22	5245.00	1326.35	1343.78	1333.23	1343.93	0.000217	3.17	1695.32	161.46	0.16
Principle Outlet	1	PF 1	156.00	1326.57	1330.18	1327.82	1330.19	0.000100	0.77	202.49	82.32	0.09
Principle Outlet	1	PF 2	340.00	1326.57	1331.78	1328.24	1331.80	0.000100	0.98	346.33	97.69	0.09
Principle Outlet	1	PF 3	398.00	1326.57	1332.19	1328.37	1332.20	0.000100	1.03	386.68	101.58	0.09
Principle Outlet	1	PF 4	591.00	1326.57	1333.37	1328.70	1333.39	0.000100	1.15	513.03	113.74	0.10
Principle Outlet	1	PF 5	822.00	1326.57	1334.73	1329.04	1334.75	0.000100	1.19	691.37	146.27	0.10
Principle Outlet	1	PF 6	1047.00	1326.57	1335.69	1329.34	1335.71	0.000100	1.25	840.43	165.75	0.10
Principle Outlet	1	PF 7	1275.00	1326.57	1336.42	1329.62	1336.45	0.000100	1.32	967.22	175.16	0.10
Principle Outlet	1	PF 8	1509.00	1326.57	1337.07	1329.89	1337.10	0.000100	1.40	1081.54	179.71	0.10
Principle Outlet	1	PF 9	1765.00	1326.57	1337.72	1330.14	1337.76	0.000100	1.47	1200.75	184.34	0.10
Principle Outlet	1	PF 10	2090.00	1326.57	1338.47	1330.46	1338.50	0.000100	1.56	1339.30	189.54	0.10
Principle Outlet	1	PF 11	2337.00	1326.57	1338.98	1330.69	1339.03	0.000100	1.63	1438.60	193.17	0.10
Principle Outlet	1	PF 12	2612.00	1326.57	1339.53	1330.94	1339.58	0.000100	1.69	1545.23	196.96	0.11
Principle Outlet	1	PF 13	2870.00	1326.57	1340.02	1331.15	1340.07	0.000100	1.75	1642.91	200.36	0.11
Principle Outlet	1	PF 14	3290.00	1326.57	1340.79	1331.48	1340.84	0.000100	1.84	1797.27	203.72	0.11
Principle Outlet	1	PF 15	3575.00	1326.57	1341.28	1331.70	1341.33	0.000100	1.90	1898.18	205.19	0.11
Principle Outlet	1	PF 16	3990.00	1326.57	1341.96	1331.99	1342.02	0.000100	1.97	2038.63	206.81	0.11
Principle Outlet	1	PF 17	4280.00	1326.57	1342.40	1332.19	1342.46	0.000100	2.03	2129.84	206.81	0.11
Principle Outlet	1	PF 18	4655.00	1326.57	1342.96	1332.43	1343.03	0.000100	2.09	2245.52	206.81	0.11
Principle Outlet	1	PF 19	4830.00	1326.57	1343.21	1332.56	1343.28	0.000100	2.13	2297.30	206.81	0.11
Principle Outlet	1	PF 20	5065.00	1326.57	1343.55	1332.69	1343.62	0.000100	2.16	2367.10	206.81	0.11
Principle Outlet	1	PF 21	5155.00	1326.57	1343.67	1332.76	1343.75	0.000100	2.18	2393.30	206.81	0.11
Principle Outlet	1	PF 22	5245.00	1326.57	1343.80	1332.82	1343.88	0.000100	2.19	2419.36	206.81	0.11

HEC-RAS Version 3.1.2 April 2004
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: McMicken Dam Principle Outlet
Project File : po.prj
Run Date and Time: 2/6/2004 1:10:30 PM

Project in English units

PLAN DATA

Plan Title: P.O. Breast Wall as Sluice Gate
Plan File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.p02

Geometry Title: P.O. Breast Wall as Sluice Gate
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.g02

Flow Title : P.O. Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.f01

Plan Summary Information:

Number of:	Cross Sections =	39	Multiple Openings =	0
	Culverts =	0	Inline Structures =	1
	Bridges =	0	Lateral Structures =	0

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

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Program Selects Appropriate method
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: P.O. Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4	PF 5	PF 6	PF 7	PF 8
McMicken Dam Out	Principle Outlet	22	156	340	398	591	822	1047	1275	1509

River	Reach	RS	PF 9	PF 10	PF 11	PF 12	PF 13	PF 14	PF 15	PF 16
McMicken Dam Out	Principle Outlet	22	1765	2090	2337	2612	2870	3290	3575	3990

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
McMicken Dam Out	Principle Outlet	PF 1	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 2	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 3	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 4	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 5	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 6	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 7	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 8	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 9	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 10	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 11	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 12	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 13	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 14	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 15	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 16	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 17	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 18	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 19	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 20	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 21	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 22	Critical	Normal S = 0.0001

Inline Structure Gate Openings
River = McMicken Dam Out
Reach = Principle Outlet RS = 14.5
Gate = Gate #1

# Open	Open Ht	# Open	Open Ht	# Open	Open Ht	# Open	Open Ht	# Open	Open Ht
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1						

GEOMETRY DATA

Geometry Title: P.O. Breast Wall as Sluice Gate
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.g02

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 22

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1362	11000	1337	11000	1336.116	11020	1336.116	11020	1337
21020	1362								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.02	11000	.012	11020	.02

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

```
        11000   11020              6.33    6.33    6.33              .3       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 21

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1338   110001336.061   110201336.008   11020    1338
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 20

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1342   11000 1335.93   110201335.877   11020    1342
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 19

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1346   110001335.799   110201335.746   11020    1346
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 18

INPUT
Description:
Station Elevation Data    num=       6
```

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1350   110001335.668   110201335.615   11020    1350
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 17

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1354   110001335.537   110201335.484   11020    1354
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 16

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1358   110001335.407   110201335.354   11020    1358
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10             .2       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 15

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   10001335.276   10201335.276   1020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1020               2.5     2.5     2.5             .1       .3

INLINE STRUCTURE
```

```
RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 14.5

INPUT
Description:
Distance from Upstream XS =      .5
Deck/Roadway Width        =     1.5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =        2
     Sta    Elev     Sta    Elev
    1000    1362    1020    1362

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested

INLINE STRUCTURE GATE    Gate #1
      Height            =      11
      Width             =      20
      Invert            =1335.276
      Gate Coefficient  =     .58
      Gate Type         = Sluice
      Trunion Exponent  =       0
      Opening Exponent  =       1
      Head Exponent     =      .5
      Weir Coefficient  =       3
      Weir crest shape  = Broad Crested
Number of Gate Openings =       1
     Sta
    1010


CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 14

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362    10001335.243    10201335.243    1020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1020             11.5    11.5    11.5             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 13

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362    10001335.093    1020 1335.04    1020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1020               10      10      10             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 12

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1359   10001334.962   10201334.909    1020    1359

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1020                2       2       2             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 11

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1358   10001334.862 1020.571334.809 1020.57    1358

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1020.57    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1020.57                2       2       2             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 10

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1357   10001334.618 1021.141334.565 1021.14    1357

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1021.14    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1021.14                2       2       2             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 9

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1356   10001334.228 1021.711334.175 1021.71    1356
```

```
Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1021.71    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1021.71                 2       2       2             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 8

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1355    10001333.693 1022.29 1333.64 1022.29    1355

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1022.29    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1022.29                 2       2       2             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 7

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1354    10001333.014 1022.861332.961 1022.86    1354

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1022.86    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1022.86             2.87    2.87    2.87             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 6

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1353    10001331.785 1023.671331.732 1023.67    1353

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1023.67    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1023.67             4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.8*
```

```
INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1350.8    1000 1329.66 1024.94 1329.62 1024.94  1350.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1024.94    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1024.94             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.6*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1348.6    1000 1327.54  1026.2  1327.5  1026.2  1348.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012  1026.2    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000  1026.2             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.4*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1346.4    1000 1325.42 1027.47 1325.39 1027.47  1346.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1027.47    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1027.47             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.2*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1344.2    1000 1323.29 1028.73 1323.27 1028.73  1344.2

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1028.73    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1028.73             4.43    4.43    4.43              .1       .3

CROSS SECTION
```

```
RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.94285*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.88571*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.82857*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.77142*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.71428*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.65714*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.6

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                1       1       1             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.5

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169  1001.51321.169  1001.51324.169  1004.51324.169
  1004.51321.169  1007.51321.169  1007.51324.169  1010.51324.169  1010.51321.169
  1013.51321.169  1013.51324.169  1016.51324.169  1016.51321.169  1019.51321.169
  1019.51324.169  1022.51324.169  1022.51321.169  1025.51321.169  1025.51324.169
  1028.51324.169  1028.51321.154    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                3       3       3             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.4

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                7       7       7             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.3

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                1       1       1             .1       .3

CROSS SECTION
```

```
RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.2

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001324.169  1001.51324.169  1001.51321.169  1004.51321.169
  1004.51324.169  1007.51324.169  1007.51321.169  1010.51321.169  1010.51324.169
  1013.51324.169  1013.51321.169  1016.51321.169  1016.51324.169  1019.51324.169
  1019.51321.169  1022.51321.169  1022.51324.169  1025.51324.169  1025.51321.169
  1028.51321.169  1028.51324.154    10301324.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                 3       3       3              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.1

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                18      18      18              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.175    1030 1321.22    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                 1       1       1              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 3

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001322.638    10301322.681    1030    1342
```

```
Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             27.4    27.4    27.4             .6       .8

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 2.5

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1341.2  1010.7  1341.2  1051.7  1325.2  1072.9  1324.7  1095.6  1326.4
  1129.4    1340    1130  1340.2    1133 1341.22 1134.91 1341.87 1146.91 1341.87

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045  1010.7    .035    1133    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1010.7    1133            111.78  111.78  111.78             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 2

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000 1340.61  1010.6 1340.73  1024.9 1337.79  1032.9  1336.5  1059.1 1327.26
  1089.2 1326.35  1107.6 1327.22  1140.2 1338.69 1149.46 1341.79 1161.46 1341.79

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045  1010.6    .035 1149.46    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1010.6 1149.46            214.63  214.63  214.63             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 1

INPUT
Description:
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1340.3    1009    1338    1017    1336    1057 1333.69  1087.9 1327.86
  1125.9 1326.57  1148.7 1328.05  1171.3 1333.29    1182 1333.98  1183.2 1334.06
  1199.2 1339.27 1206.81 1341.82

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045    1009    .035 1206.81    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1009 1206.81                 0       0       0             .1       .3
```

SUMMARY OF MANNING'S N VALUES

River:McMicken Dam Out

Reach	River Sta.	n1	n2	n3
Principle Outlet	22	.02	.012	.02
Principle Outlet	21	.02	.012	.02
Principle Outlet	20	.02	.012	.02
Principle Outlet	19	.02	.012	.02
Principle Outlet	18	.02	.012	.02
Principle Outlet	17	.02	.012	.02
Principle Outlet	16	.02	.012	.02
Principle Outlet	15	.012	.012	.012
Principle Outlet	14.5	Inl Struct		
Principle Outlet	14	.012	.012	.012
Principle Outlet	13	.012	.012	.012
Principle Outlet	12	.012	.012	.012
Principle Outlet	11	.012	.012	.012
Principle Outlet	10	.012	.012	.012
Principle Outlet	9	.012	.012	.012
Principle Outlet	8	.012	.012	.012
Principle Outlet	7	.012	.012	.012
Principle Outlet	6	.012	.012	.012
Principle Outlet	5.8*	.012	.012	.012
Principle Outlet	5.6*	.012	.012	.012
Principle Outlet	5.4*	.012	.012	.012
Principle Outlet	5.2*	.012	.012	.012
Principle Outlet	5	.012	.012	.012
Principle Outlet	4.94285*	.012	.012	.012
Principle Outlet	4.88571*	.012	.012	.012
Principle Outlet	4.82857*	.012	.012	.012
Principle Outlet	4.77142*	.012	.012	.012
Principle Outlet	4.71428*	.012	.012	.012
Principle Outlet	4.65714*	.012	.012	.012
Principle Outlet	4.6	.012	.012	.012
Principle Outlet	4.5	.012	.012	.012
Principle Outlet	4.4	.012	.012	.012
Principle Outlet	4.3	.012	.012	.012
Principle Outlet	4.2	.012	.012	.012
Principle Outlet	4.1	.012	.012	.012
Principle Outlet	4	.012	.012	.012
Principle Outlet	3	.012	.012	.012
Principle Outlet	2.5	.045	.035	.045
Principle Outlet	2	.045	.035	.045
Principle Outlet	1	.045	.035	.045

SUMMARY OF REACH LENGTHS

River: McMicken Dam Out

Reach	River Sta.	Left	Channel	Right
Principle Outlet	22	6.33	6.33	6.33
Principle Outlet	21	10	10	10
Principle Outlet	20	10	10	10
Principle Outlet	19	10	10	10
Principle Outlet	18	10	10	10
Principle Outlet	17	10	10	10
Principle Outlet	16	10	10	10
Principle Outlet	15	2.5	2.5	2.5
Principle Outlet	14.5	Inl Struct		
Principle Outlet	14	11.5	11.5	11.5
Principle Outlet	13	10	10	10
Principle Outlet	12	2	2	2
Principle Outlet	11	2	2	2
Principle Outlet	10	2	2	2
Principle Outlet	9	2	2	2

Principle Outlet	8	2	2	2
Principle Outlet	7	2.87	2.87	2.87
Principle Outlet	6	4.43	4.43	4.43
Principle Outlet	5.8*	4.43	4.43	4.43
Principle Outlet	5.6*	4.43	4.43	4.43
Principle Outlet	5.4*	4.43	4.43	4.43
Principle Outlet	5.2*	4.43	4.43	4.43
Principle Outlet	5	4.43	4.43	4.43
Principle Outlet	4.94285*	4.43	4.43	4.43
Principle Outlet	4.88571*	4.43	4.43	4.43
Principle Outlet	4.82857*	4.43	4.43	4.43
Principle Outlet	4.77142*	4.43	4.43	4.43
Principle Outlet	4.71428*	4.43	4.43	4.43
Principle Outlet	4.65714*	4.43	4.43	4.43
Principle Outlet	4.6	1	1	1
Principle Outlet	4.5	3	3	3
Principle Outlet	4.4	7	7	7
Principle Outlet	4.3	1	1	1
Principle Outlet	4.2	3	3	3
Principle Outlet	4.1	18	18	18
Principle Outlet	4	1	1	1
Principle Outlet	3	27.4	27.4	27.4
Principle Outlet	2.5	111.78	111.78	111.78
Principle Outlet	2	214.63	214.63	214.63
Principle Outlet	1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: McMicken Dam Out

Reach	River Sta.	Contr.	Expan.
Principle Outlet	22	.3	.3
Principle Outlet	21	.25	.3
Principle Outlet	20	.25	.3
Principle Outlet	19	.25	.3
Principle Outlet	18	.25	.3
Principle Outlet	17	.25	.3
Principle Outlet	16	.2	.3
Principle Outlet	15	.1	.3
Principle Outlet	14.5	Inl Struct	
Principle Outlet	14	.1	.3
Principle Outlet	13	.1	.3
Principle Outlet	12	.1	.3
Principle Outlet	11	.1	.3
Principle Outlet	10	.1	.3
Principle Outlet	9	.1	.3
Principle Outlet	8	.1	.3
Principle Outlet	7	.1	.3
Principle Outlet	6	.1	.3
Principle Outlet	5.8*	.1	.3
Principle Outlet	5.6*	.1	.3
Principle Outlet	5.4*	.1	.3
Principle Outlet	5.2*	.1	.3
Principle Outlet	5	.1	.3
Principle Outlet	4.94285*	.1	.3
Principle Outlet	4.88571*	.1	.3
Principle Outlet	4.82857*	.1	.3
Principle Outlet	4.77142*	.1	.3
Principle Outlet	4.71428*	.1	.3
Principle Outlet	4.65714*	.1	.3
Principle Outlet	4.6	.1	.3
Principle Outlet	4.5	.1	.3
Principle Outlet	4.4	.1	.3
Principle Outlet	4.3	.1	.3
Principle Outlet	4.2	.1	.3
Principle Outlet	4.1	.1	.3
Principle Outlet	4	.1	.3

Principle Outlet	3	.6	.8
Principle Outlet	2.5	.1	.3
Principle Outlet	2	.1	.3
Principle Outlet	1	.1	.3

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet

Reach	River Sta	Profile	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)	
Principle Outlet	22	PF 1	156.00	1336.12	1338.07	1337.43	1338.07	0.000028	0.97	496.67	875.66	0.12
Principle Outlet	22	PF 2	340.00	1336.12	1339.28	1337.67	1339.28	0.000003	0.46	2144.05	1844.61	0.05
Principle Outlet	22	PF 3	398.00	1336.12	1339.65	1337.72	1339.65	0.000002	0.40	2887.05	2142.75	0.04
Principle Outlet	22	PF 4	591.00	1336.12	1340.78	1337.84	1340.78	0.000001	0.28	5819.51	3046.86	0.02
Principle Outlet	22	PF 5	822.00	1336.12	1341.99	1337.95	1341.99	0.000000	0.22	10064.26	4009.36	0.02
Principle Outlet	22	PF 6	1047.00	1336.12	1343.05	1338.03	1343.05	0.000000	0.19	14771.61	4858.67	0.01
Principle Outlet	22	PF 7	1275.00	1336.12	1344.03	1338.12	1344.03	0.000000	0.17	19945.41	5646.66	0.01
Principle Outlet	22	PF 8	1509.00	1336.12	1344.97	1338.18	1344.97	0.000000	0.16	25606.34	6398.61	0.01
Principle Outlet	22	PF 9	1765.00	1336.12	1345.86	1338.25	1345.86	0.000000	0.15	31572.06	7105.45	0.01
Principle Outlet	22	PF 10	2090.00	1336.12	1347.05	1338.32	1347.05	0.000000	0.14	40587.61	8056.82	0.01
Principle Outlet	22	PF 11	2337.00	1336.12	1347.97	1338.38	1347.97	0.000000	0.13	48353.86	8794.22	0.01
Principle Outlet	22	PF 12	2612.00	1336.12	1348.85	1338.43	1348.85	0.000000	0.12	56407.21	9498.61	0.01
Principle Outlet	22	PF 13	2870.00	1336.12	1349.70	1338.48	1349.70	0.000000	0.12	64758.61	10177.71	0.01
Principle Outlet	22	PF 14	3290.00	1336.12	1350.95	1338.55	1350.95	0.000000	0.11	78137.13	11179.96	0.00
Principle Outlet	22	PF 15	3575.00	1336.12	1351.85	1338.60	1351.85	0.000000	0.10	88481.27	11897.15	0.00
Principle Outlet	22	PF 16	3990.00	1336.12	1353.07	1338.65	1353.07	0.000000	0.10	103692.90	12879.47	0.00
Principle Outlet	22	PF 17	4280.00	1336.12	1353.94	1338.71	1353.94	0.000000	0.10	115108.00	13570.00	0.00
Principle Outlet	22	PF 18	4655.00	1336.12	1356.66	1338.75	1356.66	0.000000	0.08	154969.60	15745.59	0.00
Principle Outlet	22	PF 19	4830.00	1336.12	1358.13	1338.78	1358.13	0.000000	0.07	178975.40	16921.37	0.00
Principle Outlet	22	PF 20	5065.00	1336.12	1360.27	1338.81	1360.27	0.000000	0.06	217016.90	18633.28	0.00
Principle Outlet	22	PF 21	5155.00	1336.12	1361.01	1338.81	1361.01	0.000000	0.06	231076.00	19227.42	0.00
Principle Outlet	22	PF 22	5245.00	1336.12	1361.89	1338.83	1361.89	0.000000	0.05	248233.00	19928.50	0.00
Principle Outlet	21	PF 1	156.00	1336.01	1337.27	1337.27	1337.89	0.002294	6.32	24.70	20.00	1.00
Principle Outlet	21	PF 2	340.00	1336.01	1339.27	1338.59	1339.28	0.000043	1.57	731.25	1074.08	0.15
Principle Outlet	21	PF 3	398.00	1336.01	1339.65	1338.66	1339.65	0.000018	1.11	1203.49	1393.09	0.10
Principle Outlet	21	PF 4	591.00	1336.01	1340.78	1338.84	1340.78	0.000003	0.56	3321.42	2338.93	0.05
Principle Outlet	21	PF 5	822.00	1336.01	1341.99	1338.98	1341.99	0.000001	0.36	6740.61	3342.04	0.03
Principle Outlet	21	PF 6	1047.00	1336.01	1343.05	1339.08	1343.05	0.000000	0.28	10758.82	4226.85	0.02
Principle Outlet	21	PF 7	1275.00	1336.01	1344.03	1339.18	1344.03	0.000000	0.23	15326.45	5047.67	0.01
Principle Outlet	21	PF 8	1509.00	1336.01	1344.97	1339.25	1344.97	0.000000	0.20	20439.79	5831.06	0.01
Principle Outlet	21	PF 9	1765.00	1336.01	1345.86	1339.33	1345.86	0.000000	0.18	25917.07	6567.34	0.01
Principle Outlet	21	PF 10	2090.00	1336.01	1347.05	1339.41	1347.05	0.000000	0.16	34316.26	7558.35	0.01
Principle Outlet	21	PF 11	2337.00	1336.01	1347.97	1339.46	1347.97	0.000000	0.15	41637.21	8326.48	0.01
Principle Outlet	21	PF 12	2612.00	1336.01	1348.85	1339.52	1348.85	0.000000	0.14	49291.64	9060.22	0.01
Principle Outlet	21	PF 13	2870.00	1336.01	1349.70	1339.58	1349.70	0.000000	0.13	57282.90	9767.62	0.01
Principle Outlet	21	PF 14	3290.00	1336.01	1350.95	1339.65	1350.95	0.000000	0.12	70173.82	10811.63	0.01
Principle Outlet	21	PF 15	3575.00	1336.01	1351.85	1339.69	1351.85	0.000000	0.11	80201.14	11558.70	0.01
Principle Outlet	21	PF 16	3990.00	1336.01	1353.07	1339.75	1353.07	0.000000	0.11	95022.36	12581.95	0.00

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	21	PF 17	4280.00	1336.01	1353.94	1339.80	1353.94	0.000000	0.10	106193.00	13301.25	0.00
Principle Outlet	21	PF 18	4655.00	1336.01	1356.66	1339.86	1356.66	0.000000	0.08	145447.00	15567.48	0.00
Principle Outlet	21	PF 19	4830.00	1336.01	1358.13	1339.87	1358.13	0.000000	0.07	169227.00	16792.26	0.00
Principle Outlet	21	PF 20	5065.00	1336.01	1360.27	1339.91	1360.27	0.000000	0.06	207068.60	18575.50	0.00
Principle Outlet	21	PF 21	5155.00	1336.01	1361.01	1339.92	1361.01	0.000000	0.06	221094.00	19194.40	0.00
Principle Outlet	21	PF 22	5245.00	1336.01	1361.89	1339.93	1361.89	0.000000	0.05	238234.90	19924.68	0.00
Principle Outlet	20	PF 1	156.00	1335.88	1336.96	1337.13	1337.81	0.003827	7.41	21.04	20.00	1.27
Principle Outlet	20	PF 2	340.00	1335.88	1337.98	1337.98	1339.02	0.002115	8.18	41.58	20.00	1.00
Principle Outlet	20	PF 3	398.00	1335.88	1338.22	1338.22	1339.37	0.002085	8.61	46.24	20.00	1.00
Principle Outlet	20	PF 4	591.00	1335.88	1338.92	1338.92	1340.41	0.002049	9.81	60.25	20.00	1.00
Principle Outlet	20	PF 5	822.00	1335.88	1339.65	1339.65	1341.52	0.002067	10.98	74.86	20.00	1.00
Principle Outlet	20	PF 6	1047.00	1335.88	1340.31	1340.31	1342.50	0.002067	11.87	88.21	20.00	1.00
Principle Outlet	20	PF 7	1275.00	1335.88	1342.38	1340.91	1343.70	0.000905	9.43	202.27	401.35	0.65
Principle Outlet	20	PF 8	1509.00	1335.88	1342.03	1341.54	1344.39	0.001663	12.31	123.04	51.25	0.88
Principle Outlet	20	PF 9	1765.00	1335.88	1345.86	1343.27	1345.86	0.000004	0.78	7629.47	3874.98	0.04
Principle Outlet	20	PF 10	2090.00	1335.88	1347.05	1343.39	1347.05	0.000001	0.51	12950.92	5065.41	0.03
Principle Outlet	20	PF 11	2337.00	1335.88	1347.97	1343.46	1347.97	0.000001	0.39	18046.25	5987.41	0.02
Principle Outlet	20	PF 12	2612.00	1335.88	1348.85	1343.54	1348.85	0.000000	0.32	23706.60	6868.02	0.02
Principle Outlet	20	PF 13	2870.00	1335.88	1349.70	1343.59	1349.70	0.000000	0.27	29897.94	7717.02	0.01
Principle Outlet	20	PF 14	3290.00	1335.88	1350.95	1343.70	1350.95	0.000000	0.22	40350.64	8969.83	0.01
Principle Outlet	20	PF 15	3575.00	1335.88	1351.85	1343.75	1351.85	0.000000	0.19	48793.80	9866.31	0.01
Principle Outlet	20	PF 16	3990.00	1335.88	1353.07	1343.82	1353.07	0.000000	0.17	61663.93	11094.34	0.01
Principle Outlet	20	PF 17	4280.00	1335.88	1353.94	1343.86	1353.94	0.000000	0.15	71612.63	11957.50	0.01
Principle Outlet	20	PF 18	4655.00	1335.88	1356.66	1343.93	1356.66	0.000000	0.10	107828.60	14676.98	0.00
Principle Outlet	20	PF 19	4830.00	1335.88	1358.13	1343.95	1358.13	0.000000	0.09	130479.80	16146.71	0.00
Principle Outlet	20	PF 20	5065.00	1335.88	1360.27	1343.99	1360.27	0.000000	0.07	167321.60	18286.60	0.00
Principle Outlet	20	PF 21	5155.00	1335.88	1361.01	1344.00	1361.01	0.000000	0.07	181178.40	19029.28	0.00
Principle Outlet	20	PF 22	5245.00	1335.88	1361.89	1344.01	1361.89	0.000000	0.06	198238.60	19905.62	0.00
Principle Outlet	19	PF 1	156.00	1335.75	1336.75	1337.00	1337.74	0.004870	7.99	19.52	20.00	1.43
Principle Outlet	19	PF 2	340.00	1335.75	1337.63	1337.84	1338.93	0.003018	9.17	37.09	20.00	1.19
Principle Outlet	19	PF 3	398.00	1335.75	1337.85	1338.09	1339.27	0.002890	9.56	41.61	20.00	1.17
Principle Outlet	19	PF 4	591.00	1335.75	1338.52	1338.79	1340.32	0.002696	10.74	55.04	20.00	1.14
Principle Outlet	19	PF 5	822.00	1335.75	1339.23	1339.53	1341.42	0.002614	11.88	69.19	20.00	1.13
Principle Outlet	19	PF 6	1047.00	1335.75	1339.89	1340.17	1342.40	0.002535	12.72	82.29	20.00	1.11
Principle Outlet	19	PF 7	1275.00	1335.75	1340.79	1340.79	1343.30	0.002111	12.71	100.29	20.00	1.00
Principle Outlet	19	PF 8	1509.00	1335.75	1341.46	1341.39	1344.19	0.002065	13.28	113.67	20.00	0.98
Principle Outlet	19	PF 9	1765.00	1335.75	1342.22	1342.02	1345.13	0.001980	13.69	128.88	20.00	0.95

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	19	PF 10	2090.00	1335.75	1343.12	1342.76	1346.26	0.001924	14.22	146.99	20.00	0.92
Principle Outlet	19	PF 11	2337.00	1335.75	1343.34	1343.30	1347.04	0.002218	15.44	151.35	20.00	0.99
Principle Outlet	19	PF 12	2612.00	1335.75	1344.38	1343.88	1347.96	0.001947	15.17	172.19	20.00	0.91
Principle Outlet	19	PF 13	2870.00	1335.75	1344.91	1344.41	1348.74	0.002003	15.71	182.68	20.00	0.92
Principle Outlet	19	PF 14	3290.00	1335.75	1346.21	1345.24	1350.00	0.001798	15.68	235.41	278.48	0.86
Principle Outlet	19	PF 15	3575.00	1335.75	1351.85	1347.61	1351.85	0.000001	0.52	21679.12	7327.13	0.02
Principle Outlet	19	PF 16	3990.00	1335.75	1353.07	1347.69	1353.07	0.000001	0.37	31622.81	8862.62	0.02
Principle Outlet	19	PF 17	4280.00	1335.75	1353.94	1347.75	1353.94	0.000000	0.30	39738.32	9941.57	0.01
Principle Outlet	19	PF 18	4655.00	1335.75	1356.66	1347.82	1356.66	0.000000	0.17	71399.73	13341.23	0.01
Principle Outlet	19	PF 19	4830.00	1335.75	1358.13	1347.84	1358.13	0.000000	0.13	92357.76	15178.39	0.00
Principle Outlet	19	PF 20	5065.00	1335.75	1360.27	1347.88	1360.27	0.000000	0.09	127699.80	17853.25	0.00
Principle Outlet	19	PF 21	5155.00	1335.75	1361.01	1347.88	1361.01	0.000000	0.08	141303.80	18781.60	0.00
Principle Outlet	19	PF 22	5245.00	1335.75	1361.89	1347.91	1361.89	0.000000	0.08	158242.80	19877.02	0.00
Principle Outlet	18	PF 1	156.00	1335.62	1336.57	1336.88	1337.66	0.005665	8.38	18.63	20.00	1.53
Principle Outlet	18	PF 2	340.00	1335.62	1337.40	1337.72	1338.85	0.003590	9.69	35.09	20.00	1.29
Principle Outlet	18	PF 3	398.00	1335.62	1337.61	1337.96	1339.20	0.003446	10.12	39.32	20.00	1.27
Principle Outlet	18	PF 4	591.00	1335.62	1338.25	1338.66	1340.24	0.003169	11.32	52.20	20.00	1.23
Principle Outlet	18	PF 5	822.00	1335.62	1338.95	1339.38	1341.35	0.003003	12.44	66.06	20.00	1.21
Principle Outlet	18	PF 6	1047.00	1335.62	1339.59	1340.04	1342.32	0.002860	13.25	79.00	20.00	1.18
Principle Outlet	18	PF 7	1275.00	1335.62	1340.36	1340.67	1343.20	0.002526	13.52	94.27	20.00	1.10
Principle Outlet	18	PF 8	1509.00	1335.62	1341.61	1341.27	1344.09	0.001798	12.64	119.35	20.00	0.91
Principle Outlet	18	PF 9	1765.00	1335.62	1342.35	1341.89	1345.04	0.001766	13.15	134.23	20.00	0.89
Principle Outlet	18	PF 10	2090.00	1335.62	1343.25	1342.62	1346.18	0.001751	13.74	152.08	20.00	0.88
Principle Outlet	18	PF 11	2337.00	1335.62	1343.52	1343.16	1346.94	0.001985	14.83	157.60	20.00	0.93
Principle Outlet	18	PF 12	2612.00	1335.62	1343.75	1343.75	1347.78	0.002293	16.11	162.17	20.00	1.00
Principle Outlet	18	PF 13	2870.00	1335.62	1344.28	1344.28	1348.57	0.002332	16.62	172.68	20.00	1.00
Principle Outlet	18	PF 14	3290.00	1335.62	1345.10	1345.10	1349.80	0.002398	17.40	189.11	20.00	1.00
Principle Outlet	18	PF 15	3575.00	1335.62	1345.63	1345.63	1350.60	0.002446	17.90	199.74	20.00	1.00
Principle Outlet	18	PF 16	3990.00	1335.62	1346.40	1346.40	1351.74	0.002501	18.55	215.15	20.00	1.00
Principle Outlet	18	PF 17	4280.00	1335.62	1348.82	1346.87	1352.91	0.001696	16.24	263.51	20.00	0.79
Principle Outlet	18	PF 18	4655.00	1335.62	1356.66	1347.56	1356.66	0.000001	0.38	37347.11	11114.56	0.01
Principle Outlet	18	PF 19	4830.00	1335.62	1358.13	1347.81	1358.13	0.000000	0.25	55484.21	13564.31	0.01
Principle Outlet	18	PF 20	5065.00	1335.62	1360.27	1348.25	1360.27	0.000000	0.15	88328.43	17131.00	0.01
Principle Outlet	18	PF 21	5155.00	1335.62	1361.01	1348.35	1361.01	0.000000	0.13	101510.90	18368.80	0.00
Principle Outlet	18	PF 22	5245.00	1335.62	1361.89	1348.52	1361.89	0.000000	0.11	118248.20	19829.37	0.00
Principle Outlet	17	PF 1	156.00	1335.48	1336.41	1336.75	1337.58	0.006348	8.68	17.98	20.00	1.61
Principle Outlet	17	PF 2	340.00	1335.48	1337.18	1337.60	1338.79	0.004166	10.16	33.46	20.00	1.38

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	17	PF 3	398.00	1335.48	1337.40	1337.82	1339.13	0.003926	10.55	37.71	20.00	1.35
Principle Outlet	17	PF 4	591.00	1335.48	1338.03	1338.53	1340.17	0.003553	11.75	50.29	20.00	1.31
Principle Outlet	17	PF 5	822.00	1335.48	1338.71	1339.27	1341.27	0.003311	12.85	63.95	20.00	1.27
Principle Outlet	17	PF 6	1047.00	1335.48	1339.34	1339.92	1342.24	0.003142	13.68	76.52	20.00	1.23
Principle Outlet	17	PF 7	1275.00	1335.48	1340.04	1340.54	1343.12	0.002830	14.06	90.66	20.00	1.16
Principle Outlet	17	PF 8	1509.00	1335.48	1341.72	1341.12	1344.01	0.001604	12.14	124.26	20.00	0.86
Principle Outlet	17	PF 9	1765.00	1335.48	1342.46	1341.70	1344.96	0.001602	12.70	139.00	20.00	0.85
Principle Outlet	17	PF 10	2090.00	1335.48	1343.35	1342.50	1346.11	0.001612	13.34	156.72	20.00	0.84
Principle Outlet	17	PF 11	2337.00	1335.48	1343.65	1343.04	1346.85	0.001817	14.36	162.77	20.00	0.89
Principle Outlet	17	PF 12	2612.00	1335.48	1343.94	1343.62	1347.67	0.002061	15.49	168.62	20.00	0.94
Principle Outlet	17	PF 13	2870.00	1335.48	1343.81	1344.15	1348.45	0.002601	17.30	165.90	20.00	1.06
Principle Outlet	17	PF 14	3290.00	1335.48	1344.62	1344.97	1349.68	0.002650	18.05	182.22	20.00	1.05
Principle Outlet	17	PF 15	3575.00	1335.48	1345.15	1345.50	1350.49	0.002687	18.54	192.82	20.00	1.05
Principle Outlet	17	PF 16	3990.00	1335.48	1345.91	1346.27	1351.62	0.002733	19.18	208.05	20.00	1.05
Principle Outlet	17	PF 17	4280.00	1335.48	1348.88	1346.74	1352.86	0.001632	16.00	267.47	20.00	0.77
Principle Outlet	17	PF 18	4655.00	1335.48	1353.36	1347.35	1356.00	0.000932	13.04	356.89	20.00	0.54
Principle Outlet	17	PF 19	4830.00	1335.48	1358.13	1347.72	1358.13	0.000003	0.86	21720.56	10332.20	0.03
Principle Outlet	17	PF 20	5065.00	1335.48	1360.27	1348.12	1360.27	0.000000	0.33	49579.16	15685.89	0.01
Principle Outlet	17	PF 21	5155.00	1335.48	1361.01	1348.26	1361.01	0.000000	0.25	61920.29	17542.89	0.01
Principle Outlet	17	PF 22	5245.00	1335.48	1361.89	1348.30	1361.89	0.000000	0.19	78256.26	19734.05	0.01
Principle Outlet	16	PF 1	156.00	1335.35	1336.25	1336.62	1337.49	0.006960	8.93	17.47	20.00	1.68
Principle Outlet	16	PF 2	340.00	1335.35	1337.00	1337.47	1338.72	0.004651	10.52	32.31	20.00	1.46
Principle Outlet	16	PF 3	398.00	1335.35	1337.20	1337.70	1339.06	0.004389	10.94	36.39	20.00	1.43
Principle Outlet	16	PF 4	591.00	1335.35	1337.82	1338.37	1340.10	0.003894	12.11	48.81	20.00	1.37
Principle Outlet	16	PF 5	822.00	1335.35	1338.49	1339.14	1341.20	0.003595	13.21	62.23	20.00	1.32
Principle Outlet	16	PF 6	1047.00	1335.35	1339.11	1339.79	1342.17	0.003392	14.04	74.58	20.00	1.28
Principle Outlet	16	PF 7	1275.00	1335.35	1341.11	1340.40	1343.03	0.001442	11.13	114.55	20.00	0.82
Principle Outlet	16	PF 8	1509.00	1335.35	1341.82	1341.00	1343.95	0.001453	11.73	128.69	20.00	0.81
Principle Outlet	16	PF 9	1765.00	1335.35	1342.55	1341.63	1344.90	0.001470	12.31	143.37	20.00	0.81
Principle Outlet	16	PF 10	2090.00	1335.35	1343.43	1342.37	1346.05	0.001496	12.98	161.03	20.00	0.81
Principle Outlet	16	PF 11	2337.00	1335.35	1343.75	1342.91	1346.78	0.001681	13.96	167.46	20.00	0.85
Principle Outlet	16	PF 12	2612.00	1335.35	1344.07	1343.49	1347.58	0.001896	15.02	173.86	20.00	0.90
Principle Outlet	16	PF 13	2870.00	1335.35	1343.45	1344.02	1348.36	0.002806	17.79	161.36	20.00	1.10
Principle Outlet	16	PF 14	3290.00	1335.35	1344.26	1344.84	1349.59	0.002842	18.53	177.57	20.00	1.10
Principle Outlet	16	PF 15	3575.00	1335.35	1344.79	1345.37	1350.40	0.002872	19.01	188.10	20.00	1.09
Principle Outlet	16	PF 16	3990.00	1335.35	1346.14	1346.14	1351.48	0.002501	18.55	215.14	20.00	1.00
Principle Outlet	16	PF 17	4280.00	1335.35	1348.95	1346.63	1352.81	0.001573	15.78	271.31	20.00	0.75
Principle Outlet	16	PF 18	4655.00	1335.35	1353.38	1347.30	1355.97	0.000913	12.93	359.93	20.00	0.54

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	16	PF 19	4830.00	1335.35	1355.26	1347.59	1357.55	0.000769	12.15	397.65	20.00	0.48
Principle Outlet	16	PF 20	5065.00	1335.35	1357.79	1347.95	1359.77	0.000633	11.30	448.13	20.00	0.42
Principle Outlet	16	PF 21	5155.00	1335.35	1361.01	1348.13	1361.01	0.000004	1.03	23109.67	15052.35	0.04
Principle Outlet	16	PF 22	5245.00	1335.35	1361.89	1348.29	1361.89	0.000001	0.57	38263.34	19445.05	0.02
Principle Outlet	15	PF 1	156.00	1335.28	1336.14	1336.51	1337.41	0.007296	9.06	17.22	20.00	1.72
Principle Outlet	15	PF 2	340.00	1335.28	1336.86	1337.35	1338.65	0.004963	10.74	31.65	20.00	1.50
Principle Outlet	15	PF 3	398.00	1335.28	1337.06	1337.59	1338.99	0.004677	11.16	35.66	20.00	1.47
Principle Outlet	15	PF 4	591.00	1335.28	1337.67	1338.28	1340.04	0.004125	12.34	47.90	20.00	1.40
Principle Outlet	15	PF 5	822.00	1335.28	1338.33	1339.02	1341.14	0.003803	13.46	61.08	20.00	1.36
Principle Outlet	15	PF 6	1047.00	1335.28	1338.93	1339.67	1342.12	0.003609	14.33	73.04	20.00	1.32
Principle Outlet	15	PF 7	1275.00	1335.28	1341.17	1340.29	1342.99	0.001331	10.82	117.82	20.00	0.79
Principle Outlet	15	PF 8	1509.00	1335.28	1341.87	1340.90	1343.90	0.001355	11.44	131.94	20.00	0.78
Principle Outlet	15	PF 9	1765.00	1335.28	1342.61	1341.52	1344.86	0.001382	12.04	146.60	20.00	0.78
Principle Outlet	15	PF 10	2090.00	1335.28	1343.49	1342.26	1346.00	0.001418	12.73	164.23	20.00	0.78
Principle Outlet	15	PF 11	2337.00	1335.28	1343.82	1342.80	1346.73	0.001591	13.68	170.89	20.00	0.82
Principle Outlet	15	PF 12	2612.00	1335.28	1344.16	1343.38	1347.52	0.001790	14.71	177.62	20.00	0.87
Principle Outlet	15	PF 13	2870.00	1335.28	1343.20	1343.91	1348.29	0.002951	18.12	158.42	20.00	1.13
Principle Outlet	15	PF 14	3290.00	1335.28	1344.00	1344.74	1349.52	0.002979	18.85	174.49	20.00	1.12
Principle Outlet	15	PF 15	3575.00	1335.28	1344.52	1345.24	1350.33	0.003005	19.33	184.96	20.00	1.12
Principle Outlet	15	PF 16	3990.00	1335.28	1345.70	1346.03	1351.39	0.002717	19.14	208.52	20.00	1.04
Principle Outlet	15	PF 17	4280.00	1335.28	1348.99	1346.52	1352.77	0.001531	15.61	274.23	20.00	0.74
Principle Outlet	15	PF 18	4655.00	1335.28	1353.39	1347.20	1355.96	0.000898	12.85	362.31	20.00	0.53
Principle Outlet	15	PF 19	4830.00	1335.28	1355.27	1347.49	1357.54	0.000758	12.08	399.96	20.00	0.48
Principle Outlet	15	PF 20	5065.00	1335.28	1357.79	1347.88	1359.76	0.000625	11.25	450.37	20.00	0.42
Principle Outlet	15	PF 21	5155.00	1335.28	1358.77	1348.03	1360.64	0.000585	10.97	469.79	20.00	0.40
Principle Outlet	15	PF 22	5245.00	1335.28	1359.75	1348.16	1361.53	0.000549	10.72	489.38	20.00	0.38
Principle Outlet	14.5		Inl Struct									
Principle Outlet	14	PF 1	156.00	1335.24	1336.48	1336.48	1337.10	0.002267	6.29	24.79	20.00	1.00
Principle Outlet	14	PF 2	340.00	1335.24	1337.33	1337.33	1338.36	0.002086	8.14	41.76	20.00	0.99
Principle Outlet	14	PF 3	398.00	1335.24	1337.56	1337.56	1338.71	0.002066	8.58	46.38	20.00	0.99
Principle Outlet	14	PF 4	591.00	1335.24	1338.26	1338.26	1339.75	0.002046	9.80	60.28	20.00	1.00
Principle Outlet	14	PF 5	822.00	1335.24	1338.98	1338.98	1340.86	0.002081	11.00	74.70	20.00	1.00
Principle Outlet	14	PF 6	1047.00	1335.24	1339.65	1339.65	1341.84	0.002077	11.89	88.07	20.00	1.00
Principle Outlet	14	PF 7	1275.00	1335.24	1340.27	1340.27	1342.77	0.002100	12.69	100.47	20.00	1.00
Principle Outlet	14	PF 8	1509.00	1335.24	1340.87	1340.87	1343.66	0.002130	13.42	112.44	20.00	1.00
Principle Outlet	14	PF 9	1765.00	1335.24	1341.49	1341.49	1344.59	0.002163	14.13	124.90	20.00	1.00

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	14	PF 10	2090.00	1335.24	1342.23	1342.23	1345.70	0.002211	14.95	139.80	20.00	1.00
Principle Outlet	14	PF 11	2337.00	1335.24	1342.77	1342.77	1346.51	0.002249	15.52	150.60	20.00	1.00
Principle Outlet	14	PF 12	2612.00	1335.24	1343.35	1343.35	1347.38	0.002298	16.12	162.03	20.00	1.00
Principle Outlet	14	PF 13	2870.00	1335.24	1343.88	1343.88	1348.17	0.002332	16.62	172.69	20.00	1.00
Principle Outlet	14	PF 14	3290.00	1335.24	1344.71	1344.71	1349.40	0.002393	17.39	189.24	20.00	1.00
Principle Outlet	14	PF 15	3575.00	1335.24	1345.23	1345.23	1350.20	0.002445	17.90	199.77	20.00	1.00
Principle Outlet	14	PF 16	3990.00	1335.24	1346.00	1346.00	1351.34	0.002502	18.55	215.12	20.00	1.00
Principle Outlet	14	PF 17	4280.00	1335.24	1346.40	1346.40	1352.11	0.002614	19.18	223.16	20.00	1.01
Principle Outlet	14	PF 18	4655.00	1335.24	1347.16	1347.16	1353.08	0.002603	19.53	238.31	20.00	1.00
Principle Outlet	14	PF 19	4830.00	1335.24	1347.46	1347.46	1353.53	0.002628	19.78	244.24	20.00	1.00
Principle Outlet	14	PF 20	5065.00	1335.24	1347.84	1347.84	1354.12	0.002665	20.10	252.01	20.00	1.00
Principle Outlet	14	PF 21	5155.00	1335.24	1347.99	1347.99	1354.34	0.002677	20.21	255.02	20.00	1.00
Principle Outlet	14	PF 22	5245.00	1335.24	1348.12	1348.12	1354.56	0.002700	20.36	257.61	20.00	1.00
Principle Outlet	13	PF 1	156.00	1335.04	1336.06	1336.31	1337.02	0.004663	7.88	19.79	20.00	1.40
Principle Outlet	13	PF 2	340.00	1335.04	1336.82	1337.15	1338.28	0.003613	9.71	35.02	20.00	1.29
Principle Outlet	13	PF 3	398.00	1335.04	1337.03	1337.38	1338.63	0.003476	10.15	39.21	20.00	1.28
Principle Outlet	13	PF 4	591.00	1335.04	1337.68	1338.07	1339.67	0.003169	11.32	52.20	20.00	1.23
Principle Outlet	13	PF 5	822.00	1335.04	1338.36	1338.78	1340.78	0.003025	12.47	65.90	20.00	1.21
Principle Outlet	13	PF 6	1047.00	1335.04	1338.98	1339.47	1341.76	0.002937	13.37	78.29	20.00	1.19
Principle Outlet	13	PF 7	1275.00	1335.04	1339.59	1340.09	1342.68	0.002853	14.10	90.42	20.00	1.17
Principle Outlet	13	PF 8	1509.00	1335.04	1340.15	1340.68	1343.57	0.002850	14.85	101.59	20.00	1.16
Principle Outlet	13	PF 9	1765.00	1335.04	1340.74	1341.31	1344.50	0.002837	15.55	113.50	20.00	1.15
Principle Outlet	13	PF 10	2090.00	1335.04	1341.45	1342.03	1345.61	0.002854	16.38	127.62	20.00	1.14
Principle Outlet	13	PF 11	2337.00	1335.04	1341.97	1342.59	1346.42	0.002864	16.93	138.04	20.00	1.14
Principle Outlet	13	PF 12	2612.00	1335.04	1342.54	1343.17	1347.28	0.002866	17.47	149.52	20.00	1.13
Principle Outlet	13	PF 13	2870.00	1335.04	1343.05	1343.67	1348.07	0.002888	17.97	159.68	20.00	1.12
Principle Outlet	13	PF 14	3290.00	1335.04	1343.85	1344.53	1349.30	0.002924	18.73	175.69	20.00	1.11
Principle Outlet	13	PF 15	3575.00	1335.04	1344.37	1345.05	1350.10	0.002958	19.22	186.05	20.00	1.11
Principle Outlet	13	PF 16	3990.00	1335.04	1345.11	1345.82	1351.24	0.003002	19.87	200.84	20.00	1.10
Principle Outlet	13	PF 17	4280.00	1335.04	1345.58	1346.32	1352.02	0.003061	20.36	210.18	20.00	1.11
Principle Outlet	13	PF 18	4655.00	1335.04	1346.24	1346.98	1352.98	0.003082	20.84	223.41	20.00	1.10
Principle Outlet	13	PF 19	4830.00	1335.04	1346.56	1347.28	1353.42	0.003083	21.02	229.77	20.00	1.09
Principle Outlet	13	PF 20	5065.00	1335.04	1346.94	1347.67	1354.00	0.003111	21.33	237.45	20.00	1.09
Principle Outlet	13	PF 21	5155.00	1335.04	1347.09	1347.78	1354.23	0.003121	21.45	240.37	20.00	1.09
Principle Outlet	13	PF 22	5245.00	1335.04	1347.23	1347.98	1354.45	0.003135	21.57	243.18	20.00	1.09
Principle Outlet	12	PF 1	156.00	1334.91	1335.87	1336.17	1336.95	0.005582	8.34	18.71	20.00	1.52
Principle Outlet	12	PF 2	340.00	1334.91	1336.60	1337.02	1338.22	0.004252	10.23	33.25	20.00	1.40

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	12	PF 3	398.00	1334.91	1336.80	1337.25	1338.57	0.004077	10.68	37.26	20.00	1.38
Principle Outlet	12	PF 4	591.00	1334.91	1337.43	1337.95	1339.61	0.003659	11.87	49.81	20.00	1.33
Principle Outlet	12	PF 5	822.00	1334.91	1338.10	1338.69	1340.72	0.003428	13.00	63.22	20.00	1.29
Principle Outlet	12	PF 6	1047.00	1334.91	1338.71	1339.33	1341.70	0.003275	13.87	75.46	20.00	1.26
Principle Outlet	12	PF 7	1275.00	1334.91	1339.28	1339.96	1342.62	0.003196	14.66	86.97	20.00	1.24
Principle Outlet	12	PF 8	1509.00	1334.91	1339.83	1340.55	1343.52	0.003175	15.42	97.86	20.00	1.23
Principle Outlet	12	PF 9	1765.00	1334.91	1340.42	1341.18	1344.44	0.003124	16.08	109.73	20.00	1.21
Principle Outlet	12	PF 10	2090.00	1334.91	1341.12	1341.92	1345.55	0.003117	16.90	123.69	20.00	1.20
Principle Outlet	12	PF 11	2337.00	1334.91	1341.63	1342.46	1346.36	0.003115	17.45	133.95	20.00	1.19
Principle Outlet	12	PF 12	2612.00	1334.91	1342.20	1343.04	1347.22	0.003108	17.99	145.20	20.00	1.18
Principle Outlet	12	PF 13	2870.00	1334.91	1342.70	1343.57	1348.01	0.003120	18.49	155.23	20.00	1.17
Principle Outlet	12	PF 14	3290.00	1334.91	1344.21	1344.40	1349.10	0.002524	17.73	185.53	20.00	1.03
Principle Outlet	12	PF 15	3575.00	1334.91	1344.73	1344.91	1349.90	0.002577	18.25	195.87	20.00	1.03
Principle Outlet	12	PF 16	3990.00	1334.91	1345.46	1345.69	1351.04	0.002648	18.95	210.56	20.00	1.03
Principle Outlet	12	PF 17	4280.00	1334.91	1345.94	1346.17	1351.81	0.002712	19.45	220.05	20.00	1.03
Principle Outlet	12	PF 18	4655.00	1334.91	1346.59	1346.85	1352.78	0.002760	19.98	233.02	20.00	1.03
Principle Outlet	12	PF 19	4830.00	1334.91	1346.89	1347.15	1353.23	0.002776	20.20	239.16	20.00	1.03
Principle Outlet	12	PF 20	5065.00	1334.91	1347.27	1347.54	1353.82	0.002814	20.52	246.77	20.00	1.03
Principle Outlet	12	PF 21	5155.00	1334.91	1347.42	1347.69	1354.04	0.002828	20.65	249.66	20.00	1.03
Principle Outlet	12	PF 22	5245.00	1334.91	1347.56	1347.84	1354.26	0.002844	20.77	252.49	20.00	1.03
Principle Outlet	11	PF 1	156.00	1334.81	1335.69	1336.04	1336.92	0.007111	8.90	17.53	20.57	1.70
Principle Outlet	11	PF 2	340.00	1334.81	1336.36	1336.88	1338.19	0.005289	10.86	31.29	20.57	1.55
Principle Outlet	11	PF 3	398.00	1334.81	1336.54	1337.09	1338.54	0.005039	11.33	35.12	20.57	1.53
Principle Outlet	11	PF 4	591.00	1334.81	1337.12	1337.80	1339.58	0.004475	12.57	47.01	20.57	1.47
Principle Outlet	11	PF 5	822.00	1334.81	1337.74	1338.52	1340.68	0.004143	13.75	59.78	20.57	1.42
Principle Outlet	11	PF 6	1047.00	1334.81	1338.30	1339.17	1341.65	0.003941	14.67	71.35	20.57	1.39
Principle Outlet	11	PF 7	1275.00	1334.81	1338.83	1339.78	1342.57	0.003838	15.52	82.16	20.57	1.37
Principle Outlet	11	PF 8	1509.00	1334.81	1339.33	1340.36	1343.46	0.003788	16.31	92.54	20.57	1.35
Principle Outlet	11	PF 9	1765.00	1334.81	1339.86	1340.96	1344.39	0.003758	17.08	103.34	20.57	1.34
Principle Outlet	11	PF 10	2090.00	1334.81	1340.51	1341.70	1345.49	0.003711	17.90	116.73	20.57	1.32
Principle Outlet	11	PF 11	2337.00	1334.81	1340.98	1342.22	1346.29	0.003698	18.49	126.41	20.57	1.31
Principle Outlet	11	PF 12	2612.00	1334.81	1341.48	1342.78	1347.15	0.003703	19.11	136.71	20.57	1.31
Principle Outlet	11	PF 13	2870.00	1334.81	1341.94	1343.30	1347.93	0.003712	19.64	146.11	20.57	1.30
Principle Outlet	11	PF 14	3290.00	1334.81	1342.97	1344.12	1348.97	0.003351	19.66	167.34	20.57	1.21
Principle Outlet	11	PF 15	3575.00	1334.81	1343.44	1344.61	1349.78	0.003398	20.21	176.92	20.57	1.21
Principle Outlet	11	PF 16	3990.00	1334.81	1344.10	1345.39	1350.91	0.003459	20.93	190.59	20.57	1.21
Principle Outlet	11	PF 17	4280.00	1334.81	1344.54	1345.88	1351.68	0.003510	21.43	199.68	20.57	1.21
Principle Outlet	11	PF 18	4655.00	1334.81	1345.12	1346.53	1352.64	0.003562	22.01	211.45	20.57	1.21

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	11	PF 19	4830.00	1334.81	1345.38	1346.81	1353.08	0.003586	22.27	216.86	20.57	1.21
Principle Outlet	11	PF 20	5065.00	1334.81	1345.72	1347.21	1353.67	0.003621	22.62	223.93	20.57	1.21
Principle Outlet	11	PF 21	5155.00	1334.81	1345.85	1347.35	1353.89	0.003635	22.75	226.60	20.57	1.21
Principle Outlet	11	PF 22	5245.00	1334.81	1345.98	1347.49	1354.11	0.003650	22.88	229.25	20.57	1.21
Principle Outlet	10	PF 1	156.00	1334.57	1335.33	1335.79	1336.87	0.010506	9.94	15.69	21.14	2.03
Principle Outlet	10	PF 2	340.00	1334.57	1335.95	1336.58	1338.13	0.007186	11.86	28.66	21.14	1.80
Principle Outlet	10	PF 3	398.00	1334.57	1336.12	1336.80	1338.48	0.006768	12.34	32.25	21.14	1.76
Principle Outlet	10	PF 4	591.00	1334.57	1336.65	1337.49	1339.52	0.005861	13.61	43.43	21.14	1.67
Principle Outlet	10	PF 5	822.00	1334.57	1337.22	1338.19	1340.62	0.005302	14.80	55.53	21.14	1.61
Principle Outlet	10	PF 6	1047.00	1334.57	1337.74	1338.82	1341.58	0.004945	15.72	66.59	21.14	1.56
Principle Outlet	10	PF 7	1275.00	1334.57	1338.23	1339.43	1342.50	0.004760	16.59	76.87	21.14	1.53
Principle Outlet	10	PF 8	1509.00	1334.57	1338.69	1340.01	1343.40	0.004656	17.40	86.72	21.14	1.51
Principle Outlet	10	PF 9	1765.00	1334.57	1339.18	1340.60	1344.32	0.004574	18.19	97.05	21.14	1.50
Principle Outlet	10	PF 10	2090.00	1334.57	1339.78	1341.32	1345.42	0.004485	19.05	109.72	21.14	1.47
Principle Outlet	10	PF 11	2337.00	1334.57	1340.22	1341.85	1346.22	0.004449	19.66	118.90	21.14	1.46
Principle Outlet	10	PF 12	2612.00	1334.57	1340.68	1342.40	1347.08	0.004435	20.30	128.67	21.14	1.45
Principle Outlet	10	PF 13	2870.00	1334.57	1341.11	1342.91	1347.85	0.004408	20.83	137.80	21.14	1.44
Principle Outlet	10	PF 14	3290.00	1334.57	1341.97	1343.70	1348.88	0.004090	21.09	156.00	21.14	1.37
Principle Outlet	10	PF 15	3575.00	1334.57	1342.41	1344.23	1349.68	0.004122	21.64	165.17	21.14	1.36
Principle Outlet	10	PF 16	3990.00	1334.57	1343.02	1344.94	1350.81	0.004169	22.40	178.15	21.14	1.36
Principle Outlet	10	PF 17	4280.00	1334.57	1343.44	1345.43	1351.57	0.004198	22.88	187.05	21.14	1.36
Principle Outlet	10	PF 18	4655.00	1334.57	1343.97	1346.08	1352.53	0.004239	23.48	198.28	21.14	1.35
Principle Outlet	10	PF 19	4830.00	1334.57	1344.22	1346.36	1352.97	0.004258	23.74	203.44	21.14	1.35
Principle Outlet	10	PF 20	5065.00	1334.57	1344.54	1346.74	1353.55	0.004287	24.10	210.20	21.14	1.35
Principle Outlet	10	PF 21	5155.00	1334.57	1344.66	1346.86	1353.77	0.004299	24.23	212.76	21.14	1.35
Principle Outlet	10	PF 22	5245.00	1334.57	1344.78	1347.01	1353.99	0.004311	24.36	215.30	21.14	1.35
Principle Outlet	9	PF 1	156.00	1334.18	1334.84	1335.38	1336.80	0.016078	11.23	13.90	21.71	2.47
Principle Outlet	9	PF 2	340.00	1334.18	1335.40	1336.17	1338.07	0.010174	13.11	25.93	21.71	2.11
Principle Outlet	9	PF 3	398.00	1334.18	1335.55	1336.39	1338.42	0.009422	13.58	29.31	21.71	2.06
Principle Outlet	9	PF 4	591.00	1334.18	1336.04	1337.06	1339.45	0.007861	14.83	39.85	21.71	1.93
Principle Outlet	9	PF 5	822.00	1334.18	1336.57	1337.76	1340.55	0.006901	16.01	51.34	21.71	1.83
Principle Outlet	9	PF 6	1047.00	1334.18	1337.05	1338.38	1341.51	0.006334	16.95	61.79	21.71	1.77
Principle Outlet	9	PF 7	1275.00	1334.18	1337.50	1338.95	1342.42	0.005997	17.80	71.61	21.71	1.73
Principle Outlet	9	PF 8	1509.00	1334.18	1337.94	1339.52	1343.32	0.005783	18.61	81.08	21.71	1.70
Principle Outlet	9	PF 9	1765.00	1334.18	1338.39	1340.12	1344.24	0.005612	19.40	91.00	21.71	1.67
Principle Outlet	9	PF 10	2090.00	1334.18	1338.95	1340.82	1345.33	0.005450	20.28	103.08	21.71	1.64
Principle Outlet	9	PF 11	2337.00	1334.18	1339.36	1341.32	1346.13	0.005361	20.88	111.92	21.71	1.62

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	9	PF 12	2612.00	1334.18	1339.79	1341.87	1346.99	0.005306	21.53	121.30	21.71	1.61
Principle Outlet	9	PF 13	2870.00	1334.18	1340.20	1342.37	1347.75	0.005234	22.05	130.15	21.71	1.59
Principle Outlet	9	PF 14	3290.00	1334.18	1340.96	1343.16	1348.77	0.004901	22.43	146.65	21.71	1.52
Principle Outlet	9	PF 15	3575.00	1334.18	1341.36	1343.66	1349.58	0.004921	23.01	155.34	21.71	1.52
Principle Outlet	9	PF 16	3990.00	1334.18	1341.94	1344.39	1350.70	0.004920	23.74	168.06	21.71	1.50
Principle Outlet	9	PF 17	4280.00	1334.18	1342.33	1344.85	1351.46	0.004938	24.24	176.57	21.71	1.50
Principle Outlet	9	PF 18	4655.00	1334.18	1342.83	1345.48	1352.42	0.004962	24.85	187.35	21.71	1.49
Principle Outlet	9	PF 19	4830.00	1334.18	1343.06	1345.75	1352.86	0.004976	25.12	192.27	21.71	1.49
Principle Outlet	9	PF 20	5065.00	1334.18	1343.36	1346.13	1353.44	0.004996	25.48	198.79	21.71	1.48
Principle Outlet	9	PF 21	5155.00	1334.18	1343.47	1346.28	1353.66	0.005004	25.61	201.26	21.71	1.48
Principle Outlet	9	PF 22	5245.00	1334.18	1343.59	1346.42	1353.88	0.005013	25.75	203.71	21.71	1.48
Principle Outlet	8	PF 1	156.00	1333.64	1334.22	1334.82	1336.71	0.024516	12.65	12.33	22.29	3.00
Principle Outlet	8	PF 2	340.00	1333.64	1334.72	1335.61	1337.98	0.014431	14.49	23.46	22.29	2.49
Principle Outlet	8	PF 3	398.00	1333.64	1334.86	1335.82	1338.33	0.013150	14.94	26.64	22.29	2.41
Principle Outlet	8	PF 4	591.00	1333.64	1335.31	1336.46	1339.37	0.010604	16.18	36.53	22.29	2.23
Principle Outlet	8	PF 5	822.00	1333.64	1335.80	1337.15	1340.46	0.009021	17.32	47.45	22.29	2.09
Principle Outlet	8	PF 6	1047.00	1333.64	1336.24	1337.76	1341.42	0.008142	18.26	57.33	22.29	2.01
Principle Outlet	8	PF 7	1275.00	1333.64	1336.66	1338.34	1342.33	0.007583	19.11	66.72	22.29	1.95
Principle Outlet	8	PF 8	1509.00	1333.64	1337.07	1338.90	1343.23	0.007218	19.92	75.77	22.29	1.90
Principle Outlet	8	PF 9	1765.00	1333.64	1337.49	1339.48	1344.15	0.006922	20.70	85.27	22.29	1.86
Principle Outlet	8	PF 10	2090.00	1333.64	1338.01	1340.17	1345.25	0.006649	21.58	96.83	22.29	1.83
Principle Outlet	8	PF 11	2337.00	1333.64	1338.40	1340.68	1346.03	0.006476	22.17	105.39	22.29	1.80
Principle Outlet	8	PF 12	2612.00	1333.64	1338.80	1341.20	1346.89	0.006356	22.82	114.45	22.29	1.77
Principle Outlet	8	PF 13	2870.00	1333.64	1339.18	1341.70	1347.65	0.006243	23.36	122.88	22.29	1.75
Principle Outlet	8	PF 14	3290.00	1333.64	1339.87	1342.47	1348.67	0.005851	23.80	138.21	22.29	1.68
Principle Outlet	8	PF 15	3575.00	1333.64	1340.25	1342.94	1349.47	0.005833	24.37	146.68	22.29	1.67
Principle Outlet	8	PF 16	3990.00	1333.64	1340.80	1343.66	1350.58	0.005789	25.10	158.96	22.29	1.66
Principle Outlet	8	PF 17	4280.00	1333.64	1341.16	1344.15	1351.35	0.005791	25.61	167.09	22.29	1.65
Principle Outlet	8	PF 18	4655.00	1333.64	1341.64	1344.73	1352.30	0.005777	26.21	177.62	22.29	1.64
Principle Outlet	8	PF 19	4830.00	1333.64	1341.85	1345.03	1352.74	0.005779	26.48	182.40	22.29	1.63
Principle Outlet	8	PF 20	5065.00	1333.64	1342.14	1345.37	1353.31	0.005776	26.83	188.81	22.29	1.62
Principle Outlet	8	PF 21	5155.00	1333.64	1342.24	1345.52	1353.53	0.005781	26.96	191.18	22.29	1.62
Principle Outlet	8	PF 22	5245.00	1333.64	1342.35	1345.65	1353.75	0.005786	27.10	193.54	22.29	1.62
Principle Outlet	7	PF 1	156.00	1332.96	1333.47	1334.11	1336.58	0.036507	14.15	11.02	22.86	3.59
Principle Outlet	7	PF 2	340.00	1332.96	1333.92	1334.90	1337.88	0.020280	15.96	21.30	22.86	2.91
Principle Outlet	7	PF 3	398.00	1332.96	1334.05	1335.11	1338.23	0.018258	16.41	24.26	22.86	2.81
Principle Outlet	7	PF 4	591.00	1332.96	1334.46	1335.74	1339.27	0.014250	17.61	33.55	22.86	2.56

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	7	PF 5	822.00	1332.96	1334.91	1336.42	1340.35	0.011792	18.73	43.89	22.86	2.38
Principle Outlet	7	PF 6	1047.00	1332.96	1335.32	1337.03	1341.31	0.010430	19.65	53.29	22.86	2.27
Principle Outlet	7	PF 7	1275.00	1332.96	1335.71	1337.59	1342.23	0.009577	20.49	62.23	22.86	2.19
Principle Outlet	7	PF 8	1509.00	1332.96	1336.09	1338.12	1343.13	0.009000	21.29	70.89	22.86	2.13
Principle Outlet	7	PF 9	1765.00	1332.96	1336.49	1338.70	1344.04	0.008519	22.05	80.04	22.86	2.08
Principle Outlet	7	PF 10	2090.00	1332.96	1336.97	1339.38	1345.14	0.008092	22.94	91.11	22.86	2.02
Principle Outlet	7	PF 11	2337.00	1332.96	1337.34	1339.87	1345.92	0.007812	23.52	99.38	22.86	1.99
Principle Outlet	7	PF 12	2612.00	1332.96	1337.72	1340.37	1346.77	0.007598	24.15	108.17	22.86	1.96
Principle Outlet	7	PF 13	2870.00	1332.96	1338.08	1340.89	1347.53	0.007418	24.68	116.29	22.86	1.93
Principle Outlet	7	PF 14	3290.00	1332.96	1338.70	1341.64	1348.55	0.006951	25.18	130.64	22.86	1.86
Principle Outlet	7	PF 15	3575.00	1332.96	1339.06	1342.13	1349.35	0.006885	25.75	138.86	22.86	1.84
Principle Outlet	7	PF 16	3990.00	1332.96	1339.58	1342.80	1350.47	0.006790	26.48	150.69	22.86	1.82
Principle Outlet	7	PF 17	4280.00	1332.96	1339.93	1343.29	1351.23	0.006752	26.98	158.63	22.86	1.80
Principle Outlet	7	PF 18	4655.00	1332.96	1340.37	1343.89	1352.18	0.006698	27.57	168.85	22.86	1.79
Principle Outlet	7	PF 19	4830.00	1332.96	1340.58	1344.16	1352.61	0.006683	27.84	173.50	22.86	1.78
Principle Outlet	7	PF 20	5065.00	1332.96	1340.85	1344.52	1353.18	0.006660	28.18	179.71	22.86	1.77
Principle Outlet	7	PF 21	5155.00	1332.96	1340.95	1344.65	1353.41	0.006658	28.32	182.02	22.86	1.77
Principle Outlet	7	PF 22	5245.00	1332.96	1341.05	1344.79	1353.62	0.006656	28.46	184.32	22.86	1.77
Principle Outlet	6	PF 1	156.00	1331.73	1332.16	1332.86	1336.33	0.061602	16.38	9.52	23.67	4.55
Principle Outlet	6	PF 2	340.00	1331.73	1332.55	1333.63	1337.68	0.032192	18.18	18.70	23.67	3.61
Principle Outlet	6	PF 3	398.00	1331.73	1332.66	1333.82	1338.04	0.028532	18.61	21.38	23.67	3.45
Principle Outlet	6	PF 4	591.00	1331.73	1333.02	1334.44	1339.10	0.021429	19.79	29.87	23.67	3.10
Principle Outlet	6	PF 5	822.00	1331.73	1333.42	1335.11	1340.19	0.017170	20.87	39.39	23.67	2.85
Principle Outlet	6	PF 6	1047.00	1331.73	1333.79	1335.70	1341.14	0.014799	21.75	48.13	23.67	2.69
Principle Outlet	6	PF 7	1275.00	1331.73	1334.15	1336.22	1342.06	0.013308	22.57	56.49	23.67	2.57
Principle Outlet	6	PF 8	1509.00	1331.73	1334.49	1336.75	1342.95	0.012272	23.34	64.66	23.67	2.49
Principle Outlet	6	PF 9	1765.00	1331.73	1334.85	1337.33	1343.87	0.011436	24.09	73.27	23.67	2.41
Principle Outlet	6	PF 10	2090.00	1331.73	1335.30	1337.99	1344.96	0.010669	24.95	83.77	23.67	2.34
Principle Outlet	6	PF 11	2337.00	1331.73	1335.63	1338.47	1345.74	0.010188	25.51	91.60	23.67	2.29
Principle Outlet	6	PF 12	2612.00	1331.73	1335.98	1338.98	1346.59	0.009815	26.14	99.91	23.67	2.24
Principle Outlet	6	PF 13	2870.00	1331.73	1336.31	1339.48	1347.35	0.009501	26.67	107.61	23.67	2.20
Principle Outlet	6	PF 14	3290.00	1331.73	1336.87	1340.19	1348.36	0.008855	27.21	120.92	23.67	2.12
Principle Outlet	6	PF 15	3575.00	1331.73	1337.20	1340.69	1349.16	0.008695	27.76	128.79	23.67	2.10
Principle Outlet	6	PF 16	3990.00	1331.73	1337.68	1341.35	1350.27	0.008482	28.48	140.11	23.67	2.06
Principle Outlet	6	PF 17	4280.00	1331.73	1338.00	1341.82	1351.03	0.008377	28.97	147.74	23.67	2.04
Principle Outlet	6	PF 18	4655.00	1331.73	1338.41	1342.40	1351.97	0.008247	29.55	157.53	23.67	2.02
Principle Outlet	6	PF 19	4830.00	1331.73	1338.60	1342.68	1352.41	0.008207	29.83	161.94	23.67	2.01
Principle Outlet	6	PF 20	5065.00	1331.73	1338.85	1343.02	1352.99	0.008147	30.17	167.88	23.67	2.00

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	6	PF 21	5155.00	1331.73	1338.95	1343.16	1353.21	0.008132	30.31	170.10	23.67	1.99
Principle Outlet	6	PF 22	5245.00	1331.73	1339.04	1343.27	1353.43	0.008117	30.44	172.30	23.67	1.99
Principle Outlet	5.8*	PF 1	156.00	1329.62	1329.96	1330.71	1335.77	0.113625	19.34	8.07	24.94	5.99
Principle Outlet	5.8*	PF 2	340.00	1329.62	1330.28	1331.44	1337.30	0.056961	21.26	16.00	24.94	4.68
Principle Outlet	5.8*	PF 3	398.00	1329.62	1330.38	1331.63	1337.67	0.049708	21.67	18.37	24.94	4.45
Principle Outlet	5.8*	PF 4	591.00	1329.62	1330.68	1332.24	1338.76	0.035930	22.82	25.90	24.94	3.95
Principle Outlet	5.8*	PF 5	822.00	1329.62	1331.02	1332.87	1339.88	0.027843	23.88	34.42	24.94	3.58
Principle Outlet	5.8*	PF 6	1047.00	1329.62	1331.34	1333.45	1340.84	0.023374	24.74	42.32	24.94	3.35
Principle Outlet	5.8*	PF 7	1275.00	1329.62	1331.64	1333.97	1341.76	0.020518	25.52	49.96	24.94	3.18
Principle Outlet	5.8*	PF 8	1509.00	1329.62	1331.94	1334.50	1342.65	0.018534	26.26	57.46	24.94	3.05
Principle Outlet	5.8*	PF 9	1765.00	1329.62	1332.26	1335.03	1343.57	0.016942	26.99	65.40	24.94	2.94
Principle Outlet	5.8*	PF 10	2090.00	1329.62	1332.65	1335.68	1344.67	0.015482	27.82	75.13	24.94	2.82
Principle Outlet	5.8*	PF 11	2337.00	1329.62	1332.94	1336.14	1345.44	0.014596	28.37	82.38	24.94	2.75
Principle Outlet	5.8*	PF 12	2612.00	1329.62	1333.25	1336.65	1346.30	0.013868	28.98	90.13	24.94	2.69
Principle Outlet	5.8*	PF 13	2870.00	1329.62	1333.54	1337.10	1347.05	0.013280	29.50	97.30	24.94	2.63
Principle Outlet	5.8*	PF 14	3290.00	1329.62	1334.03	1337.80	1348.06	0.012264	30.06	109.44	24.94	2.53
Principle Outlet	5.8*	PF 15	3575.00	1329.62	1334.33	1338.26	1348.86	0.011915	30.60	116.85	24.94	2.49
Principle Outlet	5.8*	PF 16	3990.00	1329.62	1334.75	1338.92	1349.97	0.011480	31.31	127.45	24.94	2.44
Principle Outlet	5.8*	PF 17	4280.00	1329.62	1335.04	1339.36	1350.72	0.011232	31.78	134.68	24.94	2.41
Principle Outlet	5.8*	PF 18	4655.00	1329.62	1335.41	1339.93	1351.66	0.010950	32.35	143.90	24.94	2.37
Principle Outlet	5.8*	PF 19	4830.00	1329.62	1335.58	1340.16	1352.10	0.010846	32.62	148.09	24.94	2.36
Principle Outlet	5.8*	PF 20	5065.00	1329.62	1335.80	1340.52	1352.67	0.010707	32.95	153.70	24.94	2.34
Principle Outlet	5.8*	PF 21	5155.00	1329.62	1335.89	1340.64	1352.89	0.010663	33.09	155.81	24.94	2.33
Principle Outlet	5.8*	PF 22	5245.00	1329.62	1335.97	1340.77	1353.10	0.010620	33.22	157.91	24.94	2.33
Principle Outlet	5.6*	PF 1	156.00	1327.50	1327.80	1328.55	1335.00	0.172659	21.54	7.24	26.20	7.22
Principle Outlet	5.6*	PF 2	340.00	1327.50	1331.74	1329.27	1331.89	0.000131	3.08	110.51	26.20	0.26
Principle Outlet	5.6*	PF 3	398.00	1327.50	1332.13	1329.45	1332.30	0.000138	3.29	120.89	26.20	0.27
Principle Outlet	5.6*	PF 4	591.00	1327.50	1333.28	1330.03	1333.52	0.000157	3.91	150.99	26.20	0.29
Principle Outlet	5.6*	PF 5	822.00	1327.50	1334.62	1330.66	1334.92	0.000166	4.42	186.04	26.20	0.29
Principle Outlet	5.6*	PF 6	1047.00	1327.50	1335.54	1331.19	1335.93	0.000191	4.98	210.17	26.20	0.31
Principle Outlet	5.6*	PF 7	1275.00	1327.50	1336.24	1331.72	1336.72	0.000224	5.58	228.44	26.20	0.33
Principle Outlet	5.6*	PF 8	1509.00	1327.50	1336.84	1332.22	1337.43	0.000260	6.18	244.15	26.20	0.36
Principle Outlet	5.6*	PF 9	1765.00	1327.50	1329.81	1332.74	1343.27	0.023236	29.44	59.95	26.20	3.43
Principle Outlet	5.6*	PF 10	2090.00	1327.50	1330.16	1333.36	1344.37	0.020927	30.25	69.08	26.20	3.28
Principle Outlet	5.6*	PF 11	2337.00	1327.50	1330.42	1333.78	1345.14	0.019539	30.79	75.90	26.20	3.19
Principle Outlet	5.6*	PF 12	2612.00	1327.50	1330.70	1334.30	1346.00	0.018390	31.39	83.21	26.20	3.10
Principle Outlet	5.6*	PF 13	2870.00	1327.50	1330.95	1334.74	1346.75	0.017469	31.90	89.98	26.20	3.03

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	5.6*	PF 14	3290.00	1327.50	1331.39	1335.36	1347.76	0.016000	32.48	101.31	26.20	2.91
Principle Outlet	5.6*	PF 15	3575.00	1327.50	1331.66	1335.87	1348.56	0.015422	33.00	108.35	26.20	2.86
Principle Outlet	5.6*	PF 16	3990.00	1327.50	1332.04	1336.50	1349.67	0.014711	33.69	118.42	26.20	2.79
Principle Outlet	5.6*	PF 17	4280.00	1327.50	1332.30	1336.93	1350.42	0.014301	34.16	125.30	26.20	2.75
Principle Outlet	5.6*	PF 18	4655.00	1327.50	1332.64	1337.47	1351.36	0.013840	34.72	134.07	26.20	2.70
Principle Outlet	5.6*	PF 19	4830.00	1327.50	1332.79	1337.71	1351.79	0.013662	34.98	138.06	26.20	2.69
Principle Outlet	5.6*	PF 20	5065.00	1327.50	1332.99	1338.03	1352.36	0.013430	35.32	143.42	26.20	2.66
Principle Outlet	5.6*	PF 21	5155.00	1327.50	1333.07	1338.18	1352.58	0.013352	35.45	145.44	26.20	2.65
Principle Outlet	5.6*	PF 22	5245.00	1327.50	1333.15	1338.29	1352.80	0.013278	35.57	147.44	26.20	2.64
Principle Outlet	5.4*	PF 1	156.00	1325.39	1330.21	1326.40	1330.23	0.000017	1.18	131.91	27.47	0.10
Principle Outlet	5.4*	PF 2	340.00	1325.39	1331.80	1327.09	1331.86	0.000034	1.94	175.66	27.47	0.13
Principle Outlet	5.4*	PF 3	398.00	1325.39	1332.20	1327.27	1332.27	0.000039	2.13	186.72	27.47	0.14
Principle Outlet	5.4*	PF 4	591.00	1325.39	1333.37	1327.85	1333.48	0.000055	2.70	218.79	27.47	0.17
Principle Outlet	5.4*	PF 5	822.00	1325.39	1334.72	1328.44	1334.88	0.000068	3.21	255.89	27.47	0.19
Principle Outlet	5.4*	PF 6	1047.00	1325.39	1335.66	1328.96	1335.88	0.000085	3.72	281.73	27.47	0.20
Principle Outlet	5.4*	PF 7	1275.00	1325.39	1336.38	1329.47	1336.66	0.000105	4.23	301.55	27.47	0.22
Principle Outlet	5.4*	PF 8	1509.00	1325.39	1337.01	1329.96	1337.36	0.000126	4.73	318.78	27.47	0.24
Principle Outlet	5.4*	PF 9	1765.00	1325.39	1337.64	1330.45	1338.07	0.000149	5.25	336.19	27.47	0.26
Principle Outlet	5.4*	PF 10	2090.00	1325.39	1338.36	1331.06	1338.89	0.000179	5.88	355.74	27.47	0.29
Principle Outlet	5.4*	PF 11	2337.00	1325.39	1338.85	1331.49	1339.47	0.000203	6.33	369.37	27.47	0.30
Principle Outlet	5.4*	PF 12	2612.00	1325.39	1339.37	1331.97	1340.09	0.000229	6.81	383.62	27.47	0.32
Principle Outlet	5.4*	PF 13	2870.00	1325.39	1339.84	1332.40	1340.65	0.000253	7.24	396.43	27.47	0.34
Principle Outlet	5.4*	PF 14	3290.00	1325.39	1340.56	1333.05	1341.53	0.000293	7.91	416.16	27.47	0.36
Principle Outlet	5.4*	PF 15	3575.00	1325.39	1341.02	1333.50	1342.10	0.000320	8.34	428.87	27.47	0.37
Principle Outlet	5.4*	PF 16	3990.00	1325.39	1341.65	1334.11	1342.89	0.000359	8.94	446.30	27.47	0.39
Principle Outlet	5.4*	PF 17	4280.00	1325.39	1329.70	1334.52	1350.12	0.017648	36.26	118.03	27.47	3.08
Principle Outlet	5.4*	PF 18	4655.00	1325.39	1330.01	1335.05	1351.05	0.016967	36.81	126.46	27.47	3.02
Principle Outlet	5.4*	PF 19	4830.00	1325.39	1330.15	1335.29	1351.48	0.016698	37.07	130.30	27.47	3.00
Principle Outlet	5.4*	PF 20	5065.00	1325.39	1330.34	1335.58	1352.06	0.016370	37.40	135.42	27.47	2.97
Principle Outlet	5.4*	PF 21	5155.00	1325.39	1330.41	1335.73	1352.28	0.016254	37.53	137.35	27.47	2.96
Principle Outlet	5.4*	PF 22	5245.00	1325.39	1330.48	1335.85	1352.50	0.016142	37.66	139.28	27.47	2.95
Principle Outlet	5.2*	PF 1	156.00	1323.27	1330.22	1324.25	1330.23	0.000005	0.78	199.26	28.73	0.05
Principle Outlet	5.2*	PF 2	340.00	1323.27	1331.82	1324.91	1331.85	0.000013	1.39	245.33	28.73	0.08
Principle Outlet	5.2*	PF 3	398.00	1323.27	1332.23	1325.09	1332.26	0.000016	1.55	257.00	28.73	0.09
Principle Outlet	5.2*	PF 4	591.00	1323.27	1333.40	1325.65	1333.47	0.000025	2.03	290.86	28.73	0.11
Principle Outlet	5.2*	PF 5	822.00	1323.27	1334.77	1326.21	1334.86	0.000034	2.49	329.96	28.73	0.13
Principle Outlet	5.2*	PF 6	1047.00	1323.27	1335.72	1326.74	1335.85	0.000045	2.93	357.32	28.73	0.15

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	5.2*	PF 7	1275.00	1323.27	1336.45	1327.23	1336.63	0.000057	3.37	378.46	28.73	0.16
Principle Outlet	5.2*	PF 8	1509.00	1323.27	1337.10	1327.70	1337.32	0.000070	3.80	396.92	28.73	0.18
Principle Outlet	5.2*	PF 9	1765.00	1323.27	1337.75	1328.18	1338.03	0.000084	4.25	415.61	28.73	0.20
Principle Outlet	5.2*	PF 10	2090.00	1323.27	1338.48	1328.77	1338.84	0.000104	4.79	436.70	28.73	0.22
Principle Outlet	5.2*	PF 11	2337.00	1323.27	1338.99	1329.17	1339.41	0.000119	5.18	451.46	28.73	0.23
Principle Outlet	5.2*	PF 12	2612.00	1323.27	1339.53	1329.66	1340.02	0.000136	5.59	466.95	28.73	0.24
Principle Outlet	5.2*	PF 13	2870.00	1323.27	1340.02	1330.06	1340.57	0.000152	5.97	480.88	28.73	0.26
Principle Outlet	5.2*	PF 14	3290.00	1323.27	1340.77	1330.71	1341.43	0.000178	6.55	502.40	28.73	0.28
Principle Outlet	5.2*	PF 15	3575.00	1323.27	1341.25	1331.13	1342.00	0.000196	6.92	516.29	28.73	0.29
Principle Outlet	5.2*	PF 16	3990.00	1323.27	1341.92	1331.73	1342.78	0.000222	7.45	535.40	28.73	0.30
Principle Outlet	5.2*	PF 17	4280.00	1323.27	1342.35	1332.13	1343.29	0.000241	7.81	547.72	28.73	0.32
Principle Outlet	5.2*	PF 18	4655.00	1323.27	1342.89	1332.64	1343.95	0.000265	8.26	563.38	28.73	0.33
Principle Outlet	5.2*	PF 19	4830.00	1323.27	1343.13	1332.83	1344.25	0.000277	8.47	570.37	28.73	0.33
Principle Outlet	5.2*	PF 20	5065.00	1323.27	1343.46	1333.18	1344.65	0.000292	8.74	579.81	28.73	0.34
Principle Outlet	5.2*	PF 21	5155.00	1323.27	1343.58	1333.31	1344.80	0.000298	8.84	583.35	28.73	0.35
Principle Outlet	5.2*	PF 22	5245.00	1323.27	1343.71	1333.42	1344.95	0.000303	8.94	586.85	28.73	0.35
Principle Outlet	5	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.71	30.00	0.03
Principle Outlet	5	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	319.99	30.00	0.06
Principle Outlet	5	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.23	30.00	0.06
Principle Outlet	5	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.77	30.00	0.08
Principle Outlet	5	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.80	30.00	0.10
Principle Outlet	5	PF 6	1047.00	1321.15	1335.75	1324.53	1335.84	0.000026	2.39	437.60	30.00	0.11
Principle Outlet	5	PF 7	1275.00	1321.15	1336.49	1325.00	1336.61	0.000034	2.77	459.93	30.00	0.12
Principle Outlet	5	PF 8	1509.00	1321.15	1337.15	1325.45	1337.30	0.000042	3.15	479.49	30.00	0.14
Principle Outlet	5	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.33	30.00	0.15
Principle Outlet	5	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.78	30.00	0.17
Principle Outlet	5	PF 11	2337.00	1321.15	1339.08	1326.90	1339.37	0.000075	4.35	537.53	30.00	0.18
Principle Outlet	5	PF 12	2612.00	1321.15	1339.63	1327.36	1339.98	0.000087	4.71	554.08	30.00	0.19
Principle Outlet	5	PF 13	2870.00	1321.15	1340.13	1327.75	1340.52	0.000098	5.04	568.99	30.00	0.20
Principle Outlet	5	PF 14	3290.00	1321.15	1340.90	1328.35	1341.38	0.000116	5.56	592.05	30.00	0.22
Principle Outlet	5	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.95	30.00	0.23
Principle Outlet	5	PF 16	3990.00	1321.15	1342.08	1329.35	1342.71	0.000147	6.36	627.51	30.00	0.25
Principle Outlet	5	PF 17	4280.00	1321.15	1342.52	1329.77	1343.22	0.000160	6.68	640.81	30.00	0.25
Principle Outlet	5	PF 18	4655.00	1321.15	1343.09	1330.24	1343.86	0.000177	7.08	657.72	30.00	0.27
Principle Outlet	5	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.29	30.00	0.27
Principle Outlet	5	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.49	30.00	0.28
Principle Outlet	5	PF 21	5155.00	1321.15	1343.81	1330.90	1344.70	0.000200	7.59	679.32	30.00	0.28
Principle Outlet	5	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.12	30.00	0.28

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.94285*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.94285*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.94285*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.94285*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.94285*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.84	30.00	0.10
Principle Outlet	4.94285*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.64	30.00	0.11
Principle Outlet	4.94285*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.97	30.00	0.12
Principle Outlet	4.94285*	PF 8	1509.00	1321.15	1337.15	1325.44	1337.30	0.000042	3.15	479.53	30.00	0.14
Principle Outlet	4.94285*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.37	30.00	0.15
Principle Outlet	4.94285*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.82	30.00	0.17
Principle Outlet	4.94285*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.56	30.00	0.18
Principle Outlet	4.94285*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.12	30.00	0.19
Principle Outlet	4.94285*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	569.02	30.00	0.20
Principle Outlet	4.94285*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.08	30.00	0.22
Principle Outlet	4.94285*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.98	30.00	0.23
Principle Outlet	4.94285*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.71	0.000147	6.36	627.54	30.00	0.24
Principle Outlet	4.94285*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.84	30.00	0.25
Principle Outlet	4.94285*	PF 18	4655.00	1321.15	1343.09	1330.25	1343.86	0.000177	7.08	657.74	30.00	0.27
Principle Outlet	4.94285*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.31	30.00	0.27
Principle Outlet	4.94285*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.51	30.00	0.28
Principle Outlet	4.94285*	PF 21	5155.00	1321.15	1343.81	1330.90	1344.70	0.000200	7.59	679.34	30.00	0.28
Principle Outlet	4.94285*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.13	30.00	0.28
Principle Outlet	4.88571*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.88571*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.88571*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.88571*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.88571*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.84	30.00	0.10
Principle Outlet	4.88571*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.64	30.00	0.11
Principle Outlet	4.88571*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.97	30.00	0.12
Principle Outlet	4.88571*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.53	30.00	0.14
Principle Outlet	4.88571*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.36	30.00	0.15
Principle Outlet	4.88571*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.81	30.00	0.17
Principle Outlet	4.88571*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.55	30.00	0.18
Principle Outlet	4.88571*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.11	30.00	0.19
Principle Outlet	4.88571*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	569.01	30.00	0.20
Principle Outlet	4.88571*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.06	30.00	0.22
Principle Outlet	4.88571*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.96	30.00	0.23

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.88571*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.71	0.000147	6.36	627.52	30.00	0.25
Principle Outlet	4.88571*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.81	30.00	0.25
Principle Outlet	4.88571*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.71	30.00	0.27
Principle Outlet	4.88571*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.28	30.00	0.27
Principle Outlet	4.88571*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.48	30.00	0.28
Principle Outlet	4.88571*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.31	30.00	0.28
Principle Outlet	4.88571*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.10	30.00	0.28
Principle Outlet	4.82857*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.82857*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.82857*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.82857*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.82857*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.82857*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.82857*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.82857*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.52	30.00	0.14
Principle Outlet	4.82857*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.35	30.00	0.15
Principle Outlet	4.82857*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.81	30.00	0.17
Principle Outlet	4.82857*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.54	30.00	0.18
Principle Outlet	4.82857*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.10	30.00	0.19
Principle Outlet	4.82857*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.99	30.00	0.20
Principle Outlet	4.82857*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.05	30.00	0.22
Principle Outlet	4.82857*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.94	30.00	0.23
Principle Outlet	4.82857*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.50	30.00	0.25
Principle Outlet	4.82857*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.79	30.00	0.25
Principle Outlet	4.82857*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.69	30.00	0.27
Principle Outlet	4.82857*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.15	0.000185	7.26	665.26	30.00	0.27
Principle Outlet	4.82857*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.45	30.00	0.28
Principle Outlet	4.82857*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.28	30.00	0.28
Principle Outlet	4.82857*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.08	30.00	0.28
Principle Outlet	4.77142*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.77142*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.77142*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.77142*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.77142*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.77142*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.77142*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.77142*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.51	30.00	0.14

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.77142*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.35	30.00	0.15
Principle Outlet	4.77142*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.80	30.00	0.17
Principle Outlet	4.77142*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.53	30.00	0.18
Principle Outlet	4.77142*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.08	30.00	0.19
Principle Outlet	4.77142*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.98	30.00	0.20
Principle Outlet	4.77142*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.37	0.000116	5.56	592.03	30.00	0.22
Principle Outlet	4.77142*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.93	30.00	0.23
Principle Outlet	4.77142*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.47	30.00	0.25
Principle Outlet	4.77142*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.77	30.00	0.25
Principle Outlet	4.77142*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.66	30.00	0.27
Principle Outlet	4.77142*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.23	30.00	0.27
Principle Outlet	4.77142*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.42	30.00	0.28
Principle Outlet	4.77142*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.25	30.00	0.28
Principle Outlet	4.77142*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	683.05	30.00	0.28
Principle Outlet	4.71428*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.71428*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.71428*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.71428*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.71428*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.71428*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.71428*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.71428*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.51	30.00	0.14
Principle Outlet	4.71428*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.34	30.00	0.15
Principle Outlet	4.71428*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.79	30.00	0.17
Principle Outlet	4.71428*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.52	30.00	0.18
Principle Outlet	4.71428*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.97	0.000087	4.71	554.07	30.00	0.19
Principle Outlet	4.71428*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.96	30.00	0.20
Principle Outlet	4.71428*	PF 14	3290.00	1321.15	1340.89	1328.38	1341.37	0.000116	5.56	592.02	30.00	0.22
Principle Outlet	4.71428*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.91	30.00	0.23
Principle Outlet	4.71428*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.45	30.00	0.25
Principle Outlet	4.71428*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.75	30.00	0.25
Principle Outlet	4.71428*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.64	30.00	0.27
Principle Outlet	4.71428*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.20	30.00	0.27
Principle Outlet	4.71428*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.40	30.00	0.28
Principle Outlet	4.71428*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.22	30.00	0.28
Principle Outlet	4.71428*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	683.02	30.00	0.28
Principle Outlet	4.65714*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.65714*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.65714*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.65714*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.65714*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.82	30.00	0.10
Principle Outlet	4.65714*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.62	30.00	0.11
Principle Outlet	4.65714*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.95	30.00	0.12
Principle Outlet	4.65714*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.50	30.00	0.14
Principle Outlet	4.65714*	PF 9	1765.00	1321.15	1337.80	1325.91	1338.00	0.000052	3.53	499.33	30.00	0.15
Principle Outlet	4.65714*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.78	30.00	0.17
Principle Outlet	4.65714*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.51	30.00	0.18
Principle Outlet	4.65714*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.97	0.000087	4.71	554.06	30.00	0.19
Principle Outlet	4.65714*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.95	30.00	0.20
Principle Outlet	4.65714*	PF 14	3290.00	1321.15	1340.89	1328.38	1341.37	0.000116	5.56	592.01	30.00	0.22
Principle Outlet	4.65714*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.89	30.00	0.23
Principle Outlet	4.65714*	PF 16	3990.00	1321.15	1342.07	1329.36	1342.70	0.000147	6.36	627.43	30.00	0.25
Principle Outlet	4.65714*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.73	30.00	0.25
Principle Outlet	4.65714*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.61	30.00	0.27
Principle Outlet	4.65714*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.18	30.00	0.27
Principle Outlet	4.65714*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.37	30.00	0.28
Principle Outlet	4.65714*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.69	0.000200	7.59	679.19	30.00	0.28
Principle Outlet	4.65714*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	682.99	30.00	0.28
Principle Outlet	4.6	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.71	30.00	0.03
Principle Outlet	4.6	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	319.99	30.00	0.06
Principle Outlet	4.6	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.23	30.00	0.06
Principle Outlet	4.6	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.77	30.00	0.08
Principle Outlet	4.6	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.78	30.00	0.10
Principle Outlet	4.6	PF 6	1047.00	1321.15	1335.75	1324.53	1335.84	0.000026	2.39	437.57	30.00	0.11
Principle Outlet	4.6	PF 7	1275.00	1321.15	1336.49	1325.00	1336.61	0.000034	2.77	459.91	30.00	0.12
Principle Outlet	4.6	PF 8	1509.00	1321.15	1337.14	1325.45	1337.30	0.000042	3.15	479.45	30.00	0.14
Principle Outlet	4.6	PF 9	1765.00	1321.15	1337.80	1325.91	1338.00	0.000052	3.54	499.28	30.00	0.15
Principle Outlet	4.6	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.73	30.00	0.17
Principle Outlet	4.6	PF 11	2337.00	1321.15	1339.08	1326.90	1339.37	0.000075	4.35	537.45	30.00	0.18
Principle Outlet	4.6	PF 12	2612.00	1321.15	1339.63	1327.36	1339.97	0.000087	4.71	554.00	30.00	0.19
Principle Outlet	4.6	PF 13	2870.00	1321.15	1340.13	1327.75	1340.52	0.000098	5.04	568.89	30.00	0.20
Principle Outlet	4.6	PF 14	3290.00	1321.15	1340.89	1328.35	1341.37	0.000116	5.56	591.94	30.00	0.22
Principle Outlet	4.6	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.82	30.00	0.23
Principle Outlet	4.6	PF 16	3990.00	1321.15	1342.07	1329.35	1342.70	0.000147	6.36	627.36	30.00	0.25
Principle Outlet	4.6	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.66	30.00	0.25

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.6	PF 18	4655.00	1321.15	1343.08	1330.24	1343.86	0.000177	7.08	657.54	30.00	0.27
Principle Outlet	4.6	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.11	30.00	0.27
Principle Outlet	4.6	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.29	30.00	0.28
Principle Outlet	4.6	PF 21	5155.00	1321.15	1343.80	1330.90	1344.69	0.000200	7.59	679.11	30.00	0.28
Principle Outlet	4.6	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	682.91	30.00	0.28
Principle Outlet	4.5	PF 1	156.00	1321.15	1330.22	1322.67	1330.22	0.000007	0.69	226.44	30.00	0.04
Principle Outlet	4.5	PF 2	340.00	1321.15	1331.82	1323.69	1331.85	0.000020	1.24	274.58	30.00	0.07
Principle Outlet	4.5	PF 3	398.00	1321.15	1332.23	1324.44	1332.26	0.000024	1.39	286.77	30.00	0.08
Principle Outlet	4.5	PF 4	591.00	1321.15	1333.41	1324.96	1333.46	0.000037	1.83	322.17	30.00	0.10
Principle Outlet	4.5	PF 5	822.00	1321.15	1334.77	1325.52	1334.85	0.000050	2.26	363.02	30.00	0.11
Principle Outlet	4.5	PF 6	1047.00	1321.15	1335.72	1326.04	1335.83	0.000065	2.67	391.64	30.00	0.13
Principle Outlet	4.5	PF 7	1275.00	1321.15	1336.46	1326.51	1336.61	0.000082	3.08	413.77	30.00	0.15
Principle Outlet	4.5	PF 8	1509.00	1321.15	1337.11	1326.97	1337.29	0.000100	3.48	433.10	30.00	0.16
Principle Outlet	4.5	PF 9	1765.00	1321.15	1337.76	1327.44	1337.99	0.000121	3.90	452.69	30.00	0.18
Principle Outlet	4.5	PF 10	2090.00	1321.15	1338.50	1328.00	1338.80	0.000147	4.40	474.82	30.00	0.19
Principle Outlet	4.5	PF 11	2337.00	1321.15	1339.01	1328.40	1339.36	0.000168	4.77	490.29	30.00	0.21
Principle Outlet	4.5	PF 12	2612.00	1321.15	1339.55	1328.86	1339.97	0.000191	5.16	506.57	30.00	0.22
Principle Outlet	4.5	PF 13	2870.00	1321.15	1340.04	1329.25	1340.51	0.000212	5.51	521.19	30.00	0.23
Principle Outlet	4.5	PF 14	3290.00	1321.15	1340.80	1329.89	1341.36	0.000247	6.05	543.81	30.00	0.25
Principle Outlet	4.5	PF 15	3575.00	1321.15	1341.28	1330.29	1341.92	0.000271	6.40	558.40	30.00	0.26
Principle Outlet	4.5	PF 16	3990.00	1321.15	1341.95	1330.86	1342.69	0.000305	6.90	578.50	30.00	0.28
Principle Outlet	4.5	PF 17	4280.00	1321.15	1342.39	1331.25	1343.20	0.000330	7.24	591.49	30.00	0.29
Principle Outlet	4.5	PF 18	4655.00	1321.15	1342.93	1331.77	1343.84	0.000361	7.66	607.97	30.00	0.30
Principle Outlet	4.5	PF 19	4830.00	1321.15	1343.18	1331.99	1344.14	0.000376	7.85	615.35	30.00	0.31
Principle Outlet	4.5	PF 20	5065.00	1321.15	1343.51	1332.29	1344.53	0.000395	8.10	625.28	30.00	0.31
Principle Outlet	4.5	PF 21	5155.00	1321.15	1343.64	1332.41	1344.68	0.000402	8.20	629.01	30.00	0.32
Principle Outlet	4.5	PF 22	5245.00	1321.15	1343.76	1332.51	1344.83	0.000410	8.29	632.71	30.00	0.32
Principle Outlet	4.4	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.69	30.00	0.03
Principle Outlet	4.4	PF 2	340.00	1321.15	1331.83	1322.75	1331.84	0.000006	1.06	319.91	30.00	0.06
Principle Outlet	4.4	PF 3	398.00	1321.15	1332.23	1322.93	1332.26	0.000008	1.20	332.13	30.00	0.06
Principle Outlet	4.4	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.62	30.00	0.08
Principle Outlet	4.4	PF 5	822.00	1321.15	1334.78	1324.03	1334.84	0.000019	2.01	408.57	30.00	0.10
Principle Outlet	4.4	PF 6	1047.00	1321.15	1335.74	1324.53	1335.83	0.000026	2.39	437.30	30.00	0.11
Principle Outlet	4.4	PF 7	1275.00	1321.15	1336.48	1325.00	1336.60	0.000034	2.77	459.55	30.00	0.12
Principle Outlet	4.4	PF 8	1509.00	1321.15	1337.13	1325.45	1337.28	0.000042	3.15	479.01	30.00	0.14
Principle Outlet	4.4	PF 9	1765.00	1321.15	1337.79	1325.91	1337.98	0.000052	3.54	498.75	30.00	0.15
Principle Outlet	4.4	PF 10	2090.00	1321.15	1338.53	1326.49	1338.78	0.000065	4.01	521.09	30.00	0.17

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.4	PF 11	2337.00	1321.15	1339.05	1326.90	1339.35	0.000075	4.35	536.71	30.00	0.18
Principle Outlet	4.4	PF 12	2612.00	1321.15	1339.60	1327.36	1339.95	0.000087	4.72	553.15	30.00	0.19
Principle Outlet	4.4	PF 13	2870.00	1321.15	1340.09	1327.75	1340.49	0.000098	5.05	567.93	30.00	0.20
Principle Outlet	4.4	PF 14	3290.00	1321.15	1340.86	1328.35	1341.34	0.000116	5.57	590.82	30.00	0.22
Principle Outlet	4.4	PF 15	3575.00	1321.15	1341.35	1328.78	1341.89	0.000129	5.90	605.58	30.00	0.23
Principle Outlet	4.4	PF 16	3990.00	1321.15	1342.03	1329.35	1342.66	0.000148	6.37	625.95	30.00	0.25
Principle Outlet	4.4	PF 17	4280.00	1321.15	1342.47	1329.77	1343.16	0.000161	6.70	639.12	30.00	0.26
Principle Outlet	4.4	PF 18	4655.00	1321.15	1343.02	1330.24	1343.81	0.000178	7.10	655.84	30.00	0.27
Principle Outlet	4.4	PF 19	4830.00	1321.15	1343.27	1330.48	1344.10	0.000186	7.28	663.33	30.00	0.27
Principle Outlet	4.4	PF 20	5065.00	1321.15	1343.61	1330.78	1344.49	0.000197	7.52	673.41	30.00	0.28
Principle Outlet	4.4	PF 21	5155.00	1321.15	1343.73	1330.90	1344.63	0.000202	7.61	677.19	30.00	0.28
Principle Outlet	4.4	PF 22	5245.00	1321.15	1343.86	1331.00	1344.78	0.000206	7.70	680.95	30.00	0.28
Principle Outlet	4.3	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.69	30.00	0.03
Principle Outlet	4.3	PF 2	340.00	1321.15	1331.83	1322.75	1331.84	0.000006	1.06	319.91	30.00	0.06
Principle Outlet	4.3	PF 3	398.00	1321.15	1332.23	1322.93	1332.26	0.000008	1.20	332.13	30.00	0.06
Principle Outlet	4.3	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.62	30.00	0.08
Principle Outlet	4.3	PF 5	822.00	1321.15	1334.78	1324.03	1334.84	0.000019	2.01	408.56	30.00	0.10
Principle Outlet	4.3	PF 6	1047.00	1321.15	1335.74	1324.53	1335.83	0.000026	2.39	437.29	30.00	0.11
Principle Outlet	4.3	PF 7	1275.00	1321.15	1336.48	1325.00	1336.60	0.000034	2.77	459.55	30.00	0.12
Principle Outlet	4.3	PF 8	1509.00	1321.15	1337.13	1325.45	1337.28	0.000042	3.15	479.00	30.00	0.14
Principle Outlet	4.3	PF 9	1765.00	1321.15	1337.79	1325.91	1337.98	0.000052	3.54	498.74	30.00	0.15
Principle Outlet	4.3	PF 10	2090.00	1321.15	1338.53	1326.49	1338.78	0.000065	4.01	521.07	30.00	0.17
Principle Outlet	4.3	PF 11	2337.00	1321.15	1339.05	1326.90	1339.35	0.000075	4.35	536.69	30.00	0.18
Principle Outlet	4.3	PF 12	2612.00	1321.15	1339.60	1327.36	1339.95	0.000087	4.72	553.14	30.00	0.19
Principle Outlet	4.3	PF 13	2870.00	1321.15	1340.09	1327.75	1340.49	0.000098	5.05	567.91	30.00	0.20
Principle Outlet	4.3	PF 14	3290.00	1321.15	1340.86	1328.35	1341.34	0.000116	5.57	590.79	30.00	0.22
Principle Outlet	4.3	PF 15	3575.00	1321.15	1341.35	1328.78	1341.89	0.000129	5.90	605.56	30.00	0.23
Principle Outlet	4.3	PF 16	3990.00	1321.15	1342.03	1329.35	1342.66	0.000148	6.37	625.91	30.00	0.25
Principle Outlet	4.3	PF 17	4280.00	1321.15	1342.46	1329.77	1343.16	0.000161	6.70	639.08	30.00	0.26
Principle Outlet	4.3	PF 18	4655.00	1321.15	1343.02	1330.24	1343.80	0.000178	7.10	655.80	30.00	0.27
Principle Outlet	4.3	PF 19	4830.00	1321.15	1343.27	1330.48	1344.09	0.000186	7.28	663.28	30.00	0.27
Principle Outlet	4.3	PF 20	5065.00	1321.15	1343.61	1330.78	1344.49	0.000197	7.52	673.36	30.00	0.28
Principle Outlet	4.3	PF 21	5155.00	1321.15	1343.73	1330.90	1344.63	0.000202	7.61	677.14	30.00	0.28
Principle Outlet	4.3	PF 22	5245.00	1321.15	1343.86	1331.00	1344.78	0.000206	7.70	680.90	30.00	0.28
Principle Outlet	4.2	PF 1	156.00	1321.17	1330.22	1322.67	1330.22	0.000007	0.69	226.41	30.00	0.04
Principle Outlet	4.2	PF 2	340.00	1321.17	1331.82	1323.68	1331.84	0.000018	1.24	274.50	30.00	0.07
Principle Outlet	4.2	PF 3	398.00	1321.17	1332.22	1324.44	1332.25	0.000021	1.39	286.68	30.00	0.08

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.2	PF 4	591.00	1321.17	1333.40	1324.97	1333.45	0.000033	1.84	322.01	30.00	0.10
Principle Outlet	4.2	PF 5	822.00	1321.17	1334.76	1325.52	1334.84	0.000045	2.27	362.81	30.00	0.11
Principle Outlet	4.2	PF 6	1047.00	1321.17	1335.71	1326.03	1335.83	0.000059	2.68	391.36	30.00	0.13
Principle Outlet	4.2	PF 7	1275.00	1321.17	1336.45	1326.51	1336.60	0.000075	3.08	413.42	30.00	0.15
Principle Outlet	4.2	PF 8	1509.00	1321.17	1337.09	1326.95	1337.28	0.000092	3.49	432.65	30.00	0.16
Principle Outlet	4.2	PF 9	1765.00	1321.17	1337.74	1327.43	1337.98	0.000111	3.90	452.15	30.00	0.18
Principle Outlet	4.2	PF 10	2090.00	1321.17	1338.47	1327.99	1338.78	0.000135	4.41	474.16	30.00	0.20
Principle Outlet	4.2	PF 11	2337.00	1321.17	1338.99	1328.41	1339.34	0.000155	4.77	489.53	30.00	0.21
Principle Outlet	4.2	PF 12	2612.00	1321.17	1339.52	1328.86	1339.94	0.000176	5.17	505.69	30.00	0.22
Principle Outlet	4.2	PF 13	2870.00	1321.17	1340.01	1329.25	1340.48	0.000196	5.52	520.20	30.00	0.23
Principle Outlet	4.2	PF 14	3290.00	1321.17	1340.76	1329.89	1341.33	0.000229	6.06	542.64	30.00	0.25
Principle Outlet	4.2	PF 15	3575.00	1321.17	1341.24	1330.26	1341.88	0.000251	6.42	557.11	30.00	0.26
Principle Outlet	4.2	PF 16	3990.00	1321.17	1341.90	1330.87	1342.65	0.000283	6.91	577.03	30.00	0.28
Principle Outlet	4.2	PF 17	4280.00	1321.17	1342.33	1331.26	1343.15	0.000306	7.26	589.88	30.00	0.29
Principle Outlet	4.2	PF 18	4655.00	1321.17	1342.88	1331.77	1343.79	0.000336	7.68	606.19	30.00	0.30
Principle Outlet	4.2	PF 19	4830.00	1321.17	1343.12	1332.00	1344.08	0.000350	7.87	613.48	30.00	0.31
Principle Outlet	4.2	PF 20	5065.00	1321.17	1343.45	1332.29	1344.47	0.000368	8.13	623.31	30.00	0.31
Principle Outlet	4.2	PF 21	5155.00	1321.17	1343.57	1332.41	1344.62	0.000375	8.22	626.99	30.00	0.32
Principle Outlet	4.2	PF 22	5245.00	1321.17	1343.69	1332.51	1344.76	0.000382	8.32	630.66	30.00	0.32
Principle Outlet	4.1	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.66	30.00	0.03
Principle Outlet	4.1	PF 2	340.00	1321.15	1331.82	1322.75	1331.84	0.000006	1.06	319.84	30.00	0.06
Principle Outlet	4.1	PF 3	398.00	1321.15	1332.23	1322.93	1332.25	0.000008	1.20	332.04	30.00	0.06
Principle Outlet	4.1	PF 4	591.00	1321.15	1333.41	1323.46	1333.45	0.000013	1.61	367.47	30.00	0.08
Principle Outlet	4.1	PF 5	822.00	1321.15	1334.77	1324.03	1334.84	0.000019	2.01	408.35	30.00	0.10
Principle Outlet	4.1	PF 6	1047.00	1321.15	1335.73	1324.53	1335.82	0.000026	2.40	437.02	30.00	0.11
Principle Outlet	4.1	PF 7	1275.00	1321.15	1336.47	1325.00	1336.59	0.000034	2.78	459.20	30.00	0.13
Principle Outlet	4.1	PF 8	1509.00	1321.15	1337.11	1325.45	1337.27	0.000042	3.15	478.57	30.00	0.14
Principle Outlet	4.1	PF 9	1765.00	1321.15	1337.77	1325.91	1337.96	0.000052	3.54	498.22	30.00	0.15
Principle Outlet	4.1	PF 10	2090.00	1321.15	1338.51	1326.49	1338.76	0.000065	4.02	520.42	30.00	0.17
Principle Outlet	4.1	PF 11	2337.00	1321.15	1339.03	1326.90	1339.32	0.000076	4.36	535.95	30.00	0.18
Principle Outlet	4.1	PF 12	2612.00	1321.15	1339.57	1327.36	1339.92	0.000087	4.73	552.28	30.00	0.19
Principle Outlet	4.1	PF 13	2870.00	1321.15	1340.06	1327.75	1340.46	0.000098	5.06	566.95	30.00	0.21
Principle Outlet	4.1	PF 14	3290.00	1321.15	1340.82	1328.35	1341.30	0.000117	5.58	589.66	30.00	0.22
Principle Outlet	4.1	PF 15	3575.00	1321.15	1341.31	1328.78	1341.85	0.000130	5.92	604.31	30.00	0.23
Principle Outlet	4.1	PF 16	3990.00	1321.15	1341.98	1329.35	1342.61	0.000148	6.39	624.49	30.00	0.25
Principle Outlet	4.1	PF 17	4280.00	1321.15	1342.41	1329.77	1343.11	0.000162	6.71	637.53	30.00	0.26
Principle Outlet	4.1	PF 18	4655.00	1321.15	1342.96	1330.24	1343.75	0.000179	7.12	654.08	30.00	0.27
Principle Outlet	4.1	PF 19	4830.00	1321.15	1343.21	1330.48	1344.04	0.000188	7.30	661.48	30.00	0.27

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.1	PF 20	5065.00	1321.15	1343.54	1330.78	1344.43	0.000199	7.54	671.46	30.00	0.28
Principle Outlet	4.1	PF 21	5155.00	1321.15	1343.67	1330.90	1344.57	0.000203	7.63	675.21	30.00	0.28
Principle Outlet	4.1	PF 22	5245.00	1321.15	1343.79	1331.00	1344.72	0.000207	7.73	678.92	30.00	0.29
Principle Outlet	4	PF 1	156.00	1321.18	1330.22	1322.14	1330.22	0.000002	0.58	270.58	30.00	0.03
Principle Outlet	4	PF 2	340.00	1321.18	1331.82	1322.79	1331.84	0.000006	1.07	318.75	30.00	0.06
Principle Outlet	4	PF 3	398.00	1321.18	1332.23	1322.96	1332.25	0.000008	1.20	330.95	30.00	0.06
Principle Outlet	4	PF 4	591.00	1321.18	1333.41	1323.49	1333.45	0.000013	1.61	366.37	30.00	0.08
Principle Outlet	4	PF 5	822.00	1321.18	1334.77	1324.07	1334.84	0.000019	2.02	407.25	30.00	0.10
Principle Outlet	4	PF 6	1047.00	1321.18	1335.73	1324.56	1335.82	0.000026	2.40	435.91	30.00	0.11
Principle Outlet	4	PF 7	1275.00	1321.18	1336.47	1325.04	1336.59	0.000034	2.78	458.08	30.00	0.13
Principle Outlet	4	PF 8	1509.00	1321.18	1337.11	1325.49	1337.27	0.000043	3.16	477.44	30.00	0.14
Principle Outlet	4	PF 9	1765.00	1321.18	1337.77	1325.97	1337.96	0.000053	3.55	497.08	30.00	0.15
Principle Outlet	4	PF 10	2090.00	1321.18	1338.51	1326.53	1338.76	0.000066	4.02	519.27	30.00	0.17
Principle Outlet	4	PF 11	2337.00	1321.18	1339.02	1326.94	1339.32	0.000076	4.37	534.79	30.00	0.18
Principle Outlet	4	PF 12	2612.00	1321.18	1339.57	1327.39	1339.92	0.000088	4.74	551.11	30.00	0.19
Principle Outlet	4	PF 13	2870.00	1321.18	1340.06	1327.76	1340.46	0.000099	5.07	565.77	30.00	0.21
Principle Outlet	4	PF 14	3290.00	1321.18	1340.81	1328.42	1341.30	0.000118	5.59	588.46	30.00	0.22
Principle Outlet	4	PF 15	3575.00	1321.18	1341.30	1328.82	1341.85	0.000130	5.93	603.09	30.00	0.23
Principle Outlet	4	PF 16	3990.00	1321.18	1341.97	1329.40	1342.61	0.000149	6.40	623.25	30.00	0.25
Principle Outlet	4	PF 17	4280.00	1321.18	1342.41	1329.80	1343.11	0.000163	6.73	636.28	30.00	0.26
Principle Outlet	4	PF 18	4655.00	1321.18	1342.96	1330.29	1343.75	0.000180	7.13	652.81	30.00	0.27
Principle Outlet	4	PF 19	4830.00	1321.18	1343.20	1330.52	1344.04	0.000189	7.32	660.20	30.00	0.27
Principle Outlet	4	PF 20	5065.00	1321.18	1343.54	1330.81	1344.42	0.000200	7.56	670.17	30.00	0.28
Principle Outlet	4	PF 21	5155.00	1321.18	1343.66	1330.93	1344.57	0.000204	7.65	673.91	30.00	0.28
Principle Outlet	4	PF 22	5245.00	1321.18	1343.79	1331.04	1344.72	0.000208	7.74	677.62	30.00	0.29
Principle Outlet	3	PF 1	156.00	1322.64	1330.21	1323.60	1330.22	0.000004	0.69	226.65	30.00	0.04
Principle Outlet	3	PF 2	340.00	1322.64	1331.82	1324.25	1331.84	0.000010	1.24	274.69	30.00	0.07
Principle Outlet	3	PF 3	398.00	1322.64	1332.22	1324.43	1332.25	0.000012	1.39	286.84	30.00	0.08
Principle Outlet	3	PF 4	591.00	1322.64	1333.40	1324.96	1333.45	0.000019	1.83	322.12	30.00	0.10
Principle Outlet	3	PF 5	822.00	1322.64	1334.76	1325.49	1334.83	0.000027	2.27	362.85	30.00	0.11
Principle Outlet	3	PF 6	1047.00	1322.64	1335.70	1326.02	1335.82	0.000035	2.68	391.33	30.00	0.13
Principle Outlet	3	PF 7	1275.00	1322.64	1336.44	1326.48	1336.58	0.000045	3.08	413.31	30.00	0.15
Principle Outlet	3	PF 8	1509.00	1322.64	1337.08	1326.94	1337.26	0.000056	3.49	432.46	30.00	0.16
Principle Outlet	3	PF 9	1765.00	1322.64	1337.72	1327.42	1337.96	0.000068	3.91	451.86	30.00	0.18
Principle Outlet	3	PF 10	2090.00	1322.64	1338.45	1327.99	1338.75	0.000084	4.41	473.74	30.00	0.20
Principle Outlet	3	PF 11	2337.00	1322.64	1338.96	1328.41	1339.31	0.000096	4.78	489.01	30.00	0.21
Principle Outlet	3	PF 12	2612.00	1322.64	1339.50	1328.84	1339.91	0.000110	5.17	505.05	30.00	0.22

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	3	PF 13	2870.00	1322.64	1339.97	1329.25	1340.45	0.000124	5.53	519.45	30.00	0.23
Principle Outlet	3	PF 14	3290.00	1322.64	1340.72	1329.87	1341.29	0.000146	6.07	541.71	30.00	0.25
Principle Outlet	3	PF 15	3575.00	1322.64	1341.19	1330.29	1341.84	0.000161	6.43	556.05	30.00	0.26
Principle Outlet	3	PF 16	3990.00	1322.64	1341.85	1330.87	1342.60	0.000183	6.93	575.78	30.00	0.28
Principle Outlet	3	PF 17	4280.00	1322.64	1342.28	1331.22	1343.10	0.000199	7.27	588.50	30.00	0.29
Principle Outlet	3	PF 18	4655.00	1322.64	1342.81	1331.72	1343.73	0.000219	7.70	604.63	30.00	0.30
Principle Outlet	3	PF 19	4830.00	1322.64	1343.05	1331.96	1344.02	0.000229	7.89	611.83	30.00	0.31
Principle Outlet	3	PF 20	5065.00	1322.64	1343.38	1332.28	1344.41	0.000242	8.15	621.54	30.00	0.32
Principle Outlet	3	PF 21	5155.00	1322.64	1343.50	1332.38	1344.56	0.000247	8.25	625.19	30.00	0.32
Principle Outlet	3	PF 22	5245.00	1322.64	1343.62	1332.51	1344.70	0.000252	8.34	628.80	30.00	0.32
Principle Outlet	2.5	PF 1	156.00	1324.70	1330.22	1325.91	1330.22	0.000030	0.58	267.80	66.23	0.05
Principle Outlet	2.5	PF 2	340.00	1324.70	1331.82	1326.48	1331.83	0.000052	0.89	380.45	74.32	0.07
Principle Outlet	2.5	PF 3	398.00	1324.70	1332.22	1326.61	1332.24	0.000058	0.97	411.04	76.37	0.07
Principle Outlet	2.5	PF 4	591.00	1324.70	1333.40	1327.02	1333.42	0.000071	1.17	504.56	82.32	0.08
Principle Outlet	2.5	PF 5	822.00	1324.70	1334.76	1327.43	1334.79	0.000077	1.32	621.34	89.19	0.09
Principle Outlet	2.5	PF 6	1047.00	1324.70	1335.72	1327.81	1335.75	0.000086	1.48	708.74	94.01	0.09
Principle Outlet	2.5	PF 7	1275.00	1324.70	1336.46	1328.13	1336.50	0.000098	1.64	779.50	97.74	0.10
Principle Outlet	2.5	PF 8	1509.00	1324.70	1337.10	1328.47	1337.15	0.000111	1.79	843.55	100.99	0.11
Principle Outlet	2.5	PF 9	1765.00	1324.70	1337.76	1328.80	1337.81	0.000123	1.94	910.69	104.29	0.12
Principle Outlet	2.5	PF 10	2090.00	1324.70	1338.50	1329.20	1338.56	0.000137	2.11	989.21	108.03	0.12
Principle Outlet	2.5	PF 11	2337.00	1324.70	1339.01	1329.48	1339.09	0.000147	2.23	1045.79	110.64	0.13
Principle Outlet	2.5	PF 12	2612.00	1324.70	1339.56	1329.77	1339.64	0.000157	2.36	1106.81	113.39	0.13
Principle Outlet	2.5	PF 13	2870.00	1324.70	1340.05	1330.04	1340.14	0.000166	2.47	1162.93	115.88	0.14
Principle Outlet	2.5	PF 14	3290.00	1324.70	1340.81	1330.45	1340.91	0.000179	2.63	1252.45	120.07	0.14
Principle Outlet	2.5	PF 15	3575.00	1324.70	1341.30	1330.71	1341.41	0.000185	2.72	1312.94	133.22	0.15
Principle Outlet	2.5	PF 16	3990.00	1324.70	1341.97	1331.09	1342.10	0.000188	2.86	1404.83	146.91	0.15
Principle Outlet	2.5	PF 17	4280.00	1324.70	1342.41	1331.34	1342.54	0.000191	2.95	1469.07	146.91	0.15
Principle Outlet	2.5	PF 18	4655.00	1324.70	1342.96	1331.65	1343.11	0.000193	3.06	1550.63	146.91	0.15
Principle Outlet	2.5	PF 19	4830.00	1324.70	1343.21	1331.77	1343.36	0.000194	3.11	1587.13	146.91	0.15
Principle Outlet	2.5	PF 20	5065.00	1324.70	1343.55	1331.97	1343.70	0.000195	3.17	1636.35	146.91	0.16
Principle Outlet	2.5	PF 21	5155.00	1324.70	1343.67	1332.04	1343.83	0.000195	3.19	1654.84	146.91	0.16
Principle Outlet	2.5	PF 22	5245.00	1324.70	1343.80	1332.10	1343.96	0.000195	3.22	1673.21	146.91	0.16
Principle Outlet	2	PF 1	156.00	1326.35	1330.20	1327.48	1330.21	0.000092	0.82	190.15	65.33	0.08
Principle Outlet	2	PF 2	340.00	1326.35	1331.80	1327.95	1331.82	0.000112	1.13	301.78	74.40	0.10
Principle Outlet	2	PF 3	398.00	1326.35	1332.21	1328.08	1332.23	0.000116	1.20	332.36	76.70	0.10
Principle Outlet	2	PF 4	591.00	1326.35	1333.38	1328.45	1333.41	0.000125	1.39	426.52	83.38	0.11
Principle Outlet	2	PF 5	822.00	1326.35	1334.75	1328.84	1334.78	0.000120	1.51	545.31	91.11	0.11

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	2	PF 6	1047.00	1326.35	1335.70	1329.18	1335.74	0.000128	1.65	634.71	96.52	0.11
Principle Outlet	2	PF 7	1275.00	1326.35	1336.43	1329.50	1336.48	0.000140	1.80	707.30	100.70	0.12
Principle Outlet	2	PF 8	1509.00	1326.35	1337.08	1329.82	1337.14	0.000156	1.95	773.72	106.28	0.13
Principle Outlet	2	PF 9	1765.00	1326.35	1337.73	1330.13	1337.80	0.000171	2.09	845.02	112.19	0.13
Principle Outlet	2	PF 10	2090.00	1326.35	1338.47	1330.48	1338.55	0.000186	2.25	930.00	117.96	0.14
Principle Outlet	2	PF 11	2337.00	1326.35	1338.98	1330.74	1339.07	0.000196	2.36	992.00	121.98	0.15
Principle Outlet	2	PF 12	2612.00	1326.35	1339.53	1331.02	1339.62	0.000206	2.47	1059.58	126.26	0.15
Principle Outlet	2	PF 13	2870.00	1326.35	1340.02	1331.29	1340.12	0.000214	2.56	1122.35	130.10	0.15
Principle Outlet	2	PF 14	3290.00	1326.35	1340.78	1331.67	1340.89	0.000223	2.69	1224.57	146.44	0.16
Principle Outlet	2	PF 15	3575.00	1326.35	1341.27	1331.92	1341.39	0.000224	2.77	1296.84	147.90	0.16
Principle Outlet	2	PF 16	3990.00	1326.35	1341.95	1332.27	1342.08	0.000223	2.88	1399.64	161.46	0.16
Principle Outlet	2	PF 17	4280.00	1326.35	1342.39	1332.50	1342.52	0.000222	2.95	1470.46	161.46	0.16
Principle Outlet	2	PF 18	4655.00	1326.35	1342.94	1332.79	1343.08	0.000220	3.04	1560.29	161.46	0.16
Principle Outlet	2	PF 19	4830.00	1326.35	1343.19	1332.91	1343.34	0.000219	3.08	1600.50	161.46	0.16
Principle Outlet	2	PF 20	5065.00	1326.35	1343.53	1333.10	1343.68	0.000218	3.13	1654.72	161.46	0.16
Principle Outlet	2	PF 21	5155.00	1326.35	1343.65	1333.18	1343.81	0.000217	3.15	1675.08	161.46	0.16
Principle Outlet	2	PF 22	5245.00	1326.35	1343.78	1333.23	1343.93	0.000217	3.17	1695.32	161.46	0.16
Principle Outlet	1	PF 1	156.00	1326.57	1330.18	1327.82	1330.19	0.000100	0.77	202.49	82.32	0.09
Principle Outlet	1	*PF 2*	*340.00*	*1326.57*	*1331.78*	*1328.24*	*1331.80*	*0.000100*	*0.98*	*346.33*	*97.69*	0.09
Principle Outlet	1	PF 3	398.00	1326.57	1332.19	1328.37	1332.20	0.000100	1.03	386.68	101.58	0.09
Principle Outlet	1	PF 4	591.00	1326.57	1333.37	1328.70	1333.39	0.000100	1.15	513.03	113.74	0.10
Principle Outlet	1	PF 5	822.00	1326.57	1334.73	1329.04	1334.75	0.000100	1.19	691.37	146.27	0.10
Principle Outlet	1	PF 6	1047.00	1326.57	1335.69	1329.34	1335.71	0.000100	1.25	840.43	165.75	0.10
Principle Outlet	1	PF 7	1275.00	1326.57	1336.42	1329.62	1336.45	0.000100	1.32	967.22	175.16	0.10
Principle Outlet	1	PF 8	1509.00	1326.57	1337.07	1329.89	1337.10	0.000100	1.40	1081.54	179.71	0.10
Principle Outlet	1	PF 9	1765.00	1326.57	1337.72	1330.14	1337.76	0.000100	1.47	1200.75	184.34	0.10
Principle Outlet	1	PF 10	2090.00	1326.57	1338.47	1330.46	1338.50	0.000100	1.56	1339.30	189.54	0.10
Principle Outlet	1	PF 11	2337.00	1326.57	1338.98	1330.69	1339.03	0.000100	1.63	1438.60	193.17	0.10
Principle Outlet	1	PF 12	2612.00	1326.57	1339.53	1330.94	1339.58	0.000100	1.69	1545.23	196.96	0.11
Principle Outlet	1	PF 13	2870.00	1326.57	1340.02	1331.15	1340.07	0.000100	1.75	1642.91	200.36	0.11
Principle Outlet	1	PF 14	3290.00	1326.57	1340.79	1331.48	1340.84	0.000100	1.84	1797.27	203.72	0.11
Principle Outlet	1	PF 15	3575.00	1326.57	1341.28	1331.70	1341.33	0.000100	1.90	1898.18	205.19	0.11
Principle Outlet	1	PF 16	3990.00	1326.57	1341.96	1331.99	1342.02	0.000100	1.97	2038.63	206.81	0.11
Principle Outlet	1	PF 17	4280.00	1326.57	1342.40	1332.19	1342.46	0.000100	2.03	2129.84	206.81	0.11
Principle Outlet	1	PF 18	4655.00	1326.57	1342.96	1332.43	1343.03	0.000100	2.09	2245.52	206.81	0.11
Principle Outlet	1	PF 19	4830.00	1326.57	1343.21	1332.56	1343.28	0.000100	2.13	2297.30	206.81	0.11
Principle Outlet	1	PF 20	5065.00	1326.57	1343.55	1332.69	1343.62	0.000100	2.16	2367.10	206.81	0.11
Principle Outlet	1	PF 21	5155.00	1326.57	1343.67	1332.76	1343.75	0.000100	2.18	2393.30	206.81	0.11

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	1	PF 22	5245.00	1326.57	1343.80	1332.82	1343.88	0.000100	2.19	2419.36	206.81	0.11

HEC-RAS Plan: Sluice Gate River: McMicken Dam Out Reach: Principle Outlet

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Q Total	Q Weir	Q Gates
			(ft)	(ft)	(cfs)	(cfs)	(cfs)
Principle Outlet	14.5	PF 1	1363.85	1363.24			
Principle Outlet	14.5	PF 2	1365.12	1364.08			
Principle Outlet	14.5	PF 3	1365.46	1364.31			
Principle Outlet	14.5	PF 4	1366.51	1365.01			
Principle Outlet	14.5	PF 5	1367.62	1365.75			
Principle Outlet	14.5	PF 6	1368.60	1366.40			
Principle Outlet	14.5	PF 7	1342.99	1341.17	1275.00		1275.00
Principle Outlet	14.5	PF 8	1343.90	1341.87	1509.00		1509.00
Principle Outlet	14.5	PF 9	1344.86	1342.61	1765.00		1765.00
Principle Outlet	14.5	PF 10	1346.00	1343.49	2090.00		2090.00
Principle Outlet	14.5	PF 11	1346.73	1343.82	2337.00		2337.00
Principle Outlet	14.5	PF 12	1347.52	1344.16	2612.00		2612.00
Principle Outlet	14.5	PF 13	1374.92	1370.60			
Principle Outlet	14.5	PF 14	1376.16	1371.46			
Principle Outlet	14.5	PF 15	1376.96	1371.99			
Principle Outlet	14.5	PF 16	1378.10	1372.76			
Principle Outlet	14.5	PF 17	1352.77	1348.99	4280.00		4280.00
Principle Outlet	14.5	PF 18	1355.96	1353.39	4655.00		4655.00
Principle Outlet	14.5	PF 19	1357.54	1355.27	4830.00		4830.00
Principle Outlet	14.5	PF 20	1359.76	1357.79	5065.00		5065.00
Principle Outlet	14.5	PF 21	1360.64	1358.77	5155.00		5155.00
Principle Outlet	14.5	PF 22	1361.53	1359.75	5245.00		5245.00

HEC-RAS Version 3.1.2 April 2004
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: McMicken Dam Principle Outlet
Project File : po.prj
Run Date and Time: 2/10/2004 9:35:47 AM

Project in English units

PLAN DATA

Plan Title: P.O. Breast Wall as Bridge w/Cd = 0.815
Plan File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.p03

Geometry Title: P.O. Breast Wall as Bridge w/Cd = 0.815
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.g03

Flow Title : P.O. Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.f01

Plan Summary Information:

Number of:	Cross Sections	= 39	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

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

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Program Selects Appropriate method
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: P.O. Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4	PF 5	PF 6	PF 7	PF 8
McMicken Dam Out	Principle Outlet	22	156	340	398	591	822	1047	1275	1509

River	Reach	RS	PF 9	PF 10	PF 11	PF 12	PF 13	PF 14	PF 15	PF 16
McMicken Dam Out	Principle Outlet	22	1765	2090	2337	2612	2870	3290	3575	3990

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
McMicken Dam Out	Principle Outlet	PF 1	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 2	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 3	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 4	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 5	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 6	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 7	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 8	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 9	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 10	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 11	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 12	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 13	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 14	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 15	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 16	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 17	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 18	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 19	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 20	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 21	Critical	Normal S = 0.0001
McMicken Dam Out	Principle Outlet	PF 22	Critical	Normal S = 0.0001

Inline Structure Gate Openings
River = McMicken Dam Out
Reach = Principle Outlet RS = 14.5
Gate = Gate #1

# Open	Open Ht	# Open	Open Ht	# Open	Open Ht	# Open	Open Ht	# Open	Open Ht
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1	11	1	11	1	11	1
11	1	11	1						

GEOMETRY DATA

Geometry Title: P.O. Breast Wall as Bridge w/Cd = 0.815
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Principal Outlet\po.g03

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 22

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1362	11000	1337	11000	1336.116	11020	1336.116	11020	1337
21020	1362								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.02	11000	.012	11020	.02

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

```
        11000   11020              6.33    6.33    6.33              .3       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 21

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1338   110001336.061   110201336.008   11020    1338
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 20

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1342   11000 1335.93   11020 1335.877   11020    1342
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 19

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1346   110001335.799   110201335.746   11020    1346
   21020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 18

INPUT
Description:
Station Elevation Data    num=       6
```

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1350   110001335.668   110201335.615   11020    1350
   21020    1362

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 17

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1354   110001335.537   110201335.484   11020    1354
   21020    1362

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10            .25       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 16

INPUT
Description:
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362   11000    1358   110001335.407   110201335.354   11020    1358
   21020    1362

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000     .02   11000    .012   11020     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11000   11020               10      10      10             .2       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 15

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362    10001335.276    10201335.276    1020    1362

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1020               2.5     2.5     2.5             .1       .3

BRIDGE
```

```
RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 14.5

INPUT
Description:
Distance from Upstream XS =       .5
Deck/Roadway Width        =     1.5
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    1000    1362 1346.26    1020    1362 1346.26

Upstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362    10001335.276    10201335.276    1020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1020              .1       .3

Downstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    1000    1362 1346.26    1020    1362 1346.26

Downstream Bridge Cross Section Data
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1362    10001335.243    10201335.243    1020    1362

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1020    .012

Bank Sta: Left   Right    Coeff Contr.   Expan.
          1000    1020              .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 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 Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =      .7
           Submerged Inlet + Outlet Cd =    .815
           Max Low Cord                =

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line
```

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 14

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1362	10001335.243		10201335.243		1020	1362

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1020	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1020	11.5	11.5	11.5	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 13

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1362	10001335.093		1020 1335.04		1020	1362

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1020	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1020	10	10	10	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 12

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1359	10001334.962		10201334.909		1020	1359

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1020	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1020	2	2	2	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 11

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1358	10001334.862		1020.571334.809		1020.57	1358

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
    1000    .012    1000    .012 1020.57    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1020.57                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 10

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1357    10001334.618 1021.141334.565 1021.14    1357

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1021.14    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1021.14                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 9

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1356    10001334.228 1021.711334.175 1021.71    1356

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1021.71    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1021.71                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 8

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1355    10001333.693 1022.29 1333.64 1022.29    1355

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1022.29    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1022.29                 2       2       2              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 7

INPUT
Description:
Station Elevation Data    num=       4
```

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1354    10001333.014 1022.861332.961 1022.86    1354

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1022.86    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1022.86              2.87    2.87    2.87             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 6

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1353    10001331.785 1023.671331.732 1023.67    1353

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1023.67    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1023.67              4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.8*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1350.8    1000 1329.66 1024.94 1329.62 1024.94  1350.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1024.94    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1024.94              4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.6*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1348.6    1000 1327.54  1026.2  1327.5  1026.2  1348.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012  1026.2    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000  1026.2              4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
```

```
REACH: Principle Outlet   RS: 5.4*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1346.4    1000 1325.42 1027.47 1325.39 1027.47  1346.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1027.47    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1027.47              4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5.2*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1344.2    1000 1323.29 1028.73 1323.27 1028.73  1344.2

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012 1028.73    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000 1028.73              4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 5

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030              4.43    4.43    4.43              .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.94285*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030              4.43    4.43    4.43              .1       .3
```

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.88571*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.82857*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.77142*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.012	1000	.012	1030	.012

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1000	1030	4.43	4.43	4.43	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 4.71428*

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1342	1000	1321.17	1030	1321.15	1030	1342

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.65714*

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    1000 1321.17    1030 1321.15    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030             4.43    4.43    4.43             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.6

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                1       1       1             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.5

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169  1001.51321.169  1001.51324.169  1004.51324.169
  1004.51321.169  1007.51321.169  1007.51324.169  1010.51324.169  1010.51321.169
  1013.51321.169  1013.51324.169  1016.51324.169  1016.51321.169  1019.51321.169
  1019.51324.169  1022.51324.169  1022.51321.169  1025.51321.169  1025.51324.169
  1028.51324.169  1028.51321.154    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                3       3       3             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
```

```
REACH: Principle Outlet   RS: 4.4

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                 7       7       7             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.3

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                 1       1       1             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.2

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001324.169  1001.51324.169  1001.51321.169  1004.51321.169
  1004.51324.169  1007.51324.169  1007.51321.169  1010.51321.169  1010.51324.169
  1013.51324.169  1013.51321.169  1016.51321.169  1016.51324.169  1019.51324.169
  1019.51321.169  1022.51321.169  1022.51324.169  1025.51324.169  1025.51321.169
  1028.51321.169  1028.51324.154    10301324.154    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                 3       3       3             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4.1

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.169    10301321.154    1030    1342

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

```
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030               18      18      18             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 4

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001321.175    1030 1321.22    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030                1       1       1             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 3

INPUT
Description:
Station Elevation Data    num=       4
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000    1342    10001322.638    10301322.681    1030    1342

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .012    1000    .012    1030    .012

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1000    1030              27.4    27.4    27.4             .6       .8

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 2.5

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    1000  1341.2  1010.7  1341.2  1051.7  1325.2  1072.9  1324.7  1095.6  1326.4
  1129.4    1340    1130  1340.2    1133 1341.22 1134.91 1341.87 1146.91 1341.87

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    1000    .045  1010.7    .035    1133    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        1010.7    1133            111.78  111.78  111.78             .1       .3

CROSS SECTION


RIVER: McMicken Dam Out
REACH: Principle Outlet   RS: 2

INPUT
Description:
```

Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1340.61	1010.6	1340.73	1024.9	1337.79	1032.9	1336.5	1059.1	1327.26
1089.2	1326.35	1107.6	1327.22	1140.2	1338.69	1149.46	1341.79	1161.46	1341.79

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1010.6	.035	1149.46	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1010.6	1149.46	214.63	214.63	214.63	.1	.3

CROSS SECTION

RIVER: McMicken Dam Out
REACH: Principle Outlet RS: 1

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	1340.3	1009	1338	1017	1336	1057	1333.69	1087.9	1327.86
1125.9	1326.57	1148.7	1328.05	1171.3	1333.29	1182	1333.98	1183.2	1334.06
1199.2	1339.27	1206.81	1341.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.045	1009	.035	1206.81	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1009	1206.81	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:McMicken Dam Out

Reach	River Sta.	n1	n2	n3
Principle Outlet	22	.02	.012	.02
Principle Outlet	21	.02	.012	.02
Principle Outlet	20	.02	.012	.02
Principle Outlet	19	.02	.012	.02
Principle Outlet	18	.02	.012	.02
Principle Outlet	17	.02	.012	.02
Principle Outlet	16	.02	.012	.02
Principle Outlet	15	.012	.012	.012
Principle Outlet	14.5	Bridge		
Principle Outlet	14	.012	.012	.012
Principle Outlet	13	.012	.012	.012
Principle Outlet	12	.012	.012	.012
Principle Outlet	11	.012	.012	.012
Principle Outlet	10	.012	.012	.012
Principle Outlet	9	.012	.012	.012
Principle Outlet	8	.012	.012	.012
Principle Outlet	7	.012	.012	.012
Principle Outlet	6	.012	.012	.012
Principle Outlet	5.8*	.012	.012	.012
Principle Outlet	5.6*	.012	.012	.012
Principle Outlet	5.4*	.012	.012	.012
Principle Outlet	5.2*	.012	.012	.012
Principle Outlet	5	.012	.012	.012
Principle Outlet	4.94285*	.012	.012	.012
Principle Outlet	4.88571*	.012	.012	.012
Principle Outlet	4.82857*	.012	.012	.012
Principle Outlet	4.77142*	.012	.012	.012
Principle Outlet	4.71428*	.012	.012	.012
Principle Outlet	4.65714*	.012	.012	.012
Principle Outlet	4.6	.012	.012	.012

Principle Outlet	4.5	.012	.012	.012
Principle Outlet	4.4	.012	.012	.012
Principle Outlet	4.3	.012	.012	.012
Principle Outlet	4.2	.012	.012	.012
Principle Outlet	4.1	.012	.012	.012
Principle Outlet	4	.012	.012	.012
Principle Outlet	3	.012	.012	.012
Principle Outlet	2.5	.045	.035	.045
Principle Outlet	2	.045	.035	.045
Principle Outlet	1	.045	.035	.045

SUMMARY OF REACH LENGTHS

River: McMicken Dam Out

Reach	River Sta.	Left	Channel	Right
Principle Outlet	22	6.33	6.33	6.33
Principle Outlet	21	10	10	10
Principle Outlet	20	10	10	10
Principle Outlet	19	10	10	10
Principle Outlet	18	10	10	10
Principle Outlet	17	10	10	10
Principle Outlet	16	10	10	10
Principle Outlet	15	2.5	2.5	2.5
Principle Outlet	14.5	Bridge		
Principle Outlet	14	11.5	11.5	11.5
Principle Outlet	13	10	10	10
Principle Outlet	12	2	2	2
Principle Outlet	11	2	2	2
Principle Outlet	10	2	2	2
Principle Outlet	9	2	2	2
Principle Outlet	8	2	2	2
Principle Outlet	7	2.87	2.87	2.87
Principle Outlet	6	4.43	4.43	4.43
Principle Outlet	5.8*	4.43	4.43	4.43
Principle Outlet	5.6*	4.43	4.43	4.43
Principle Outlet	5.4*	4.43	4.43	4.43
Principle Outlet	5.2*	4.43	4.43	4.43
Principle Outlet	5	4.43	4.43	4.43
Principle Outlet	4.94285*	4.43	4.43	4.43
Principle Outlet	4.88571*	4.43	4.43	4.43
Principle Outlet	4.82857*	4.43	4.43	4.43
Principle Outlet	4.77142*	4.43	4.43	4.43
Principle Outlet	4.71428*	4.43	4.43	4.43
Principle Outlet	4.65714*	4.43	4.43	4.43
Principle Outlet	4.6	1	1	1
Principle Outlet	4.5	3	3	3
Principle Outlet	4.4	7	7	7
Principle Outlet	4.3	1	1	1
Principle Outlet	4.2	3	3	3
Principle Outlet	4.1	18	18	18
Principle Outlet	4	1	1	1
Principle Outlet	3	27.4	27.4	27.4
Principle Outlet	2.5	111.78	111.78	111.78
Principle Outlet	2	214.63	214.63	214.63
Principle Outlet	1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: McMicken Dam Out

Reach	River Sta.	Contr.	Expan.
Principle Outlet	22	.3	.3

Principle Outlet	21		.25	.3
Principle Outlet	20		.25	.3
Principle Outlet	19		.25	.3
Principle Outlet	18		.25	.3
Principle Outlet	17		.25	.3
Principle Outlet	16		.2	.3
Principle Outlet	15		.1	.3
Principle Outlet	14.5	Bridge		
Principle Outlet	14		.1	.3
Principle Outlet	13		.1	.3
Principle Outlet	12		.1	.3
Principle Outlet	11		.1	.3
Principle Outlet	10		.1	.3
Principle Outlet	9		.1	.3
Principle Outlet	8		.1	.3
Principle Outlet	7		.1	.3
Principle Outlet	6		.1	.3
Principle Outlet	5.8*		.1	.3
Principle Outlet	5.6*		.1	.3
Principle Outlet	5.4*		.1	.3
Principle Outlet	5.2*		.1	.3
Principle Outlet	5		.1	.3
Principle Outlet	4.94285*		.1	.3
Principle Outlet	4.88571*		.1	.3
Principle Outlet	4.82857*		.1	.3
Principle Outlet	4.77142*		.1	.3
Principle Outlet	4.71428*		.1	.3
Principle Outlet	4.65714*		.1	.3
Principle Outlet	4.6		.1	.3
Principle Outlet	4.5		.1	.3
Principle Outlet	4.4		.1	.3
Principle Outlet	4.3		.1	.3
Principle Outlet	4.2		.1	.3
Principle Outlet	4.1		.1	.3
Principle Outlet	4		.1	.3
Principle Outlet	3		.6	.8
Principle Outlet	2.5		.1	.3
Principle Outlet	2		.1	.3
Principle Outlet	1		.1	.3

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet

Reach	River Sta	Profile	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)	
Principle Outlet	22	PF 1	156.00	1336.12	1338.07	1337.43	1338.07	0.000028	0.97	496.67	875.66	0.12
Principle Outlet	22	PF 2	340.00	1336.12	1339.28	1337.67	1339.28	0.000003	0.46	2144.05	1844.61	0.05
Principle Outlet	22	PF 3	398.00	1336.12	1339.65	1337.72	1339.65	0.000002	0.40	2887.05	2142.75	0.04
Principle Outlet	22	PF 4	591.00	1336.12	1340.78	1337.84	1340.78	0.000001	0.28	5819.51	3046.86	0.02
Principle Outlet	22	PF 5	822.00	1336.12	1341.99	1337.95	1341.99	0.000000	0.22	10064.26	4009.36	0.02
Principle Outlet	22	PF 6	1047.00	1336.12	1343.05	1338.03	1343.05	0.000000	0.19	14771.61	4858.67	0.01
Principle Outlet	22	PF 7	1275.00	1336.12	1344.03	1338.12	1344.03	0.000000	0.17	19945.41	5646.66	0.01
Principle Outlet	22	PF 8	1509.00	1336.12	1344.93	1338.18	1344.93	0.000000	0.16	25302.62	6360.53	0.01
Principle Outlet	22	PF 9	1765.00	1336.12	1345.89	1338.25	1345.89	0.000000	0.15	31826.71	7134.06	0.01
Principle Outlet	22	PF 10	2090.00	1336.12	1347.10	1338.32	1347.10	0.000000	0.13	41030.41	8100.66	0.01
Principle Outlet	22	PF 11	2337.00	1336.12	1347.98	1338.38	1347.98	0.000000	0.13	48437.63	8801.84	0.01
Principle Outlet	22	PF 12	2612.00	1336.12	1348.85	1338.43	1348.85	0.000000	0.12	56407.21	9498.61	0.01
Principle Outlet	22	PF 13	2870.00	1336.12	1349.70	1338.48	1349.70	0.000000	0.12	64758.61	10177.71	0.01
Principle Outlet	22	PF 14	3290.00	1336.12	1350.95	1338.55	1350.95	0.000000	0.11	78137.13	11179.96	0.00
Principle Outlet	22	PF 15	3575.00	1336.12	1351.85	1338.60	1351.85	0.000000	0.10	88481.27	11897.15	0.00
Principle Outlet	22	PF 16	3990.00	1336.12	1353.07	1338.65	1353.07	0.000000	0.10	103692.90	12879.47	0.00
Principle Outlet	22	PF 17	4280.00	1336.12	1355.89	1338.71	1355.89	0.000000	0.08	143184.00	15134.94	0.00
Principle Outlet	22	PF 18	4655.00	1336.12	1358.18	1338.75	1358.18	0.000000	0.07	179848.10	16962.58	0.00
Principle Outlet	22	PF 19	4830.00	1336.12	1359.26	1338.78	1359.26	0.000000	0.06	198650.90	17827.32	0.00
Principle Outlet	22	PF 20	5065.00	1336.12	1360.64	1338.81	1360.64	0.000000	0.06	224053.70	18932.99	0.00
Principle Outlet	22	PF 21	5155.00	1336.12	1361.23	1338.81	1361.23	0.000000	0.06	235350.90	19404.47	0.00
Principle Outlet	22	PF 22	5245.00	1336.12	1361.81	1338.83	1361.81	0.000000	0.05	246688.30	19866.39	0.00
Principle Outlet	21	PF 1	156.00	1336.01	1337.27	1337.27	1337.89	0.002294	6.32	24.70	20.00	1.00
Principle Outlet	21	PF 2	340.00	1336.01	1339.27	1338.59	1339.28	0.000043	1.57	731.25	1074.08	0.15
Principle Outlet	21	PF 3	398.00	1336.01	1339.65	1338.66	1339.65	0.000018	1.11	1203.49	1393.09	0.10
Principle Outlet	21	PF 4	591.00	1336.01	1340.78	1338.84	1340.78	0.000003	0.56	3321.42	2338.93	0.05
Principle Outlet	21	PF 5	822.00	1336.01	1341.99	1338.98	1341.99	0.000001	0.36	6740.61	3342.04	0.03
Principle Outlet	21	PF 6	1047.00	1336.01	1343.05	1339.08	1343.05	0.000000	0.28	10758.82	4226.85	0.02
Principle Outlet	21	PF 7	1275.00	1336.01	1344.03	1339.18	1344.03	0.000000	0.23	15326.45	5047.67	0.01
Principle Outlet	21	PF 8	1509.00	1336.01	1344.93	1339.25	1344.93	0.000000	0.20	20163.14	5791.38	0.01
Principle Outlet	21	PF 9	1765.00	1336.01	1345.89	1339.33	1345.89	0.000000	0.18	26152.49	6597.15	0.01
Principle Outlet	21	PF 10	2090.00	1336.01	1347.10	1339.41	1347.10	0.000000	0.16	34731.79	7604.03	0.01
Principle Outlet	21	PF 11	2337.00	1336.01	1347.98	1339.46	1347.98	0.000000	0.15	41716.53	8334.41	0.01
Principle Outlet	21	PF 12	2612.00	1336.01	1348.85	1339.52	1348.85	0.000000	0.14	49291.64	9060.22	0.01
Principle Outlet	21	PF 13	2870.00	1336.01	1349.70	1339.58	1349.70	0.000000	0.13	57282.90	9767.62	0.01
Principle Outlet	21	PF 14	3290.00	1336.01	1350.95	1339.65	1350.95	0.000000	0.12	70173.82	10811.63	0.01
Principle Outlet	21	PF 15	3575.00	1336.01	1351.85	1339.69	1351.85	0.000000	0.11	80201.14	11558.70	0.01
Principle Outlet	21	PF 16	3990.00	1336.01	1353.07	1339.75	1353.07	0.000000	0.11	95022.36	12581.95	0.00

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	21	PF 17	4280.00	1336.01	1355.89	1339.80	1355.89	0.000000	0.08	133807.00	14931.40	0.00
Principle Outlet	21	PF 18	4655.00	1336.01	1358.18	1339.86	1358.18	0.000000	0.07	170093.20	16835.19	0.00
Principle Outlet	21	PF 19	4830.00	1336.01	1359.26	1339.87	1359.26	0.000000	0.06	188777.70	17735.96	0.00
Principle Outlet	21	PF 20	5065.00	1336.01	1360.64	1339.91	1360.64	0.000000	0.06	214086.10	18887.70	0.00
Principle Outlet	21	PF 21	5155.00	1336.01	1361.23	1339.92	1361.23	0.000000	0.06	225362.40	19378.82	0.00
Principle Outlet	21	PF 22	5245.00	1336.01	1361.81	1339.93	1361.81	0.000000	0.05	236690.50	19859.98	0.00
Principle Outlet	20	PF 1	156.00	1335.88	1336.96	1337.13	1337.81	0.003827	7.41	21.04	20.00	1.27
Principle Outlet	20	PF 2	340.00	1335.88	1337.98	1337.98	1339.02	0.002115	8.18	41.58	20.00	1.00
Principle Outlet	20	PF 3	398.00	1335.88	1338.22	1338.22	1339.37	0.002085	8.61	46.24	20.00	1.00
Principle Outlet	20	PF 4	591.00	1335.88	1338.92	1338.92	1340.41	0.002049	9.81	60.25	20.00	1.00
Principle Outlet	20	PF 5	822.00	1335.88	1339.65	1339.65	1341.52	0.002067	10.98	74.86	20.00	1.00
Principle Outlet	20	PF 6	1047.00	1335.88	1340.31	1340.31	1342.50	0.002067	11.87	88.21	20.00	1.00
Principle Outlet	20	PF 7	1275.00	1335.88	1342.38	1340.91	1343.70	0.000905	9.43	202.27	401.35	0.65
Principle Outlet	20	PF 8	1509.00	1335.88	1342.19	1341.54	1344.38	0.001505	11.91	143.92	210.67	0.84
Principle Outlet	20	PF 9	1765.00	1335.88	1345.89	1343.27	1345.89	0.000003	0.77	7769.18	3910.87	0.04
Principle Outlet	20	PF 10	2090.00	1335.88	1347.10	1343.39	1347.10	0.000001	0.50	13230.05	5120.22	0.03
Principle Outlet	20	PF 11	2337.00	1335.88	1347.98	1343.46	1347.98	0.000001	0.39	18103.31	5996.93	0.02
Principle Outlet	20	PF 12	2612.00	1335.88	1348.85	1343.54	1348.85	0.000000	0.32	23706.60	6868.02	0.02
Principle Outlet	20	PF 13	2870.00	1335.88	1349.70	1343.59	1349.70	0.000000	0.27	29897.94	7717.02	0.01
Principle Outlet	20	PF 14	3290.00	1335.88	1350.95	1343.70	1350.95	0.000000	0.22	40350.64	8969.83	0.01
Principle Outlet	20	PF 15	3575.00	1335.88	1351.85	1343.75	1351.85	0.000000	0.19	48793.80	9866.31	0.01
Principle Outlet	20	PF 16	3990.00	1335.88	1353.07	1343.82	1353.07	0.000000	0.17	61663.93	11094.34	0.01
Principle Outlet	20	PF 17	4280.00	1335.88	1355.89	1343.86	1355.89	0.000000	0.11	96916.92	13913.68	0.00
Principle Outlet	20	PF 18	4655.00	1335.88	1358.18	1343.93	1358.18	0.000000	0.08	131312.90	16198.22	0.00
Principle Outlet	20	PF 19	4830.00	1335.88	1359.26	1343.95	1359.26	0.000000	0.08	149406.30	17279.16	0.00
Principle Outlet	20	PF 20	5065.00	1335.88	1360.64	1343.99	1360.64	0.000000	0.07	174242.60	18661.23	0.00
Principle Outlet	20	PF 21	5155.00	1335.88	1361.23	1344.00	1361.23	0.000000	0.06	185414.30	19250.59	0.00
Principle Outlet	20	PF 22	5245.00	1335.88	1361.81	1344.01	1361.81	0.000000	0.06	196696.20	19827.98	0.00
Principle Outlet	19	PF 1	156.00	1335.75	1336.75	1337.00	1337.74	0.004870	7.99	19.52	20.00	1.43
Principle Outlet	19	PF 2	340.00	1335.75	1337.63	1337.84	1338.93	0.003018	9.17	37.09	20.00	1.19
Principle Outlet	19	PF 3	398.00	1335.75	1337.85	1338.09	1339.27	0.002890	9.56	41.61	20.00	1.17
Principle Outlet	19	PF 4	591.00	1335.75	1338.52	1338.79	1340.32	0.002696	10.74	55.04	20.00	1.14
Principle Outlet	19	PF 5	822.00	1335.75	1339.23	1339.53	1341.42	0.002614	11.88	69.19	20.00	1.13
Principle Outlet	19	PF 6	1047.00	1335.75	1339.89	1340.17	1342.40	0.002535	12.72	82.29	20.00	1.11
Principle Outlet	19	PF 7	1275.00	1335.75	1340.79	1340.79	1343.30	0.002111	12.71	100.29	20.00	1.00
Principle Outlet	19	PF 8	1509.00	1335.75	1341.39	1341.39	1344.19	0.002131	13.42	112.42	20.00	1.00
Principle Outlet	19	PF 9	1765.00	1335.75	1342.02	1342.02	1345.12	0.002159	14.12	124.98	20.00	1.00

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	19	PF 10	2090.00	1335.75	1342.76	1342.76	1346.23	0.002212	14.95	139.78	20.00	1.00
Principle Outlet	19	PF 11	2337.00	1335.75	1343.30	1343.30	1347.04	0.002252	15.52	150.53	20.00	1.00
Principle Outlet	19	PF 12	2612.00	1335.75	1344.38	1343.88	1347.96	0.001947	15.17	172.18	20.00	0.91
Principle Outlet	19	PF 13	2870.00	1335.75	1344.91	1344.41	1348.74	0.002003	15.71	182.68	20.00	0.92
Principle Outlet	19	PF 14	3290.00	1335.75	1346.21	1345.24	1350.00	0.001798	15.68	235.41	278.48	0.86
Principle Outlet	19	PF 15	3575.00	1335.75	1351.85	1347.61	1351.85	0.000001	0.52	21679.12	7327.13	0.02
Principle Outlet	19	PF 16	3990.00	1335.75	1353.07	1347.69	1353.07	0.000001	0.37	31622.81	8862.62	0.02
Principle Outlet	19	PF 17	4280.00	1335.75	1355.89	1347.75	1355.89	0.000000	0.18	61578.94	12386.94	0.01
Principle Outlet	19	PF 18	4655.00	1335.75	1358.18	1347.82	1358.18	0.000000	0.12	93141.30	15242.78	0.00
Principle Outlet	19	PF 19	4830.00	1335.75	1359.26	1347.84	1359.26	0.000000	0.11	110348.00	16593.95	0.00
Principle Outlet	19	PF 20	5065.00	1335.75	1360.64	1347.88	1360.64	0.000000	0.09	134476.00	18321.54	0.00
Principle Outlet	19	PF 21	5155.00	1335.75	1361.23	1347.88	1361.23	0.000000	0.08	145491.00	19058.24	0.00
Principle Outlet	19	PF 22	5245.00	1335.75	1361.81	1347.91	1361.81	0.000000	0.08	156703.40	19779.98	0.00
Principle Outlet	18	PF 1	156.00	1335.62	1336.57	1336.88	1337.66	0.005665	8.38	18.63	20.00	1.53
Principle Outlet	18	PF 2	340.00	1335.62	1337.40	1337.72	1338.85	0.003590	9.69	35.09	20.00	1.29
Principle Outlet	18	PF 3	398.00	1335.62	1337.61	1337.96	1339.20	0.003446	10.12	39.32	20.00	1.27
Principle Outlet	18	PF 4	591.00	1335.62	1338.25	1338.66	1340.24	0.003169	11.32	52.20	20.00	1.23
Principle Outlet	18	PF 5	822.00	1335.62	1338.95	1339.38	1341.35	0.003003	12.44	66.06	20.00	1.21
Principle Outlet	18	PF 6	1047.00	1335.62	1339.59	1340.04	1342.32	0.002860	13.25	79.00	20.00	1.18
Principle Outlet	18	PF 7	1275.00	1335.62	1340.36	1340.67	1343.20	0.002526	13.52	94.27	20.00	1.10
Principle Outlet	18	PF 8	1509.00	1335.62	1340.94	1341.27	1344.09	0.002520	14.23	106.02	20.00	1.09
Principle Outlet	18	PF 9	1765.00	1335.62	1341.57	1341.89	1345.01	0.002503	14.88	118.61	20.00	1.08
Principle Outlet	18	PF 10	2090.00	1335.62	1342.31	1342.62	1346.12	0.002526	15.68	133.29	20.00	1.07
Principle Outlet	18	PF 11	2337.00	1335.62	1342.84	1343.16	1346.93	0.002548	16.23	143.96	20.00	1.07
Principle Outlet	18	PF 12	2612.00	1335.62	1343.75	1343.75	1347.78	0.002295	16.11	162.12	20.00	1.00
Principle Outlet	18	PF 13	2870.00	1335.62	1344.28	1344.28	1348.57	0.002332	16.62	172.68	20.00	1.00
Principle Outlet	18	PF 14	3290.00	1335.62	1345.10	1345.10	1349.80	0.002398	17.40	189.11	20.00	1.00
Principle Outlet	18	PF 15	3575.00	1335.62	1345.63	1345.63	1350.60	0.002446	17.90	199.74	20.00	1.00
Principle Outlet	18	PF 16	3990.00	1335.62	1346.40	1346.40	1351.74	0.002501	18.55	215.15	20.00	1.00
Principle Outlet	18	PF 17	4280.00	1335.62	1355.89	1346.87	1355.89	0.000001	0.47	29345.22	9841.78	0.02
Principle Outlet	18	PF 18	4655.00	1335.62	1358.18	1347.56	1358.18	0.000000	0.23	56185.17	13650.17	0.01
Principle Outlet	18	PF 19	4830.00	1335.62	1359.26	1347.81	1359.26	0.000000	0.18	71915.65	15451.93	0.01
Principle Outlet	18	PF 20	5065.00	1335.62	1360.64	1348.25	1360.64	0.000000	0.14	94863.23	17755.39	0.00
Principle Outlet	18	PF 21	5155.00	1335.62	1361.23	1348.35	1361.23	0.000000	0.12	105616.90	18737.65	0.00
Principle Outlet	18	PF 22	5245.00	1335.62	1361.81	1348.52	1361.81	0.000000	0.11	116713.70	19699.97	0.00
Principle Outlet	17	PF 1	156.00	1335.48	1336.41	1336.75	1337.58	0.006348	8.68	17.98	20.00	1.61
Principle Outlet	17	PF 2	340.00	1335.48	1337.18	1337.60	1338.79	0.004166	10.16	33.46	20.00	1.38

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	17	PF 3	398.00	1335.48	1337.40	1337.82	1339.13	0.003926	10.55	37.71	20.00	1.35
Principle Outlet	17	PF 4	591.00	1335.48	1338.03	1338.53	1340.17	0.003553	11.75	50.29	20.00	1.31
Principle Outlet	17	PF 5	822.00	1335.48	1338.71	1339.27	1341.27	0.003311	12.85	63.95	20.00	1.27
Principle Outlet	17	PF 6	1047.00	1335.48	1339.34	1339.92	1342.24	0.003142	13.68	76.52	20.00	1.23
Principle Outlet	17	PF 7	1275.00	1335.48	1340.04	1340.54	1343.12	0.002830	14.06	90.66	20.00	1.16
Principle Outlet	17	PF 8	1509.00	1335.48	1340.63	1341.12	1344.00	0.002790	14.75	102.33	20.00	1.15
Principle Outlet	17	PF 9	1765.00	1335.48	1341.25	1341.70	1344.92	0.002750	15.38	114.74	20.00	1.13
Principle Outlet	17	PF 10	2090.00	1335.48	1341.98	1342.50	1346.03	0.002742	16.14	129.45	20.00	1.12
Principle Outlet	17	PF 11	2337.00	1335.48	1342.48	1343.04	1346.84	0.002785	16.76	139.43	20.00	1.12
Principle Outlet	17	PF 12	2612.00	1335.48	1343.28	1343.62	1347.67	0.002575	16.80	155.45	20.00	1.06
Principle Outlet	17	PF 13	2870.00	1335.48	1343.81	1344.15	1348.45	0.002601	17.30	165.90	20.00	1.06
Principle Outlet	17	PF 14	3290.00	1335.48	1344.62	1344.97	1349.68	0.002650	18.05	182.22	20.00	1.05
Principle Outlet	17	PF 15	3575.00	1335.48	1345.15	1345.50	1350.49	0.002687	18.54	192.82	20.00	1.05
Principle Outlet	17	PF 16	3990.00	1335.48	1345.91	1346.27	1351.62	0.002733	19.18	208.05	20.00	1.05
Principle Outlet	17	PF 17	4280.00	1335.48	1352.98	1346.74	1355.31	0.000830	12.25	349.42	20.00	0.52
Principle Outlet	17	PF 18	4655.00	1335.48	1358.18	1347.35	1358.18	0.000003	0.80	22258.68	10461.59	0.03
Principle Outlet	17	PF 19	4830.00	1335.48	1359.26	1347.72	1359.26	0.000001	0.48	35041.94	13166.67	0.02
Principle Outlet	17	PF 20	5065.00	1335.48	1360.64	1348.12	1360.64	0.000000	0.29	55633.09	16622.78	0.01
Principle Outlet	17	PF 21	5155.00	1335.48	1361.23	1348.26	1361.23	0.000000	0.24	65864.00	18096.17	0.01
Principle Outlet	17	PF 22	5245.00	1335.48	1361.81	1348.30	1361.81	0.000000	0.20	76729.32	19539.65	0.01
Principle Outlet	16	PF 1	156.00	1335.35	1336.25	1336.62	1337.49	0.006960	8.93	17.47	20.00	1.68
Principle Outlet	16	PF 2	340.00	1335.35	1337.00	1337.47	1338.72	0.004651	10.52	32.31	20.00	1.46
Principle Outlet	16	PF 3	398.00	1335.35	1337.20	1337.70	1339.06	0.004389	10.94	36.39	20.00	1.43
Principle Outlet	16	PF 4	591.00	1335.35	1337.82	1338.37	1340.10	0.003894	12.11	48.81	20.00	1.37
Principle Outlet	16	PF 5	822.00	1335.35	1338.49	1339.14	1341.20	0.003595	13.21	62.23	20.00	1.32
Principle Outlet	16	PF 6	1047.00	1335.35	1339.11	1339.79	1342.17	0.003392	14.04	74.58	20.00	1.28
Principle Outlet	16	PF 7	1275.00	1335.35	1339.78	1340.40	1343.04	0.003087	14.49	88.01	20.00	1.22
Principle Outlet	16	PF 8	1509.00	1335.35	1340.36	1341.00	1343.93	0.003021	15.16	99.56	20.00	1.20
Principle Outlet	16	PF 9	1765.00	1335.35	1341.72	1341.63	1344.73	0.002076	13.93	126.72	20.00	0.98
Principle Outlet	16	PF 10	2090.00	1335.35	1342.49	1342.37	1345.85	0.002108	14.69	142.23	20.00	0.97
Principle Outlet	16	PF 11	2337.00	1335.35	1343.05	1342.91	1346.66	0.002135	15.23	153.47	20.00	0.97
Principle Outlet	16	PF 12	2612.00	1335.35	1342.93	1343.49	1347.58	0.002792	17.30	150.95	20.00	1.11
Principle Outlet	16	PF 13	2870.00	1335.35	1343.45	1344.02	1348.36	0.002806	17.79	161.36	20.00	1.10
Principle Outlet	16	PF 14	3290.00	1335.35	1344.26	1344.84	1349.59	0.002842	18.53	177.57	20.00	1.10
Principle Outlet	16	PF 15	3575.00	1335.35	1344.79	1345.37	1350.40	0.002872	19.01	188.10	20.00	1.09
Principle Outlet	16	PF 16	3990.00	1335.35	1346.46	1346.14	1351.49	0.002317	18.01	221.49	20.00	0.95
Principle Outlet	16	PF 17	4280.00	1335.35	1353.00	1346.63	1355.29	0.000813	12.15	352.40	20.00	0.51
Principle Outlet	16	PF 18	4655.00	1335.35	1355.61	1347.30	1357.66	0.000685	11.51	404.56	20.00	0.45

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	16	PF 19	4830.00	1335.35	1356.79	1347.59	1358.77	0.000642	11.28	428.18	20.00	0.43
Principle Outlet	16	PF 20	5065.00	1335.35	1360.64	1347.95	1360.64	0.000008	1.37	17866.50	13196.27	0.05
Principle Outlet	16	PF 21	5155.00	1335.35	1361.23	1348.13	1361.23	0.000003	0.87	26579.19	16163.80	0.03
Principle Outlet	16	PF 22	5245.00	1335.35	1361.81	1348.29	1361.81	0.000001	0.60	36766.43	19056.25	0.02
Principle Outlet	15	PF 1	156.00	1335.28	1336.14	1336.51	1337.41	0.007296	9.06	17.22	20.00	1.72
Principle Outlet	15	PF 2	340.00	1335.28	1336.86	1337.35	1338.65	0.004963	10.74	31.65	20.00	1.50
Principle Outlet	15	PF 3	398.00	1335.28	1337.06	1337.59	1338.99	0.004677	11.16	35.66	20.00	1.47
Principle Outlet	15	PF 4	591.00	1335.28	1337.67	1338.28	1340.04	0.004125	12.34	47.90	20.00	1.40
Principle Outlet	15	PF 5	822.00	1335.28	1338.33	1339.02	1341.14	0.003803	13.46	61.08	20.00	1.36
Principle Outlet	15	PF 6	1047.00	1335.28	1338.93	1339.67	1342.12	0.003609	14.33	73.04	20.00	1.32
Principle Outlet	15	PF 7	1275.00	1335.28	1339.59	1340.29	1342.98	0.003271	14.78	86.28	20.00	1.25
Principle Outlet	15	PF 8	1509.00	1335.28	1340.16	1340.90	1343.87	0.003191	15.45	97.69	20.00	1.23
Principle Outlet	15	PF 9	1765.00	1335.28	1341.83	1341.52	1344.65	0.001884	13.46	131.17	20.00	0.93
Principle Outlet	15	PF 10	2090.00	1335.28	1342.61	1342.26	1345.76	0.001933	14.24	146.72	20.00	0.93
Principle Outlet	15	PF 11	2337.00	1335.28	1343.18	1342.80	1346.57	0.001971	14.79	158.01	20.00	0.93
Principle Outlet	15	PF 12	2612.00	1335.28	1342.68	1343.38	1347.51	0.002942	17.63	148.12	20.00	1.14
Principle Outlet	15	PF 13	2870.00	1335.28	1343.20	1343.91	1348.29	0.002951	18.12	158.42	20.00	1.13
Principle Outlet	15	PF 14	3290.00	1335.28	1344.00	1344.74	1349.52	0.002979	18.85	174.49	20.00	1.12
Principle Outlet	15	PF 15	3575.00	1335.28	1344.52	1345.24	1350.33	0.003005	19.33	184.96	20.00	1.12
Principle Outlet	15	PF 16	3990.00	1335.28	1346.57	1346.03	1351.42	0.002201	17.67	225.84	20.00	0.93
Principle Outlet	15	PF 17	4280.00	1335.28	1353.01	1346.52	1355.28	0.000800	12.06	354.76	20.00	0.50
Principle Outlet	15	PF 18	4655.00	1335.28	1355.62	1347.20	1357.66	0.000675	11.44	406.84	20.00	0.45
Principle Outlet	15	PF 19	4830.00	1335.28	1356.80	1347.49	1358.76	0.000634	11.22	430.43	20.00	0.43
Principle Outlet	15	PF 20	5065.00	1335.28	1358.41	1347.88	1360.27	0.000586	10.95	462.63	20.00	0.40
Principle Outlet	15	PF 21	5155.00	1335.28	1359.04	1348.03	1360.87	0.000569	10.85	475.24	20.00	0.39
Principle Outlet	15	PF 22	5245.00	1335.28	1359.65	1348.16	1361.45	0.000554	10.76	487.50	20.00	0.38
Principle Outlet	14.5		Bridge									
Principle Outlet	14	PF 1	156.00	1335.24	1336.10	1336.48	1337.39	0.007445	9.12	17.11	20.00	1.74
Principle Outlet	14	PF 2	340.00	1335.24	1336.81	1337.33	1338.63	0.005082	10.82	31.42	20.00	1.52
Principle Outlet	14	PF 3	398.00	1335.24	1337.01	1337.56	1338.98	0.004787	11.24	35.40	20.00	1.49
Principle Outlet	14	PF 4	591.00	1335.24	1337.61	1338.26	1340.03	0.004269	12.48	47.37	20.00	1.43
Principle Outlet	14	PF 5	822.00	1335.24	1338.27	1338.98	1341.13	0.003891	13.56	60.62	20.00	1.37
Principle Outlet	14	PF 6	1047.00	1335.24	1338.88	1339.65	1342.10	0.003664	14.41	72.67	20.00	1.33
Principle Outlet	14	PF 7	1275.00	1335.24	1339.52	1340.27	1342.97	0.003352	14.90	85.57	20.00	1.27
Principle Outlet	14	PF 8	1509.00	1335.24	1340.08	1340.87	1343.86	0.003282	15.60	96.75	20.00	1.25
Principle Outlet	14	PF 9	1765.00	1335.24	1341.49	1341.49	1344.59	0.002163	14.13	124.90	20.00	1.00

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	14	PF 10	2090.00	1335.24	1342.23	1342.23	1345.70	0.002211	14.95	139.80	20.00	1.00
Principle Outlet	14	PF 11	2337.00	1335.24	1342.77	1342.77	1346.51	0.002249	15.52	150.60	20.00	1.00
Principle Outlet	14	PF 12	2612.00	1335.24	1342.58	1343.35	1347.50	0.003016	17.80	146.78	20.00	1.16
Principle Outlet	14	PF 13	2870.00	1335.24	1343.32	1343.88	1348.22	0.002801	17.78	161.45	20.00	1.10
Principle Outlet	14	PF 14	3290.00	1335.24	1344.35	1344.71	1349.42	0.002656	18.07	182.05	20.00	1.06
Principle Outlet	14	PF 15	3575.00	1335.24	1344.87	1345.23	1350.22	0.002700	18.57	192.50	20.00	1.05
Principle Outlet	14	PF 16	3990.00	1335.24	1346.00	1346.00	1351.34	0.002502	18.55	215.12	20.00	1.00
Principle Outlet	14	PF 17	4280.00	1335.24	1346.40	1346.40	1352.11	0.002614	19.18	223.16	20.00	1.01
Principle Outlet	14	PF 18	4655.00	1335.24	1347.16	1347.16	1353.08	0.002603	19.53	238.31	20.00	1.00
Principle Outlet	14	PF 19	4830.00	1335.24	1347.46	1347.46	1353.53	0.002628	19.78	244.24	20.00	1.00
Principle Outlet	14	PF 20	5065.00	1335.24	1347.84	1347.84	1354.12	0.002665	20.10	252.01	20.00	1.00
Principle Outlet	14	PF 21	5155.00	1335.24	1347.99	1347.99	1354.34	0.002677	20.21	255.02	20.00	1.00
Principle Outlet	14	PF 22	5245.00	1335.24	1348.12	1348.12	1354.56	0.002700	20.36	257.61	20.00	1.00
Principle Outlet	13	PF 1	156.00	1335.04	1335.89	1336.31	1337.28	0.008376	9.46	16.50	20.00	1.83
Principle Outlet	13	PF 2	340.00	1335.04	1336.57	1337.15	1338.55	0.005800	11.29	30.13	20.00	1.62
Principle Outlet	13	PF 3	398.00	1335.04	1336.77	1337.38	1338.90	0.005439	11.71	33.98	20.00	1.58
Principle Outlet	13	PF 4	591.00	1335.04	1337.34	1338.07	1339.96	0.004820	12.98	45.54	20.00	1.52
Principle Outlet	13	PF 5	822.00	1335.04	1337.99	1338.78	1341.07	0.004365	14.08	58.36	20.00	1.45
Principle Outlet	13	PF 6	1047.00	1335.04	1338.58	1339.47	1342.03	0.004061	14.91	70.21	20.00	1.40
Principle Outlet	13	PF 7	1275.00	1335.04	1339.19	1340.09	1342.90	0.003731	15.45	82.51	20.00	1.34
Principle Outlet	13	PF 8	1509.00	1335.04	1339.74	1340.68	1343.79	0.003632	16.15	93.43	20.00	1.32
Principle Outlet	13	PF 9	1765.00	1335.04	1340.74	1341.31	1344.50	0.002837	15.55	113.50	20.00	1.15
Principle Outlet	13	PF 10	2090.00	1335.04	1341.45	1342.03	1345.61	0.002854	16.38	127.62	20.00	1.14
Principle Outlet	13	PF 11	2337.00	1335.04	1341.97	1342.59	1346.42	0.002864	16.93	138.04	20.00	1.14
Principle Outlet	13	PF 12	2612.00	1335.04	1343.17	1343.17	1347.20	0.002295	16.11	162.12	20.00	1.00
Principle Outlet	13	PF 13	2870.00	1335.04	1342.81	1343.67	1348.14	0.003141	18.53	154.86	20.00	1.17
Principle Outlet	13	PF 14	3290.00	1335.04	1343.71	1344.53	1349.33	0.003051	19.02	172.96	20.00	1.14
Principle Outlet	13	PF 15	3575.00	1335.04	1344.22	1345.05	1350.14	0.003086	19.52	183.16	20.00	1.14
Principle Outlet	13	PF 16	3990.00	1335.04	1345.11	1345.82	1351.24	0.003002	19.87	200.84	20.00	1.10
Principle Outlet	13	PF 17	4280.00	1335.04	1345.58	1346.32	1352.02	0.003061	20.36	210.18	20.00	1.11
Principle Outlet	13	PF 18	4655.00	1335.04	1346.24	1346.98	1352.98	0.003082	20.84	223.41	20.00	1.10
Principle Outlet	13	PF 19	4830.00	1335.04	1346.56	1347.28	1353.42	0.003083	21.02	229.77	20.00	1.09
Principle Outlet	13	PF 20	5065.00	1335.04	1346.94	1347.67	1354.00	0.003111	21.33	237.45	20.00	1.09
Principle Outlet	13	PF 21	5155.00	1335.04	1347.09	1347.78	1354.23	0.003121	21.45	240.37	20.00	1.09
Principle Outlet	13	PF 22	5245.00	1335.04	1347.23	1347.98	1354.45	0.003135	21.57	243.18	20.00	1.09
Principle Outlet	12	PF 1	156.00	1334.91	1335.75	1336.17	1337.18	0.008841	9.61	16.23	20.00	1.88
Principle Outlet	12	PF 2	340.00	1334.91	1336.41	1337.02	1338.48	0.006248	11.55	29.43	20.00	1.68

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	12	PF 3	398.00	1334.91	1336.60	1337.25	1338.82	0.005814	11.96	33.27	20.00	1.63
Principle Outlet	12	PF 4	591.00	1334.91	1337.17	1337.95	1339.89	0.005144	13.25	44.59	20.00	1.56
Principle Outlet	12	PF 5	822.00	1334.91	1337.80	1338.69	1341.00	0.004644	14.38	57.18	20.00	1.50
Principle Outlet	12	PF 6	1047.00	1334.91	1338.38	1339.33	1341.97	0.004309	15.21	68.83	20.00	1.45
Principle Outlet	12	PF 7	1275.00	1334.91	1338.98	1339.96	1342.84	0.003967	15.78	80.81	20.00	1.38
Principle Outlet	12	PF 8	1509.00	1334.91	1339.51	1340.55	1343.73	0.003856	16.49	91.53	20.00	1.36
Principle Outlet	12	PF 9	1765.00	1334.91	1340.42	1341.18	1344.44	0.003124	16.08	109.73	20.00	1.21
Principle Outlet	12	PF 10	2090.00	1334.91	1341.12	1341.92	1345.55	0.003117	16.90	123.69	20.00	1.20
Principle Outlet	12	PF 11	2337.00	1334.91	1341.63	1342.46	1346.36	0.003115	17.45	133.95	20.00	1.19
Principle Outlet	12	PF 12	2612.00	1334.91	1342.51	1343.04	1347.13	0.002760	17.23	151.57	20.00	1.10
Principle Outlet	12	PF 13	2870.00	1334.91	1342.51	1343.57	1348.08	0.003339	18.95	151.46	20.00	1.21
Principle Outlet	12	PF 14	3290.00	1334.91	1343.38	1344.40	1349.27	0.003253	19.48	168.93	20.00	1.18
Principle Outlet	12	PF 15	3575.00	1334.91	1343.89	1344.91	1350.08	0.003280	19.97	179.06	20.00	1.18
Principle Outlet	12	PF 16	3990.00	1334.91	1345.46	1345.69	1351.04	0.002648	18.95	210.56	20.00	1.03
Principle Outlet	12	PF 17	4280.00	1334.91	1345.94	1346.17	1351.81	0.002712	19.45	220.05	20.00	1.03
Principle Outlet	12	PF 18	4655.00	1334.91	1346.59	1346.85	1352.78	0.002760	19.98	233.02	20.00	1.03
Principle Outlet	12	PF 19	4830.00	1334.91	1346.89	1347.15	1353.23	0.002776	20.20	239.16	20.00	1.03
Principle Outlet	12	PF 20	5065.00	1334.91	1347.27	1347.54	1353.82	0.002814	20.52	246.77	20.00	1.03
Principle Outlet	12	PF 21	5155.00	1334.91	1347.42	1347.69	1354.04	0.002828	20.65	249.66	20.00	1.03
Principle Outlet	12	PF 22	5245.00	1334.91	1347.56	1347.84	1354.26	0.002844	20.77	252.49	20.00	1.03
Principle Outlet	11	PF 1	156.00	1334.81	1335.59	1336.04	1337.15	0.010418	10.01	15.58	20.57	2.03
Principle Outlet	11	PF 2	340.00	1334.81	1336.21	1336.88	1338.45	0.007249	12.00	28.33	20.57	1.80
Principle Outlet	11	PF 3	398.00	1334.81	1336.39	1337.09	1338.79	0.006712	12.41	32.06	20.57	1.75
Principle Outlet	11	PF 4	591.00	1334.81	1336.93	1337.80	1339.86	0.005882	13.73	43.04	20.57	1.67
Principle Outlet	11	PF 5	822.00	1334.81	1337.51	1338.52	1340.97	0.005328	14.93	55.05	20.57	1.61
Principle Outlet	11	PF 6	1047.00	1334.81	1338.06	1339.17	1341.93	0.004920	15.80	66.27	20.57	1.55
Principle Outlet	11	PF 7	1275.00	1334.81	1338.61	1339.78	1342.80	0.004551	16.44	77.58	20.57	1.49
Principle Outlet	11	PF 8	1509.00	1334.81	1339.11	1340.36	1343.69	0.004416	17.18	87.83	20.57	1.47
Principle Outlet	11	PF 9	1765.00	1334.81	1339.86	1340.96	1344.39	0.003758	17.08	103.34	20.57	1.34
Principle Outlet	11	PF 10	2090.00	1334.81	1340.51	1341.70	1345.49	0.003711	17.90	116.73	20.57	1.32
Principle Outlet	11	PF 11	2337.00	1334.81	1340.98	1342.22	1346.29	0.003698	18.49	126.41	20.57	1.31
Principle Outlet	11	PF 12	2612.00	1334.81	1341.66	1342.78	1347.04	0.003444	18.62	140.30	20.57	1.26
Principle Outlet	11	PF 13	2870.00	1334.81	1341.82	1343.30	1348.02	0.003888	19.97	143.70	20.57	1.33
Principle Outlet	11	PF 14	3290.00	1334.81	1342.60	1344.12	1349.19	0.003807	20.59	159.76	20.57	1.30
Principle Outlet	11	PF 15	3575.00	1334.81	1343.07	1344.61	1349.99	0.003831	21.11	169.33	20.57	1.30
Principle Outlet	11	PF 16	3990.00	1334.81	1344.10	1345.39	1350.91	0.003459	20.93	190.59	20.57	1.21
Principle Outlet	11	PF 17	4280.00	1334.81	1344.54	1345.88	1351.68	0.003510	21.43	199.68	20.57	1.21
Principle Outlet	11	PF 18	4655.00	1334.81	1345.12	1346.53	1352.64	0.003562	22.01	211.45	20.57	1.21

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	11	PF 19	4830.00	1334.81	1345.38	1346.81	1353.08	0.003586	22.27	216.86	20.57	1.21
Principle Outlet	11	PF 20	5065.00	1334.81	1345.72	1347.21	1353.67	0.003621	22.62	223.93	20.57	1.21
Principle Outlet	11	PF 21	5155.00	1334.81	1345.85	1347.35	1353.89	0.003635	22.75	226.60	20.57	1.21
Principle Outlet	11	PF 22	5245.00	1334.81	1345.98	1347.49	1354.11	0.003650	22.88	229.25	20.57	1.21
Principle Outlet	10	PF 1	156.00	1334.57	1335.27	1335.79	1337.10	0.013885	10.83	14.40	21.14	2.31
Principle Outlet	10	PF 2	340.00	1334.57	1335.85	1336.58	1338.40	0.009233	12.83	26.49	21.14	2.02
Principle Outlet	10	PF 3	398.00	1334.57	1336.01	1336.80	1338.74	0.008500	13.26	30.02	21.14	1.96
Principle Outlet	10	PF 4	591.00	1334.57	1336.51	1337.49	1339.81	0.007272	14.58	40.53	21.14	1.86
Principle Outlet	10	PF 5	822.00	1334.57	1337.05	1338.19	1340.93	0.006464	15.79	52.06	21.14	1.77
Principle Outlet	10	PF 6	1047.00	1334.57	1337.56	1338.82	1341.88	0.005911	16.68	62.78	21.14	1.71
Principle Outlet	10	PF 7	1275.00	1334.57	1338.07	1339.43	1342.74	0.005452	17.36	73.46	21.14	1.64
Principle Outlet	10	PF 8	1509.00	1334.57	1338.53	1340.01	1343.63	0.005246	18.11	83.30	21.14	1.61
Principle Outlet	10	PF 9	1765.00	1334.57	1339.18	1340.60	1344.32	0.004574	18.19	97.05	21.14	1.50
Principle Outlet	10	PF 10	2090.00	1334.57	1339.78	1341.32	1345.42	0.004485	19.05	109.72	21.14	1.47
Principle Outlet	10	PF 11	2337.00	1334.57	1340.22	1341.85	1346.22	0.004449	19.66	118.90	21.14	1.46
Principle Outlet	10	PF 12	2612.00	1334.57	1340.80	1342.40	1346.95	0.004187	19.89	131.30	21.14	1.41
Principle Outlet	10	PF 13	2870.00	1334.57	1341.03	1342.91	1347.94	0.004567	21.09	136.09	21.14	1.46
Principle Outlet	10	PF 14	3290.00	1334.57	1341.74	1343.70	1349.10	0.004469	21.77	151.13	21.14	1.43
Principle Outlet	10	PF 15	3575.00	1334.57	1342.18	1344.23	1349.89	0.004472	22.29	160.39	21.14	1.43
Principle Outlet	10	PF 16	3990.00	1334.57	1343.02	1344.94	1350.81	0.004169	22.40	178.15	21.14	1.36
Principle Outlet	10	PF 17	4280.00	1334.57	1343.44	1345.43	1351.57	0.004198	22.88	187.05	21.14	1.36
Principle Outlet	10	PF 18	4655.00	1334.57	1343.97	1346.08	1352.53	0.004239	23.48	198.28	21.14	1.35
Principle Outlet	10	PF 19	4830.00	1334.57	1344.22	1346.36	1352.97	0.004258	23.74	203.44	21.14	1.35
Principle Outlet	10	PF 20	5065.00	1334.57	1344.54	1346.74	1353.55	0.004287	24.10	210.20	21.14	1.35
Principle Outlet	10	PF 21	5155.00	1334.57	1344.66	1346.86	1353.77	0.004299	24.23	212.76	21.14	1.35
Principle Outlet	10	PF 22	5245.00	1334.57	1344.78	1347.01	1353.99	0.004311	24.36	215.30	21.14	1.35
Principle Outlet	9	PF 1	156.00	1334.18	1334.80	1335.38	1337.02	0.019717	11.95	13.05	21.71	2.72
Principle Outlet	9	PF 2	340.00	1334.18	1335.33	1336.17	1338.33	0.012269	13.90	24.46	21.71	2.31
Principle Outlet	9	PF 3	398.00	1334.18	1335.48	1336.39	1338.68	0.011226	14.35	27.74	21.71	2.24
Principle Outlet	9	PF 4	591.00	1334.18	1335.94	1337.06	1339.74	0.009304	15.65	37.77	21.71	2.09
Principle Outlet	9	PF 5	822.00	1334.18	1336.45	1337.76	1340.86	0.008100	16.86	48.75	21.71	1.98
Principle Outlet	9	PF 6	1047.00	1334.18	1336.92	1338.38	1341.82	0.007318	17.76	58.94	21.71	1.90
Principle Outlet	9	PF 7	1275.00	1334.18	1337.38	1338.95	1342.68	0.006699	18.47	69.04	21.71	1.82
Principle Outlet	9	PF 8	1509.00	1334.18	1337.82	1339.52	1343.55	0.006364	19.22	78.53	21.71	1.78
Principle Outlet	9	PF 9	1765.00	1334.18	1338.39	1340.12	1344.24	0.005612	19.40	91.00	21.71	1.67
Principle Outlet	9	PF 10	2090.00	1334.18	1338.95	1340.82	1345.33	0.005450	20.28	103.08	21.71	1.64
Principle Outlet	9	PF 11	2337.00	1334.18	1339.36	1341.32	1346.13	0.005361	20.88	111.92	21.71	1.62

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	9	PF 12	2612.00	1334.18	1339.88	1341.87	1346.85	0.005071	21.20	123.23	21.71	1.57
Principle Outlet	9	PF 13	2870.00	1334.18	1340.13	1342.37	1347.85	0.005394	22.28	128.79	21.71	1.61
Principle Outlet	9	PF 14	3290.00	1334.18	1340.80	1343.16	1349.00	0.005245	22.98	143.16	21.71	1.58
Principle Outlet	9	PF 15	3575.00	1334.18	1341.20	1343.66	1349.79	0.005231	23.52	151.99	21.71	1.57
Principle Outlet	9	PF 16	3990.00	1334.18	1341.94	1344.39	1350.70	0.004920	23.74	168.06	21.71	1.50
Principle Outlet	9	PF 17	4280.00	1334.18	1342.33	1344.85	1351.46	0.004938	24.24	176.57	21.71	1.50
Principle Outlet	9	PF 18	4655.00	1334.18	1342.83	1345.48	1352.42	0.004962	24.85	187.35	21.71	1.49
Principle Outlet	9	PF 19	4830.00	1334.18	1343.06	1345.75	1352.86	0.004976	25.12	192.27	21.71	1.49
Principle Outlet	9	PF 20	5065.00	1334.18	1343.36	1346.13	1353.44	0.004996	25.48	198.79	21.71	1.48
Principle Outlet	9	PF 21	5155.00	1334.18	1343.47	1346.28	1353.66	0.005004	25.61	201.26	21.71	1.48
Principle Outlet	9	PF 22	5245.00	1334.18	1343.59	1346.42	1353.88	0.005013	25.75	203.71	21.71	1.48
Principle Outlet	8	PF 1	156.00	1333.64	1334.19	1334.82	1336.93	0.028655	13.27	11.76	22.29	3.22
Principle Outlet	8	PF 2	340.00	1333.64	1334.67	1335.61	1338.24	0.016660	15.15	22.44	22.29	2.66
Principle Outlet	8	PF 3	398.00	1333.64	1334.81	1335.82	1338.59	0.015094	15.60	25.52	22.29	2.57
Principle Outlet	8	PF 4	591.00	1333.64	1335.24	1336.46	1339.66	0.012097	16.86	35.05	22.29	2.37
Principle Outlet	8	PF 5	822.00	1333.64	1335.71	1337.15	1340.77	0.010268	18.06	45.53	22.29	2.23
Principle Outlet	8	PF 6	1047.00	1333.64	1336.14	1337.76	1341.74	0.009169	18.98	55.16	22.29	2.13
Principle Outlet	8	PF 7	1275.00	1333.64	1336.57	1338.34	1342.60	0.008316	19.70	64.73	22.29	2.04
Principle Outlet	8	PF 8	1509.00	1333.64	1336.98	1338.90	1343.46	0.007802	20.44	73.84	22.29	1.98
Principle Outlet	8	PF 9	1765.00	1333.64	1337.49	1339.48	1344.15	0.006922	20.70	85.27	22.29	1.86
Principle Outlet	8	PF 10	2090.00	1333.64	1338.01	1340.17	1345.25	0.006649	21.58	96.83	22.29	1.83
Principle Outlet	8	PF 11	2337.00	1333.64	1338.40	1340.68	1346.03	0.006476	22.17	105.39	22.29	1.80
Principle Outlet	8	PF 12	2612.00	1333.64	1338.87	1341.20	1346.75	0.006126	22.54	115.90	22.29	1.74
Principle Outlet	8	PF 13	2870.00	1333.64	1339.13	1341.70	1347.75	0.006397	23.55	121.85	22.29	1.78
Principle Outlet	8	PF 14	3290.00	1333.64	1339.75	1342.47	1348.89	0.006182	24.27	135.58	22.29	1.73
Principle Outlet	8	PF 15	3575.00	1333.64	1340.13	1342.94	1349.69	0.006131	24.80	144.13	22.29	1.72
Principle Outlet	8	PF 16	3990.00	1333.64	1340.80	1343.66	1350.58	0.005789	25.10	158.96	22.29	1.66
Principle Outlet	8	PF 17	4280.00	1333.64	1341.16	1344.15	1351.35	0.005791	25.61	167.09	22.29	1.65
Principle Outlet	8	PF 18	4655.00	1333.64	1341.64	1344.73	1352.30	0.005777	26.21	177.62	22.29	1.64
Principle Outlet	8	PF 19	4830.00	1333.64	1341.85	1345.03	1352.74	0.005779	26.48	182.40	22.29	1.63
Principle Outlet	8	PF 20	5065.00	1333.64	1342.14	1345.37	1353.31	0.005776	26.83	188.81	22.29	1.62
Principle Outlet	8	PF 21	5155.00	1333.64	1342.24	1345.52	1353.53	0.005781	26.96	191.18	22.29	1.62
Principle Outlet	8	PF 22	5245.00	1333.64	1342.35	1345.65	1353.75	0.005786	27.10	193.54	22.29	1.62
Principle Outlet	7	PF 1	156.00	1332.96	1333.45	1334.11	1336.80	0.041094	14.67	10.63	22.86	3.79
Principle Outlet	7	PF 2	340.00	1332.96	1333.89	1334.90	1338.14	0.022775	16.55	20.55	22.86	3.08
Principle Outlet	7	PF 3	398.00	1332.96	1334.01	1335.11	1338.49	0.020368	16.97	23.45	22.86	2.95
Principle Outlet	7	PF 4	591.00	1332.96	1334.41	1335.74	1339.55	0.015832	18.21	32.46	22.86	2.69

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	7	PF 5	822.00	1332.96	1334.85	1336.42	1340.67	0.013091	19.36	42.46	22.86	2.50
Principle Outlet	7	PF 6	1047.00	1332.96	1335.25	1337.03	1341.63	0.011518	20.28	51.62	22.86	2.38
Principle Outlet	7	PF 7	1275.00	1332.96	1335.64	1337.59	1342.49	0.010340	21.01	60.70	22.86	2.27
Principle Outlet	7	PF 8	1509.00	1332.96	1336.02	1338.12	1343.37	0.009605	21.75	69.39	22.86	2.20
Principle Outlet	7	PF 9	1765.00	1332.96	1336.49	1338.70	1344.04	0.008519	22.05	80.04	22.86	2.08
Principle Outlet	7	PF 10	2090.00	1332.96	1336.97	1339.38	1345.14	0.008092	22.94	91.11	22.86	2.02
Principle Outlet	7	PF 11	2337.00	1332.96	1337.34	1339.87	1345.92	0.007812	23.52	99.38	22.86	1.99
Principle Outlet	7	PF 12	2612.00	1332.96	1337.77	1340.37	1346.64	0.007372	23.90	109.28	22.86	1.93
Principle Outlet	7	PF 13	2870.00	1332.96	1338.04	1340.89	1347.64	0.007579	24.86	115.44	22.86	1.95
Principle Outlet	7	PF 14	3290.00	1332.96	1338.61	1341.64	1348.78	0.007276	25.58	128.60	22.86	1.90
Principle Outlet	7	PF 15	3575.00	1332.96	1338.97	1342.13	1349.58	0.007187	26.13	136.80	22.86	1.88
Principle Outlet	7	PF 16	3990.00	1332.96	1339.58	1342.80	1350.47	0.006790	26.48	150.69	22.86	1.82
Principle Outlet	7	PF 17	4280.00	1332.96	1339.93	1343.29	1351.23	0.006752	26.98	158.63	22.86	1.80
Principle Outlet	7	PF 18	4655.00	1332.96	1340.37	1343.89	1352.18	0.006698	27.57	168.85	22.86	1.79
Principle Outlet	7	PF 19	4830.00	1332.96	1340.58	1344.16	1352.61	0.006683	27.84	173.50	22.86	1.78
Principle Outlet	7	PF 20	5065.00	1332.96	1340.85	1344.52	1353.18	0.006660	28.18	179.71	22.86	1.77
Principle Outlet	7	PF 21	5155.00	1332.96	1340.95	1344.65	1353.41	0.006658	28.32	182.02	22.86	1.77
Principle Outlet	7	PF 22	5245.00	1332.96	1341.05	1344.79	1353.62	0.006656	28.46	184.32	22.86	1.77
Principle Outlet	6	PF 1	156.00	1331.73	1332.15	1332.86	1336.54	0.066994	16.80	9.28	23.67	4.73
Principle Outlet	6	PF 2	340.00	1331.73	1332.53	1333.63	1337.94	0.035048	18.67	18.21	23.67	3.75
Principle Outlet	6	PF 3	398.00	1331.73	1332.64	1333.82	1338.29	0.030930	19.08	20.86	23.67	3.58
Principle Outlet	6	PF 4	591.00	1331.73	1332.99	1334.44	1339.38	0.023186	20.28	29.15	23.67	3.22
Principle Outlet	6	PF 5	822.00	1331.73	1333.38	1335.11	1340.49	0.018593	21.40	38.41	23.67	2.96
Principle Outlet	6	PF 6	1047.00	1331.73	1333.74	1335.70	1341.46	0.015988	22.29	46.96	23.67	2.79
Principle Outlet	6	PF 7	1275.00	1331.73	1334.10	1336.22	1342.32	0.014132	23.01	55.41	23.67	2.65
Principle Outlet	6	PF 8	1509.00	1331.73	1334.45	1336.75	1343.19	0.012925	23.73	63.58	23.67	2.55
Principle Outlet	6	PF 9	1765.00	1331.73	1334.85	1337.33	1343.87	0.011436	24.09	73.27	23.67	2.41
Principle Outlet	6	PF 10	2090.00	1331.73	1335.30	1337.99	1344.96	0.010669	24.95	83.77	23.67	2.34
Principle Outlet	6	PF 11	2337.00	1331.73	1335.63	1338.47	1345.74	0.010188	25.51	91.60	23.67	2.29
Principle Outlet	6	PF 12	2612.00	1331.73	1336.01	1338.98	1346.46	0.009581	25.93	100.72	23.67	2.22
Principle Outlet	6	PF 13	2870.00	1331.73	1336.28	1339.48	1347.45	0.009667	26.83	106.99	23.67	2.22
Principle Outlet	6	PF 14	3290.00	1331.73	1336.80	1340.19	1348.59	0.009185	27.55	119.42	23.67	2.16
Principle Outlet	6	PF 15	3575.00	1331.73	1337.14	1340.69	1349.39	0.009002	28.09	127.27	23.67	2.13
Principle Outlet	6	PF 16	3990.00	1331.73	1337.68	1341.35	1350.27	0.008482	28.48	140.11	23.67	2.06
Principle Outlet	6	PF 17	4280.00	1331.73	1338.00	1341.82	1351.03	0.008377	28.97	147.74	23.67	2.04
Principle Outlet	6	PF 18	4655.00	1331.73	1338.41	1342.40	1351.97	0.008247	29.55	157.53	23.67	2.02
Principle Outlet	6	PF 19	4830.00	1331.73	1338.60	1342.68	1352.41	0.008207	29.83	161.94	23.67	2.01
Principle Outlet	6	PF 20	5065.00	1331.73	1338.85	1343.02	1352.99	0.008147	30.17	167.88	23.67	2.00

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	6	PF 21	5155.00	1331.73	1338.95	1343.16	1353.21	0.008132	30.31	170.10	23.67	1.99
Principle Outlet	6	PF 22	5245.00	1331.73	1339.04	1343.27	1353.43	0.008117	30.44	172.30	23.67	1.99
Principle Outlet	5.8*	PF 1	156.00	1329.62	1329.96	1330.71	1335.96	0.119928	19.66	7.94	24.94	6.14
Principle Outlet	5.8*	PF 2	340.00	1329.62	1330.27	1331.44	1337.54	0.060386	21.64	15.71	24.94	4.80
Principle Outlet	5.8*	PF 3	398.00	1329.62	1330.36	1331.63	1337.91	0.052607	22.05	18.05	24.94	4.57
Principle Outlet	5.8*	PF 4	591.00	1329.62	1330.66	1332.24	1339.03	0.037997	23.22	25.45	24.94	4.05
Principle Outlet	5.8*	PF 5	822.00	1329.62	1331.00	1332.87	1340.18	0.029506	24.32	33.80	24.94	3.68
Principle Outlet	5.8*	PF 6	1047.00	1329.62	1331.31	1333.45	1341.16	0.024743	25.19	41.57	24.94	3.44
Principle Outlet	5.8*	PF 7	1275.00	1329.62	1331.62	1333.97	1342.02	0.021468	25.89	49.25	24.94	3.25
Principle Outlet	5.8*	PF 8	1509.00	1329.62	1331.92	1334.50	1342.89	0.019255	26.59	56.76	24.94	3.11
Principle Outlet	5.8*	PF 9	1765.00	1329.62	1332.26	1335.03	1343.57	0.016942	26.99	65.40	24.94	2.94
Principle Outlet	5.8*	PF 10	2090.00	1329.62	1332.65	1335.68	1344.67	0.015482	27.82	75.13	24.94	2.82
Principle Outlet	5.8*	PF 11	2337.00	1329.62	1332.94	1336.14	1345.44	0.014596	28.37	82.38	24.94	2.75
Principle Outlet	5.8*	PF 12	2612.00	1329.62	1333.28	1336.65	1346.16	0.013614	28.81	90.68	24.94	2.66
Principle Outlet	5.8*	PF 13	2870.00	1329.62	1333.52	1337.10	1347.15	0.013460	29.63	96.87	24.94	2.65
Principle Outlet	5.8*	PF 14	3290.00	1329.62	1333.99	1337.80	1348.29	0.012616	30.35	108.41	24.94	2.57
Principle Outlet	5.8*	PF 15	3575.00	1329.62	1334.28	1338.26	1349.08	0.012241	30.87	115.79	24.94	2.53
Principle Outlet	5.8*	PF 16	3990.00	1329.62	1334.75	1338.92	1349.97	0.011480	31.31	127.45	24.94	2.44
Principle Outlet	5.8*	PF 17	4280.00	1329.62	1335.04	1339.36	1350.72	0.011232	31.78	134.68	24.94	2.41
Principle Outlet	5.8*	PF 18	4655.00	1329.62	1335.41	1339.93	1351.66	0.010950	32.35	143.90	24.94	2.37
Principle Outlet	5.8*	PF 19	4830.00	1329.62	1335.58	1340.16	1352.10	0.010846	32.62	148.09	24.94	2.36
Principle Outlet	5.8*	PF 20	5065.00	1329.62	1335.80	1340.52	1352.67	0.010707	32.95	153.70	24.94	2.34
Principle Outlet	5.8*	PF 21	5155.00	1329.62	1335.89	1340.64	1352.89	0.010663	33.09	155.81	24.94	2.33
Principle Outlet	5.8*	PF 22	5245.00	1329.62	1335.97	1340.77	1353.10	0.010620	33.22	157.91	24.94	2.33
Principle Outlet	5.6*	PF 1	156.00	1327.50	1327.79	1328.55	1335.16	0.179111	21.78	7.16	26.20	7.34
Principle Outlet	5.6*	PF 2	340.00	1327.50	1331.74	1329.27	1331.89	0.000131	3.08	110.51	26.20	0.26
Principle Outlet	5.6*	PF 3	398.00	1327.50	1332.13	1329.45	1332.30	0.000138	3.29	120.89	26.20	0.27
Principle Outlet	5.6*	PF 4	591.00	1327.50	1333.28	1330.03	1333.52	0.000157	3.91	150.99	26.20	0.29
Principle Outlet	5.6*	PF 5	822.00	1327.50	1334.62	1330.66	1334.92	0.000166	4.42	186.04	26.20	0.29
Principle Outlet	5.6*	PF 6	1047.00	1327.50	1335.54	1331.19	1335.93	0.000191	4.98	210.17	26.20	0.31
Principle Outlet	5.6*	PF 7	1275.00	1327.50	1336.24	1331.72	1336.72	0.000224	5.58	228.44	26.20	0.33
Principle Outlet	5.6*	PF 8	1509.00	1327.50	1336.84	1332.22	1337.43	0.000260	6.18	244.15	26.20	0.36
Principle Outlet	5.6*	PF 9	1765.00	1327.50	1329.81	1332.74	1343.27	0.023236	29.44	59.95	26.20	3.43
Principle Outlet	5.6*	PF 10	2090.00	1327.50	1330.16	1333.36	1344.37	0.020927	30.25	69.08	26.20	3.28
Principle Outlet	5.6*	PF 11	2337.00	1327.50	1330.42	1333.78	1345.14	0.019539	30.79	75.90	26.20	3.19
Principle Outlet	5.6*	PF 12	2612.00	1327.50	1330.71	1334.30	1345.86	0.018112	31.24	83.62	26.20	3.08
Principle Outlet	5.6*	PF 13	2870.00	1327.50	1330.94	1334.74	1346.86	0.017666	32.01	89.65	26.20	3.05

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	5.6*	PF 14	3290.00	1327.50	1331.36	1335.36	1347.99	0.016381	32.73	100.52	26.20	2.94
Principle Outlet	5.6*	PF 15	3575.00	1327.50	1331.63	1335.87	1348.79	0.015774	33.24	107.54	26.20	2.89
Principle Outlet	5.6*	PF 16	3990.00	1327.50	1332.04	1336.50	1349.67	0.014711	33.69	118.42	26.20	2.79
Principle Outlet	5.6*	PF 17	4280.00	1327.50	1332.30	1336.93	1350.42	0.014301	34.16	125.30	26.20	2.75
Principle Outlet	5.6*	PF 18	4655.00	1327.50	1332.64	1337.47	1351.36	0.013840	34.72	134.07	26.20	2.70
Principle Outlet	5.6*	PF 19	4830.00	1327.50	1332.79	1337.71	1351.79	0.013662	34.98	138.06	26.20	2.69
Principle Outlet	5.6*	PF 20	5065.00	1327.50	1332.99	1338.03	1352.36	0.013430	35.32	143.42	26.20	2.66
Principle Outlet	5.6*	PF 21	5155.00	1327.50	1333.07	1338.18	1352.58	0.013352	35.45	145.44	26.20	2.65
Principle Outlet	5.6*	PF 22	5245.00	1327.50	1333.15	1338.29	1352.80	0.013278	35.57	147.44	26.20	2.64
Principle Outlet	5.4*	PF 1	156.00	1325.39	1330.21	1326.40	1330.23	0.000017	1.18	131.91	27.47	0.10
Principle Outlet	5.4*	PF 2	340.00	1325.39	1331.80	1327.09	1331.86	0.000034	1.94	175.66	27.47	0.13
Principle Outlet	5.4*	PF 3	398.00	1325.39	1332.20	1327.27	1332.27	0.000039	2.13	186.72	27.47	0.14
Principle Outlet	5.4*	PF 4	591.00	1325.39	1333.37	1327.85	1333.48	0.000055	2.70	218.79	27.47	0.17
Principle Outlet	5.4*	PF 5	822.00	1325.39	1334.72	1328.44	1334.88	0.000068	3.21	255.89	27.47	0.19
Principle Outlet	5.4*	PF 6	1047.00	1325.39	1335.66	1328.96	1335.88	0.000085	3.72	281.73	27.47	0.20
Principle Outlet	5.4*	PF 7	1275.00	1325.39	1336.38	1329.47	1336.66	0.000105	4.23	301.55	27.47	0.22
Principle Outlet	5.4*	PF 8	1509.00	1325.39	1337.01	1329.96	1337.36	0.000126	4.73	318.78	27.47	0.24
Principle Outlet	5.4*	PF 9	1765.00	1325.39	1337.64	1330.45	1338.07	0.000149	5.25	336.19	27.47	0.26
Principle Outlet	5.4*	PF 10	2090.00	1325.39	1338.36	1331.06	1338.89	0.000179	5.88	355.74	27.47	0.29
Principle Outlet	5.4*	PF 11	2337.00	1325.39	1338.85	1331.49	1339.47	0.000203	6.33	369.37	27.47	0.30
Principle Outlet	5.4*	PF 12	2612.00	1325.39	1339.37	1331.97	1340.09	0.000229	6.81	383.62	27.47	0.32
Principle Outlet	5.4*	PF 13	2870.00	1325.39	1339.84	1332.40	1340.65	0.000253	7.24	396.43	27.47	0.34
Principle Outlet	5.4*	PF 14	3290.00	1325.39	1340.56	1333.05	1341.53	0.000293	7.91	416.16	27.47	0.36
Principle Outlet	5.4*	PF 15	3575.00	1325.39	1341.02	1333.50	1342.10	0.000320	8.34	428.87	27.47	0.37
Principle Outlet	5.4*	PF 16	3990.00	1325.39	1341.65	1334.11	1342.89	0.000359	8.94	446.30	27.47	0.39
Principle Outlet	5.4*	PF 17	4280.00	1325.39	1329.70	1334.52	1350.12	0.017648	36.26	118.03	27.47	3.08
Principle Outlet	5.4*	PF 18	4655.00	1325.39	1330.01	1335.05	1351.05	0.016967	36.81	126.46	27.47	3.02
Principle Outlet	5.4*	PF 19	4830.00	1325.39	1330.15	1335.29	1351.48	0.016698	37.07	130.30	27.47	3.00
Principle Outlet	5.4*	PF 20	5065.00	1325.39	1330.34	1335.58	1352.06	0.016370	37.40	135.42	27.47	2.97
Principle Outlet	5.4*	PF 21	5155.00	1325.39	1330.41	1335.73	1352.28	0.016254	37.53	137.35	27.47	2.96
Principle Outlet	5.4*	PF 22	5245.00	1325.39	1330.48	1335.85	1352.50	0.016142	37.66	139.28	27.47	2.95
Principle Outlet	5.2*	PF 1	156.00	1323.27	1330.22	1324.25	1330.23	0.000005	0.78	199.26	28.73	0.05
Principle Outlet	5.2*	PF 2	340.00	1323.27	1331.82	1324.91	1331.85	0.000013	1.39	245.33	28.73	0.08
Principle Outlet	5.2*	PF 3	398.00	1323.27	1332.23	1325.09	1332.26	0.000016	1.55	257.00	28.73	0.09
Principle Outlet	5.2*	PF 4	591.00	1323.27	1333.40	1325.65	1333.47	0.000025	2.03	290.86	28.73	0.11
Principle Outlet	5.2*	PF 5	822.00	1323.27	1334.77	1326.21	1334.86	0.000034	2.49	329.96	28.73	0.13
Principle Outlet	5.2*	PF 6	1047.00	1323.27	1335.72	1326.74	1335.85	0.000045	2.93	357.32	28.73	0.15

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	5.2*	PF 7	1275.00	1323.27	1336.45	1327.23	1336.63	0.000057	3.37	378.46	28.73	0.16
Principle Outlet	5.2*	PF 8	1509.00	1323.27	1337.10	1327.70	1337.32	0.000070	3.80	396.92	28.73	0.18
Principle Outlet	5.2*	PF 9	1765.00	1323.27	1337.75	1328.18	1338.03	0.000084	4.25	415.61	28.73	0.20
Principle Outlet	5.2*	PF 10	2090.00	1323.27	1338.48	1328.77	1338.84	0.000104	4.79	436.70	28.73	0.22
Principle Outlet	5.2*	PF 11	2337.00	1323.27	1338.99	1329.17	1339.41	0.000119	5.18	451.46	28.73	0.23
Principle Outlet	5.2*	PF 12	2612.00	1323.27	1339.53	1329.66	1340.02	0.000136	5.59	466.95	28.73	0.24
Principle Outlet	5.2*	PF 13	2870.00	1323.27	1340.02	1330.06	1340.57	0.000152	5.97	480.88	28.73	0.26
Principle Outlet	5.2*	PF 14	3290.00	1323.27	1340.77	1330.71	1341.43	0.000178	6.55	502.40	28.73	0.28
Principle Outlet	5.2*	PF 15	3575.00	1323.27	1341.25	1331.13	1342.00	0.000196	6.92	516.29	28.73	0.29
Principle Outlet	5.2*	PF 16	3990.00	1323.27	1341.92	1331.73	1342.78	0.000222	7.45	535.40	28.73	0.30
Principle Outlet	5.2*	PF 17	4280.00	1323.27	1342.35	1332.13	1343.29	0.000241	7.81	547.72	28.73	0.32
Principle Outlet	5.2*	PF 18	4655.00	1323.27	1342.89	1332.64	1343.95	0.000265	8.26	563.38	28.73	0.33
Principle Outlet	5.2*	PF 19	4830.00	1323.27	1343.13	1332.83	1344.25	0.000277	8.47	570.37	28.73	0.33
Principle Outlet	5.2*	PF 20	5065.00	1323.27	1343.46	1333.18	1344.65	0.000292	8.74	579.81	28.73	0.34
Principle Outlet	5.2*	PF 21	5155.00	1323.27	1343.58	1333.31	1344.80	0.000298	8.84	583.35	28.73	0.35
Principle Outlet	5.2*	PF 22	5245.00	1323.27	1343.71	1333.42	1344.95	0.000303	8.94	586.85	28.73	0.35
Principle Outlet	5	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.71	30.00	0.03
Principle Outlet	5	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	319.99	30.00	0.06
Principle Outlet	5	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.23	30.00	0.06
Principle Outlet	5	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.77	30.00	0.08
Principle Outlet	5	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.80	30.00	0.10
Principle Outlet	5	PF 6	1047.00	1321.15	1335.75	1324.53	1335.84	0.000026	2.39	437.60	30.00	0.11
Principle Outlet	5	PF 7	1275.00	1321.15	1336.49	1325.00	1336.61	0.000034	2.77	459.93	30.00	0.12
Principle Outlet	5	PF 8	1509.00	1321.15	1337.15	1325.45	1337.30	0.000042	3.15	479.49	30.00	0.14
Principle Outlet	5	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.33	30.00	0.15
Principle Outlet	5	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.78	30.00	0.17
Principle Outlet	5	PF 11	2337.00	1321.15	1339.08	1326.90	1339.37	0.000075	4.35	537.53	30.00	0.18
Principle Outlet	5	PF 12	2612.00	1321.15	1339.63	1327.36	1339.98	0.000087	4.71	554.08	30.00	0.19
Principle Outlet	5	PF 13	2870.00	1321.15	1340.13	1327.75	1340.52	0.000098	5.04	568.99	30.00	0.20
Principle Outlet	5	PF 14	3290.00	1321.15	1340.90	1328.35	1341.38	0.000116	5.56	592.05	30.00	0.22
Principle Outlet	5	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.95	30.00	0.23
Principle Outlet	5	PF 16	3990.00	1321.15	1342.08	1329.35	1342.71	0.000147	6.36	627.51	30.00	0.25
Principle Outlet	5	PF 17	4280.00	1321.15	1342.52	1329.77	1343.22	0.000160	6.68	640.81	30.00	0.25
Principle Outlet	5	PF 18	4655.00	1321.15	1343.09	1330.24	1343.86	0.000177	7.08	657.72	30.00	0.27
Principle Outlet	5	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.29	30.00	0.27
Principle Outlet	5	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.49	30.00	0.28
Principle Outlet	5	PF 21	5155.00	1321.15	1343.81	1330.90	1344.70	0.000200	7.59	679.32	30.00	0.28
Principle Outlet	5	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.12	30.00	0.28

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.94285*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.94285*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.94285*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.94285*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.94285*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.84	30.00	0.10
Principle Outlet	4.94285*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.64	30.00	0.11
Principle Outlet	4.94285*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.97	30.00	0.12
Principle Outlet	4.94285*	PF 8	1509.00	1321.15	1337.15	1325.44	1337.30	0.000042	3.15	479.53	30.00	0.14
Principle Outlet	4.94285*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.37	30.00	0.15
Principle Outlet	4.94285*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.82	30.00	0.17
Principle Outlet	4.94285*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.56	30.00	0.18
Principle Outlet	4.94285*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.12	30.00	0.19
Principle Outlet	4.94285*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	569.02	30.00	0.20
Principle Outlet	4.94285*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.08	30.00	0.22
Principle Outlet	4.94285*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.98	30.00	0.23
Principle Outlet	4.94285*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.71	0.000147	6.36	627.54	30.00	0.24
Principle Outlet	4.94285*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.84	30.00	0.25
Principle Outlet	4.94285*	PF 18	4655.00	1321.15	1343.09	1330.25	1343.86	0.000177	7.08	657.74	30.00	0.27
Principle Outlet	4.94285*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.31	30.00	0.27
Principle Outlet	4.94285*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.51	30.00	0.28
Principle Outlet	4.94285*	PF 21	5155.00	1321.15	1343.81	1330.90	1344.70	0.000200	7.59	679.34	30.00	0.28
Principle Outlet	4.94285*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.13	30.00	0.28
Principle Outlet	4.88571*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.88571*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.88571*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.88571*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.88571*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.84	30.00	0.10
Principle Outlet	4.88571*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.64	30.00	0.11
Principle Outlet	4.88571*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.97	30.00	0.12
Principle Outlet	4.88571*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.53	30.00	0.14
Principle Outlet	4.88571*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.36	30.00	0.15
Principle Outlet	4.88571*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.81	30.00	0.17
Principle Outlet	4.88571*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.55	30.00	0.18
Principle Outlet	4.88571*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.11	30.00	0.19
Principle Outlet	4.88571*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	569.01	30.00	0.20
Principle Outlet	4.88571*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.06	30.00	0.22
Principle Outlet	4.88571*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.96	30.00	0.23

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.88571*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.71	0.000147	6.36	627.52	30.00	0.25
Principle Outlet	4.88571*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.81	30.00	0.25
Principle Outlet	4.88571*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.71	30.00	0.27
Principle Outlet	4.88571*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.16	0.000185	7.26	665.28	30.00	0.27
Principle Outlet	4.88571*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.48	30.00	0.28
Principle Outlet	4.88571*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.31	30.00	0.28
Principle Outlet	4.88571*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.10	30.00	0.28
Principle Outlet	4.82857*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.82857*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.82857*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.82857*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.82857*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.82857*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.82857*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.82857*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.52	30.00	0.14
Principle Outlet	4.82857*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.35	30.00	0.15
Principle Outlet	4.82857*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.81	30.00	0.17
Principle Outlet	4.82857*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.54	30.00	0.18
Principle Outlet	4.82857*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.10	30.00	0.19
Principle Outlet	4.82857*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.99	30.00	0.20
Principle Outlet	4.82857*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.38	0.000116	5.56	592.05	30.00	0.22
Principle Outlet	4.82857*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.94	30.00	0.23
Principle Outlet	4.82857*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.50	30.00	0.25
Principle Outlet	4.82857*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.79	30.00	0.25
Principle Outlet	4.82857*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.69	30.00	0.27
Principle Outlet	4.82857*	PF 19	4830.00	1321.15	1343.34	1330.48	1344.15	0.000185	7.26	665.26	30.00	0.27
Principle Outlet	4.82857*	PF 20	5065.00	1321.15	1343.68	1330.78	1344.55	0.000196	7.50	675.45	30.00	0.28
Principle Outlet	4.82857*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.28	30.00	0.28
Principle Outlet	4.82857*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.85	0.000204	7.68	683.08	30.00	0.28
Principle Outlet	4.77142*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.77142*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.77142*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.77142*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.77142*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.77142*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.77142*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.77142*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.51	30.00	0.14

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.77142*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.35	30.00	0.15
Principle Outlet	4.77142*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.80	30.00	0.17
Principle Outlet	4.77142*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.53	30.00	0.18
Principle Outlet	4.77142*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.98	0.000087	4.71	554.08	30.00	0.19
Principle Outlet	4.77142*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.98	30.00	0.20
Principle Outlet	4.77142*	PF 14	3290.00	1321.15	1340.90	1328.38	1341.37	0.000116	5.56	592.03	30.00	0.22
Principle Outlet	4.77142*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.93	30.00	0.23
Principle Outlet	4.77142*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.47	30.00	0.25
Principle Outlet	4.77142*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.77	30.00	0.25
Principle Outlet	4.77142*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.66	30.00	0.27
Principle Outlet	4.77142*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.23	30.00	0.27
Principle Outlet	4.77142*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.42	30.00	0.28
Principle Outlet	4.77142*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.25	30.00	0.28
Principle Outlet	4.77142*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	683.05	30.00	0.28
Principle Outlet	4.71428*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03
Principle Outlet	4.71428*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.71428*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.71428*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.71428*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.83	30.00	0.10
Principle Outlet	4.71428*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.63	30.00	0.11
Principle Outlet	4.71428*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.96	30.00	0.12
Principle Outlet	4.71428*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.51	30.00	0.14
Principle Outlet	4.71428*	PF 9	1765.00	1321.15	1337.81	1325.91	1338.00	0.000052	3.53	499.34	30.00	0.15
Principle Outlet	4.71428*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.79	30.00	0.17
Principle Outlet	4.71428*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.52	30.00	0.18
Principle Outlet	4.71428*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.97	0.000087	4.71	554.07	30.00	0.19
Principle Outlet	4.71428*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.96	30.00	0.20
Principle Outlet	4.71428*	PF 14	3290.00	1321.15	1340.89	1328.38	1341.37	0.000116	5.56	592.02	30.00	0.22
Principle Outlet	4.71428*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.91	30.00	0.23
Principle Outlet	4.71428*	PF 16	3990.00	1321.15	1342.08	1329.36	1342.70	0.000147	6.36	627.45	30.00	0.25
Principle Outlet	4.71428*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.75	30.00	0.25
Principle Outlet	4.71428*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.64	30.00	0.27
Principle Outlet	4.71428*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.20	30.00	0.27
Principle Outlet	4.71428*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.40	30.00	0.28
Principle Outlet	4.71428*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.70	0.000200	7.59	679.22	30.00	0.28
Principle Outlet	4.71428*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	683.02	30.00	0.28
Principle Outlet	4.65714*	PF 1	156.00	1321.15	1330.22	1322.10	1330.22	0.000002	0.57	271.76	30.00	0.03

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.65714*	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	320.04	30.00	0.06
Principle Outlet	4.65714*	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.27	30.00	0.06
Principle Outlet	4.65714*	PF 4	591.00	1321.15	1333.42	1323.45	1333.46	0.000013	1.61	367.82	30.00	0.08
Principle Outlet	4.65714*	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.82	30.00	0.10
Principle Outlet	4.65714*	PF 6	1047.00	1321.15	1335.75	1324.51	1335.84	0.000026	2.39	437.62	30.00	0.11
Principle Outlet	4.65714*	PF 7	1275.00	1321.15	1336.49	1324.99	1336.61	0.000034	2.77	459.95	30.00	0.12
Principle Outlet	4.65714*	PF 8	1509.00	1321.15	1337.14	1325.44	1337.30	0.000042	3.15	479.50	30.00	0.14
Principle Outlet	4.65714*	PF 9	1765.00	1321.15	1337.80	1325.91	1338.00	0.000052	3.53	499.33	30.00	0.15
Principle Outlet	4.65714*	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.78	30.00	0.17
Principle Outlet	4.65714*	PF 11	2337.00	1321.15	1339.08	1326.91	1339.37	0.000075	4.35	537.51	30.00	0.18
Principle Outlet	4.65714*	PF 12	2612.00	1321.15	1339.63	1327.35	1339.97	0.000087	4.71	554.06	30.00	0.19
Principle Outlet	4.65714*	PF 13	2870.00	1321.15	1340.13	1327.74	1340.52	0.000098	5.04	568.95	30.00	0.20
Principle Outlet	4.65714*	PF 14	3290.00	1321.15	1340.89	1328.38	1341.37	0.000116	5.56	592.01	30.00	0.22
Principle Outlet	4.65714*	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.89	30.00	0.23
Principle Outlet	4.65714*	PF 16	3990.00	1321.15	1342.07	1329.36	1342.70	0.000147	6.36	627.43	30.00	0.25
Principle Outlet	4.65714*	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.73	30.00	0.25
Principle Outlet	4.65714*	PF 18	4655.00	1321.15	1343.08	1330.25	1343.86	0.000177	7.08	657.61	30.00	0.27
Principle Outlet	4.65714*	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.18	30.00	0.27
Principle Outlet	4.65714*	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.37	30.00	0.28
Principle Outlet	4.65714*	PF 21	5155.00	1321.15	1343.80	1330.90	1344.69	0.000200	7.59	679.19	30.00	0.28
Principle Outlet	4.65714*	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	682.99	30.00	0.28
Principle Outlet	4.6	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.71	30.00	0.03
Principle Outlet	4.6	PF 2	340.00	1321.15	1331.83	1322.75	1331.85	0.000006	1.06	319.99	30.00	0.06
Principle Outlet	4.6	PF 3	398.00	1321.15	1332.24	1322.93	1332.26	0.000008	1.20	332.23	30.00	0.06
Principle Outlet	4.6	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.77	30.00	0.08
Principle Outlet	4.6	PF 5	822.00	1321.15	1334.79	1324.03	1334.85	0.000019	2.01	408.78	30.00	0.10
Principle Outlet	4.6	PF 6	1047.00	1321.15	1335.75	1324.53	1335.84	0.000026	2.39	437.57	30.00	0.11
Principle Outlet	4.6	PF 7	1275.00	1321.15	1336.49	1325.00	1336.61	0.000034	2.77	459.91	30.00	0.12
Principle Outlet	4.6	PF 8	1509.00	1321.15	1337.14	1325.45	1337.30	0.000042	3.15	479.45	30.00	0.14
Principle Outlet	4.6	PF 9	1765.00	1321.15	1337.80	1325.91	1338.00	0.000052	3.54	499.28	30.00	0.15
Principle Outlet	4.6	PF 10	2090.00	1321.15	1338.55	1326.49	1338.80	0.000065	4.01	521.73	30.00	0.17
Principle Outlet	4.6	PF 11	2337.00	1321.15	1339.08	1326.90	1339.37	0.000075	4.35	537.45	30.00	0.18
Principle Outlet	4.6	PF 12	2612.00	1321.15	1339.63	1327.36	1339.97	0.000087	4.71	554.00	30.00	0.19
Principle Outlet	4.6	PF 13	2870.00	1321.15	1340.13	1327.75	1340.52	0.000098	5.04	568.89	30.00	0.20
Principle Outlet	4.6	PF 14	3290.00	1321.15	1340.89	1328.35	1341.37	0.000116	5.56	591.94	30.00	0.22
Principle Outlet	4.6	PF 15	3575.00	1321.15	1341.39	1328.78	1341.93	0.000128	5.89	606.82	30.00	0.23
Principle Outlet	4.6	PF 16	3990.00	1321.15	1342.07	1329.35	1342.70	0.000147	6.36	627.36	30.00	0.25
Principle Outlet	4.6	PF 17	4280.00	1321.15	1342.52	1329.77	1343.21	0.000160	6.68	640.66	30.00	0.25

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.6	PF 18	4655.00	1321.15	1343.08	1330.24	1343.86	0.000177	7.08	657.54	30.00	0.27
Principle Outlet	4.6	PF 19	4830.00	1321.15	1343.33	1330.48	1344.15	0.000185	7.26	665.11	30.00	0.27
Principle Outlet	4.6	PF 20	5065.00	1321.15	1343.67	1330.78	1344.55	0.000196	7.50	675.29	30.00	0.28
Principle Outlet	4.6	PF 21	5155.00	1321.15	1343.80	1330.90	1344.69	0.000200	7.59	679.11	30.00	0.28
Principle Outlet	4.6	PF 22	5245.00	1321.15	1343.93	1331.00	1344.84	0.000204	7.68	682.91	30.00	0.28
Principle Outlet	4.5	PF 1	156.00	1321.15	1330.22	1322.67	1330.22	0.000007	0.69	226.44	30.00	0.04
Principle Outlet	4.5	PF 2	340.00	1321.15	1331.82	1323.69	1331.85	0.000020	1.24	274.58	30.00	0.07
Principle Outlet	4.5	PF 3	398.00	1321.15	1332.23	1324.44	1332.26	0.000024	1.39	286.77	30.00	0.08
Principle Outlet	4.5	PF 4	591.00	1321.15	1333.41	1324.96	1333.46	0.000037	1.83	322.17	30.00	0.10
Principle Outlet	4.5	PF 5	822.00	1321.15	1334.77	1325.52	1334.85	0.000050	2.26	363.02	30.00	0.11
Principle Outlet	4.5	PF 6	1047.00	1321.15	1335.72	1326.04	1335.83	0.000065	2.67	391.64	30.00	0.13
Principle Outlet	4.5	PF 7	1275.00	1321.15	1336.46	1326.51	1336.61	0.000082	3.08	413.77	30.00	0.15
Principle Outlet	4.5	PF 8	1509.00	1321.15	1337.11	1326.97	1337.29	0.000100	3.48	433.10	30.00	0.16
Principle Outlet	4.5	PF 9	1765.00	1321.15	1337.76	1327.44	1337.99	0.000121	3.90	452.69	30.00	0.18
Principle Outlet	4.5	PF 10	2090.00	1321.15	1338.50	1328.00	1338.80	0.000147	4.40	474.82	30.00	0.19
Principle Outlet	4.5	PF 11	2337.00	1321.15	1339.01	1328.40	1339.36	0.000168	4.77	490.29	30.00	0.21
Principle Outlet	4.5	PF 12	2612.00	1321.15	1339.55	1328.86	1339.97	0.000191	5.16	506.57	30.00	0.22
Principle Outlet	4.5	PF 13	2870.00	1321.15	1340.04	1329.25	1340.51	0.000212	5.51	521.19	30.00	0.23
Principle Outlet	4.5	PF 14	3290.00	1321.15	1340.80	1329.89	1341.36	0.000247	6.05	543.81	30.00	0.25
Principle Outlet	4.5	PF 15	3575.00	1321.15	1341.28	1330.29	1341.92	0.000271	6.40	558.40	30.00	0.26
Principle Outlet	4.5	PF 16	3990.00	1321.15	1341.95	1330.86	1342.69	0.000305	6.90	578.50	30.00	0.28
Principle Outlet	4.5	PF 17	4280.00	1321.15	1342.39	1331.25	1343.20	0.000330	7.24	591.49	30.00	0.29
Principle Outlet	4.5	PF 18	4655.00	1321.15	1342.93	1331.77	1343.84	0.000361	7.66	607.97	30.00	0.30
Principle Outlet	4.5	PF 19	4830.00	1321.15	1343.18	1331.99	1344.14	0.000376	7.85	615.35	30.00	0.31
Principle Outlet	4.5	PF 20	5065.00	1321.15	1343.51	1332.29	1344.53	0.000395	8.10	625.28	30.00	0.31
Principle Outlet	4.5	PF 21	5155.00	1321.15	1343.64	1332.41	1344.68	0.000402	8.20	629.01	30.00	0.32
Principle Outlet	4.5	PF 22	5245.00	1321.15	1343.76	1332.51	1344.83	0.000410	8.29	632.71	30.00	0.32
Principle Outlet	4.4	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.69	30.00	0.03
Principle Outlet	4.4	PF 2	340.00	1321.15	1331.83	1322.75	1331.84	0.000006	1.06	319.91	30.00	0.06
Principle Outlet	4.4	PF 3	398.00	1321.15	1332.23	1322.93	1332.26	0.000008	1.20	332.13	30.00	0.06
Principle Outlet	4.4	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.62	30.00	0.08
Principle Outlet	4.4	PF 5	822.00	1321.15	1334.78	1324.03	1334.84	0.000019	2.01	408.57	30.00	0.10
Principle Outlet	4.4	PF 6	1047.00	1321.15	1335.74	1324.53	1335.83	0.000026	2.39	437.30	30.00	0.11
Principle Outlet	4.4	PF 7	1275.00	1321.15	1336.48	1325.00	1336.60	0.000034	2.77	459.55	30.00	0.12
Principle Outlet	4.4	PF 8	1509.00	1321.15	1337.13	1325.45	1337.28	0.000042	3.15	479.01	30.00	0.14
Principle Outlet	4.4	PF 9	1765.00	1321.15	1337.79	1325.91	1337.98	0.000052	3.54	498.75	30.00	0.15
Principle Outlet	4.4	PF 10	2090.00	1321.15	1338.53	1326.49	1338.78	0.000065	4.01	521.09	30.00	0.17

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.4	PF 11	2337.00	1321.15	1339.05	1326.90	1339.35	0.000075	4.35	536.71	30.00	0.18
Principle Outlet	4.4	PF 12	2612.00	1321.15	1339.60	1327.36	1339.95	0.000087	4.72	553.15	30.00	0.19
Principle Outlet	4.4	PF 13	2870.00	1321.15	1340.09	1327.75	1340.49	0.000098	5.05	567.93	30.00	0.20
Principle Outlet	4.4	PF 14	3290.00	1321.15	1340.86	1328.35	1341.34	0.000116	5.57	590.82	30.00	0.22
Principle Outlet	4.4	PF 15	3575.00	1321.15	1341.35	1328.78	1341.89	0.000129	5.90	605.58	30.00	0.23
Principle Outlet	4.4	PF 16	3990.00	1321.15	1342.03	1329.35	1342.66	0.000148	6.37	625.95	30.00	0.25
Principle Outlet	4.4	PF 17	4280.00	1321.15	1342.47	1329.77	1343.16	0.000161	6.70	639.12	30.00	0.26
Principle Outlet	4.4	PF 18	4655.00	1321.15	1343.02	1330.24	1343.81	0.000178	7.10	655.84	30.00	0.27
Principle Outlet	4.4	PF 19	4830.00	1321.15	1343.27	1330.48	1344.10	0.000186	7.28	663.33	30.00	0.27
Principle Outlet	4.4	PF 20	5065.00	1321.15	1343.61	1330.78	1344.49	0.000197	7.52	673.41	30.00	0.28
Principle Outlet	4.4	PF 21	5155.00	1321.15	1343.73	1330.90	1344.63	0.000202	7.61	677.19	30.00	0.28
Principle Outlet	4.4	PF 22	5245.00	1321.15	1343.86	1331.00	1344.78	0.000206	7.70	680.95	30.00	0.28
Principle Outlet	4.3	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.69	30.00	0.03
Principle Outlet	4.3	PF 2	340.00	1321.15	1331.83	1322.75	1331.84	0.000006	1.06	319.91	30.00	0.06
Principle Outlet	4.3	PF 3	398.00	1321.15	1332.23	1322.93	1332.26	0.000008	1.20	332.13	30.00	0.06
Principle Outlet	4.3	PF 4	591.00	1321.15	1333.42	1323.46	1333.46	0.000013	1.61	367.62	30.00	0.08
Principle Outlet	4.3	PF 5	822.00	1321.15	1334.78	1324.03	1334.84	0.000019	2.01	408.56	30.00	0.10
Principle Outlet	4.3	PF 6	1047.00	1321.15	1335.74	1324.53	1335.83	0.000026	2.39	437.29	30.00	0.11
Principle Outlet	4.3	PF 7	1275.00	1321.15	1336.48	1325.00	1336.60	0.000034	2.77	459.55	30.00	0.12
Principle Outlet	4.3	PF 8	1509.00	1321.15	1337.13	1325.45	1337.28	0.000042	3.15	479.00	30.00	0.14
Principle Outlet	4.3	PF 9	1765.00	1321.15	1337.79	1325.91	1337.98	0.000052	3.54	498.74	30.00	0.15
Principle Outlet	4.3	PF 10	2090.00	1321.15	1338.53	1326.49	1338.78	0.000065	4.01	521.07	30.00	0.17
Principle Outlet	4.3	PF 11	2337.00	1321.15	1339.05	1326.90	1339.35	0.000075	4.35	536.69	30.00	0.18
Principle Outlet	4.3	PF 12	2612.00	1321.15	1339.60	1327.36	1339.95	0.000087	4.72	553.14	30.00	0.19
Principle Outlet	4.3	PF 13	2870.00	1321.15	1340.09	1327.75	1340.49	0.000098	5.05	567.91	30.00	0.20
Principle Outlet	4.3	PF 14	3290.00	1321.15	1340.86	1328.35	1341.34	0.000116	5.57	590.79	30.00	0.22
Principle Outlet	4.3	PF 15	3575.00	1321.15	1341.35	1328.78	1341.89	0.000129	5.90	605.56	30.00	0.23
Principle Outlet	4.3	PF 16	3990.00	1321.15	1342.03	1329.35	1342.66	0.000148	6.37	625.91	30.00	0.25
Principle Outlet	4.3	PF 17	4280.00	1321.15	1342.46	1329.77	1343.16	0.000161	6.70	639.08	30.00	0.26
Principle Outlet	4.3	PF 18	4655.00	1321.15	1343.02	1330.24	1343.80	0.000178	7.10	655.80	30.00	0.27
Principle Outlet	4.3	PF 19	4830.00	1321.15	1343.27	1330.48	1344.09	0.000186	7.28	663.28	30.00	0.27
Principle Outlet	4.3	PF 20	5065.00	1321.15	1343.61	1330.78	1344.49	0.000197	7.52	673.36	30.00	0.28
Principle Outlet	4.3	PF 21	5155.00	1321.15	1343.73	1330.90	1344.63	0.000202	7.61	677.14	30.00	0.28
Principle Outlet	4.3	PF 22	5245.00	1321.15	1343.86	1331.00	1344.78	0.000206	7.70	680.90	30.00	0.28
Principle Outlet	4.2	PF 1	156.00	1321.17	1330.22	1322.67	1330.22	0.000007	0.69	226.41	30.00	0.04
Principle Outlet	4.2	PF 2	340.00	1321.17	1331.82	1323.68	1331.84	0.000018	1.24	274.50	30.00	0.07
Principle Outlet	4.2	PF 3	398.00	1321.17	1332.22	1324.44	1332.25	0.000021	1.39	286.68	30.00	0.08

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.2	PF 4	591.00	1321.17	1333.40	1324.97	1333.45	0.000033	1.84	322.01	30.00	0.10
Principle Outlet	4.2	PF 5	822.00	1321.17	1334.76	1325.52	1334.84	0.000045	2.27	362.81	30.00	0.11
Principle Outlet	4.2	PF 6	1047.00	1321.17	1335.71	1326.03	1335.83	0.000059	2.68	391.36	30.00	0.13
Principle Outlet	4.2	PF 7	1275.00	1321.17	1336.45	1326.51	1336.60	0.000075	3.08	413.42	30.00	0.15
Principle Outlet	4.2	PF 8	1509.00	1321.17	1337.09	1326.95	1337.28	0.000092	3.49	432.65	30.00	0.16
Principle Outlet	4.2	PF 9	1765.00	1321.17	1337.74	1327.43	1337.98	0.000111	3.90	452.15	30.00	0.18
Principle Outlet	4.2	PF 10	2090.00	1321.17	1338.47	1327.99	1338.78	0.000135	4.41	474.16	30.00	0.20
Principle Outlet	4.2	PF 11	2337.00	1321.17	1338.99	1328.41	1339.34	0.000155	4.77	489.53	30.00	0.21
Principle Outlet	4.2	PF 12	2612.00	1321.17	1339.52	1328.86	1339.94	0.000176	5.17	505.69	30.00	0.22
Principle Outlet	4.2	PF 13	2870.00	1321.17	1340.01	1329.25	1340.48	0.000196	5.52	520.20	30.00	0.23
Principle Outlet	4.2	PF 14	3290.00	1321.17	1340.76	1329.89	1341.33	0.000229	6.06	542.64	30.00	0.25
Principle Outlet	4.2	PF 15	3575.00	1321.17	1341.24	1330.26	1341.88	0.000251	6.42	557.11	30.00	0.26
Principle Outlet	4.2	PF 16	3990.00	1321.17	1341.90	1330.87	1342.65	0.000283	6.91	577.03	30.00	0.28
Principle Outlet	4.2	PF 17	4280.00	1321.17	1342.33	1331.26	1343.15	0.000306	7.26	589.88	30.00	0.29
Principle Outlet	4.2	PF 18	4655.00	1321.17	1342.88	1331.77	1343.79	0.000336	7.68	606.19	30.00	0.30
Principle Outlet	4.2	PF 19	4830.00	1321.17	1343.12	1332.00	1344.08	0.000350	7.87	613.48	30.00	0.31
Principle Outlet	4.2	PF 20	5065.00	1321.17	1343.45	1332.29	1344.47	0.000368	8.13	623.31	30.00	0.31
Principle Outlet	4.2	PF 21	5155.00	1321.17	1343.57	1332.41	1344.62	0.000375	8.22	626.99	30.00	0.32
Principle Outlet	4.2	PF 22	5245.00	1321.17	1343.69	1332.51	1344.76	0.000382	8.32	630.66	30.00	0.32
Principle Outlet	4.1	PF 1	156.00	1321.15	1330.22	1322.11	1330.22	0.000002	0.57	271.66	30.00	0.03
Principle Outlet	4.1	PF 2	340.00	1321.15	1331.82	1322.75	1331.84	0.000006	1.06	319.84	30.00	0.06
Principle Outlet	4.1	PF 3	398.00	1321.15	1332.23	1322.93	1332.25	0.000008	1.20	332.04	30.00	0.06
Principle Outlet	4.1	PF 4	591.00	1321.15	1333.41	1323.46	1333.45	0.000013	1.61	367.47	30.00	0.08
Principle Outlet	4.1	PF 5	822.00	1321.15	1334.77	1324.03	1334.84	0.000019	2.01	408.35	30.00	0.10
Principle Outlet	4.1	PF 6	1047.00	1321.15	1335.73	1324.53	1335.82	0.000026	2.40	437.02	30.00	0.11
Principle Outlet	4.1	PF 7	1275.00	1321.15	1336.47	1325.00	1336.59	0.000034	2.78	459.20	30.00	0.13
Principle Outlet	4.1	PF 8	1509.00	1321.15	1337.11	1325.45	1337.27	0.000042	3.15	478.57	30.00	0.14
Principle Outlet	4.1	PF 9	1765.00	1321.15	1337.77	1325.91	1337.96	0.000052	3.54	498.22	30.00	0.15
Principle Outlet	4.1	PF 10	2090.00	1321.15	1338.51	1326.49	1338.76	0.000065	4.02	520.42	30.00	0.17
Principle Outlet	4.1	PF 11	2337.00	1321.15	1339.03	1326.90	1339.32	0.000076	4.36	535.95	30.00	0.18
Principle Outlet	4.1	PF 12	2612.00	1321.15	1339.57	1327.36	1339.92	0.000087	4.73	552.28	30.00	0.19
Principle Outlet	4.1	PF 13	2870.00	1321.15	1340.06	1327.75	1340.46	0.000098	5.06	566.95	30.00	0.21
Principle Outlet	4.1	PF 14	3290.00	1321.15	1340.82	1328.35	1341.30	0.000117	5.58	589.66	30.00	0.22
Principle Outlet	4.1	PF 15	3575.00	1321.15	1341.31	1328.78	1341.85	0.000130	5.92	604.31	30.00	0.23
Principle Outlet	4.1	PF 16	3990.00	1321.15	1341.98	1329.35	1342.61	0.000148	6.39	624.49	30.00	0.25
Principle Outlet	4.1	PF 17	4280.00	1321.15	1342.41	1329.77	1343.11	0.000162	6.71	637.53	30.00	0.26
Principle Outlet	4.1	PF 18	4655.00	1321.15	1342.96	1330.24	1343.75	0.000179	7.12	654.08	30.00	0.27
Principle Outlet	4.1	PF 19	4830.00	1321.15	1343.21	1330.48	1344.04	0.000188	7.30	661.48	30.00	0.27

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	4.1	PF 20	5065.00	1321.15	1343.54	1330.78	1344.43	0.000199	7.54	671.46	30.00	0.28
Principle Outlet	4.1	PF 21	5155.00	1321.15	1343.67	1330.90	1344.57	0.000203	7.63	675.21	30.00	0.28
Principle Outlet	4.1	PF 22	5245.00	1321.15	1343.79	1331.00	1344.72	0.000207	7.73	678.92	30.00	0.29
Principle Outlet	4	PF 1	156.00	1321.18	1330.22	1322.14	1330.22	0.000002	0.58	270.58	30.00	0.03
Principle Outlet	4	PF 2	340.00	1321.18	1331.82	1322.79	1331.84	0.000006	1.07	318.75	30.00	0.06
Principle Outlet	4	PF 3	398.00	1321.18	1332.23	1322.96	1332.25	0.000008	1.20	330.95	30.00	0.06
Principle Outlet	4	PF 4	591.00	1321.18	1333.41	1323.49	1333.45	0.000013	1.61	366.37	30.00	0.08
Principle Outlet	4	PF 5	822.00	1321.18	1334.77	1324.07	1334.84	0.000019	2.02	407.25	30.00	0.10
Principle Outlet	4	PF 6	1047.00	1321.18	1335.73	1324.56	1335.82	0.000026	2.40	435.91	30.00	0.11
Principle Outlet	4	PF 7	1275.00	1321.18	1336.47	1325.04	1336.59	0.000034	2.78	458.08	30.00	0.13
Principle Outlet	4	PF 8	1509.00	1321.18	1337.11	1325.49	1337.27	0.000043	3.16	477.44	30.00	0.14
Principle Outlet	4	PF 9	1765.00	1321.18	1337.77	1325.97	1337.96	0.000053	3.55	497.08	30.00	0.15
Principle Outlet	4	PF 10	2090.00	1321.18	1338.51	1326.53	1338.76	0.000066	4.02	519.27	30.00	0.17
Principle Outlet	4	PF 11	2337.00	1321.18	1339.02	1326.94	1339.32	0.000076	4.37	534.79	30.00	0.18
Principle Outlet	4	PF 12	2612.00	1321.18	1339.57	1327.39	1339.92	0.000088	4.74	551.11	30.00	0.19
Principle Outlet	4	PF 13	2870.00	1321.18	1340.06	1327.76	1340.46	0.000099	5.07	565.77	30.00	0.21
Principle Outlet	4	PF 14	3290.00	1321.18	1340.81	1328.42	1341.30	0.000118	5.59	588.46	30.00	0.22
Principle Outlet	4	PF 15	3575.00	1321.18	1341.30	1328.82	1341.85	0.000130	5.93	603.09	30.00	0.23
Principle Outlet	4	PF 16	3990.00	1321.18	1341.97	1329.40	1342.61	0.000149	6.40	623.25	30.00	0.25
Principle Outlet	4	PF 17	4280.00	1321.18	1342.41	1329.80	1343.11	0.000163	6.73	636.28	30.00	0.26
Principle Outlet	4	PF 18	4655.00	1321.18	1342.96	1330.29	1343.75	0.000180	7.13	652.81	30.00	0.27
Principle Outlet	4	PF 19	4830.00	1321.18	1343.20	1330.52	1344.04	0.000189	7.32	660.20	30.00	0.27
Principle Outlet	4	PF 20	5065.00	1321.18	1343.54	1330.81	1344.42	0.000200	7.56	670.17	30.00	0.28
Principle Outlet	4	PF 21	5155.00	1321.18	1343.66	1330.93	1344.57	0.000204	7.65	673.91	30.00	0.28
Principle Outlet	4	PF 22	5245.00	1321.18	1343.79	1331.04	1344.72	0.000208	7.74	677.62	30.00	0.29
Principle Outlet	3	PF 1	156.00	1322.64	1330.21	1323.60	1330.22	0.000004	0.69	226.65	30.00	0.04
Principle Outlet	3	PF 2	340.00	1322.64	1331.82	1324.25	1331.84	0.000010	1.24	274.69	30.00	0.07
Principle Outlet	3	PF 3	398.00	1322.64	1332.22	1324.43	1332.25	0.000012	1.39	286.84	30.00	0.08
Principle Outlet	3	PF 4	591.00	1322.64	1333.40	1324.96	1333.45	0.000019	1.83	322.12	30.00	0.10
Principle Outlet	3	PF 5	822.00	1322.64	1334.76	1325.49	1334.83	0.000027	2.27	362.85	30.00	0.11
Principle Outlet	3	PF 6	1047.00	1322.64	1335.70	1326.02	1335.82	0.000035	2.68	391.33	30.00	0.13
Principle Outlet	3	PF 7	1275.00	1322.64	1336.44	1326.48	1336.58	0.000045	3.08	413.31	30.00	0.15
Principle Outlet	3	PF 8	1509.00	1322.64	1337.08	1326.94	1337.26	0.000056	3.49	432.46	30.00	0.16
Principle Outlet	3	PF 9	1765.00	1322.64	1337.72	1327.42	1337.96	0.000068	3.91	451.86	30.00	0.18
Principle Outlet	3	PF 10	2090.00	1322.64	1338.45	1327.99	1338.75	0.000084	4.41	473.74	30.00	0.20
Principle Outlet	3	PF 11	2337.00	1322.64	1338.96	1328.41	1339.31	0.000096	4.78	489.01	30.00	0.21
Principle Outlet	3	PF 12	2612.00	1322.64	1339.50	1328.84	1339.91	0.000110	5.17	505.05	30.00	0.22

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	3	PF 13	2870.00	1322.64	1339.97	1329.25	1340.45	0.000124	5.53	519.45	30.00	0.23
Principle Outlet	3	PF 14	3290.00	1322.64	1340.72	1329.87	1341.29	0.000146	6.07	541.71	30.00	0.25
Principle Outlet	3	PF 15	3575.00	1322.64	1341.19	1330.29	1341.84	0.000161	6.43	556.05	30.00	0.26
Principle Outlet	3	PF 16	3990.00	1322.64	1341.85	1330.87	1342.60	0.000183	6.93	575.78	30.00	0.28
Principle Outlet	3	PF 17	4280.00	1322.64	1342.28	1331.22	1343.10	0.000199	7.27	588.50	30.00	0.29
Principle Outlet	3	PF 18	4655.00	1322.64	1342.81	1331.72	1343.73	0.000219	7.70	604.63	30.00	0.30
Principle Outlet	3	PF 19	4830.00	1322.64	1343.05	1331.96	1344.02	0.000229	7.89	611.83	30.00	0.31
Principle Outlet	3	PF 20	5065.00	1322.64	1343.38	1332.28	1344.41	0.000242	8.15	621.54	30.00	0.32
Principle Outlet	3	PF 21	5155.00	1322.64	1343.50	1332.38	1344.56	0.000247	8.25	625.19	30.00	0.32
Principle Outlet	3	PF 22	5245.00	1322.64	1343.62	1332.51	1344.70	0.000252	8.34	628.80	30.00	0.32
Principle Outlet	2.5	PF 1	156.00	1324.70	1330.22	1325.91	1330.22	0.000030	0.58	267.80	66.23	0.05
Principle Outlet	2.5	PF 2	340.00	1324.70	1331.82	1326.48	1331.83	0.000052	0.89	380.45	74.32	0.07
Principle Outlet	2.5	PF 3	398.00	1324.70	1332.22	1326.61	1332.24	0.000058	0.97	411.04	76.37	0.07
Principle Outlet	2.5	PF 4	591.00	1324.70	1333.40	1327.02	1333.42	0.000071	1.17	504.56	82.32	0.08
Principle Outlet	2.5	PF 5	822.00	1324.70	1334.76	1327.43	1334.79	0.000077	1.32	621.34	89.19	0.09
Principle Outlet	2.5	PF 6	1047.00	1324.70	1335.72	1327.81	1335.75	0.000086	1.48	708.74	94.01	0.09
Principle Outlet	2.5	PF 7	1275.00	1324.70	1336.46	1328.13	1336.50	0.000098	1.64	779.50	97.74	0.10
Principle Outlet	2.5	PF 8	1509.00	1324.70	1337.10	1328.47	1337.15	0.000111	1.79	843.55	100.99	0.11
Principle Outlet	2.5	PF 9	1765.00	1324.70	1337.76	1328.80	1337.81	0.000123	1.94	910.69	104.29	0.12
Principle Outlet	2.5	PF 10	2090.00	1324.70	1338.50	1329.20	1338.56	0.000137	2.11	989.21	108.03	0.12
Principle Outlet	2.5	PF 11	2337.00	1324.70	1339.01	1329.48	1339.09	0.000147	2.23	1045.79	110.64	0.13
Principle Outlet	2.5	PF 12	2612.00	1324.70	1339.56	1329.77	1339.64	0.000157	2.36	1106.81	113.39	0.13
Principle Outlet	2.5	PF 13	2870.00	1324.70	1340.05	1330.04	1340.14	0.000166	2.47	1162.93	115.88	0.14
Principle Outlet	2.5	PF 14	3290.00	1324.70	1340.81	1330.45	1340.91	0.000179	2.63	1252.45	120.07	0.14
Principle Outlet	2.5	PF 15	3575.00	1324.70	1341.30	1330.71	1341.41	0.000185	2.72	1312.94	133.22	0.15
Principle Outlet	2.5	PF 16	3990.00	1324.70	1341.97	1331.09	1342.10	0.000188	2.86	1404.83	146.91	0.15
Principle Outlet	2.5	PF 17	4280.00	1324.70	1342.41	1331.34	1342.54	0.000191	2.95	1469.07	146.91	0.15
Principle Outlet	2.5	PF 18	4655.00	1324.70	1342.96	1331.65	1343.11	0.000193	3.06	1550.63	146.91	0.15
Principle Outlet	2.5	PF 19	4830.00	1324.70	1343.21	1331.77	1343.36	0.000194	3.11	1587.13	146.91	0.15
Principle Outlet	2.5	PF 20	5065.00	1324.70	1343.55	1331.97	1343.70	0.000195	3.17	1636.35	146.91	0.16
Principle Outlet	2.5	PF 21	5155.00	1324.70	1343.67	1332.04	1343.83	0.000195	3.19	1654.84	146.91	0.16
Principle Outlet	2.5	PF 22	5245.00	1324.70	1343.80	1332.10	1343.96	0.000195	3.22	1673.21	146.91	0.16
Principle Outlet	2	PF 1	156.00	1326.35	1330.20	1327.48	1330.21	0.000092	0.82	190.15	65.33	0.08
Principle Outlet	2	PF 2	340.00	1326.35	1331.80	1327.95	1331.82	0.000112	1.13	301.78	74.40	0.10
Principle Outlet	2	PF 3	398.00	1326.35	1332.21	1328.08	1332.23	0.000116	1.20	332.36	76.70	0.10
Principle Outlet	2	PF 4	591.00	1326.35	1333.38	1328.45	1333.41	0.000125	1.39	426.52	83.38	0.11
Principle Outlet	2	PF 5	822.00	1326.35	1334.75	1328.84	1334.78	0.000120	1.51	545.31	91.11	0.11

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	2	PF 6	1047.00	1326.35	1335.70	1329.18	1335.74	0.000128	1.65	634.71	96.52	0.11
Principle Outlet	2	PF 7	1275.00	1326.35	1336.43	1329.50	1336.48	0.000140	1.80	707.30	100.70	0.12
Principle Outlet	2	PF 8	1509.00	1326.35	1337.08	1329.82	1337.14	0.000156	1.95	773.72	106.28	0.13
Principle Outlet	2	PF 9	1765.00	1326.35	1337.73	1330.13	1337.80	0.000171	2.09	845.02	112.19	0.13
Principle Outlet	2	PF 10	2090.00	1326.35	1338.47	1330.48	1338.55	0.000186	2.25	930.00	117.96	0.14
Principle Outlet	2	PF 11	2337.00	1326.35	1338.98	1330.74	1339.07	0.000196	2.36	992.00	121.98	0.15
Principle Outlet	2	PF 12	2612.00	1326.35	1339.53	1331.02	1339.62	0.000206	2.47	1059.58	126.26	0.15
Principle Outlet	2	PF 13	2870.00	1326.35	1340.02	1331.29	1340.12	0.000214	2.56	1122.35	130.10	0.15
Principle Outlet	2	PF 14	3290.00	1326.35	1340.78	1331.67	1340.89	0.000223	2.69	1224.57	146.44	0.16
Principle Outlet	2	PF 15	3575.00	1326.35	1341.27	1331.92	1341.39	0.000224	2.77	1296.84	147.90	0.16
Principle Outlet	2	PF 16	3990.00	1326.35	1341.95	1332.27	1342.08	0.000223	2.88	1399.64	161.46	0.16
Principle Outlet	2	PF 17	4280.00	1326.35	1342.39	1332.50	1342.52	0.000222	2.95	1470.46	161.46	0.16
Principle Outlet	2	PF 18	4655.00	1326.35	1342.94	1332.79	1343.08	0.000220	3.04	1560.29	161.46	0.16
Principle Outlet	2	PF 19	4830.00	1326.35	1343.19	1332.91	1343.34	0.000219	3.08	1600.50	161.46	0.16
Principle Outlet	2	PF 20	5065.00	1326.35	1343.53	1333.10	1343.68	0.000218	3.13	1654.72	161.46	0.16
Principle Outlet	2	PF 21	5155.00	1326.35	1343.65	1333.18	1343.81	0.000217	3.15	1675.08	161.46	0.16
Principle Outlet	2	PF 22	5245.00	1326.35	1343.78	1333.23	1343.93	0.000217	3.17	1695.32	161.46	0.16
Principle Outlet	1	PF 1	156.00	1326.57	1330.18	1327.82	1330.19	0.000100	0.77	202.49	82.32	0.09
Principle Outlet	1	PF 2	340.00	1326.57	1331.78	1328.24	1331.80	0.000100	0.98	346.33	97.69	0.09
Principle Outlet	1	PF 3	398.00	1326.57	1332.19	1328.37	1332.20	0.000100	1.03	386.68	101.58	0.09
Principle Outlet	1	PF 4	591.00	1326.57	1333.37	1328.70	1333.39	0.000100	1.15	513.03	113.74	0.10
Principle Outlet	1	PF 5	822.00	1326.57	1334.73	1329.04	1334.75	0.000100	1.19	691.37	146.27	0.10
Principle Outlet	1	PF 6	1047.00	1326.57	1335.69	1329.34	1335.71	0.000100	1.25	840.43	165.75	0.10
Principle Outlet	1	PF 7	1275.00	1326.57	1336.42	1329.62	1336.45	0.000100	1.32	967.22	175.16	0.10
Principle Outlet	1	PF 8	1509.00	1326.57	1337.07	1329.89	1337.10	0.000100	1.40	1081.54	179.71	0.10
Principle Outlet	1	PF 9	1765.00	1326.57	1337.72	1330.14	1337.76	0.000100	1.47	1200.75	184.34	0.10
Principle Outlet	1	PF 10	2090.00	1326.57	1338.47	1330.46	1338.50	0.000100	1.56	1339.30	189.54	0.10
Principle Outlet	1	PF 11	2337.00	1326.57	1338.98	1330.69	1339.03	0.000100	1.63	1438.60	193.17	0.10
Principle Outlet	1	PF 12	2612.00	1326.57	1339.53	1330.94	1339.58	0.000100	1.69	1545.23	196.96	0.11
Principle Outlet	1	PF 13	2870.00	1326.57	1340.02	1331.15	1340.07	0.000100	1.75	1642.91	200.36	0.11
Principle Outlet	1	PF 14	3290.00	1326.57	1340.79	1331.48	1340.84	0.000100	1.84	1797.27	203.72	0.11
Principle Outlet	1	PF 15	3575.00	1326.57	1341.28	1331.70	1341.33	0.000100	1.90	1898.18	205.19	0.11
Principle Outlet	1	PF 16	3990.00	1326.57	1341.96	1331.99	1342.02	0.000100	1.97	2038.63	206.81	0.11
Principle Outlet	1	PF 17	4280.00	1326.57	1342.40	1332.19	1342.46	0.000100	2.03	2129.84	206.81	0.11
Principle Outlet	1	PF 18	4655.00	1326.57	1342.96	1332.43	1343.03	0.000100	2.09	2245.52	206.81	0.11
Principle Outlet	1	PF 19	4830.00	1326.57	1343.21	1332.56	1343.28	0.000100	2.13	2297.30	206.81	0.11
Principle Outlet	1	PF 20	5065.00	1326.57	1343.55	1332.69	1343.62	0.000100	2.16	2367.10	206.81	0.11
Principle Outlet	1	PF 21	5155.00	1326.57	1343.67	1332.76	1343.75	0.000100	2.18	2393.30	206.81	0.11

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	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)	
Principle Outlet	1	PF 22	5245.00	1326.57	1343.80	1332.82	1343.88	0.000100	2.19	2419.36	206.81	0.11

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Principle Outlet	16	PF 1	1337.49	1336.25	1336.62	0.07	0.02	20.00		156.00		8.93
Principle Outlet	16	PF 2	1338.72	1337.00	1337.47	0.04	0.03	20.00		340.00		10.52
Principle Outlet	16	PF 3	1339.06	1337.20	1337.70	0.04	0.03	20.00		398.00		10.94
Principle Outlet	16	PF 4	1340.10	1337.82	1338.37	0.04	0.03	20.00		591.00		12.11
Principle Outlet	16	PF 5	1341.20	1338.49	1339.14	0.03	0.04	20.00		822.00		13.21
Principle Outlet	16	PF 6	1342.17	1339.11	1339.79	0.03	0.04	20.00		1047.00		14.04
Principle Outlet	16	PF 7	1343.04	1339.78	1340.40	0.03	0.05	20.00		1275.00		14.49
Principle Outlet	16	PF 8	1343.93	1340.36	1341.00	0.03	0.05	20.00		1509.00		15.16
Principle Outlet	16	PF 9	1344.73	1341.72	1341.63	0.02	0.06	20.00		1765.00		13.93
Principle Outlet	16	PF 10	1345.85	1342.49	1342.37	0.02	0.06	20.00		2090.00		14.69
Principle Outlet	16	PF 11	1346.66	1343.05	1342.91	0.02	0.06	20.00		2337.00		15.23
Principle Outlet	16	PF 12	1347.58	1342.93	1343.49	0.03	0.07	20.00		2612.00		17.30
Principle Outlet	16	PF 13	1348.36	1343.45	1344.02	0.03	0.07	20.00		2870.00		17.79
Principle Outlet	16	PF 14	1349.59	1344.26	1344.84	0.03	0.07	20.00		3290.00		18.53
Principle Outlet	16	PF 15	1350.40	1344.79	1345.37	0.03	0.07	20.00		3575.00		19.01
Principle Outlet	16	PF 16	1351.49	1346.46	1346.14	0.02	0.06	20.00		3990.00		18.01
Principle Outlet	16	PF 17	1355.29	1353.00	1346.63	0.01	0.01	20.00		4280.00		12.15
Principle Outlet	16	PF 18	1357.66	1355.61	1347.30	0.01	0.01	20.00		4655.00		11.51
Principle Outlet	16	PF 19	1358.77	1356.79	1347.59	0.01	0.01	20.00		4830.00		11.28
Principle Outlet	16	PF 20	1360.64	1360.64	1347.95	0.00	0.37	13196.27	2187.17	690.66	2187.17	1.37
Principle Outlet	16	PF 21	1361.23	1361.23	1348.13	0.00	0.37	16163.80	2352.84	449.32	2352.84	0.87
Principle Outlet	16	PF 22	1361.81	1361.81	1348.29	0.00	0.36	19056.25	2465.13	314.74	2465.13	0.60
Principle Outlet	15	PF 1	1337.41	1336.14	1336.51	0.07	0.01	20.00		156.00		9.06
Principle Outlet	15	PF 2	1338.65	1336.86	1337.35	0.05	0.01	20.00		340.00		10.74
Principle Outlet	15	PF 3	1338.99	1337.06	1337.59	0.05	0.02	20.00		398.00		11.16
Principle Outlet	15	PF 4	1340.04	1337.67	1338.28	0.04	0.02	20.00		591.00		12.34
Principle Outlet	15	PF 5	1341.14	1338.33	1339.02	0.04	0.02	20.00		822.00		13.46
Principle Outlet	15	PF 6	1342.12	1338.93	1339.67	0.04	0.03	20.00		1047.00		14.33
Principle Outlet	15	PF 7	1342.98	1339.59	1340.29	0.03	0.03	20.00		1275.00		14.78
Principle Outlet	15	PF 8	1343.87	1340.16	1340.90	0.03	0.03	20.00		1509.00		15.45
Principle Outlet	15	PF 9	1344.65	1341.83	1341.52	0.00	0.01	20.00		1765.00		13.46
Principle Outlet	15	PF 10	1345.76	1342.61	1342.26	0.00	0.00	20.00		2090.00		14.24
Principle Outlet	15	PF 11	1346.57	1343.18	1342.80	0.00	0.00	20.00		2337.00		14.79
Principle Outlet	15	PF 12	1347.51	1342.68	1343.38	0.03	0.04	20.00		2612.00		17.63
Principle Outlet	15	PF 13	1348.29	1343.20	1343.91	0.03	0.04	20.00		2870.00		18.12
Principle Outlet	15	PF 14	1349.52	1344.00	1344.74	0.03	0.04	20.00		3290.00		18.85
Principle Outlet	15	PF 15	1350.33	1344.52	1345.24	0.03	0.04	20.00		3575.00		19.33
Principle Outlet	15	PF 16	1351.42	1346.57	1346.03	0.00	0.03	20.00		3990.00		17.67

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Principle Outlet	15	PF 17	1355.28	1353.01	1346.52			20.00		4280.00		12.06
Principle Outlet	15	PF 18	1357.66	1355.62	1347.20			20.00		4655.00		11.44
Principle Outlet	15	PF 19	1358.76	1356.80	1347.49			20.00		4830.00		11.22
Principle Outlet	15	PF 20	1360.27	1358.41	1347.88			20.00		5065.00		10.95
Principle Outlet	15	PF 21	1360.87	1359.04	1348.03			20.00		5155.00		10.85
Principle Outlet	15	PF 22	1361.45	1359.65	1348.16			20.00		5245.00		10.76
Principle Outlet	14.5 BR U	PF 1	1337.41	1336.14	1336.51	0.00	0.00	20.00		156.00		9.04
Principle Outlet	14.5 BR U	PF 2	1338.65	1336.86	1337.36	0.00	0.00	20.00		340.00		10.74
Principle Outlet	14.5 BR U	PF 3	1338.99	1337.06	1337.57	0.00	0.00	20.00		398.00		11.16
Principle Outlet	14.5 BR U	PF 4	1340.03	1337.67	1338.29	0.00	0.00	20.00		591.00		12.33
Principle Outlet	14.5 BR U	PF 5	1341.14	1338.33	1339.03	0.00	0.00	20.00		822.00		13.45
Principle Outlet	14.5 BR U	PF 6	1342.12	1338.93	1339.68	0.00	0.00	20.00		1047.00		14.33
Principle Outlet	14.5 BR U	PF 7	1342.98	1339.59	1340.30	0.00	0.00	20.00		1275.00		14.78
Principle Outlet	14.5 BR U	PF 8	1343.87	1340.16	1340.90	0.00	0.00	20.00		1509.00		15.45
Principle Outlet	14.5 BR U	PF 9	1344.64	1341.78	1341.52	0.00	0.02	20.00		1765.00		13.58
Principle Outlet	14.5 BR U	PF 10	1345.76	1342.56	1342.25	0.00	0.02	20.00		2090.00		14.36
Principle Outlet	14.5 BR U	PF 11	1346.57	1343.12	1342.81	0.00	0.02	20.00		2337.00		14.89
Principle Outlet	14.5 BR U	PF 12	1347.51	1342.68	1343.38	0.00	0.00	20.00		2612.00		17.63
Principle Outlet	14.5 BR U	PF 13	1348.29	1343.20	1343.89	0.00	0.00	20.00		2870.00		18.12
Principle Outlet	14.5 BR U	PF 14	1349.52	1344.00	1344.71	0.00	0.00	20.00		3290.00		18.85
Principle Outlet	14.5 BR U	PF 15	1350.33	1344.52	1345.27	0.00	0.00	20.00		3575.00		19.33
Principle Outlet	14.5 BR U	PF 16	1351.38	1346.26	1346.03	0.00	0.01	20.00		3990.00		18.16
Principle Outlet	14.5 BR U	PF 17	1355.27	1346.26	1346.27			20.00		4280.00		19.48
Principle Outlet	14.5 BR U	PF 18	1357.65	1346.26	1346.27			20.00		4655.00		21.19
Principle Outlet	14.5 BR U	PF 19	1358.75	1346.26	1346.27			20.00		4830.00		21.99
Principle Outlet	14.5 BR U	PF 20	1360.27	1346.26	1346.27			20.00		5065.00		23.06
Principle Outlet	14.5 BR U	PF 21	1360.87	1346.26	1346.27			20.00		5155.00		23.47
Principle Outlet	14.5 BR U	PF 22	1361.45	1346.26	1346.27			20.00		5245.00		23.88
Principle Outlet	14.5 BR D	PF 1	1337.39	1336.10	1336.48	0.01	0.00	20.00		156.00		9.12
Principle Outlet	14.5 BR D	PF 2	1338.64	1336.81	1337.33	0.01	0.00	20.00		340.00		10.83
Principle Outlet	14.5 BR D	PF 3	1338.98	1337.01	1337.56	0.01	0.00	20.00		398.00		11.25
Principle Outlet	14.5 BR D	PF 4	1340.03	1337.61	1338.23	0.01	0.01	20.00		591.00		12.48
Principle Outlet	14.5 BR D	PF 5	1341.13	1338.27	1339.00	0.01	0.00	20.00		822.00		13.57
Principle Outlet	14.5 BR D	PF 6	1342.10	1338.88	1339.64	0.01	0.00	20.00		1047.00		14.41
Principle Outlet	14.5 BR D	PF 7	1342.97	1339.52	1340.27	0.00	0.01	20.00		1275.00		14.90
Principle Outlet	14.5 BR D	PF 8	1343.86	1340.08	1340.85	0.00	0.01	20.00		1509.00		15.60
Principle Outlet	14.5 BR D	PF 9	1344.61	1341.81	1341.49	0.00	0.03	20.00		1765.00		13.44

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Principle Outlet	14.5 BR D	PF 10	1345.73	1342.59	1342.23	0.00	0.03	20.00		2090.00		14.23
Principle Outlet	14.5 BR D	PF 11	1346.54	1343.15	1342.77	0.00	0.03	20.00		2337.00		14.77
Principle Outlet	14.5 BR D	PF 12	1347.50	1342.58	1343.35	0.00	0.01	20.00		2612.00		17.80
Principle Outlet	14.5 BR D	PF 13	1348.22	1343.32	1343.88	0.00	0.06	20.00		2870.00		17.78
Principle Outlet	14.5 BR D	PF 14	1349.46	1344.11	1344.70	0.00	0.05	20.00		3290.00		18.56
Principle Outlet	14.5 BR D	PF 15	1350.26	1344.63	1345.23	0.00	0.05	20.00		3575.00		19.05
Principle Outlet	14.5 BR D	PF 16	1351.37	1346.28	1346.00	0.00	0.03			3990.00		18.11
Principle Outlet	14.5 BR D	PF 17	1352.11	1346.26	1346.27			20.00		4280.00		19.42
Principle Outlet	14.5 BR D	PF 18	1353.08	1346.26	1346.26			20.00		4655.00		21.13
Principle Outlet	14.5 BR D	PF 19	1353.53	1346.26	1346.27			20.00		4830.00		21.92
Principle Outlet	14.5 BR D	PF 20	1354.12	1346.26	1346.26			20.00		5065.00		22.99
Principle Outlet	14.5 BR D	PF 21	1354.34	1346.26	1346.27			20.00		5155.00		23.40
Principle Outlet	14.5 BR D	PF 22	1354.56	1346.26	1346.27			20.00		5245.00		23.80
Principle Outlet	14	PF 1	1337.39	1336.10	1336.48	0.00	0.00	20.00		156.00		9.12
Principle Outlet	14	PF 2	1338.63	1336.81	1337.33	0.00	0.00	20.00		340.00		10.82
Principle Outlet	14	PF 3	1338.98	1337.01	1337.56	0.00	0.00	20.00		398.00		11.24
Principle Outlet	14	PF 4	1340.03	1337.61	1338.26	0.00	0.00	20.00		591.00		12.48
Principle Outlet	14	PF 5	1341.13	1338.27	1338.98	0.00	0.00	20.00		822.00		13.56
Principle Outlet	14	PF 6	1342.10	1338.88	1339.65	0.00	0.00	20.00		1047.00		14.41
Principle Outlet	14	PF 7	1342.97	1339.52	1340.27	0.00	0.00	20.00		1275.00		14.90
Principle Outlet	14	PF 8	1343.86	1340.08	1340.87	0.00	0.00	20.00		1509.00		15.60
Principle Outlet	14	PF 9	1344.59	1341.49	1341.49	0.02	0.00	20.00		1765.00		14.13
Principle Outlet	14	PF 10	1345.70	1342.23	1342.23	0.03	0.00	20.00		2090.00		14.95
Principle Outlet	14	PF 11	1346.51	1342.77	1342.77	0.03	0.00	20.00		2337.00		15.52
Principle Outlet	14	PF 12	1347.50	1342.58	1343.35	0.00	0.00	20.00		2612.00		17.80
Principle Outlet	14	PF 13	1348.22	1343.32	1343.88	0.00	0.00	20.00		2870.00		17.78
Principle Outlet	14	PF 14	1349.42	1344.35	1344.71	0.00	0.20	20.00		3290.00		18.07
Principle Outlet	14	PF 15	1350.22	1344.87	1345.23	0.00	0.20	20.00		3575.00		18.57
Principle Outlet	14	PF 16	1351.34	1346.00	1346.00	0.03	0.00	20.00		3990.00		18.55
Principle Outlet	14	PF 17	1352.11	1346.40	1346.40	0.03	0.03	20.00		4280.00		19.18
Principle Outlet	14	PF 18	1353.08	1347.16	1347.16	0.03	0.00	20.00		4655.00		19.53
Principle Outlet	14	PF 19	1353.53	1347.46	1347.46	0.03	0.00	20.00		4830.00		19.78
Principle Outlet	14	PF 20	1354.12	1347.84	1347.84	0.03	0.00	20.00		5065.00		20.10
Principle Outlet	14	PF 21	1354.34	1347.99	1347.99	0.03	0.00	20.00		5155.00		20.21
Principle Outlet	14	PF 22	1354.56	1348.12	1348.12	0.03	0.01	20.00		5245.00		20.36
Principle Outlet	13	PF 1	1337.28	1335.89	1336.31	0.09	0.01	20.00		156.00		9.46
Principle Outlet	13	PF 2	1338.55	1336.57	1337.15	0.06	0.02	20.00		340.00		11.29

HEC-RAS Plan: Bridge .815 River: McMicken Dam Out Reach: Principle Outlet (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Principle Outlet	13	PF 3	1338.90	1336.77	1337.38	0.06	0.02	20.00		398.00		11.71
Principle Outlet	13	PF 4	1339.96	1337.34	1338.07	0.05	0.02	20.00		591.00		12.98
Principle Outlet	13	PF 5	1341.07	1337.99	1338.78	0.05	0.02	20.00		822.00		14.08
Principle Outlet	13	PF 6	1342.03	1338.58	1339.47	0.04	0.02	20.00		1047.00		14.91
Principle Outlet	13	PF 7	1342.90	1339.19	1340.09	0.04	0.03	20.00		1275.00		15.45
Principle Outlet	13	PF 8	1343.79	1339.74	1340.68	0.04	0.03	20.00		1509.00		16.15
Principle Outlet	13	PF 9	1344.50	1340.74	1341.31	0.03	0.07	20.00		1765.00		15.55
Principle Outlet	13	PF 10	1345.61	1341.45	1342.03	0.03	0.07	20.00		2090.00		16.38
Principle Outlet	13	PF 11	1346.42	1341.97	1342.59	0.03	0.07	20.00		2337.00		16.93
Principle Outlet	13	PF 12	1347.20	1343.17	1343.17	0.02	0.00	20.00		2612.00		16.11
Principle Outlet	13	PF 13	1348.14	1342.81	1343.67	0.03	0.04	20.00		2870.00		18.53
Principle Outlet	13	PF 14	1349.33	1343.71	1344.53	0.03	0.05	20.00		3290.00		19.02
Principle Outlet	13	PF 15	1350.14	1344.22	1345.05	0.03	0.06	20.00		3575.00		19.52
Principle Outlet	13	PF 16	1351.24	1345.11	1345.82	0.03	0.08	20.00		3990.00		19.87
Principle Outlet	13	PF 17	1352.02	1345.58	1346.32	0.03	0.07	20.00		4280.00		20.36
Principle Outlet	13	PF 18	1352.98	1346.24	1346.98	0.03	0.08	20.00		4655.00		20.84
Principle Outlet	13	PF 19	1353.42	1346.56	1347.28	0.03	0.08	20.00		4830.00		21.02
Principle Outlet	13	PF 20	1354.00	1346.94	1347.67	0.03	0.08	20.00		5065.00		21.33
Principle Outlet	13	PF 21	1354.23	1347.09	1347.78	0.03	0.08	20.00		5155.00		21.45
Principle Outlet	13	PF 22	1354.45	1347.23	1347.98	0.03	0.08	20.00		5245.00		21.57

Memo

Stantec

To:	FILE Phoenix	From:	Mike Gerlach Phoenix
File:	82000267 (Task 102)	Date:	26 February 2004

Reference: Emergency Spillway Hydraulic Model

The emergency spillway is a trapezoidal, grouted rock, broad crested weir approximately 2,000 feet in length with a 2,500-foot long, 2,000-foot wide approach channel. It is located at the left (north) abutment of the dam. The COE design was based on elevations referenced to NGVD29. The design plans show the spillway crest to be at elevation 1,354.0 feet. New mapping and survey data is referenced to NAVD88. Recent survey show that the crest elevation varies across its length, ranging in elevation from 1,355.215 feet to 1,355.526 feet. The arithmetic average elevation of the spillway crest is 1,355.381 feet. The spillway breadth is approximately 6 feet and the upstream and downstream face slopes are 2.5H:1V. The approach channel is a trapezoidal section with a level bed slope. The emergency spillway outlet channel is graded at a slope of 0.6 percent with a low flow section that directs flow over a siphon on the Beardsley Canal and to the principle outlet channel. Spillway releases are contained on the south side of the outlet channel by a levee that extends to the Beardsley Canal. Figure 1 is a recent aerial photo of the emergency spillway and is overlain with 2-foot contour interval mapping.

The emergency spillway stage-discharge relation was estimated by the USACE using the weir equation. The length and discharge coefficient vary with stage and were estimated from separate relations. Because the spillway length is much greater than the flow depth, the weir was treated as a rectangular section. A stage-length relation was computed by dividing the flow area of the trapezoidal section at critical flow by the assumed critical depth. The stage-discharge coefficient relation was determined using the results of a backwater analysis for the approach channel to estimate head. Head was assumed to be the difference of the energy grade line elevation at the entrance to the approach channel (pool elevation) and the crest of the weir section. Manning's n-values used in the backwater analysis are 0.025 and 0.030. The resulting stage-discharge rating curve is provided in Table 1 and shown graphically in Figure 2.

Over time, parts of the approach channel have become occupied by dense vegetation as can be seen in Figure 1. The presence of the vegetation has severely limited the spillway capacity. In 1999, the District developed an HEC-RAS model to simulate the impacts of the vegetation on the performance of the emergency spillway. The results of that analysis show that the control section is at the upper end of the approach channel and that the capacity is significantly less than the design condition. A stage-discharge rating curve based on the results of the HEC-RAS model is shown in Figure 2. Cross section data used in the analysis are based on the design plans and therefore reflect elevations reference to NGVD29. Manning's n-values used in the HEC-RAS model vary from 0.06 to 0.12. In 2003, the District revised the

HEC-RAS model for the approach channel based on a more detailed method for estimating Manning's n-values. The recommended maximum Manning's n-value is 0.08 with an upper limit to account for blockage by debris of 0.12.

Table 1
Emergency spillway stage-discharge rating table

Pool Elevation Feet[1] (1)	Head feet (2)	Length feet (3)	C_d (4)	Discharge cfs (5)
1,355.4	0.0	1,980.0	3.09	0
1,355.9	0.5	1,983.3	3.08	2,160
1,356.4	1.0	1,986.5	3.01	5,969
1,356.9	1.5	1,989.7	2.92	10,721
1,357.4	2.0	1,992.5	2.82	15,890
1,357.9	2.5	1,995.5	2.73	21,567
1,358.4	3.0	1,998.4	2.69	28,027
1,359.4	4.0	2,003.3	2.65	42,507
1,360.4	5.0	2,007.3	2.62	58,800
1,361.4	6.0	2,010.3	2.60	76,800

1. Pool elevations estimated by the USACE are adjusted from NGVD29 to NAVD 88 by +1.381 feet to reflect recent survey data.

Figure 1
McMicken Dam Emergency Spillway

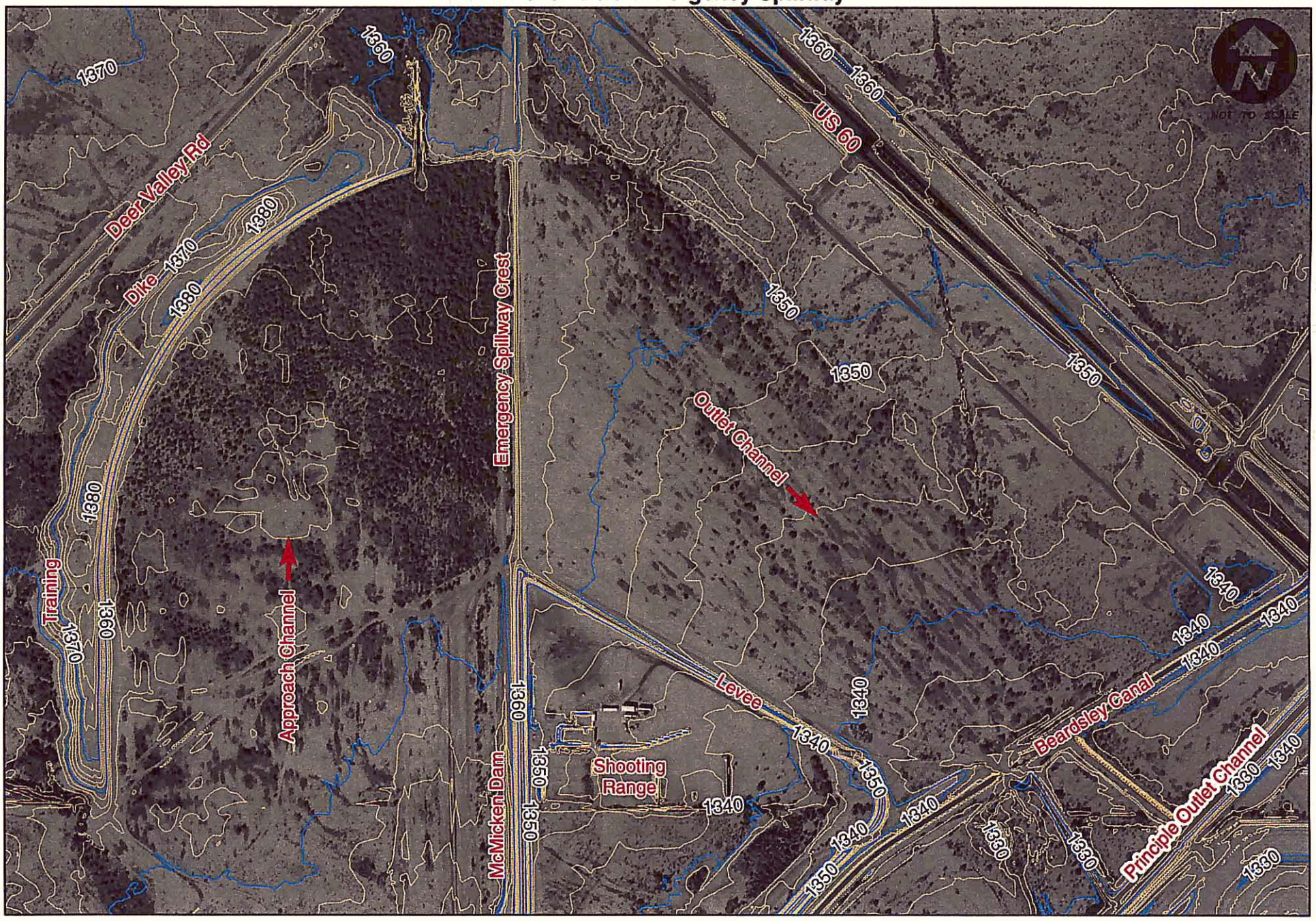


Figure 2
Stage-discharge relations for the emergency spillway

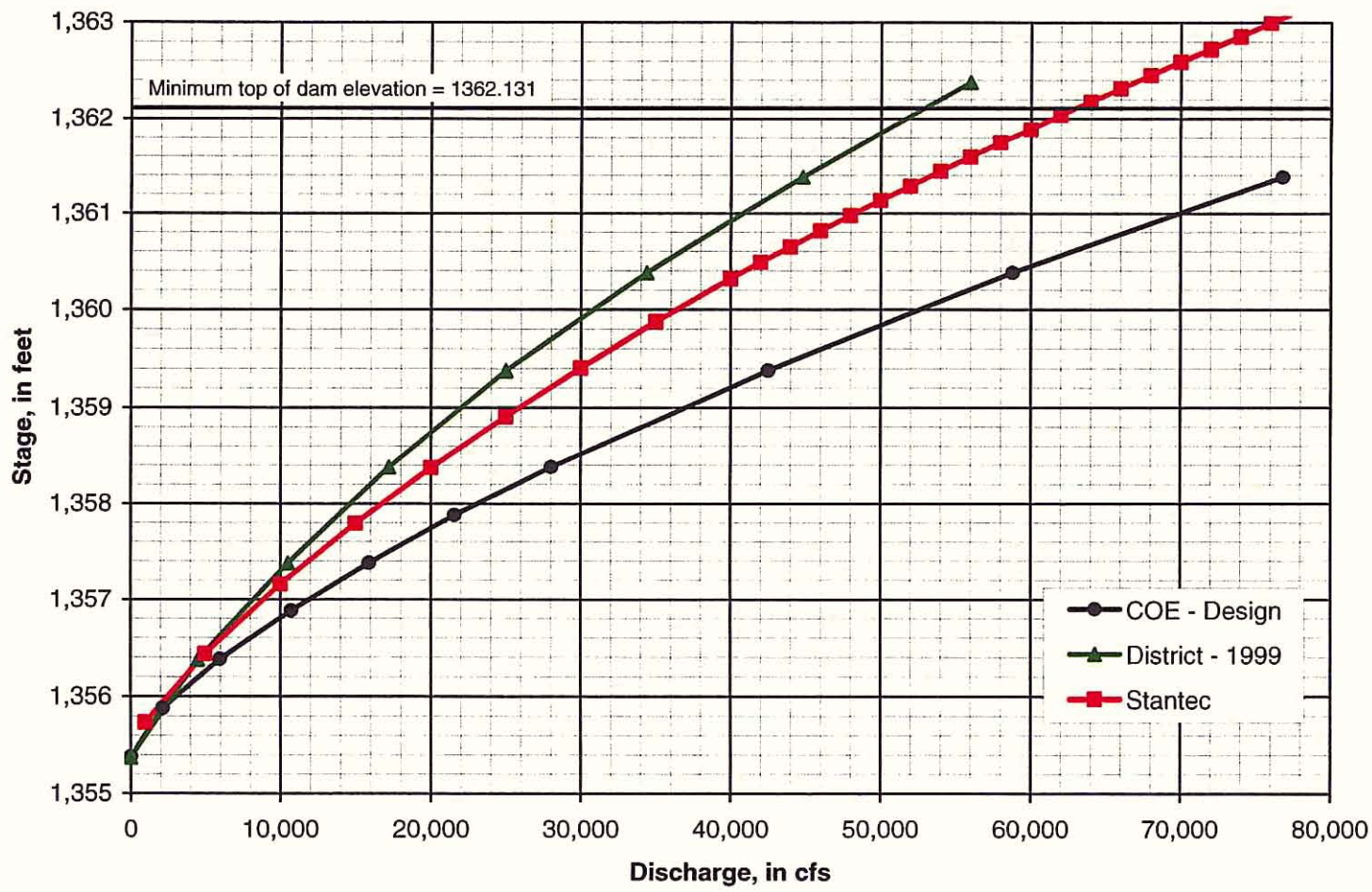
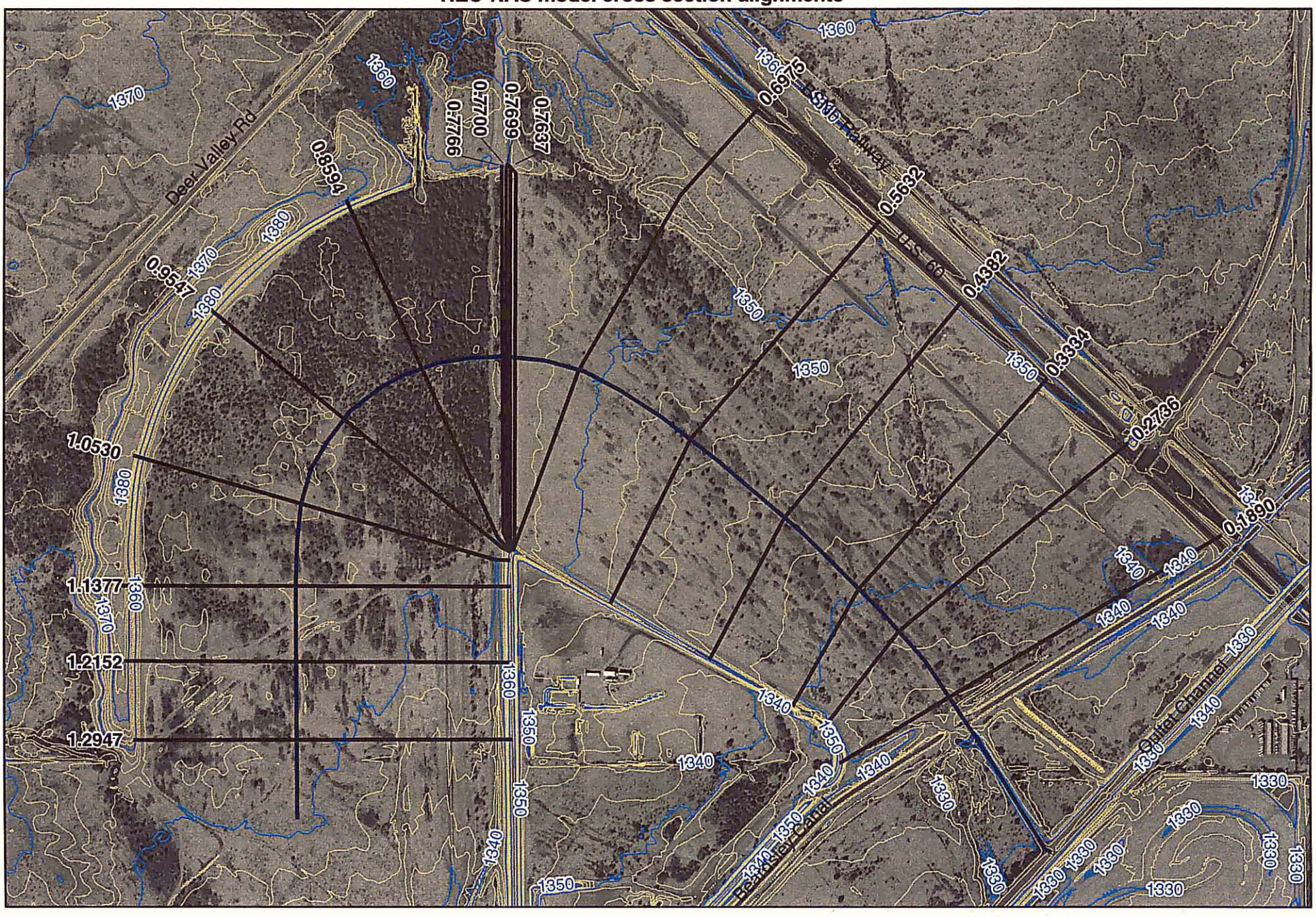


Figure 3
HEC-RAS model cross section alignments



Comparison of the rating curves is somewhat complicated by the different vertical datums. For the purposes of this study, a new HEC-RAS model of the approach and outlet channel was created and is based on the most current mapping. Printouts of the model input as well as summary output are provided at the back of this memo. Input and output files are also provided digitally on CD. The purpose of this model is to develop a stage-discharge rating curve tied to the same vertical datum as is used for the 2-D modeling. Manning's n-values used in this model are taken from the 2003 District analysis. Cross section alignments are shown in Figure 3. The resulting stage-discharge rating curve is shown in Figure 2 along with the 1999 District and design rating curves. The USACE and 1999 District rating curves are adjusted by 1.381 feet to account for the difference in mapping datums.

HEC-RAS Version 3.1.2 April 2004
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: McMicken Dam Emergency Spillway
Project File : EmergSpwy.prj
Run Date and Time: 8/16/2004 10:01:30 AM

Project in English units

PLAN DATA

Plan Title: Existing Condition
Plan File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.p01

Geometry Title: Existing Condition
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.g01

Flow Title : Emergency Spillway Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.f01

Plan Summary Information:

Number of:	Cross Sections	= 16	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Emergency Spillway Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4	PF 5	PF 6	PF 7	PF 8
McMicken Dam	Emerg Spwy	1.2947	1000	5000	10000	15000	20000	25000	30000	35000

HEC-RAS Version 3.1.2 April 2004
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: McMicken Dam Emergency Spillway
Project File : EmergSpwy.prj
Run Date and Time: 8/16/2004 10:01:30 AM

Project in English units

PLAN DATA

Plan Title: Existing Condition
Plan File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.p01

Geometry Title: Existing Condition
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.g01

Flow Title : Emergency Spillway Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.f01

Plan Summary Information:

Number of:	Cross Sections	= 16	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

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

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Emergency Spillway Rating Curve
Flow File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4	PF 5	PF 6	PF 7	PF 8
McMicken Dam	Emerg Spwy	1.2947	1000	5000	10000	15000	20000	25000	30000	35000

River	Reach	RS	PF 9	PF 10	PF 11	PF 12	PF 13	PF 14	PF 15	PF 16
McMicken Dam	Emerg Spwy	1.2947	40000	42000	44000	46000	48000	50000	52000	54000

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
McMicken Dam	Emerg Spwy	PF 1		Critical
McMicken Dam	Emerg Spwy	PF 2		Critical
McMicken Dam	Emerg Spwy	PF 3		Critical
McMicken Dam	Emerg Spwy	PF 4		Critical
McMicken Dam	Emerg Spwy	PF 5		Critical
McMicken Dam	Emerg Spwy	PF 6		Critical
McMicken Dam	Emerg Spwy	PF 7		Critical
McMicken Dam	Emerg Spwy	PF 8		Critical
McMicken Dam	Emerg Spwy	PF 9		Critical
McMicken Dam	Emerg Spwy	PF 10		Critical
McMicken Dam	Emerg Spwy	PF 11		Critical
McMicken Dam	Emerg Spwy	PF 12		Critical
McMicken Dam	Emerg Spwy	PF 13		Critical
McMicken Dam	Emerg Spwy	PF 14		Critical

GEOMETRY DATA

Geometry Title: Existing Condition
Geometry File : w:\active\82000267\Analysis\HEC-RAS\Emergency Spwy\EmergSpwy.g01

CROSS SECTION

RIVER: McMicken Dam
REACH: Emerg Spwy RS: 1.2947

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1362.83	34.32	1354.55	35.1	1354.36	48.76	1352.6	81.72	1352.07
117.74	1351.46	128.04	1351.17	264.02	1351.17	315.03	1351.2	1000.34	1351.57
1202.88	1349.83	1442.81	1347.05	1475.76	1345.91	1708.85	1347.46	1731.19	1347.66
1761.35	1347.46	1791.92	1346.5	1850.47	1347.66	1898.1	1347.61	1903.11	1346.98
1955.76	1342.45	1963.76	1343.94	1985.76	1347.59	2006.29	1353.78	2029.33	1361.24
2035.72	1363.31								

Manning's n Values num= 1

Sta	n Val
0	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	2035.72	423.95	419.94	414.2	.9	.3

CROSS SECTION

RIVER: McMicken Dam
REACH: Emerg Spwy RS: 1.2152

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1372.56	11.15	1372.33	47.31	1362.12	66.98	1356.58	71.91	1355.14
75.11	1354.99	75.64	1354.96	128.19	1351.85	713.64	1351.81	1080.98	1351.92

```
 1524.68 1350.28 1805.41 1347.84 1927.08 1349.47 1952.84 1348.68 2001.16 1346.97
 2031.93 1351.09 2041.16 1352.56 2063.38 1360.29 2066.63 1361.43 2071.16 1363.03
  2075.1 1363.17

Manning's n Values        num=       1
     Sta   n Val
       0     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11.15  2075.1            408.14  409.26  410.91             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 1.1377

INPUT
Description:
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1376.57    15.8 1376.39   52.48 1365.73   86.36 1355.72      94 1353.47
  104.39 1352.94  152.81 1351.73  304.53 1351.89 1115.13 1352.15 1744.12 1349.83
 2015.81 1349.16 2035.99 1351.43 2055.81 1353.63 2072.07 1360.09 2073.27 1360.48
 2078.71 1362.21 2083.29 1361.91 2090.14 1361.95

Manning's n Values        num=       1
     Sta   n Val
       0     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.8 2078.71            698.43     447  143.29             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 1.053

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1378.32     9.7 1378.38   20.23 1374.31   63.44 1357.97   66.42 1357.27
   79.26 1355.07    96.7 1352.09  109.87 1351.89  174.78 1351.29  197.09 1350.95
   202.3 1350.71  499.77 1351.21 1045.34 1352.33 1069.47 1352.36 1116.61 1352.37
 1212.27 1352.01 1670.91 1350.61 2027.66 1349.51 2034.83 1349.49  2056.6 1351.55
 2074.83 1353.34 2086.27 1356.84  2089.5 1357.81 2102.92 1361.79

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03  109.87     .05  499.77     .03 1212.27     .06 2027.66     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           9.7 2102.92            882.5  519.26   46.34             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 0.9547

INPUT
Description:
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1379.89   17.35 1380.36   97.86  1354.8  103.74 1353.05  105.61 1352.67
  111.35 1352.67  725.75 1352.36     9501352.201 1302.49 1351.95 1494.27 1351.92
 1698.01  1351.9 1989.34 1349.83 2041.47 1349.66 2064.01 1351.28 2079.15 1352.41
 2098.59 1354.11 2107.32  1357.4 2113.62  1359.1 2119.94 1360.81 2126.95 1361.76
```

```
Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03  105.61     .06     950     .07 1989.34     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         17.35 2126.95            934.74  502.75    5.57             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy          RS: 0.8594

INPUT
Description:
Station Elevation Data     num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1370.89    3.38 1370.84   17.54 1370.52    21.8 1368.48   47.79 1358.23
   53.59 1356.69   66.95 1353.15   105.4 1353.36  180.14 1353.13   723.9 1351.83
  848.09 1351.64 1263.71 1351.55 1568.15 1351.66 1790.79 1351.76 1997.09 1349.79
 1997.48 1349.79 2005.98 1350.32 2011.28 1350.53 2050.33 1353.37 2067.29 1354.47
 2080.82 1358.61 2086.17 1359.72  2086.9 1359.82 2099.29 1361.42

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03   66.95     .08 1997.09     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         17.54 2099.29            855.56  437.43    3.93             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy          RS: 0.7766

INPUT
Description:
Station Elevation Data     num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1361.4     .34  1361.4     .77  1361.4   20.69 1357.09   20.92 1357.04
   44.76 1354.09   50.99 1353.79   81.83 1352.33   95.08 1352.14  140.68 1352.03
  148.03 1351.78  281.41 1351.66  310.16 1351.66  320.33 1351.67 1095.72 1351.64
 1126.63 1351.55 1294.77 1351.71  1505.4 1351.42  1557.3 1351.45 1821.14 1351.67
 1897.48 1350.91  1981.6 1351.83 2010.75 1352.98 2031.15 1353.24  2054.2 1354.61
 2067.15    1358  2076.7 1359.62 2077.26 1359.71 2092.22 1361.29

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03   81.83     .06 1095.72     .05 1821.14    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           .77 2092.22               30      30       1             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy          RS: 0.77

INPUT
Description:
Station Elevation Data     num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1361.4     .34  1361.4     .77  1361.4   20.69 1357.09   20.92 1357.04
  34.5291355.356 159.5291355.356 309.5291355.526 559.529 1355.48 809.5291355.257
1059.5291355.2571309.5291355.4521559.5291355.4521809.5291355.2152057.6591355.215
 2067.15    1358  2076.7 1359.62 2077.26 1359.71 2092.22 1361.29

Manning's n Values          num=       1
     Sta   n Val
```

```
       0    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           .77 2092.22                 6       6       6             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 0.7699

INPUT
Description:
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1361.4     .34  1361.4     .77  1361.4   20.69 1357.09   20.92 1357.04
  34.5291355.356 159.5291355.356 309.5291355.526 559.529 1355.48 809.5291355.257
1059.5291355.2571309.5291355.4521559.5291355.4521809.5291355.2152057.6591355.215
 2067.15    1358  2076.7 1359.62 2077.26 1359.71 2092.22 1361.29

Manning's n Values        num=       1
     Sta   n Val
       0    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           .77 2092.22             7.89   32.06    3.98             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 0.7637

INPUT
Description:
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1361.41    8.54 1361.38   51.62 1355.66   51.64 1355.66   73.37 1354.53
   77.76  1354.3   80.33 1354.29  127.22 1354.13  146.98  1354.2  219.02 1354.36
  264.95 1354.38  291.25 1354.72   337.1 1354.98  397.49 1354.77 1134.16 1354.52
 1312.05  1354.6 1558.34  1354.7 1604.46 1354.62 1753.15  1352.9 1862.21 1354.81
 1893.32 1354.69 1965.89 1354.47 2057.98 1354.52 2058.82 1354.52 2072.87 1354.35
  2094.6 1359.99 2099.54 1361.27 2099.85 1361.33 2114.99 1361.72

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03    8.54     .03 2099.54     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          8.54 2099.54           911.64  349.35    7.99             .1       .3

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 0.6975

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1359.02   40.37 1357.98   44.05 1357.83   65.25 1353.78   65.29 1353.77
    65.7 1353.83   85.09 1356.64   92.91 1357.98     109 1358.01  458.22 1356.81
  527.03 1355.79  610.47 1359.17  621.89 1359.45  633.79 1359.72  724.46 1355.75
  795.51  1353.2  797.33 1353.13  803.02 1352.08 1261.77 1350.92 1403.77 1350.54
 1457.91 1350.52 1499.16 1350.68 1528.56 1350.82 1646.96 1351.36 1709.41 1351.61
 2314.19 1352.92 2412.78 1351.97 2497.95 1353.85 2589.31 1353.88 2673.26 1354.02
 2701.23 1354.32  2711.7  1354.2  2727.7 1358.46 2732.73 1359.79 2739.08 1361.06
 2749.98 1361.37

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03  803.02     .07 1261.77     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        633.79 2739.08              893  709.42  599.77             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  633.79 1359.72       F

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 0.5632

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1355.44   16.45  1355.4    21.5 1355.99   32.39 1355.38   60.93 1352.79
   66.78 1350.99  323.28 1351.97  362.86 1352.23  367.92 1352.08  370.74  1352.1
  380.15 1352.16   413.1 1352.19  486.39 1351.68  845.48 1349.33  864.21  1347.7
  867.24 1347.69  924.89 1347.43 1529.03 1346.46  1546.5 1346.51 2014.02 1347.06
 2378.37 1347.84 2497.55 1347.91 2515.02 1348.31 2523.09 1350.09 2534.31 1352.58
 2539.72 1354.08

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03  864.21     .05  1546.5     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        845.48 2539.72             635.1  659.66  614.02             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0   413.1 1352.19       F

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 0.4382

INPUT
Description:
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1354.89    6.13 1354.72   25.23 1354.08   40.24 1351.56   51.03 1349.43
   141.4 1348.61  254.72 1347.65   346.9 1347.06  716.47 1346.35  739.96 1346.17
  797.43 1348.49  804.62 1348.47  913.13 1345.14  961.46 1344.99 1300.23 1343.94
 1496.29 1343.17 1505.21 1343.17 1759.97 1342.86 1850.87 1343.17 2309.71 1344.27
 2339.01 1344.29 2340.49 1344.34 2344.75 1345.41 2350.22 1346.56 2354.88 1347.54
 2367.32 1351.54 2370.58 1351.11

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03  913.13     .04 1850.87     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        804.62 2367.32             607.08  553.74  511.84             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  797.43 1348.49       F

CROSS SECTION


RIVER: McMicken Dam
REACH: Emerg Spwy         RS: 0.3334

INPUT
Description:
```

Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1351.71	4.36	1352.12	20.94	1351.57	36.49	1350.98	61.62	1346.88
73.81	1344.66	78.99	1344.43	137.61	1344.33	216.26	1346.08	247.67	1345.71
312.98	1345.65	508.96	1346.32	622.86	1344.22	851.57	1342.4	903.35	1341.72
945.25	1341.32	973.86	1341.36	996.29	1343.04	1049.42	1341.83	1063.02	1341.81
1098.75	1341.76	1300.71	1341.01	1519.59	1340.95	2014.49	1340.4	2169.91	1340.01
2189.54	1340.71	2207.08	1340.9	2222.63	1344.6	2224.68	1345.05	2241.94	1348.83

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	851.57	.05	1519.59	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
996.29	2241.94	446.4	315.77	204.89	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	508.96	1346.32	F

CROSS SECTION

RIVER: McMicken Dam
REACH: Emerg Spwy RS: 0.2736

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1341.7	3.79	1343.69	11.16	1347.22	20	1347.35	23.68	1347.29
25.36	1347.44	115.62	1343.85	147.91	1342.93	157.87	1342.38	169.27	1342.3
627.55	1343.46	879.5	1344.54	948.38	1342.91	1024.01	1341.94	1069.12	1343.49
1182.46	1340.19	1203.07	1340	1253.74	1339.54	1278.09	1339.35	1300.61	1339.28
1335.1	1339.1	1596	1339.25	2122.04	1338.27	2152.98	1338.55	2193.16	1338.9
2204	1341.37	2213.92	1342.5	2217.05	1343.8	2231.27	1349.69	2234.24	1351.28
2237.73	1351.23	2241.69	1350.27						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	1203.07	.04	1596	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1069.12	2234.24	570.29	446.49	225.03	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	25.36	1347.44	F
25.36	879.5	1344.54	F

CROSS SECTION

RIVER: McMicken Dam
REACH: Emerg Spwy RS: 0.189

INPUT
Description:
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1341.98	1.93	1342.09	26.36	1345.23	66.31	1344.34	70.84	1344.26
120.24	1340.44	121.38	1340.39	122.47	1340.44	186.48	1341.12	218.73	1339.72
305.22	1339.62	315.58	1339.8	316.75	1339.8	320.05	1339.77	325.44	1339.61
369.75	1339.69	448.33	1340.94	543.48	1339.25	584.74	1339.19	633.36	1339.42
680.35	1341.37	838.64	1340.46	903.29	1340.72	948.65	1340.22	1013.39	1340.18
1046.19	1340.26	1268.02	1337.54	1278.84	1337.56	1286.97	1337.53	1291.85	1337.55
1297.15	1337.49	1306.42	1337.47	1342.71	1336.85	1358.17	1336.74	1483.79	1335.87
1648.35	1335.53	1833.07	1334.73	1843.87	1334.99	1856.43	1334.59	1868.71	1334.65
1880.6	1334.81	2007.99	1336.05	2043.27	1336.88	2059.21	1336.99	2077.34	1337.14
2088.18	1337.18	2101.39	1337.26	2166.77	1337.47	2221.89	1337.95	2223.92	1338.08
2234.41	1338.44	2297.47	1339.39	2321.89	1340.81	2336.54	1341	2349.23	1342.23
2372.53	1349.65	2373.69	1350.02	2384.22	1353.28	2388.58	1353.21		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	680.35	.03	1046.19	.04	1833.07	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
1046.19	2384.22		0	0	0 .1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	680.35	1341.37	F

SUMMARY OF MANNING'S N VALUES

River:McMicken Dam

Reach	River Sta.	n1	n2	n3	n4	n5
Emerg Spwy	1.2947	.03				
Emerg Spwy	1.2152	.03				
Emerg Spwy	1.1377	.03				
Emerg Spwy	1.053	.03	.05	.03	.06	.03
Emerg Spwy	0.9547	.03	.06	.07	.03	
Emerg Spwy	0.8594	.03	.08	.03		
Emerg Spwy	0.7766	.03	.06	.05	.035	
Emerg Spwy	0.77	.035				
Emerg Spwy	0.7699	.035				
Emerg Spwy	0.7637	.03	.03	.03		
Emerg Spwy	0.6975	.03	.07	.03		
Emerg Spwy	0.5632	.03	.05	.03		
Emerg Spwy	0.4382	.03	.04	.03		
Emerg Spwy	0.3334	.03	.05	.03		
Emerg Spwy	0.2736	.03	.04	.03		
Emerg Spwy	0.189	.06	.03	.04	.03	

SUMMARY OF REACH LENGTHS

River: McMicken Dam

Reach	River Sta.	Left	Channel	Right
Emerg Spwy	1.2947	423.95	419.94	414.2
Emerg Spwy	1.2152	408.14	409.26	410.91
Emerg Spwy	1.1377	698.43	447	143.29
Emerg Spwy	1.053	882.5	519.26	46.34
Emerg Spwy	0.9547	934.74	502.75	5.57
Emerg Spwy	0.8594	855.56	437.43	3.93
Emerg Spwy	0.7766	30	30	1
Emerg Spwy	0.77	6	6	6
Emerg Spwy	0.7699	7.89	32.06	3.98
Emerg Spwy	0.7637	911.64	349.35	7.99
Emerg Spwy	0.6975	893	709.42	599.77
Emerg Spwy	0.5632	635.1	659.66	614.02
Emerg Spwy	0.4382	607.08	553.74	511.84
Emerg Spwy	0.3334	446.4	315.77	204.89
Emerg Spwy	0.2736	570.29	446.49	225.03
Emerg Spwy	0.189	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: McMicken Dam

Reach	River Sta.	Contr.	Expan.
Emerg Spwy	1.2947	.9	.3

Emerg Spwy	1.2152	.1	.3
Emerg Spwy	1.1377	.1	.3
Emerg Spwy	1.053	.1	.3
Emerg Spwy	0.9547	.1	.3
Emerg Spwy	0.8594	.1	.3
Emerg Spwy	0.7766	.1	.3
Emerg Spwy	0.77	.1	.3
Emerg Spwy	0.7699	.1	.3
Emerg Spwy	0.7637	.1	.3
Emerg Spwy	0.6975	.1	.3
Emerg Spwy	0.5632	.1	.3
Emerg Spwy	0.4382	.1	.3
Emerg Spwy	0.3334	.1	.3
Emerg Spwy	0.2736	.1	.3
Emerg Spwy	0.189	.1	.3

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy

Reach	River Sta	Profile	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)	
Emerg Spwy	1.2947	PF 1	1000.00	1342.45	1355.74	1346.54	1355.74	0.000000	0.08	11999.22	1982.94	0.01
Emerg Spwy	1.2947	PF 2	5000.00	1342.45	1356.44	1348.00	1356.44	0.000004	0.37	13398.41	1988.03	0.03
Emerg Spwy	1.2947	PF 3	10000.00	1342.45	1357.15	1348.76	1357.16	0.000013	0.67	14816.53	1993.19	0.04
Emerg Spwy	1.2947	PF 4	15000.00	1342.45	1357.79	1349.39	1357.80	0.000022	0.93	16075.63	1997.75	0.06
Emerg Spwy	1.2947	PF 5	20000.00	1342.45	1358.36	1349.93	1358.38	0.000031	1.16	17217.37	2001.88	0.07
Emerg Spwy	1.2947	PF 6	25000.00	1342.45	1358.88	1350.41	1358.91	0.000040	1.37	18271.36	2005.69	0.08
Emerg Spwy	1.2947	PF 7	30000.00	1342.45	1359.37	1350.85	1359.41	0.000049	1.56	19250.34	2009.21	0.09
Emerg Spwy	1.2947	PF 8	35000.00	1342.45	1359.83	1351.72	1359.88	0.000057	1.74	20171.08	2012.52	0.10
Emerg Spwy	1.2947	PF 9	40000.00	1342.45	1360.26	1351.96	1360.32	0.000065	1.90	21041.43	2015.65	0.10
Emerg Spwy	1.2947	PF 10	42000.00	1342.45	1360.43	1352.03	1360.49	0.000068	1.96	21377.39	2016.86	0.11
Emerg Spwy	1.2947	PF 11	44000.00	1342.45	1360.59	1352.11	1360.65	0.000071	2.03	21704.93	2018.03	0.11
Emerg Spwy	1.2947	PF 12	46000.00	1342.45	1360.75	1352.19	1360.82	0.000074	2.09	22035.86	2019.22	0.11
Emerg Spwy	1.2947	PF 13	48000.00	1342.45	1360.91	1352.26	1360.98	0.000077	2.15	22345.28	2020.32	0.11
Emerg Spwy	1.2947	PF 14	50000.00	1342.45	1361.06	1352.35	1361.14	0.000079	2.21	22656.36	2021.44	0.12
Emerg Spwy	1.2947	PF 15	52000.00	1342.45	1361.21	1352.42	1361.29	0.000082	2.26	22968.60	2022.55	0.12
Emerg Spwy	1.2947	PF 16	54000.00	1342.45	1361.36	1352.50	1361.45	0.000085	2.32	23270.38	2023.63	0.12
Emerg Spwy	1.2947	PF 17	56000.00	1342.45	1361.51	1352.57	1361.60	0.000087	2.38	23570.84	2024.71	0.12
Emerg Spwy	1.2947	PF 18	58000.00	1342.45	1361.65	1352.61	1361.75	0.000090	2.43	23859.35	2025.74	0.12
Emerg Spwy	1.2947	PF 19	60000.00	1342.45	1361.80	1352.72	1361.89	0.000093	2.48	24148.25	2026.77	0.13
Emerg Spwy	1.2947	PF 20	62000.00	1342.45	1361.94	1352.79	1362.04	0.000095	2.54	24431.60	2027.78	0.13
Emerg Spwy	1.2947	PF 21	64000.00	1342.45	1362.08	1352.83	1362.18	0.000098	2.59	24713.85	2028.79	0.13
Emerg Spwy	1.2947	PF 22	66000.00	1342.45	1362.21	1352.90	1362.32	0.000100	2.64	24990.31	2029.77	0.13
Emerg Spwy	1.2947	PF 23	68000.00	1342.45	1362.35	1352.98	1362.46	0.000103	2.69	25262.92	2030.74	0.13
Emerg Spwy	1.2947	PF 24	70000.00	1342.45	1362.48	1353.04	1362.60	0.000105	2.74	25532.95	2031.70	0.14
Emerg Spwy	1.2947	PF 25	72000.00	1342.45	1362.61	1353.10	1362.73	0.000108	2.79	25796.39	2032.64	0.14
Emerg Spwy	1.2947	PF 26	74000.00	1342.45	1362.74	1353.18	1362.86	0.000110	2.84	26056.98	2033.57	0.14
Emerg Spwy	1.2947	PF 27	76000.00	1342.45	1362.87	1353.23	1363.00	0.000112	2.89	26318.44	2034.35	0.14
Emerg Spwy	1.2947	PF 28	78000.00	1342.45	1362.99	1353.31	1363.13	0.000115	2.94	26572.99	2034.74	0.14
Emerg Spwy	1.2947	PF 29	80000.00	1342.45	1363.12	1353.36	1363.25	0.000117	2.98	26825.13	2035.12	0.14
Emerg Spwy	1.2152	PF 1	1000.00	1346.97	1355.74	1349.03	1355.74	0.000001	0.11	9439.69	1980.43	0.01
Emerg Spwy	1.2152	PF 2	5000.00	1346.97	1356.44	1350.28	1356.44	0.000009	0.46	10827.92	1984.84	0.03
Emerg Spwy	1.2152	PF 3	10000.00	1346.97	1357.14	1351.24	1357.15	0.000024	0.82	12226.05	1989.34	0.06
Emerg Spwy	1.2152	PF 4	15000.00	1346.97	1357.76	1352.11	1357.78	0.000040	1.11	13463.59	1993.33	0.08
Emerg Spwy	1.2152	PF 5	20000.00	1346.97	1358.32	1352.38	1358.35	0.000054	1.37	14583.66	1996.94	0.09
Emerg Spwy	1.2152	PF 6	25000.00	1346.97	1358.84	1352.63	1358.88	0.000068	1.60	15616.38	2000.26	0.10
Emerg Spwy	1.2152	PF 7	30000.00	1346.97	1359.32	1352.86	1359.37	0.000080	1.81	16574.76	2003.33	0.11
Emerg Spwy	1.2152	PF 8	35000.00	1346.97	1359.77	1353.05	1359.83	0.000091	2.00	17475.59	2006.22	0.12
Emerg Spwy	1.2152	PF 9	40000.00	1346.97	1360.19	1353.26	1360.27	0.000102	2.18	18326.71	2008.95	0.13
Emerg Spwy	1.2152	PF 10	42000.00	1346.97	1360.36	1353.35	1360.44	0.000106	2.25	18655.16	2009.99	0.13

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	1.2152	PF 11	44000.00	1346.97	1360.52	1353.42	1360.60	0.000110	2.32	18975.19	2011.01	0.13
Emerg Spwy	1.2152	PF 12	46000.00	1346.97	1360.68	1353.50	1360.76	0.000114	2.38	19298.82	2012.04	0.14
Emerg Spwy	1.2152	PF 13	48000.00	1346.97	1360.83	1353.58	1360.92	0.000118	2.45	19600.75	2013.00	0.14
Emerg Spwy	1.2152	PF 14	50000.00	1346.97	1360.98	1353.65	1361.08	0.000121	2.51	19904.54	2013.97	0.14
Emerg Spwy	1.2152	PF 15	52000.00	1346.97	1361.13	1353.70	1361.23	0.000125	2.57	20209.96	2014.94	0.14
Emerg Spwy	1.2152	PF 16	54000.00	1346.97	1361.28	1353.79	1361.38	0.000129	2.63	20504.70	2015.88	0.15
Emerg Spwy	1.2152	PF 17	56000.00	1346.97	1361.42	1353.86	1361.53	0.000132	2.69	20797.59	2016.81	0.15
Emerg Spwy	1.2152	PF 18	58000.00	1346.97	1361.56	1353.93	1361.68	0.000135	2.75	21079.05	2017.70	0.15
Emerg Spwy	1.2152	PF 19	60000.00	1346.97	1361.70	1354.00	1361.82	0.000139	2.81	21361.13	2018.59	0.15
Emerg Spwy	1.2152	PF 20	62000.00	1346.97	1361.84	1354.07	1361.96	0.000142	2.87	21637.66	2019.46	0.15
Emerg Spwy	1.2152	PF 21	64000.00	1346.97	1361.97	1354.15	1362.11	0.000145	2.92	21913.08	2020.33	0.16
Emerg Spwy	1.2152	PF 22	66000.00	1346.97	1362.11	1354.22	1362.24	0.000148	2.98	22182.94	2021.19	0.16
Emerg Spwy	1.2152	PF 23	68000.00	1346.97	1362.24	1354.27	1362.38	0.000151	3.03	22448.96	2022.02	0.16
Emerg Spwy	1.2152	PF 24	70000.00	1346.97	1362.37	1354.35	1362.52	0.000154	3.08	22712.39	2022.85	0.16
Emerg Spwy	1.2152	PF 25	72000.00	1346.97	1362.50	1354.41	1362.65	0.000157	3.13	22969.00	2023.66	0.16
Emerg Spwy	1.2152	PF 26	74000.00	1346.97	1362.62	1354.48	1362.78	0.000160	3.19	23223.24	2024.46	0.17
Emerg Spwy	1.2152	PF 27	76000.00	1346.97	1362.75	1354.50	1362.91	0.000163	3.24	23478.08	2025.26	0.17
Emerg Spwy	1.2152	PF 28	78000.00	1346.97	1362.87	1354.60	1363.04	0.000166	3.29	23726.34	2026.05	0.17
Emerg Spwy	1.2152	PF 29	80000.00	1346.97	1362.99	1354.67	1363.16	0.000169	3.34	23972.23	2026.82	0.17
Emerg Spwy	1.1377	PF 1	1000.00	1349.16	1355.74	1350.24	1355.74	0.000001	0.12	8668.63	1974.81	0.01
Emerg Spwy	1.1377	PF 2	5000.00	1349.16	1356.43	1351.32	1356.44	0.000012	0.50	10043.89	1978.92	0.04
Emerg Spwy	1.1377	PF 3	10000.00	1349.16	1357.13	1352.23	1357.14	0.000030	0.88	11422.00	1983.02	0.06
Emerg Spwy	1.1377	PF 4	15000.00	1349.16	1357.74	1352.54	1357.76	0.000049	1.19	12639.26	1986.64	0.08
Emerg Spwy	1.1377	PF 5	20000.00	1349.16	1358.30	1352.80	1358.33	0.000066	1.46	13740.44	1989.91	0.10
Emerg Spwy	1.1377	PF 6	25000.00	1349.16	1358.81	1353.04	1358.85	0.000081	1.69	14755.34	1992.92	0.11
Emerg Spwy	1.1377	PF 7	30000.00	1349.16	1359.28	1353.26	1359.33	0.000095	1.91	15696.99	1995.70	0.12
Emerg Spwy	1.1377	PF 8	35000.00	1349.16	1359.72	1353.48	1359.79	0.000108	2.11	16582.14	1998.32	0.13
Emerg Spwy	1.1377	PF 9	40000.00	1349.16	1360.14	1353.67	1360.22	0.000120	2.30	17418.14	2000.81	0.14
Emerg Spwy	1.1377	PF 10	42000.00	1349.16	1360.30	1353.75	1360.39	0.000125	2.37	17740.87	2001.86	0.14
Emerg Spwy	1.1377	PF 11	44000.00	1349.16	1360.46	1353.83	1360.55	0.000129	2.44	18055.45	2002.87	0.14
Emerg Spwy	1.1377	PF 12	46000.00	1349.16	1360.62	1353.91	1360.71	0.000133	2.50	18373.61	2003.91	0.15
Emerg Spwy	1.1377	PF 13	48000.00	1349.16	1360.76	1353.98	1360.87	0.000138	2.57	18669.91	2004.87	0.15
Emerg Spwy	1.1377	PF 14	50000.00	1349.16	1360.91	1354.05	1361.02	0.000142	2.64	18968.56	2005.84	0.15
Emerg Spwy	1.1377	PF 15	52000.00	1349.16	1361.06	1354.11	1361.18	0.000146	2.70	19268.82	2006.82	0.15
Emerg Spwy	1.1377	PF 16	54000.00	1349.16	1361.21	1354.20	1361.33	0.000150	2.76	19558.45	2007.76	0.16
Emerg Spwy	1.1377	PF 17	56000.00	1349.16	1361.35	1354.25	1361.47	0.000153	2.82	19846.25	2008.70	0.16
Emerg Spwy	1.1377	PF 18	58000.00	1349.16	1361.49	1354.34	1361.62	0.000157	2.88	20122.90	2009.60	0.16
Emerg Spwy	1.1377	PF 19	60000.00	1349.16	1361.63	1354.41	1361.76	0.000161	2.94	20400.17	2010.50	0.16
Emerg Spwy	1.1377	PF 20	62000.00	1349.16	1361.76	1354.48	1361.90	0.000164	3.00	20671.91	2011.38	0.16

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	1.1377	PF 21	64000.00	1349.16	1361.90	1354.54	1362.04	0.000168	3.06	20942.54	2012.26	0.17
Emerg Spwy	1.1377	PF 22	66000.00	1349.16	1362.03	1354.60	1362.18	0.000171	3.11	21208.65	2021.75	0.17
Emerg Spwy	1.1377	PF 23	68000.00	1349.16	1362.16	1354.67	1362.31	0.000175	3.17	21471.43	2024.58	0.17
Emerg Spwy	1.1377	PF 24	70000.00	1349.16	1362.29	1354.75	1362.45	0.000178	3.22	21731.79	2026.00	0.17
Emerg Spwy	1.1377	PF 25	72000.00	1349.16	1362.41	1354.81	1362.58	0.000181	3.28	21985.32	2026.42	0.17
Emerg Spwy	1.1377	PF 26	74000.00	1349.16	1362.53	1354.88	1362.71	0.000184	3.33	22236.67	2026.84	0.18
Emerg Spwy	1.1377	PF 27	76000.00	1349.16	1362.66	1354.94	1362.84	0.000187	3.38	22488.32	2027.26	0.18
Emerg Spwy	1.1377	PF 28	78000.00	1349.16	1362.78	1355.00	1362.96	0.000190	3.43	22733.58	2027.67	0.18
Emerg Spwy	1.1377	PF 29	80000.00	1349.16	1362.90	1355.05	1363.09	0.000193	3.48	22976.42	2028.08	0.18
Emerg Spwy	1.053	PF 1	1000.00	1349.49	1355.74	1350.66	1355.74	0.000002	0.11	8933.23	2007.29	0.01
Emerg Spwy	1.053	PF 2	5000.00	1349.49	1356.43	1351.58	1356.43	0.000027	0.48	10318.10	2013.56	0.04
Emerg Spwy	1.053	PF 3	10000.00	1349.49	1357.11	1352.11	1357.12	0.000070	0.85	11696.93	2019.80	0.06
Emerg Spwy	1.053	PF 4	15000.00	1349.49	1357.71	1352.45	1357.73	0.000114	1.16	12912.98	2024.62	0.08
Emerg Spwy	1.053	PF 5	20000.00	1349.49	1358.25	1352.72	1358.29	0.000154	1.43	14013.34	2028.30	0.10
Emerg Spwy	1.053	PF 6	25000.00	1349.49	1358.75	1352.95	1358.80	0.000191	1.66	15027.50	2031.31	0.11
Emerg Spwy	1.053	PF 7	30000.00	1349.49	1359.22	1353.17	1359.27	0.000225	1.88	15968.67	2034.09	0.12
Emerg Spwy	1.053	PF 8	35000.00	1349.49	1359.65	1353.38	1359.72	0.000256	2.08	16853.94	2036.71	0.13
Emerg Spwy	1.053	PF 9	40000.00	1349.49	1360.06	1353.56	1360.14	0.000285	2.26	17690.31	2039.18	0.14
Emerg Spwy	1.053	PF 10	42000.00	1349.49	1360.22	1353.66	1360.30	0.000296	2.33	18013.24	2040.13	0.14
Emerg Spwy	1.053	PF 11	44000.00	1349.49	1360.37	1353.74	1360.46	0.000307	2.40	18327.85	2041.06	0.14
Emerg Spwy	1.053	PF 12	46000.00	1349.49	1360.53	1353.81	1360.62	0.000317	2.47	18646.84	2042.00	0.14
Emerg Spwy	1.053	PF 13	48000.00	1349.49	1360.68	1353.89	1360.77	0.000327	2.53	18942.78	2042.87	0.15
Emerg Spwy	1.053	PF 14	50000.00	1349.49	1360.82	1353.95	1360.93	0.000337	2.60	19241.85	2043.75	0.15
Emerg Spwy	1.053	PF 15	52000.00	1349.49	1360.97	1354.02	1361.08	0.000347	2.66	19542.54	2044.64	0.15
Emerg Spwy	1.053	PF 16	54000.00	1349.49	1361.11	1354.11	1361.23	0.000356	2.72	19832.62	2045.49	0.15
Emerg Spwy	1.053	PF 17	56000.00	1349.49	1361.25	1354.18	1361.37	0.000365	2.78	20120.83	2046.34	0.16
Emerg Spwy	1.053	PF 18	58000.00	1349.49	1361.39	1354.24	1361.51	0.000374	2.84	20397.65	2047.15	0.16
Emerg Spwy	1.053	PF 19	60000.00	1349.49	1361.52	1354.32	1361.65	0.000383	2.90	20675.35	2047.97	0.16
Emerg Spwy	1.053	PF 20	62000.00	1349.49	1361.66	1354.35	1361.79	0.000392	2.96	20947.39	2048.77	0.16
Emerg Spwy	1.053	PF 21	64000.00	1349.49	1361.79	1354.45	1361.93	0.000400	3.02	21218.55	2049.56	0.17
Emerg Spwy	1.053	PF 22	66000.00	1349.49	1361.92	1354.47	1362.06	0.000408	3.07	21484.28	2049.92	0.17
Emerg Spwy	1.053	PF 23	68000.00	1349.49	1362.04	1354.58	1362.20	0.000416	3.13	21746.29	2050.25	0.17
Emerg Spwy	1.053	PF 24	70000.00	1349.49	1362.17	1354.63	1362.33	0.000424	3.18	22005.60	2050.59	0.17
Emerg Spwy	1.053	PF 25	72000.00	1349.49	1362.29	1354.71	1362.46	0.000432	3.23	22257.69	2050.91	0.17
Emerg Spwy	1.053	PF 26	74000.00	1349.49	1362.42	1354.76	1362.58	0.000439	3.29	22508.06	2051.24	0.17
Emerg Spwy	1.053	PF 27	76000.00	1349.49	1362.54	1354.82	1362.71	0.000447	3.34	22758.73	2051.56	0.18
Emerg Spwy	1.053	PF 28	78000.00	1349.49	1362.66	1354.90	1362.84	0.000454	3.39	23002.67	2051.87	0.18
Emerg Spwy	1.053	PF 29	80000.00	1349.49	1362.78	1354.95	1362.96	0.000462	3.44	23244.64	2052.19	0.18

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.9547	PF 1	1000.00	1349.66	1355.74	1351.10	1355.74	0.000006	0.13	7545.47	2007.99	0.01
Emerg Spwy	0.9547	PF 2	5000.00	1349.66	1356.40	1352.47	1356.41	0.000080	0.56	8885.83	2011.86	0.05
Emerg Spwy	0.9547	PF 3	10000.00	1349.66	1357.05	1352.87	1357.06	0.000204	0.98	10185.46	2015.60	0.08
Emerg Spwy	0.9547	PF 4	15000.00	1349.66	1357.61	1353.16	1357.64	0.000323	1.32	11321.41	2019.09	0.10
Emerg Spwy	0.9547	PF 5	20000.00	1349.66	1358.12	1353.42	1358.16	0.000430	1.62	12347.12	2022.57	0.12
Emerg Spwy	0.9547	PF 6	25000.00	1349.66	1358.59	1353.66	1358.64	0.000526	1.88	13293.23	2025.77	0.13
Emerg Spwy	0.9547	PF 7	30000.00	1349.66	1359.02	1353.88	1359.09	0.000612	2.12	14171.49	2028.74	0.14
Emerg Spwy	0.9547	PF 8	35000.00	1349.66	1359.43	1354.09	1359.51	0.000690	2.33	14998.72	2031.53	0.15
Emerg Spwy	0.9547	PF 9	40000.00	1349.66	1359.81	1354.29	1359.91	0.000761	2.53	15781.38	2034.17	0.16
Emerg Spwy	0.9547	PF 10	42000.00	1349.66	1359.96	1354.36	1360.07	0.000788	2.61	16083.90	2035.19	0.16
Emerg Spwy	0.9547	PF 11	44000.00	1349.66	1360.10	1354.44	1360.22	0.000814	2.69	16378.37	2036.18	0.17
Emerg Spwy	0.9547	PF 12	46000.00	1349.66	1360.25	1354.51	1360.37	0.000837	2.76	16678.70	2037.19	0.17
Emerg Spwy	0.9547	PF 13	48000.00	1349.66	1360.39	1354.58	1360.51	0.000863	2.83	16954.80	2038.11	0.17
Emerg Spwy	0.9547	PF 14	50000.00	1349.66	1360.53	1354.66	1360.66	0.000887	2.90	17235.25	2039.06	0.18
Emerg Spwy	0.9547	PF 15	52000.00	1349.66	1360.66	1354.73	1360.80	0.000909	2.97	17518.58	2040.01	0.18
Emerg Spwy	0.9547	PF 16	54000.00	1349.66	1360.80	1354.79	1360.94	0.000931	3.04	17790.82	2040.92	0.18
Emerg Spwy	0.9547	PF 17	56000.00	1349.66	1360.93	1354.86	1361.08	0.000953	3.10	18062.22	2042.27	0.18
Emerg Spwy	0.9547	PF 18	58000.00	1349.66	1361.06	1354.93	1361.21	0.000975	3.17	18321.58	2043.61	0.19
Emerg Spwy	0.9547	PF 19	60000.00	1349.66	1361.19	1355.01	1361.35	0.000995	3.23	18582.85	2044.95	0.19
Emerg Spwy	0.9547	PF 20	62000.00	1349.66	1361.31	1355.08	1361.48	0.001016	3.29	18838.55	2046.27	0.19
Emerg Spwy	0.9547	PF 21	64000.00	1349.66	1361.44	1355.14	1361.61	0.001035	3.35	19094.42	2047.59	0.19
Emerg Spwy	0.9547	PF 22	66000.00	1349.66	1361.56	1355.21	1361.74	0.001054	3.41	19344.70	2048.87	0.20
Emerg Spwy	0.9547	PF 23	68000.00	1349.66	1361.68	1355.27	1361.86	0.001073	3.47	19591.88	2050.14	0.20
Emerg Spwy	0.9547	PF 24	70000.00	1349.66	1361.80	1355.34	1361.99	0.001091	3.53	19836.95	2051.13	0.20
Emerg Spwy	0.9547	PF 25	72000.00	1349.66	1361.91	1355.40	1362.11	0.001110	3.59	20074.34	2051.49	0.20
Emerg Spwy	0.9547	PF 26	74000.00	1349.66	1362.03	1355.46	1362.23	0.001127	3.64	20310.51	2051.86	0.20
Emerg Spwy	0.9547	PF 27	76000.00	1349.66	1362.14	1355.53	1362.36	0.001144	3.70	20547.73	2052.22	0.21
Emerg Spwy	0.9547	PF 28	78000.00	1349.66	1362.26	1355.59	1362.47	0.001161	3.75	20777.72	2052.57	0.21
Emerg Spwy	0.9547	PF 29	80000.00	1349.66	1362.37	1355.64	1362.59	0.001178	3.81	21006.25	2052.92	0.21
Emerg Spwy	0.8594	PF 1	1000.00	1349.79	1355.73	1351.73	1355.73	0.000008	0.13	7710.66	2014.20	0.01
Emerg Spwy	0.8594	PF 2	5000.00	1349.79	1356.35	1352.26	1356.36	0.000118	0.56	8964.26	2018.58	0.05
Emerg Spwy	0.8594	PF 3	10000.00	1349.79	1356.92	1352.68	1356.94	0.000316	0.99	10110.21	2022.58	0.08
Emerg Spwy	0.8594	PF 4	15000.00	1349.79	1357.41	1353.03	1357.43	0.000523	1.35	11092.20	2025.99	0.10
Emerg Spwy	0.8594	PF 5	20000.00	1349.79	1357.84	1353.33	1357.88	0.000721	1.67	11972.56	2029.04	0.12
Emerg Spwy	0.8594	PF 6	25000.00	1349.79	1358.24	1353.58	1358.30	0.000906	1.96	12784.79	2031.84	0.14
Emerg Spwy	0.8594	PF 7	30000.00	1349.79	1358.61	1353.79	1358.69	0.001078	2.22	13539.44	2034.00	0.15
Emerg Spwy	0.8594	PF 8	35000.00	1349.79	1358.96	1354.00	1359.06	0.001236	2.46	14252.73	2036.58	0.16
Emerg Spwy	0.8594	PF 9	40000.00	1349.79	1359.29	1354.20	1359.41	0.001384	2.68	14929.34	2039.02	0.17
Emerg Spwy	0.8594	PF 10	42000.00	1349.79	1359.42	1354.28	1359.54	0.001440	2.76	15191.75	2039.97	0.18

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.8594	PF 11	44000.00	1349.79	1359.55	1354.36	1359.67	0.001496	2.85	15446.31	2040.88	0.18
Emerg Spwy	0.8594	PF 12	46000.00	1349.79	1359.68	1354.43	1359.81	0.001545	2.93	15710.94	2041.84	0.19
Emerg Spwy	0.8594	PF 13	48000.00	1349.79	1359.79	1354.49	1359.93	0.001601	3.01	15947.04	2042.87	0.19
Emerg Spwy	0.8594	PF 14	50000.00	1349.79	1359.91	1354.58	1360.06	0.001652	3.09	16191.00	2044.08	0.19
Emerg Spwy	0.8594	PF 15	52000.00	1349.79	1360.03	1354.64	1360.19	0.001698	3.16	16440.84	2045.34	0.20
Emerg Spwy	0.8594	PF 16	54000.00	1349.79	1360.15	1354.72	1360.31	0.001746	3.24	16678.60	2046.53	0.20
Emerg Spwy	0.8594	PF 17	56000.00	1349.79	1360.27	1354.78	1360.44	0.001791	3.31	16917.25	2047.73	0.20
Emerg Spwy	0.8594	PF 18	58000.00	1349.79	1360.38	1354.85	1360.55	0.001839	3.38	17142.04	2048.86	0.21
Emerg Spwy	0.8594	PF 19	60000.00	1349.79	1360.49	1354.92	1360.67	0.001883	3.45	17371.20	2050.01	0.21
Emerg Spwy	0.8594	PF 20	62000.00	1349.79	1360.60	1354.99	1360.79	0.001927	3.52	17594.73	2051.13	0.21
Emerg Spwy	0.8594	PF 21	64000.00	1349.79	1360.71	1355.06	1360.91	0.001969	3.59	17817.88	2052.25	0.21
Emerg Spwy	0.8594	PF 22	66000.00	1349.79	1360.81	1355.12	1361.02	0.002011	3.66	18037.89	2053.35	0.22
Emerg Spwy	0.8594	PF 23	68000.00	1349.79	1360.92	1355.18	1361.13	0.002051	3.73	18255.01	2054.43	0.22
Emerg Spwy	0.8594	PF 24	70000.00	1349.79	1361.02	1355.26	1361.25	0.002090	3.79	18471.25	2055.52	0.22
Emerg Spwy	0.8594	PF 25	72000.00	1349.79	1361.13	1355.30	1361.36	0.002131	3.85	18679.06	2056.55	0.23
Emerg Spwy	0.8594	PF 26	74000.00	1349.79	1361.23	1355.38	1361.46	0.002170	3.92	18886.72	2057.59	0.23
Emerg Spwy	0.8594	PF 27	76000.00	1349.79	1361.33	1355.45	1361.57	0.002206	3.98	19097.26	2058.64	0.23
Emerg Spwy	0.8594	PF 28	78000.00	1349.79	1361.43	1355.50	1361.68	0.002244	4.04	19299.60	2059.60	0.23
Emerg Spwy	0.8594	PF 29	80000.00	1349.79	1361.52	1355.57	1361.79	0.002280	4.10	19501.50	2059.85	0.23
Emerg Spwy	0.7766	PF 1	1000.00	1350.91	1355.73	1351.80	1355.73	0.000003	0.12	8114.28	2026.96	0.01
Emerg Spwy	0.7766	PF 2	5000.00	1350.91	1356.32	1352.22	1356.33	0.000045	0.54	9319.64	2034.03	0.04
Emerg Spwy	0.7766	PF 3	10000.00	1350.91	1356.84	1352.57	1356.85	0.000127	0.96	10367.28	2040.15	0.08
Emerg Spwy	0.7766	PF 4	15000.00	1350.91	1357.26	1352.87	1357.29	0.000219	1.33	11239.67	2044.46	0.10
Emerg Spwy	0.7766	PF 5	20000.00	1350.91	1357.64	1353.11	1357.68	0.000313	1.67	12009.69	2047.63	0.12
Emerg Spwy	0.7766	PF 6	25000.00	1350.91	1357.98	1353.37	1358.04	0.000405	1.97	12713.81	2050.53	0.14
Emerg Spwy	0.7766	PF 7	30000.00	1350.91	1358.30	1353.60	1358.38	0.000494	2.24	13363.88	2053.83	0.16
Emerg Spwy	0.7766	PF 8	35000.00	1350.91	1358.60	1353.81	1358.70	0.000580	2.50	13977.34	2056.97	0.17
Emerg Spwy	0.7766	PF 9	40000.00	1350.91	1358.88	1354.01	1359.00	0.000662	2.75	14558.79	2059.94	0.18
Emerg Spwy	0.7766	PF 10	42000.00	1350.91	1358.99	1354.09	1359.12	0.000694	2.84	14784.67	2061.10	0.19
Emerg Spwy	0.7766	PF 11	44000.00	1350.91	1359.10	1354.17	1359.23	0.000725	2.93	15002.36	2062.21	0.19
Emerg Spwy	0.7766	PF 12	46000.00	1350.91	1359.21	1354.24	1359.35	0.000754	3.02	15234.52	2063.39	0.20
Emerg Spwy	0.7766	PF 13	48000.00	1350.91	1359.31	1354.30	1359.46	0.000786	3.11	15432.55	2064.40	0.20
Emerg Spwy	0.7766	PF 14	50000.00	1350.91	1359.41	1354.39	1359.57	0.000816	3.20	15642.02	2065.47	0.20
Emerg Spwy	0.7766	PF 15	52000.00	1350.91	1359.51	1354.45	1359.68	0.000843	3.28	15860.67	2066.58	0.21
Emerg Spwy	0.7766	PF 16	54000.00	1350.91	1359.61	1354.53	1359.79	0.000872	3.36	16065.31	2067.62	0.21
Emerg Spwy	0.7766	PF 17	56000.00	1350.91	1359.71	1354.59	1359.90	0.000898	3.44	16272.84	2068.71	0.22
Emerg Spwy	0.7766	PF 18	58000.00	1350.91	1359.81	1354.67	1360.00	0.000928	3.52	16463.55	2070.01	0.22
Emerg Spwy	0.7766	PF 19	60000.00	1350.91	1359.90	1354.73	1360.10	0.000955	3.60	16661.47	2071.36	0.22
Emerg Spwy	0.7766	PF 20	62000.00	1350.91	1359.99	1354.80	1360.20	0.000982	3.68	16853.45	2072.66	0.23

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.7766	PF 21	64000.00	1350.91	1360.09	1354.87	1360.31	0.001008	3.75	17046.56	2073.98	0.23
Emerg Spwy	0.7766	PF 22	66000.00	1350.91	1360.18	1354.93	1360.41	0.001034	3.83	17236.49	2075.27	0.23
Emerg Spwy	0.7766	PF 23	68000.00	1350.91	1360.27	1354.99	1360.50	0.001059	3.90	17424.01	2076.54	0.24
Emerg Spwy	0.7766	PF 24	70000.00	1350.91	1360.36	1355.07	1360.60	0.001083	3.97	17611.90	2077.81	0.24
Emerg Spwy	0.7766	PF 25	72000.00	1350.91	1360.44	1355.13	1360.70	0.001109	4.05	17789.76	2079.02	0.24
Emerg Spwy	0.7766	PF 26	74000.00	1350.91	1360.53	1355.18	1360.79	0.001134	4.12	17968.47	2080.23	0.25
Emerg Spwy	0.7766	PF 27	76000.00	1350.91	1360.62	1355.25	1360.89	0.001157	4.19	18152.38	2081.48	0.25
Emerg Spwy	0.7766	PF 28	78000.00	1350.91	1360.70	1355.31	1360.98	0.001181	4.26	18326.48	2082.65	0.25
Emerg Spwy	0.7766	PF 29	80000.00	1350.91	1360.79	1355.38	1361.08	0.001204	4.32	18501.18	2083.84	0.26
Emerg Spwy	0.77	PF 1	1000.00	1355.22	1355.69	1355.56	1355.73	0.005469	1.50	667.81	2027.46	0.46
Emerg Spwy	0.77	PF 2	5000.00	1355.22	1356.16	1355.92	1356.31	0.007133	3.08	1621.43	2032.86	0.61
Emerg Spwy	0.77	PF 3	10000.00	1355.22	1356.55	1356.26	1356.81	0.007687	4.16	2405.20	2037.28	0.67
Emerg Spwy	0.77	PF 4	15000.00	1355.22	1356.86	1356.55	1357.24	0.007846	4.92	3051.14	2040.92	0.71
Emerg Spwy	0.77	PF 5	20000.00	1355.22	1357.14	1356.82	1357.62	0.007924	5.53	3617.35	2043.76	0.73
Emerg Spwy	0.77	PF 6	25000.00	1355.22	1357.40	1357.05	1357.96	0.007916	6.04	4138.53	2045.81	0.75
Emerg Spwy	0.77	PF 7	30000.00	1355.22	1357.63	1357.26	1358.28	0.007941	6.50	4614.23	2047.67	0.76
Emerg Spwy	0.77	PF 8	35000.00	1355.22	1357.85	1357.46	1358.59	0.007908	6.90	5069.61	2049.46	0.77
Emerg Spwy	0.77	PF 9	40000.00	1355.22	1358.06	1357.66	1358.88	0.007869	7.27	5502.60	2051.30	0.78
Emerg Spwy	0.77	PF 10	42000.00	1355.22	1358.14	1357.72	1359.00	0.007838	7.40	5673.66	2052.18	0.78
Emerg Spwy	0.77	PF 11	44000.00	1355.22	1358.22	1357.81	1359.10	0.007867	7.55	5828.76	2052.98	0.79
Emerg Spwy	0.77	PF 12	46000.00	1355.22	1358.32	1357.86	1359.22	0.007644	7.62	6039.58	2054.06	0.78
Emerg Spwy	0.77	PF 13	48000.00	1355.22	1358.38	1357.96	1359.32	0.007836	7.80	6150.42	2054.62	0.79
Emerg Spwy	0.77	PF 14	50000.00	1355.22	1358.45	1358.03	1359.43	0.007827	7.93	6306.20	2055.42	0.80
Emerg Spwy	0.77	PF 15	52000.00	1355.22	1358.55	1358.10	1359.54	0.007653	8.00	6501.20	2056.42	0.79
Emerg Spwy	0.77	PF 16	54000.00	1355.22	1358.62	1358.17	1359.64	0.007632	8.11	6656.87	2057.21	0.79
Emerg Spwy	0.77	PF 17	56000.00	1355.22	1358.71	1358.21	1359.75	0.007535	8.20	6830.94	2058.10	0.79
Emerg Spwy	0.77	PF 18	58000.00	1355.22	1358.77	1358.31	1359.85	0.007613	8.34	6955.57	2058.74	0.80
Emerg Spwy	0.77	PF 19	60000.00	1355.22	1358.84	1358.37	1359.95	0.007573	8.44	7110.91	2059.53	0.80
Emerg Spwy	0.77	PF 20	62000.00	1355.22	1358.91	1358.44	1360.05	0.007574	8.55	7252.98	2060.26	0.80
Emerg Spwy	0.77	PF 21	64000.00	1355.22	1358.99	1358.50	1360.15	0.007534	8.64	7405.41	2061.04	0.80
Emerg Spwy	0.77	PF 22	66000.00	1355.22	1359.06	1358.56	1360.24	0.007506	8.74	7552.87	2061.79	0.80
Emerg Spwy	0.77	PF 23	68000.00	1355.22	1359.13	1358.62	1360.34	0.007481	8.83	7698.12	2062.53	0.81
Emerg Spwy	0.77	PF 24	70000.00	1355.22	1359.20	1358.67	1360.44	0.007431	8.92	7850.22	2063.31	0.81
Emerg Spwy	0.77	PF 25	72000.00	1355.22	1359.26	1358.76	1360.53	0.007469	9.03	7972.90	2063.93	0.81
Emerg Spwy	0.77	PF 26	74000.00	1355.22	1359.33	1358.83	1360.62	0.007476	9.13	8103.68	2064.60	0.81
Emerg Spwy	0.77	PF 27	76000.00	1355.22	1359.40	1358.87	1360.72	0.007408	9.20	8258.45	2065.39	0.81
Emerg Spwy	0.77	PF 28	78000.00	1355.22	1359.46	1358.95	1360.80	0.007426	9.30	8383.02	2066.02	0.81
Emerg Spwy	0.77	PF 29	80000.00	1355.22	1359.52	1359.01	1360.89	0.007420	9.40	8514.44	2066.69	0.82

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.7699	PF 1	1000.00	1355.22	1355.56	1355.56	1355.66	0.031537	2.53	394.69	2025.91	1.01
Emerg Spwy	0.7699	PF 2	5000.00	1355.22	1355.92	1355.92	1356.22	0.023167	4.39	1138.11	2030.12	1.03
Emerg Spwy	0.7699	PF 3	10000.00	1355.22	1356.26	1356.26	1356.73	0.019632	5.51	1814.30	2033.95	1.03
Emerg Spwy	0.7699	PF 4	15000.00	1355.22	1356.55	1356.55	1357.15	0.016951	6.20	2419.88	2037.36	1.00
Emerg Spwy	0.7699	PF 5	20000.00	1355.22	1356.82	1356.82	1357.53	0.015540	6.77	2953.49	2040.37	0.99
Emerg Spwy	0.7699	PF 6	25000.00	1355.22	1357.05	1357.05	1357.87	0.014814	7.29	3427.28	2043.01	0.99
Emerg Spwy	0.7699	PF 7	30000.00	1355.22	1357.26	1357.26	1358.20	0.014332	7.77	3862.90	2044.72	1.00
Emerg Spwy	0.7699	PF 8	35000.00	1355.22	1357.46	1357.46	1358.50	0.013944	8.19	4273.65	2046.34	1.00
Emerg Spwy	0.7699	PF 9	40000.00	1355.22	1357.66	1357.66	1358.79	0.013554	8.56	4671.23	2047.90	1.00
Emerg Spwy	0.7699	PF 10	42000.00	1355.22	1357.72	1357.72	1358.91	0.013533	8.73	4812.74	2048.45	1.00
Emerg Spwy	0.7699	PF 11	44000.00	1355.22	1357.81	1357.81	1359.02	0.013125	8.81	4995.31	2049.17	0.99
Emerg Spwy	0.7699	PF 12	46000.00	1355.22	1357.86	1357.86	1359.13	0.013405	9.02	5098.38	2049.57	1.01
Emerg Spwy	0.7699	PF 13	48000.00	1355.22	1357.96	1357.96	1359.24	0.012917	9.07	5289.56	2050.32	1.00
Emerg Spwy	0.7699	PF 14	50000.00	1355.22	1358.03	1358.03	1359.34	0.012778	9.19	5439.00	2050.98	0.99
Emerg Spwy	0.7699	PF 15	52000.00	1355.22	1358.10	1358.10	1359.45	0.012710	9.32	5578.23	2051.69	1.00
Emerg Spwy	0.7699	PF 16	54000.00	1355.22	1358.17	1358.17	1359.55	0.012624	9.44	5718.51	2052.41	1.00
Emerg Spwy	0.7699	PF 17	56000.00	1355.22	1358.21	1358.21	1359.65	0.012905	9.64	5806.71	2052.86	1.01
Emerg Spwy	0.7699	PF 18	58000.00	1355.22	1358.31	1358.31	1359.75	0.012331	9.65	6013.00	2053.92	0.99
Emerg Spwy	0.7699	PF 19	60000.00	1355.22	1358.37	1358.37	1359.85	0.012357	9.78	6133.36	2054.54	1.00
Emerg Spwy	0.7699	PF 20	62000.00	1355.22	1358.44	1358.44	1359.95	0.012174	9.87	6284.37	2055.31	0.99
Emerg Spwy	0.7699	PF 21	64000.00	1355.22	1358.50	1358.50	1360.05	0.012203	10.00	6401.30	2055.91	1.00
Emerg Spwy	0.7699	PF 22	66000.00	1355.22	1358.56	1358.56	1360.15	0.012164	10.11	6527.81	2056.55	1.00
Emerg Spwy	0.7699	PF 23	68000.00	1355.22	1358.62	1358.62	1360.24	0.012118	10.22	6654.10	2057.20	1.00
Emerg Spwy	0.7699	PF 24	70000.00	1355.22	1358.67	1358.67	1360.34	0.012190	10.36	6759.59	2057.74	1.01
Emerg Spwy	0.7699	PF 25	72000.00	1355.22	1358.76	1358.76	1360.43	0.011869	10.39	6931.19	2058.62	1.00
Emerg Spwy	0.7699	PF 26	74000.00	1355.22	1358.83	1358.83	1360.52	0.011681	10.45	7080.99	2059.38	0.99
Emerg Spwy	0.7699	PF 27	76000.00	1355.22	1358.87	1358.87	1360.62	0.011853	10.61	7164.46	2059.81	1.00
Emerg Spwy	0.7699	PF 28	78000.00	1355.22	1358.95	1358.95	1360.71	0.011629	10.66	7319.88	2060.60	1.00
Emerg Spwy	0.7699	PF 29	80000.00	1355.22	1359.01	1359.01	1360.80	0.011515	10.73	7454.98	2061.29	0.99
Emerg Spwy	0.7637	PF 1	1000.00	1352.90	1354.64	1354.63	1354.77	0.018762	2.87	348.58	1267.71	0.96
Emerg Spwy	0.7637	PF 2	5000.00	1352.90	1355.20	1355.07	1355.39	0.008225	3.54	1411.57	2015.62	0.75
Emerg Spwy	0.7637	PF 3	10000.00	1352.90	1355.63	1355.41	1355.93	0.006770	4.40	2272.62	2025.46	0.73
Emerg Spwy	0.7637	PF 4	15000.00	1352.90	1355.97	1355.70	1356.36	0.006299	5.06	2964.48	2029.78	0.74
Emerg Spwy	0.7637	PF 5	20000.00	1352.90	1356.27	1355.96	1356.75	0.006001	5.59	3577.00	2033.21	0.74
Emerg Spwy	0.7637	PF 6	25000.00	1352.90	1356.55	1356.19	1357.12	0.005685	6.01	4159.24	2036.47	0.74
Emerg Spwy	0.7637	PF 7	30000.00	1352.90	1356.79	1356.40	1357.44	0.005669	6.46	4646.31	2039.19	0.75
Emerg Spwy	0.7637	PF 8	35000.00	1352.90	1357.02	1356.61	1357.75	0.005653	6.86	5103.62	2041.74	0.76
Emerg Spwy	0.7637	PF 9	40000.00	1352.90	1357.23	1356.80	1358.04	0.005653	7.23	5531.81	2044.13	0.77
Emerg Spwy	0.7637	PF 10	42000.00	1352.90	1357.31	1356.88	1358.15	0.005665	7.38	5693.78	2045.03	0.78

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.7637	PF 11	44000.00	1352.90	1357.39	1356.96	1358.26	0.005664	7.51	5856.33	2045.93	0.78
Emerg Spwy	0.7637	PF 12	46000.00	1352.90	1357.46	1357.03	1358.37	0.005663	7.65	6015.71	2046.82	0.79
Emerg Spwy	0.7637	PF 13	48000.00	1352.90	1357.54	1357.10	1358.48	0.005663	7.78	6172.40	2047.69	0.79
Emerg Spwy	0.7637	PF 14	50000.00	1352.90	1357.62	1357.17	1358.58	0.005664	7.90	6326.41	2048.55	0.79
Emerg Spwy	0.7637	PF 15	52000.00	1352.90	1357.69	1357.22	1358.69	0.005664	8.03	6477.98	2049.39	0.80
Emerg Spwy	0.7637	PF 16	54000.00	1352.90	1357.76	1357.32	1358.79	0.005665	8.15	6627.11	2050.22	0.80
Emerg Spwy	0.7637	PF 17	56000.00	1352.90	1357.83	1357.38	1358.89	0.005681	8.27	6768.54	2051.00	0.80
Emerg Spwy	0.7637	PF 18	58000.00	1352.90	1357.90	1357.44	1359.00	0.005667	8.38	6918.79	2051.84	0.80
Emerg Spwy	0.7637	PF 19	60000.00	1352.90	1357.93	1357.52	1359.08	0.005927	8.61	6967.14	2052.11	0.82
Emerg Spwy	0.7637	PF 20	62000.00	1352.90	1357.99	1357.58	1359.18	0.005932	8.73	7104.94	2052.87	0.83
Emerg Spwy	0.7637	PF 21	64000.00	1352.90	1358.07	1357.64	1359.28	0.005910	8.83	7250.81	2053.68	0.83
Emerg Spwy	0.7637	PF 22	66000.00	1352.90	1358.13	1357.72	1359.37	0.005913	8.94	7385.71	2054.43	0.83
Emerg Spwy	0.7637	PF 23	68000.00	1352.90	1358.20	1357.78	1359.47	0.005910	9.04	7521.41	2055.18	0.83
Emerg Spwy	0.7637	PF 24	70000.00	1352.90	1358.27	1357.83	1359.56	0.005889	9.13	7662.93	2055.96	0.83
Emerg Spwy	0.7637	PF 25	72000.00	1352.90	1358.33	1357.91	1359.65	0.005896	9.24	7791.70	2056.68	0.84
Emerg Spwy	0.7637	PF 26	74000.00	1352.90	1358.39	1357.96	1359.75	0.005900	9.34	7920.27	2057.39	0.84
Emerg Spwy	0.7637	PF 27	76000.00	1352.90	1358.46	1358.02	1359.84	0.005892	9.44	8052.64	2058.12	0.84
Emerg Spwy	0.7637	PF 28	78000.00	1352.90	1358.52	1358.10	1359.93	0.005890	9.53	8181.30	2058.83	0.84
Emerg Spwy	0.7637	PF 29	80000.00	1352.90	1358.58	1358.16	1360.02	0.005886	9.63	8308.99	2059.54	0.84
Emerg Spwy	0.6975	PF 1	1000.00	1350.52	1351.63	1351.37	1351.71	0.005018	2.34	427.84	736.94	0.54
Emerg Spwy	0.6975	PF 2	5000.00	1350.52	1352.57	1352.19	1352.74	0.006973	3.39	1474.68	1439.16	0.59
Emerg Spwy	0.6975	PF 3	10000.00	1350.52	1353.08	1352.69	1353.38	0.007890	4.38	2283.15	1665.30	0.66
Emerg Spwy	0.6975	PF 4	15000.00	1350.52	1353.43	1353.07	1353.85	0.008242	5.22	2873.33	1689.72	0.71
Emerg Spwy	0.6975	PF 5	20000.00	1350.52	1353.74	1353.35	1354.27	0.008447	5.89	3393.86	1712.11	0.74
Emerg Spwy	0.6975	PF 6	25000.00	1350.52	1354.08	1353.63	1354.68	0.008682	6.22	4018.99	1911.60	0.76
Emerg Spwy	0.6975	PF 7	30000.00	1350.52	1354.34	1353.91	1355.02	0.008632	6.64	4515.01	1955.27	0.77
Emerg Spwy	0.6975	PF 8	35000.00	1350.52	1354.56	1354.16	1355.34	0.008574	7.06	4955.11	1965.13	0.78
Emerg Spwy	0.6975	PF 9	40000.00	1350.52	1354.78	1354.39	1355.64	0.008495	7.44	5377.65	1974.57	0.79
Emerg Spwy	0.6975	PF 10	42000.00	1350.52	1354.87	1354.46	1355.76	0.008435	7.57	5547.12	1978.35	0.79
Emerg Spwy	0.6975	PF 11	44000.00	1350.52	1354.95	1354.54	1355.87	0.008411	7.71	5707.47	1981.91	0.80
Emerg Spwy	0.6975	PF 12	46000.00	1350.52	1355.03	1354.61	1355.98	0.008384	7.84	5865.85	1985.43	0.80
Emerg Spwy	0.6975	PF 13	48000.00	1350.52	1355.11	1354.69	1356.09	0.008360	7.97	6021.56	1988.89	0.80
Emerg Spwy	0.6975	PF 14	50000.00	1350.52	1355.18	1354.74	1356.20	0.008334	8.10	6175.53	1992.30	0.81
Emerg Spwy	0.6975	PF 15	52000.00	1350.52	1355.26	1354.84	1356.31	0.008311	8.22	6326.80	1995.65	0.81
Emerg Spwy	0.6975	PF 16	54000.00	1350.52	1355.34	1354.90	1356.42	0.008285	8.34	6476.80	1998.97	0.81
Emerg Spwy	0.6975	PF 17	56000.00	1350.52	1355.41	1354.97	1356.52	0.008262	8.45	6624.56	2002.23	0.81
Emerg Spwy	0.6975	PF 18	58000.00	1350.52	1355.48	1355.06	1356.62	0.008271	8.58	6762.57	2005.28	0.82
Emerg Spwy	0.6975	PF 19	60000.00	1350.52	1355.69	1355.11	1356.77	0.007264	8.36	7174.35	2014.34	0.78
Emerg Spwy	0.6975	PF 20	62000.00	1350.52	1355.77	1355.20	1356.88	0.007201	8.45	7335.84	2017.79	0.78

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.6975	PF 21	64000.00	1350.52	1355.83	1355.26	1356.97	0.007262	8.58	7457.81	2023.82	0.78
Emerg Spwy	0.6975	PF 22	66000.00	1350.52	1355.91	1355.32	1357.08	0.007204	8.67	7614.99	2034.12	0.78
Emerg Spwy	0.6975	PF 23	68000.00	1350.52	1355.98	1355.40	1357.17	0.007173	8.76	7762.32	2043.77	0.78
Emerg Spwy	0.6975	PF 24	70000.00	1350.52	1356.06	1355.46	1357.27	0.007144	8.85	7908.33	2053.32	0.78
Emerg Spwy	0.6975	PF 25	72000.00	1350.52	1356.13	1355.53	1357.37	0.007107	8.94	8055.71	2062.96	0.79
Emerg Spwy	0.6975	PF 26	74000.00	1350.52	1356.20	1355.59	1357.47	0.007083	9.03	8197.60	2072.22	0.79
Emerg Spwy	0.6975	PF 27	76000.00	1350.52	1356.26	1355.64	1357.56	0.007123	9.14	8315.86	2079.94	0.79
Emerg Spwy	0.6975	PF 28	78000.00	1350.52	1356.32	1355.72	1357.65	0.007129	9.24	8444.51	2088.33	0.79
Emerg Spwy	0.6975	PF 29	80000.00	1350.52	1356.39	1355.78	1357.74	0.007138	9.33	8570.82	2096.55	0.80
Emerg Spwy	0.5632	PF 1	1000.00	1346.46	1347.31	1347.13	1347.37	0.007591	2.02	495.36	1127.20	0.54
Emerg Spwy	0.5632	PF 2	5000.00	1346.46	1348.10	1347.73	1348.25	0.005778	3.04	1645.87	1646.48	0.54
Emerg Spwy	0.5632	PF 3	10000.00	1346.46	1348.67	1348.15	1348.90	0.005115	3.88	2579.46	1663.55	0.55
Emerg Spwy	0.5632	PF 4	15000.00	1346.46	1349.13	1348.47	1349.44	0.004804	4.48	3346.73	1670.93	0.56
Emerg Spwy	0.5632	PF 5	20000.00	1346.46	1349.54	1348.77	1349.92	0.004573	4.96	4036.69	1706.93	0.56
Emerg Spwy	0.5632	PF 6	25000.00	1346.46	1349.90	1349.04	1350.35	0.004440	5.37	4671.05	1764.43	0.57
Emerg Spwy	0.5632	PF 7	30000.00	1346.46	1350.24	1349.28	1350.75	0.004338	5.74	5272.44	1817.26	0.57
Emerg Spwy	0.5632	PF 8	35000.00	1346.46	1350.55	1349.51	1351.12	0.004251	6.06	5849.61	1866.55	0.58
Emerg Spwy	0.5632	PF 9	40000.00	1346.46	1350.85	1349.73	1351.47	0.004187	6.35	6401.33	1912.48	0.58
Emerg Spwy	0.5632	PF 10	42000.00	1346.46	1350.95	1349.85	1351.60	0.004180	6.47	6608.63	1929.46	0.58
Emerg Spwy	0.5632	PF 11	44000.00	1346.46	1351.06	1349.93	1351.73	0.004153	6.57	6823.69	1966.45	0.58
Emerg Spwy	0.5632	PF 12	46000.00	1346.46	1351.17	1350.02	1351.85	0.004128	6.67	7036.14	2012.33	0.59
Emerg Spwy	0.5632	PF 13	48000.00	1346.46	1351.28	1350.11	1351.98	0.004103	6.77	7247.06	2057.49	0.59
Emerg Spwy	0.5632	PF 14	50000.00	1346.46	1351.38	1350.19	1352.10	0.004079	6.86	7455.87	2101.82	0.59
Emerg Spwy	0.5632	PF 15	52000.00	1346.46	1351.49	1350.28	1352.23	0.004054	6.95	7663.47	2145.53	0.59
Emerg Spwy	0.5632	PF 16	54000.00	1346.46	1351.59	1350.35	1352.35	0.004032	7.04	7868.54	2188.37	0.59
Emerg Spwy	0.5632	PF 17	56000.00	1346.46	1351.69	1350.44	1352.46	0.004009	7.13	8072.73	2230.61	0.59
Emerg Spwy	0.5632	PF 18	58000.00	1346.46	1351.80	1350.51	1352.58	0.003962	7.20	8292.04	2274.75	0.59
Emerg Spwy	0.5632	PF 19	60000.00	1346.46	1351.63	1350.60	1352.54	0.004841	7.76	7940.24	2203.27	0.65
Emerg Spwy	0.5632	PF 20	62000.00	1346.46	1351.70	1350.68	1352.64	0.004869	7.87	8097.21	2235.55	0.65
Emerg Spwy	0.5632	PF 21	64000.00	1346.46	1351.80	1350.75	1352.76	0.004799	7.93	8306.38	2277.62	0.65
Emerg Spwy	0.5632	PF 22	66000.00	1346.46	1351.87	1350.83	1352.86	0.004840	8.04	8451.49	2306.63	0.65
Emerg Spwy	0.5632	PF 23	68000.00	1346.46	1351.95	1350.89	1352.96	0.004852	8.14	8611.57	2338.46	0.65
Emerg Spwy	0.5632	PF 24	70000.00	1346.46	1352.03	1350.98	1353.05	0.004865	8.24	8769.46	2363.55	0.66
Emerg Spwy	0.5632	PF 25	72000.00	1346.46	1352.10	1351.06	1353.15	0.004890	8.34	8918.42	2388.05	0.66
Emerg Spwy	0.5632	PF 26	74000.00	1346.46	1352.17	1351.13	1353.25	0.004898	8.43	9075.37	2435.35	0.66
Emerg Spwy	0.5632	PF 27	76000.00	1346.46	1352.25	1351.20	1353.33	0.004874	8.49	9440.12	2470.10	0.66
Emerg Spwy	0.5632	PF 28	78000.00	1346.46	1352.32	1351.27	1353.41	0.004871	8.56	9613.52	2470.64	0.66
Emerg Spwy	0.5632	PF 29	80000.00	1346.46	1352.39	1351.34	1353.50	0.004864	8.63	9787.56	2471.19	0.67

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.4382	PF 1	1000.00	1342.86	1343.98	1343.60	1344.03	0.003609	1.79	558.43	899.15	0.40
Emerg Spwy	0.4382	PF 2	5000.00	1342.86	1344.91	1344.37	1345.05	0.004134	3.03	1651.72	1354.95	0.48
Emerg Spwy	0.4382	PF 3	10000.00	1342.86	1345.51	1344.87	1345.76	0.004445	4.00	2501.27	1444.03	0.54
Emerg Spwy	0.4382	PF 4	15000.00	1342.86	1345.95	1345.26	1346.30	0.004689	4.77	3147.31	1460.64	0.57
Emerg Spwy	0.4382	PF 5	20000.00	1342.86	1346.32	1345.59	1346.78	0.004929	5.41	3693.53	1498.39	0.60
Emerg Spwy	0.4382	PF 6	25000.00	1342.86	1346.66	1345.87	1347.21	0.005088	5.96	4192.26	1684.31	0.63
Emerg Spwy	0.4382	PF 7	30000.00	1342.86	1346.98	1346.17	1347.62	0.005166	6.43	4665.94	1869.14	0.64
Emerg Spwy	0.4382	PF 8	35000.00	1342.86	1347.27	1346.42	1348.00	0.005230	6.85	5109.82	1963.58	0.66
Emerg Spwy	0.4382	PF 9	40000.00	1342.86	1347.56	1346.68	1348.37	0.005236	7.21	5545.45	2026.32	0.67
Emerg Spwy	0.4382	PF 10	42000.00	1342.86	1347.67	1346.77	1348.51	0.005233	7.35	5715.33	2049.66	0.67
Emerg Spwy	0.4382	PF 11	44000.00	1342.86	1347.78	1346.87	1348.65	0.005228	7.48	5882.87	2069.26	0.67
Emerg Spwy	0.4382	PF 12	46000.00	1342.86	1347.89	1346.95	1348.79	0.005223	7.61	6048.21	2088.54	0.67
Emerg Spwy	0.4382	PF 13	48000.00	1342.86	1348.00	1347.04	1348.92	0.005216	7.73	6211.35	2107.52	0.68
Emerg Spwy	0.4382	PF 14	50000.00	1342.86	1348.10	1347.12	1349.06	0.005208	7.85	6372.63	2126.24	0.68
Emerg Spwy	0.4382	PF 15	52000.00	1342.86	1348.20	1347.21	1349.19	0.005204	7.96	6530.54	2144.52	0.68
Emerg Spwy	0.4382	PF 16	54000.00	1342.86	1348.31	1347.30	1349.32	0.005190	8.07	6689.95	2162.94	0.68
Emerg Spwy	0.4382	PF 17	56000.00	1342.86	1348.41	1347.39	1349.45	0.005180	8.18	6846.15	2180.94	0.69
Emerg Spwy	0.4382	PF 18	58000.00	1342.86	1348.48	1347.46	1349.56	0.005269	8.33	6959.47	2197.28	0.69
Emerg Spwy	0.4382	PF 19	60000.00	1342.86	1348.63	1347.56	1349.51	0.004353	7.73	8205.88	2218.90	0.63
Emerg Spwy	0.4382	PF 20	62000.00	1342.86	1348.73	1347.62	1349.62	0.004296	7.79	8427.19	2230.17	0.63
Emerg Spwy	0.4382	PF 21	64000.00	1342.86	1348.74	1347.73	1349.69	0.004535	8.01	8454.15	2231.54	0.65
Emerg Spwy	0.4382	PF 22	66000.00	1342.86	1348.85	1347.82	1349.80	0.004433	8.04	8698.35	2243.90	0.64
Emerg Spwy	0.4382	PF 23	68000.00	1342.86	1348.93	1347.89	1349.90	0.004421	8.11	8883.36	2253.23	0.64
Emerg Spwy	0.4382	PF 24	70000.00	1342.86	1349.01	1347.97	1349.99	0.004407	8.19	9068.02	2262.49	0.64
Emerg Spwy	0.4382	PF 25	72000.00	1342.86	1349.09	1348.04	1350.09	0.004396	8.26	9248.73	2271.53	0.65
Emerg Spwy	0.4382	PF 26	74000.00	1342.86	1349.17	1348.13	1350.19	0.004385	8.33	9428.48	2280.47	0.65
Emerg Spwy	0.4382	PF 27	76000.00	1342.86	1349.25	1348.18	1350.28	0.004374	8.40	9606.99	2289.33	0.65
Emerg Spwy	0.4382	PF 28	78000.00	1342.86	1349.33	1348.26	1350.37	0.004363	8.47	9783.95	2298.07	0.65
Emerg Spwy	0.4382	PF 29	80000.00	1342.86	1349.40	1348.36	1350.46	0.004353	8.54	9959.32	2306.70	0.65
Emerg Spwy	0.3334	PF 1	1000.00	1340.01	1341.08	1340.99	1341.19	0.007798	2.67	374.47	924.93	0.74
Emerg Spwy	0.3334	PF 2	5000.00	1340.01	1341.87	1341.65	1342.14	0.006899	4.14	1230.33	1252.34	0.72
Emerg Spwy	0.3334	PF 3	10000.00	1340.01	1342.54	1342.16	1342.91	0.005922	4.93	2096.04	1350.84	0.67
Emerg Spwy	0.3334	PF 4	15000.00	1340.01	1343.10	1342.58	1343.54	0.005266	5.44	2878.83	1452.10	0.65
Emerg Spwy	0.3334	PF 5	20000.00	1340.01	1343.60	1342.92	1344.10	0.004725	5.80	3623.90	1517.27	0.63
Emerg Spwy	0.3334	PF 6	25000.00	1340.01	1344.05	1343.26	1344.61	0.004345	6.11	4329.94	1576.55	0.61
Emerg Spwy	0.3334	PF 7	30000.00	1340.01	1344.47	1343.54	1345.07	0.004060	6.37	5001.12	1679.03	0.60
Emerg Spwy	0.3334	PF 8	35000.00	1340.01	1344.86	1343.82	1345.50	0.003847	6.61	5634.67	1724.76	0.59
Emerg Spwy	0.3334	PF 9	40000.00	1340.01	1345.23	1344.07	1345.91	0.003687	6.83	6236.06	1764.66	0.58
Emerg Spwy	0.3334	PF 10	42000.00	1340.01	1345.37	1344.19	1346.06	0.003634	6.91	6468.49	1779.94	0.58

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.3334	PF 11	44000.00	1340.01	1345.51	1344.29	1346.22	0.003585	7.00	6697.37	1794.91	0.58
Emerg Spwy	0.3334	PF 12	46000.00	1340.01	1345.64	1344.39	1346.37	0.003539	7.08	6923.45	1809.63	0.58
Emerg Spwy	0.3334	PF 13	48000.00	1340.01	1345.77	1344.47	1346.51	0.003496	7.16	7146.47	1930.62	0.57
Emerg Spwy	0.3334	PF 14	50000.00	1340.01	1345.90	1344.55	1346.66	0.003456	7.23	7366.59	1993.89	0.57
Emerg Spwy	0.3334	PF 15	52000.00	1340.01	1346.03	1344.65	1346.80	0.003418	7.31	7584.17	2056.15	0.57
Emerg Spwy	0.3334	PF 16	54000.00	1340.01	1346.16	1344.74	1346.94	0.003383	7.38	7799.36	2107.50	0.57
Emerg Spwy	0.3334	PF 17	56000.00	1340.01	1346.28	1344.82	1347.08	0.003348	7.45	8012.97	2151.93	0.57
Emerg Spwy	0.3334	PF 18	58000.00	1340.01	1346.43	1344.90	1347.21	0.003227	7.44	8647.46	2166.85	0.56
Emerg Spwy	0.3334	PF 19	60000.00	1340.01	1346.19	1344.98	1347.15	0.004087	8.15	7854.14	2118.91	0.63
Emerg Spwy	0.3334	PF 20	62000.00	1340.01	1346.28	1345.07	1347.26	0.004119	8.26	8003.32	2149.93	0.63
Emerg Spwy	0.3334	PF 21	64000.00	1340.01	1346.82	1345.14	1347.60	0.002981	7.47	9503.66	2170.82	0.54
Emerg Spwy	0.3334	PF 22	66000.00	1340.01	1346.56	1345.22	1347.50	0.003807	8.20	8930.04	2168.16	0.61
Emerg Spwy	0.3334	PF 23	68000.00	1340.01	1346.64	1345.30	1347.60	0.003800	8.27	9119.84	2169.04	0.61
Emerg Spwy	0.3334	PF 24	70000.00	1340.01	1346.71	1345.39	1347.69	0.003837	8.38	9270.79	2169.74	0.62
Emerg Spwy	0.3334	PF 25	72000.00	1340.01	1346.80	1345.46	1347.80	0.003814	8.43	9469.21	2170.66	0.62
Emerg Spwy	0.3334	PF 26	74000.00	1340.01	1346.89	1345.54	1347.90	0.003799	8.49	9658.18	2171.54	0.62
Emerg Spwy	0.3334	PF 27	76000.00	1340.01	1346.97	1345.61	1347.99	0.003806	8.57	9826.53	2172.37	0.62
Emerg Spwy	0.3334	PF 28	78000.00	1340.01	1347.05	1345.65	1348.09	0.003810	8.64	9994.96	2173.20	0.62
Emerg Spwy	0.3334	PF 29	80000.00	1340.01	1347.13	1345.75	1348.18	0.003801	8.71	10173.53	2174.08	0.62
Emerg Spwy	0.2736	PF 1	1000.00	1338.27	1339.41	1339.22	1339.48	0.003936	2.14	467.85	924.37	0.53
Emerg Spwy	0.2736	PF 2	5000.00	1338.27	1340.35	1339.88	1340.55	0.003757	3.60	1388.81	1022.39	0.54
Emerg Spwy	0.2736	PF 3	10000.00	1338.27	1341.09	1340.42	1341.42	0.003761	4.64	2155.20	1051.02	0.57
Emerg Spwy	0.2736	PF 4	15000.00	1338.27	1341.65	1340.88	1342.11	0.003867	5.43	2760.17	1074.33	0.60
Emerg Spwy	0.2736	PF 5	20000.00	1338.27	1342.14	1341.29	1342.71	0.003965	6.09	3287.99	1117.37	0.62
Emerg Spwy	0.2736	PF 6	25000.00	1338.27	1342.57	1341.65	1343.25	0.004049	6.65	3778.29	1301.63	0.64
Emerg Spwy	0.2736	PF 7	30000.00	1338.27	1342.94	1341.99	1343.73	0.004138	7.15	4232.92	1511.17	0.65
Emerg Spwy	0.2736	PF 8	35000.00	1338.27	1343.29	1342.34	1344.18	0.004207	7.60	4667.27	1698.59	0.67
Emerg Spwy	0.2736	PF 9	40000.00	1338.27	1343.60	1342.63	1344.59	0.004296	8.03	5067.19	1836.86	0.68
Emerg Spwy	0.2736	PF 10	42000.00	1338.27	1343.72	1342.78	1344.75	0.004315	8.19	5225.42	1875.19	0.69
Emerg Spwy	0.2736	PF 11	44000.00	1338.27	1343.84	1342.88	1344.91	0.004328	8.33	5382.71	1913.16	0.69
Emerg Spwy	0.2736	PF 12	46000.00	1338.27	1343.96	1343.02	1345.06	0.004351	8.48	5532.47	1948.10	0.69
Emerg Spwy	0.2736	PF 13	48000.00	1338.27	1344.05	1343.13	1345.20	0.004439	8.67	5651.76	1975.78	0.70
Emerg Spwy	0.2736	PF 14	50000.00	1338.27	1344.15	1343.25	1345.34	0.004498	8.84	5780.30	2005.51	0.71
Emerg Spwy	0.2736	PF 15	52000.00	1338.27	1344.25	1343.36	1345.48	0.004539	8.99	5913.14	2036.13	0.71
Emerg Spwy	0.2736	PF 16	54000.00	1338.27	1344.34	1343.47	1345.62	0.004597	9.16	6035.56	2064.26	0.72
Emerg Spwy	0.2736	PF 17	56000.00	1338.27	1344.40	1343.57	1345.74	0.004738	9.37	6120.25	2083.66	0.73
Emerg Spwy	0.2736	PF 18	58000.00	1338.27	1344.49	1343.68	1345.87	0.004802	9.53	6234.82	2109.85	0.74
Emerg Spwy	0.2736	PF 19	60000.00	1338.27	1344.62	1343.76	1345.77	0.004113	8.96	7453.42	2128.42	0.69
Emerg Spwy	0.2736	PF 20	62000.00	1338.27	1344.69	1343.87	1345.88	0.004145	9.07	7613.89	2130.66	0.69

HEC-RAS Plan: Ex Cond River: McMicken Dam Reach: Emerg Spwy (Continued)

Reach	River Sta	Profile	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)	
Emerg Spwy	0.2736	PF 21	64000.00	1338.27	1344.46	1343.97	1346.17	0.005937	10.57	6203.98	2102.81	0.82
Emerg Spwy	0.2736	PF 22	66000.00	1338.27	1344.61	1344.05	1346.02	0.005006	9.88	7436.84	2128.18	0.76
Emerg Spwy	0.2736	PF 23	68000.00	1338.27	1344.68	1344.16	1346.11	0.005021	9.98	7594.44	2130.38	0.76
Emerg Spwy	0.2736	PF 24	70000.00	1338.27	1344.80	1344.25	1346.22	0.004875	9.96	7841.26	2133.82	0.75
Emerg Spwy	0.2736	PF 25	72000.00	1338.27	1344.85	1344.34	1346.31	0.004955	10.11	7955.84	2135.42	0.76
Emerg Spwy	0.2736	PF 26	74000.00	1338.27	1344.92	1344.66	1346.40	0.005003	10.23	8086.37	2137.24	0.76
Emerg Spwy	0.2736	PF 27	76000.00	1338.27	1345.00	1344.72	1346.50	0.004971	10.29	8261.52	2139.67	0.76
Emerg Spwy	0.2736	PF 28	78000.00	1338.27	1345.08	1344.80	1346.59	0.004951	10.35	8427.74	2141.98	0.76
Emerg Spwy	0.2736	PF 29	80000.00	1338.27	1345.14	1344.87	1346.68	0.004988	10.46	8557.33	2143.78	0.76
Emerg Spwy	0.189	PF 1	1000.00	1334.59	1335.81	1335.81	1336.07	0.020185	4.07	245.98	469.89	0.99
Emerg Spwy	0.189	PF 2	5000.00	1334.59	1336.75	1336.75	1337.35	0.017833	6.24	801.37	680.89	1.01
Emerg Spwy	0.189	PF 3	10000.00	1334.59	1337.54	1337.54	1338.32	0.016165	7.13	1403.36	884.34	1.00
Emerg Spwy	0.189	PF 4	15000.00	1334.59	1338.07	1338.07	1339.02	0.015037	7.83	1916.44	999.19	1.00
Emerg Spwy	0.189	PF 5	20000.00	1334.59	1338.50	1338.50	1339.62	0.014317	8.50	2352.96	1048.52	1.00
Emerg Spwy	0.189	PF 6	25000.00	1334.59	1338.89	1338.89	1340.15	0.013821	9.01	2775.58	1106.54	1.00
Emerg Spwy	0.189	PF 7	30000.00	1334.59	1339.26	1339.26	1340.63	0.013205	9.38	3198.52	1219.45	1.00
Emerg Spwy	0.189	PF 8	35000.00	1334.59	1339.58	1339.58	1341.07	0.012937	9.80	3572.60	1311.51	1.00
Emerg Spwy	0.189	PF 9	40000.00	1334.59	1339.89	1339.89	1341.48	0.012443	10.12	3953.06	1535.46	0.99
Emerg Spwy	0.189	PF 10	42000.00	1334.59	1340.01	1340.01	1341.64	0.012348	10.26	4093.64	1565.62	1.00
Emerg Spwy	0.189	PF 11	44000.00	1334.59	1340.12	1340.12	1341.80	0.012289	10.40	4229.09	1594.41	1.00
Emerg Spwy	0.189	PF 12	46000.00	1334.59	1340.23	1340.23	1341.95	0.012174	10.53	4372.16	1709.29	1.00
Emerg Spwy	0.189	PF 13	48000.00	1334.59	1340.36	1340.36	1342.10	0.011753	10.58	4551.82	1760.95	0.99
Emerg Spwy	0.189	PF 14	50000.00	1334.59	1340.48	1340.48	1342.24	0.011433	10.65	4718.05	1808.50	0.98
Emerg Spwy	0.189	PF 15	52000.00	1334.59	1340.58	1340.58	1342.38	0.011275	10.76	4866.27	1892.01	0.97
Emerg Spwy	0.189	PF 16	54000.00	1334.59	1340.69	1340.69	1342.52	0.011042	10.85	5030.37	1980.91	0.97
Emerg Spwy	0.189	PF 17	56000.00	1334.59	1340.84	1340.84	1342.65	0.010544	10.83	5248.64	2057.39	0.95
Emerg Spwy	0.189	PF 18	58000.00	1334.59	1340.95	1340.95	1342.78	0.010377	10.89	5423.79	2115.14	0.95
Emerg Spwy	0.189	PF 19	60000.00	1334.59	1341.04	1341.04	1342.90	0.010335	11.00	5567.77	2149.27	0.95
Emerg Spwy	0.189	PF 20	62000.00	1334.59	1341.16	1341.16	1343.03	0.010001	11.02	5760.77	2185.33	0.94
Emerg Spwy	0.189	PF 21	64000.00	1334.59	1341.38	1341.38	1342.98	0.008358	10.41	6896.28	2232.32	0.86
Emerg Spwy	0.189	PF 22	66000.00	1334.59	1341.44	1341.44	1343.08	0.008428	10.55	7037.21	2233.79	0.87
Emerg Spwy	0.189	PF 23	68000.00	1334.59	1341.52	1341.52	1343.18	0.008366	10.63	7217.80	2235.66	0.87
Emerg Spwy	0.189	PF 24	70000.00	1334.59	1341.55	1341.55	1343.28	0.008658	10.85	7281.95	2236.33	0.88
Emerg Spwy	0.189	PF 25	72000.00	1334.59	1341.65	1341.65	1343.38	0.008448	10.87	7504.55	2238.64	0.88
Emerg Spwy	0.189	PF 26	74000.00	1334.59	1341.74	1341.74	1343.47	0.008317	10.91	7701.94	2240.69	0.87
Emerg Spwy	0.189	PF 27	76000.00	1334.59	1341.80	1341.80	1343.57	0.008360	11.03	7839.02	2242.12	0.88
Emerg Spwy	0.189	PF 28	78000.00	1334.59	1341.86	1341.86	1343.66	0.008377	11.13	7982.76	2243.60	0.88
Emerg Spwy	0.189	PF 29	80000.00	1334.59	1341.95	1341.95	1343.75	0.008273	11.18	8167.15	2245.51	0.88

CURRENT DATE: 04-26-2004 FILE DATE: 04-26-2004
CURRENT TIME: 16:01:47 FILE NAME: SVP-1

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 6.1 **********
****

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1337.50	1337.45	250.00	2 RCB	10.00	10.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

SUMMARY OF CULVERT FLOWS (cfs) FILE: SVP-1 DATE: 04-26-2004

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1342.19	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1344.93	1000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1347.20	1500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1349.22	2000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1351.57	2500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1354.35	3000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1357.63	3500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1361.45	4000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1365.83	4500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1371.09	5000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

****

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: SVP-1 DATE: 04-26-2004

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
0.00	0.000	0.00	0.00	0.00
1342.19	0.000	500.00	0.00	0.00
1344.93	0.000	1000.00	0.00	0.00
1347.20	0.000	1500.00	0.00	0.00
1349.22	0.000	2000.00	0.00	0.00
1351.57	0.000	2500.00	0.00	0.00
1354.35	0.000	3000.00	0.00	0.00
1357.63	0.000	3500.00	0.00	0.00
1361.45	0.000	4000.00	0.00	0.00
1365.83	0.000	4500.00	0.00	0.00
1371.09	0.000	5000.00	0.00	0.00

****

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

****

CURRENT DATE: 04-26-2004 FILE DATE: 04-26-2004
CURRENT TIME: 16:01:47 FILE NAME: SVP-1

PERFORMANCE CURVE FOR CULVERT 1 - 2(10.00 (ft) BY 10.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1337.50	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
500.00	1342.19	4.63	4.69	2-M2c	6.98	2.69	2.69	1.75	9.28	1.12
1000.00	1344.93	7.24	7.43	2-M2c	10.00	4.28	4.28	2.64	11.70	1.46
1500.00	1347.20	9.47	9.70	2-M2c	10.00	5.60	5.60	3.36	13.39	1.70
2000.00	1349.22	11.66	11.72	2-M2c	10.00	6.79	6.79	3.99	14.74	1.89
2500.00	1351.57	14.07	13.58	2-M2c	10.00	7.88	7.88	5.03	15.87	1.59
3000.00	1354.35	16.85	16.01	2-M2c	10.00	8.89	8.89	5.35	16.87	1.71
3500.00	1357.63	20.13	18.54	2-M2c	10.00	9.86	9.86	5.63	17.76	1.80
4000.00	1361.45	23.95	21.18	6-S2n	10.00	10.00	9.90	5.90	20.20	1.89
4500.00	1365.83	28.33	24.16	6-S2n	10.00	10.00	9.90	6.14	22.73	1.98
5000.00	1371.09	33.59	27.49	6-S2n	10.00	10.00	9.90	6.37	25.25	2.05

El. inlet face invert 1337.50 ft El. outlet invert 1337.45 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	1337.50 ft
OUTLET STATION	250.00 ft
OUTLET ELEVATION	1337.45 ft
NUMBER OF BARRELS	2
SLOPE (V/H)	0.0002
CULVERT LENGTH ALONG SLOPE	250.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	10.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

CURRENT DATE: 04-26-2004 FILE DATE: 04-26-2004
CURRENT TIME: 16:01:47 FILE NAME: SVP-1

****
********** TAILWATER **********
****

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: SVP-1
MAIN CHANNEL AND LT & RT OVER BANKS FILE DATE: 04-26-2004

LEFT CHANNEL BOUNDARY	2
RIGHT CHANNEL BOUNDARY	6
MANNING n LEFT OVER BANK	0.035
MANNING n MAIN CHANNEL	0.060
MANNING n RIGHT OVER BANK	0.035
SLOPE OF CHANNEL	0.0010 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	100.00	1364.00
2	144.00	1342.00
3	394.00	1341.45
4	410.00	1337.45
5	660.00	1337.45
6	676.00	1341.45
7	2676.00	1364.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1337.45	0.000	0.00	0.00	0.00
500.00	1339.20	0.151	1.75	1.12	0.11
1000.00	1340.09	0.161	2.64	1.46	0.16
1500.00	1340.81	0.167	3.36	1.70	0.20
2000.00	1341.44	0.172	3.99	1.89	0.23
2500.00	1342.48	0.165	5.03	1.59	0.18
3000.00	1342.80	0.167	5.35	1.71	0.20
3500.00	1343.08	0.170	5.63	1.80	0.22
4000.00	1343.34	0.172	5.90	1.89	0.23
4500.00	1343.59	0.174	6.14	1.98	0.25
5000.00	1343.82	0.175	6.37	2.05	0.26

Note: Shear stress was calculated using R.

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	1.00 ft
CREST LENGTH	1.00 ft
OVERTOPPING CREST ELEVATION	1364.00 ft

****

APPENDIX E

FAILURE MODES

7.0 FAILURE MODES AND EFFECTS ANALYSIS

As part of the Phase I assessment for McMicken Dam, URS completed a FMEA for McMicken Dam. The overall objective of the FMEA was to qualitatively assess the risks associated with various failure modes relative to McMicken Dam and its appurtenant facilities. The FMEA was completed in a workshop setting with Steven G. Vick, P.E. (subconsultant to URS) as the facilitator. A detailed FMEA report prepared by Mr. Vick is included in Appendix D. Relevant portions of this report including procedural and technical details, and key findings are summarized in the following subsections.

7.1 BACKGROUND

FMEA is a risk-based procedure that can be applied to any engineered system with complex components or component interactions. The process seeks to bring about improved understanding of system functioning, and thereby improve safety, by identifying its most vulnerable features and examining the ways in which they may malfunction. FMEA relies on the collective judgment of experienced professionals to describe potential failure occurrences, their likelihoods, and their consequences. It is important to note that FMEA does not invoke numerical probabilities associated with other quantitative risk assessment methodologies.

During the FMEA, the risks (probability of failure and consequence of failure) assigned to the various failure modes were ranked on a relative basis pertaining to the McMicken Dam system exclusively. An implication of this approach is that the risks identified for McMicken Dam cannot be directly compared to another other dams. One reason for this is that previous risk assessments did not evaluate the consequences of the various failure modes. A portfolio-wide comparison of risks (if needed) will require a more broad-based categorization scheme, or a quantitative risk assessment. The FMEA can identify the failure modes with the highest risk contributions for future quantitative risk assessments.

7.2 SYSTEM DESCRIPTION

The following components of the McMicken Dam system were defined for the purpose of the FMEA:

- Dam embankment
- Emergency spillway
- Five CMP outlets (two operational and three abandoned)

- Principal outlet
- Outlet channel and levee
- Potentially impacted downstream areas to the east

The upstream boundary of the system extends to the full drainage area or watershed for the dam extending to the White Tank Mountains to the west, and the Wickenburg and Hieroglyphic Mountains to the northwest. The system boundaries to the east include the current and anticipated residential development for a distance of 2 miles downstream of the dam.

To better reflect the characteristics of the dam and downstream areas, the dam was divided into the following three spatial segments:

- ***Segment A*** – the currently identified area of fissure hazard from the south abutment to Station 111+00.
- ***Segment B*** – the intermediate section of the dam from Station 111+00 to Station 450+00
- ***Segment C*** – Station 450+00 northward to the end of the outlet channel and outlet levee including the spillway and principal outlet

7.3 DEFINITION OF FAILURE

Failure of the system was defined as an uncontrolled release of the reservoir resulting from a breach in the embankment, discharge through the emergency spillway, or uncontrolled release from the outlet channel resulting from a breach in the outlet levee. This definition recognizes that damaging flows can occur from normal emergency spillway operation.

7.4 LIKELIHOOD AND CONSEQUENCE CATEGORIES

The likelihood of occurrence and the consequence associated with each failure mode was assigned to one of three categories based on professional judgment and subjective degree-of-belief. In assigning likelihoods, failure modes representative of the most likely and the least likely categories were evaluated first. These then became reference occurrences to which other likelihood judgments were benchmarked. The following likelihood categories were defined for McMicken Dam:

- ***Category I*** – highest likelihood of occurrence for McMicken Dam
- ***Category II*** – intermediate likelihood of occurrence for McMicken Dam
- ***Category III*** – lowest likelihood of occurrence for McMicken Dam

The consequence categories were defined in a similar manner, and were scaled to available dam-breach outflow and emergency spillway capacity. The following are the consequence category definitions:

- *Category I* – highest inundation effects for McMicken Dam resulting from discharges greater than 23,000 cfs, up to and including the maximum spillway discharge estimated to be 60,000 cfs
- *Category II* – intermediate inundation effects for McMicken Dam resulting from discharges between 10,000 cfs and 23,000 cfs
- *Category III* – lowest inundation effects for McMicken Dam resulting from discharges less than or equal to 10,000 cfs

In addition to the likelihood and consequence categories defined above, a degree of confidence (high, moderate, low) was also assigned to each failure mode. This expression of the degree of confidence simplified the judgment-forming process for the participants. Furthermore, a "low" confidence designation often indicated a need to obtain additional information.

7.5 FMEA PROCESS

As noted earlier in this section, the FMEA for McMicken Dam was conducted in a workshop setting. The participants in this workshop included Tom Renckly, P.E., Larry Lambert, P.E., and George Beckwith, P.E. of the District; Todd Ringsmuth, P.E., James Scott, P.E., and Ravi Murthy, P.E. of URS; and Steven G. Vick, P.E., a subconsultant to URS.

Discussions during the workshop were documented in tabular format (Table 7-1). These FMEA tables include the following information:

- Failure mode
- Initiating condition
- Effects
- Dam segment
- Likelihood and confidence
- Consequence and confidence
- Information needs
- Current mitigating factors

- Potential mitigating factors
- Comments

After the details pertaining to each failure mode were documented in the FMEA tables, a "binning" process was employed to combine the likelihood of failure with the corresponding consequence to obtain the risk associated with each failure mode. This "binning" was accomplished using a two-dimensional array (Table 7-2) with decreasing consequence from left to right, and decreasing likelihood of occurrence from top to bottom. Thus, the upper left corner of the array represents failure modes with the highest risk while the bottom right corner of the binning array represents failure modes with the lowest relative risk.

7.6 KEY FINDINGS

Key findings resulting from the FMEA for McMicken Dam are summarized as follows:

- None of the failure modes identified for McMicken Dam were judged to have a combination of both high likelihood of occurrence and high consequence (highest risk).
- Two failure modes that most closely approach the upper left (highest risk) of the binning array relate to the normal emergency spillway discharge for relatively large events, and erosion of the emergency spillway.
- Two failure modes (piping and structural integrity) associated with the operational CMPs were judged to have a moderate likelihood of occurrence and moderate consequence.
- The consequences of failure modes associated with the abandoned CMPs were placed in the same category (Category II) as that for the operational CMPs. However, the likelihood of failure of the abandoned CMPs was judged to be lower than that for the operating CMPs.
- Normal operation of the emergency spillway under relatively large discharges was judged to result in the highest consequence category.
- The failure mode resulting from erosion along an earth fissure was benchmarked to the highest likelihood category since the risk of the fissure across the dam alignment has been documented. However, the consequences associated with this failure mode were judged to be relatively low since the discharge resulting from an embankment breach within the segment of known fissuring was relatively low.
- An innovative approach for flood warning in order to increase warning times may be warranted for McMicken Dam. Examples of innovative methods may include the use of

satellite imagery for forecasting large storm events, and gauging streams/washes that contribute significantly to runoff reporting to the dam.

- It is unclear at this time if the escape routes and locations designated in the EAP will remain accessible and safe in the event of a large spillway discharge or dam-breach event.

The FMEA has resulted in the identification and development of "failure modes" or "potential failure modes." It is not the purpose of the analysis or the report to provide an opinion of the safety of the structure in regards to operation, stability or structural soundness. The analysis and report does not offer, nor was it in the scope or purpose, to investigate the safety of the structure. The analysis and report only identifies failure modes or potential failure modes or mechanisms that are based on site-specific conditions at McMicken Dam. That is, if these conditions potentially were to develop and/or simultaneously occur, a potential dam failure could result. At the time the FMEA was conducted and upon preparation of this report, the structure was found to be in a satisfactory operating condition.

However, it is prudent to recognize that there exist for McMicken Dam specific ways that failure could come about that warrant attention and diligent monitoring. The identification of a condition or process as a "failure mode" or a "potential failure mode" does not imply that the dam is about to fail or even, necessarily, that there is a dam safety deficiency at the site. Rather, it identifies physically possible conditions or processes (generally with a remote but still credible chance of occurrence) of which persons associated with owning, inspecting, analyzing, and operating the dam should be aware. Some of the failure modes or potential failure modes are highlighted (or prioritized) for attention of the dam owner and operator. They are prioritized because the specific conditions at the dam and appurtenant structures are such that these failure modes or potential failure modes are physically possible and are considered the most realistic and most credible potential failure modes definable at the site.

7.7 ADDITIONAL DATA NEEDS

The FMEA for McMicken Dam identified several items of information/data that will be required for subsequent quantitative risk assessments. These include the following:

- Flood frequency-magnitude relationship in order to assess the likelihood of various failure modes
- Time-rate of reservoir drawdown for various reservoir stages

- Case histories related to erosion of earth spillways and internal erosion along transverse cracks
- Transient and steady stage seepage through the embankment
- The mechanics of seepage and erosion along an earth fissure

TABLE 7.1
Summary of FMEA
McMicken Dam
Maricopa County, AZ

Failure Mode	Initiating Condition	Effect		Likelihood		Consequences		Information Needs	Current Mitigating Factors	Potential Mitigating Factors	Comments
		Type	Segment	Category	Confidence	Category	Confidence				
Embankment and Emergency Spillway											
1.0 Seismic	Earthquake	Dam Breach	A,B,C	III	High	II	High	—	• Requires joint occurrence of flood and earthquake	—	—
2.0 Overtopping	Flood >55% PMF	Dam Breach Q = 21,000 cfs	A,B	III	Moderate	II	High	• Dynamic routing needed • New stage storage (recent subsidence)	• Warning/EAP in place; • Current ADWR deficiency studies	• Consider gaging upstream watershed and simulation model	• Current uncertainty in magnitude and recurrence of overtopping flood
3.0 Emergency Spillway Discharge	Flood inflow 100 year to 55% PMF	Inundation up to Q = 61,000 cfs	C	II	Moderate	I	High	• Flood routes for 100-yr, PMF, intermediate (1/2 PMF) • Frequency of 1/3, 2/3, full spillway discharge	• Warning/EAP in place	• Consider gaging upstream watershed and simulation model	• Downstream inundation mapping available
4.0 Internal Erosion, embankment or foundation	Fissures	Dam Breach Q = 7000 cfs	A	I	High	III	Low	• To be developed after current investigations	• Current investigations		• Confirmed fissure downstream, suspected fissure upstream • Need to consider breach at actual fissure location
5.0 Internal Erosion, embankment	Filter fabric: – Opening size – Construction defects or tears at locations of fill cracking from breach repairs and old dike interface	Dam Breach	A,B	III	Low	II	Mod	• Review construction QC • Review of construction phase details in 1983	• Filter testing verifies opening size; • Fulltime construction inspection was conducted		• More likely at crack locations
6.0 Internal Erosion, embankment	Filter fabric: – Opening size – Construction defects or tears at uncracked locations	Dam Breach	A,B	III	High	II	Mod	—	• Construction inspection and Testing • Short impoundment duration		
7.0 Internal Erosion, foundation	Reservoir filling and concentrated seepage below filter due to fill-foundation interface/ foundation cracking, collapse, or permeable layers	Dam Breach	A,B	II	Mod	II	Mod		• Downstream "cutoff" may retard development; • No occurrence during historic impoundment		• Low-flow channel may expose discontinuities • Embankment cracking could encourage piping • May be progressive effect not observed during routine inspection

TABLE 7.1 (Continued)

Failure Mode	Initiating Condition	Effect		Likelihood		Consequences		Information Needs	Current Mitigating Factors	Potential Mitigating Factors	Comments
		Type	Segment	Category	Confidence	Category	Confidence				
8.0 Emergency Spillway Erosion	Floods >100 yr	Increased discharge from breach at abutment or undermining of spillway crest	C	II	Moderate	I	High	• Difficult to supplement existing data	• Grouted riprap extends to the more erosion resistant Pleistocene	• Review existing data	• Consequence will be marginally worse than spillway discharge alone
Principal Outlet Structure											
9.0 (a) Wall Failure	Fill saturation and hydrostatic pressure	Dam Breach	B	III	Mod	II	High			• Check design	
9.0 (b) Piping along wall	Reservoir Filling	Dam Breach	B	III	High	II	High		• Cut-off wall at central section. No continuous seepage pathway		
Outlet Channel and Levee											
10.0 (a) Overtopping	Insufficient capacity for 100-year outlet discharge	Levee Breach	C	I	Moderate	III	High	• Confirm hydraulics		• Increase capacity	
10.0 (b) Overtopping	Debris blockage at bridges	Levee Breach	C	III	High	III	High				
10.0 (c) Levee Instability	Channel flows at full capacity	Levee Breach	C	III	High	III	High		Recent inspection		
Operational CMPs (2)											
11.0 Structural Integrity Collapse, Corrosion, Joint Openings	Reservoir filling or pipe flow	Dam Breach	B	II	Moderate	II	High	• Investigate water rights with MWD		Remove from service and grout-full	CMPs serve no critical operational function
12.0 Internal Erosion around Outside of CMP	Reservoir filling	Dam Breach	B	II	Moderate	II	High		• Antiseep collar on each CMP	• Diaphragm filter	
Abandoned CMPs (3)											
13.0 Structural Integrity Collapse, Corrosion, Joint Openings	Reservoir filling	Dam Breach	B	III	Moderate	II	High		• Abandoned CMPs only partially penetrate embankment		
14.0 Internal Erosion around Outside of CMP	Reservoir filling	Dam Breach	B	III	Moderate	II	High		Same as above		

Segment A: the currently-identified area of fissure hazard from the south abutment to Sta. 111+00
Segment B: the intermediate section of the dam from Sta. 111+00 to Sta. 450+00
Segment C: Sta.450+00 northward to the end of the outlet channel/levee, containing the spillway and principal outlet

TABLE 7.2 FMEA BINNING MATRIX
MCMICKEN DAM
MARICOPA COUNTY, ARIZONA

		CONSEQUENCES		
		HIGH I	MODERATE II	LOW III
LIKELIHOOD	HIGH I			**4.0:** Internal Erosion along an earth fissure. *Low confidence in consequences because breach at actual fissure location/zone has not been assessed.*
				10(a): Overtopping of the outlet channel and levee due to insufficient capacity for the 100-year outlet discharge.
	MODERATE II	**3.0** Emergency spillway discharge for floods from 100-year event to approx. 55% of the PMF.	**7.0 Internal** erosion due to concentrate seepage below center filter at embankment-foundation interface, foundation cracking, or permeable layers.	
		8.0 Spillway erosion for floods larger than the 100-year flood. Although spillway has grouted riprap, a portion of the spillway may be on fill.	**11.0 Structural** integrity of the operational CMPs. Potential failure due to corrosion, collapse, opens joints.	
			12.0 Internal erosion of the embankment soils around the outside of the operational CMPs.	
	LOW III		**1.0 Seismic**	**10(b):** Overtopping of the outlet channel and levee due to debris blockage at the bridges.
			2.0: Overtopping of the embankment with inflows corresponding to 55% PMF or higher.	**10(c):** Instability of the outlet levee.
			5.0 & 6.0: Internal erosion through the embankment (cracked and uncracked section of dam) due to a defect in the center filter and the old dike/new dike interface. *Low confidence on the likelihood. Need to review construction details and records for the 1983 modifications.*	
			9.0(a): Failure of the retaining wall(s) at the principal outlet due to saturation/hydrostatic pressure.	
			9.0(b): Piping along the walls at the principal outlet.	
			13.0: Structural integrity of the abandoned CMPs - corrosion, collapse, open joints.	
			14.0: Internal erosion of the embankment fill around the outside of the abandoned CMPs.	

APPENDIX F

DAM REHABILITATION ALTERNATIVE SUPPORTING CALULATIONS

stantec.com

Memo

Stantec

To:	Hernan Aristizabal Entellus	From:	George V. Sabol, PhD, PE Principal, Water Resources Phoenix
File:	82000267	Date:	October 1, 2004

Reference: Sediment Yield to McMicken Dam

The following is a summary of available data and information regarding sediment yield to McMicken Dam.

Sediment Yield Analysis by WEST Consultants, Inc.

WEST used several methods to estimate sediment yield from the McMicken Dam watershed. The range of sediment yield is from 0.21 acre-ft per square mile per year to greater than 1.0 acre-ft per square mile per year. The most appropriate methods have a range from 0.21 to about 0.4 acre-ft per square mile per year.

Sediment Yield by Empirical Relation

The Drainage Design Manual for Maricopa County contains a plot of regional sediment yield and drainage area data (See Figure 1). Fitting a maximum envelope line to that data results in a sediment yield of about 0.22 acre-ft per square mile per year, for a 200 square mile watershed.

1953 Design Criteria

Design Memorandum No.1, Hydrology and Hydraulic Design for Trilby Wash Detention Basin and Outlet Channel (Los Angeles District, U.S. Army Corps of Engineers, November 1953), (see attachment) indicates that a sediment yield of 0.2 acre-ft per square mile per year was used to allocate the sediment dead storage volume for Trilby (McMicken) Dam in 1953. That estimate is based on sedimentation studies by the Soil Conservation Service (National Resources Conservation Service). A sediment yield of 0.2 results in a sedimentation volume of about 2,500 acre-feet for the 247 square mile watershed for the dam's 50 year life. On an average annual basis that is a rate of about 80,000 cubic yards per year. There is no reliable historic topographic data available to compare with current topography, therefore, that rate of sedimentation cannot be confirmed. However, based on observations, it is unlikely that such rate of sedimentation has occurred since 1953. Therefore, the Corps' design value of 0.2 is probably high.

Drainage Area Contributing to Sediment Yield

Two (2) factors result in reducing the size of the watershed that contributes sediment to McMicken Dam. First, the dam rehabilitation alternative results in 7 square miles being eliminated from discharging to the impoundment (See Figure 2). Second, the construction of the Central Arizona Project (CAP) canal resulted in sediment trapping upstream of the canal for 56 square miles of the contributing watershed (See Figure 2). That leaves a watershed area of 217 square miles that contributes sediment to McMicken Dam.

Summary and Recommendations

Based on available data, the sediment yield to McMicken Dam most likely has been less than the design rate of 0.2 acre-ft per square mile per year. An envelope line encompassing regional sediment yield data indicates a maximum rate of 0.22. Furthermore, the watershed area that contributes sediment to McMicken Dam has been reduced by the construction of the CAP canal, and the recommended alternative for rehabilitating McMicken Dam would reduce the drainage area to the dam. The following are recommended:

1. Maintain the Corps' original estimate of sediment yield (0.2 acre-ft per square mile per year) since that value cannot be factually contradicted and reasonable best estimates support that value.

2. Use a sediment yield drainage area of 217 square miles for the dam rehabilitation alternative.

3. Using those values and a service life of 100 years, the sedimentation dead storage volume is (0.2) (217) (100) = 4,340 acre feet.

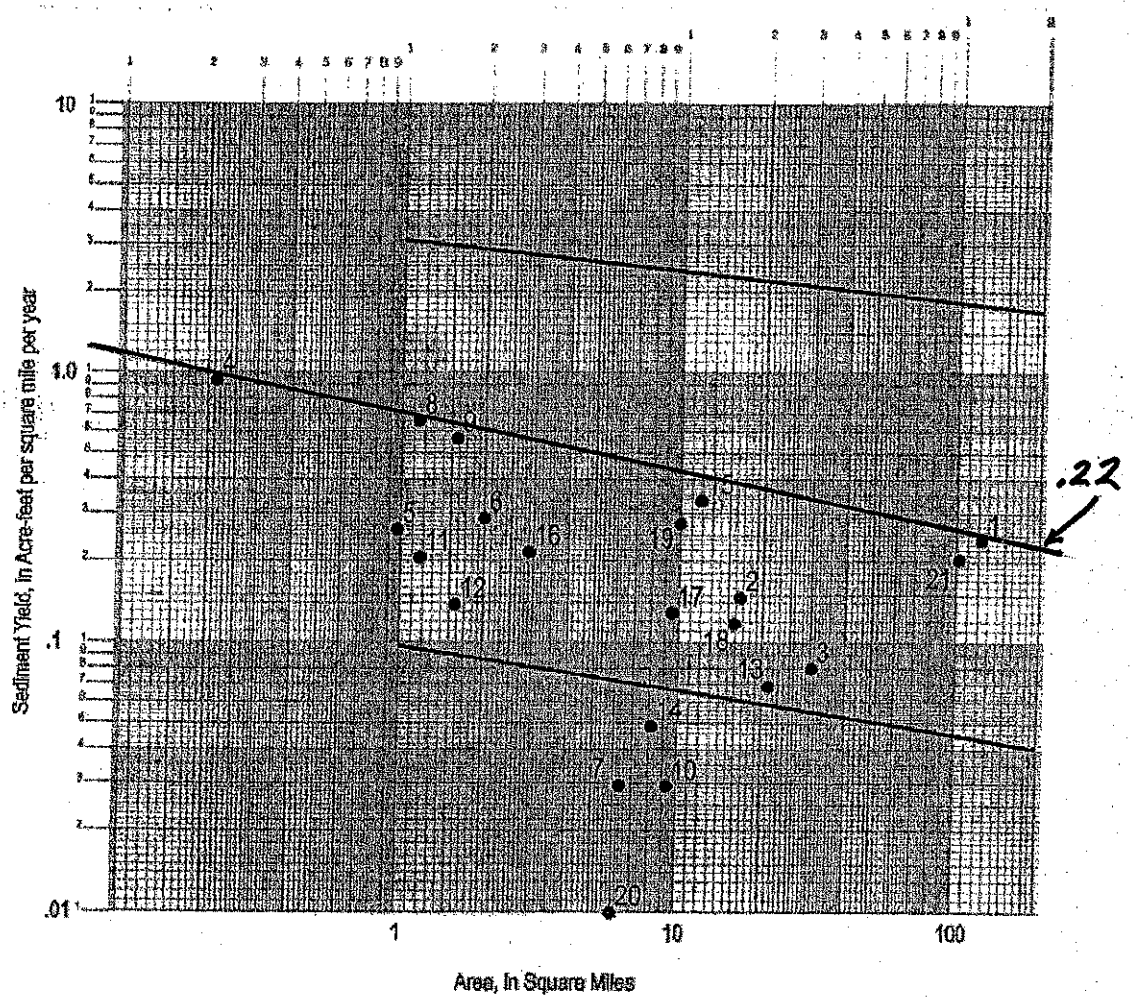
STANTEC CONSULTING INC.

George V. Sabol, PhD, PE
Principal, Water Resources
gsabol@stantec.com

c. File

Corps of Engineers used a sediment yield of 0.30 acre-feet per square mile per year for the design of Cave Buttes Dam in Maricopa County, Arizona. Although at the time (1970), sediment yield for the immediately upstream Cave Creek Dam was only 0.24 acre-feet per square mile per year. The larger value (0.30) was used for design purposes to account for large sediment inflow during the September 1970 flood that is not reflected in the 0.24 acre-feet per square mile per year measurement.

FIGURE 10.9
REGIONAL SEDIMENT YIELD AS A FUNCTION OF DRAINAGE AREA.
LINES INDICATE ENVELOPE FOR 51 U.S. WATERSHEDS BY GLYMPH (1951)



The U.S. Army Corps of Engineers (1974) indicate a range of sediment yield of 0.009 to 1.33 acre-feet per square mile per year for watersheds in Arizona and New Mexico. The U.S. Department of Agriculture (Alonso, 1997), reports sediment yield of 0.12 to 0.4 acre-feet per square mile per year for the Walnut Gulch Experimental Watershed near Tombstone, Arizona.

Figure 1

possible changes in the outlet works and the channel grades and sections between the dam and the Atchison Topeka & Santa Fe Railway bridge. Such revisions would be discussed in Design Memorandum No. 2. In general, the hydraulic design for Trilby Wash detention basin is based on the requirement of providing storage to regulate the project design flood with a peak inflow of 35,000 cubic feet per second to an outflow of 4,450 cubic feet per second, to retain the debris which would be carried into the basin by runoff from the drainage area, and to effectively pass the recommended spillway-design flood with a peak inflow of 52,000 cubic feet per second. The design methods and procedures conform to requirements of applicable provisions of the published parts and chapters of the Engineering Manual for Civil Works and "Hydraulic Design Criteria" issued by the Waterways Experiment Station. The dam would extend generally southward for a distance of about 49,500 feet along the west side of the Beardsley Canal from a point near Highway U. S. 60-70-89 to a point near the inlet of lateral No. 8 of the Beardsley Canal system. Discharges from the detention basin would be carried in an outlet channel extending generally northeastward for a distance of about 30,000 feet from the outlet works, which are near the north end of the dam, to a wash emptying into Agua Fria River about 7 miles northeast of Luke Air Force Base.

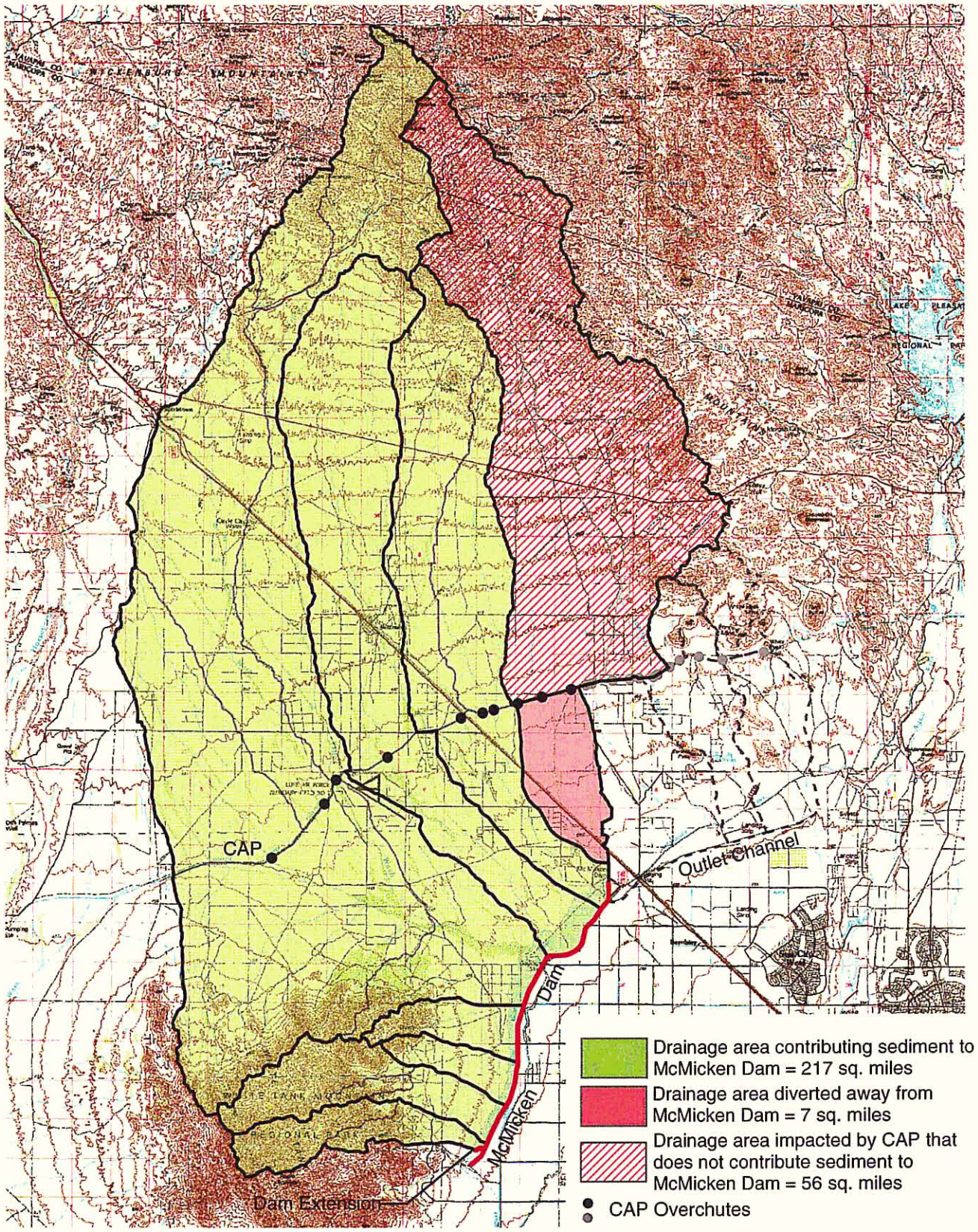
33. Area and capacity.--The area and capacity curves, shown on plate 10, were determined from a topographic map supplied by the Soil Conservation Service. This map was made on a scale of 1 inch to a half mile with contour intervals of 5 feet. The storage capacity curve was derived by computing increments of volume for intervals of 5 feet in elevation by the end-area method. The area and the capacity of the detention basin would be 2,230 acres and 19,300 acre-feet, respectively, at spillway crest (elevation 1,354.0 feet).

34. Sediment.--On the basis of sedimentation studies of the area by the Soil Conservation Service, the assumption that drainage-area conditions would not deteriorate during the next 50 years was considered reasonable and a sedimentation rate of 0.2 acre-foot per square mile per year was considered adequate. Therefore, an allocation of 2,500 acre-feet for sedimentation for the 247 square miles of drainage area during a 50-year period was used.

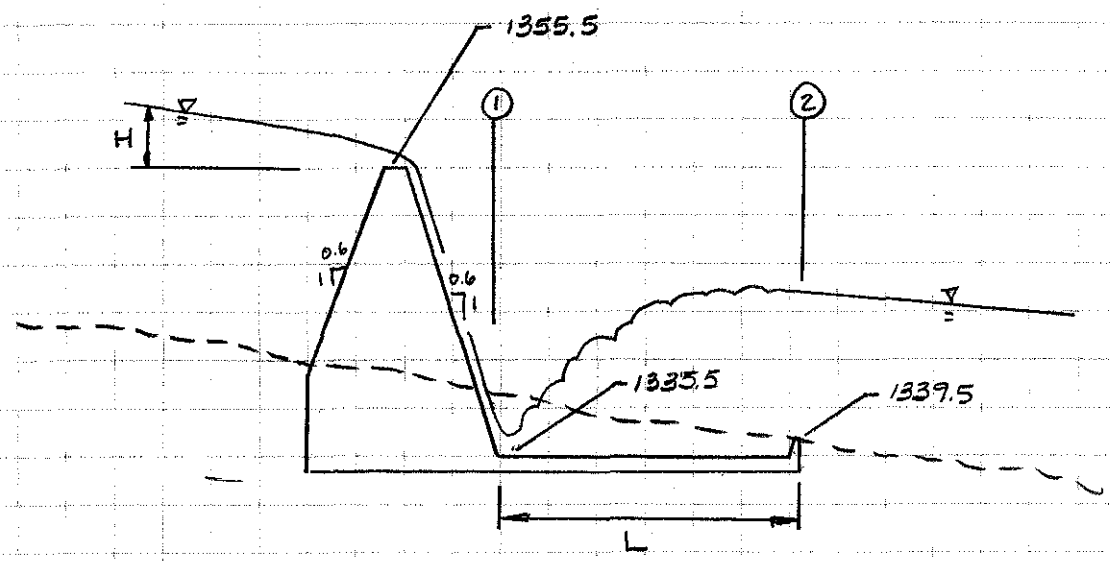
35. Dam and flood-flow channel.--The plan provides for an earth embankment with a broad-crested spillway at the left abutment and an ungated outlet structure near the left abutment. The dam (top elevation 1,361.0) would be 49,500 feet in length and 12 feet in top width. The maximum height of embankment would be 31.5 feet with an average height of approximately 23 feet. The upstream face, with a slope of 1 on 2½, would be protected from wave action and erosion due to wind and rainfall by a 12-inch blanket of screened gravel to elevation 1,347.0, the maximum water surface resulting from a flood of the magnitude experienced on 28 August 1951, the greatest flood of record. The downstream face, with a slope of 1 on 2, would not be protected. An existing detention dam constructed by Maricopa County Municipal Water Conservation District No. 1 would be incorporated in the dam embankment, as shown on plate 11. The existing

from U.S. Army Corps of Engineers, Nov. 1953

Figure 2
Watershed area for sediment yield calculations



Emergency Spillway Apron Length



From FLO-2D model results
$H \approx 5'$
$d_2 \approx 10'$

Assumptions
- Neglect effect of end sill

References
- Open Channel Hydraulics; Chow, 1959
- Hydraulic Design of Stilling Basins and Energy Dissipators; USBR, 1974

Stantec

Estimate V_1

· Figure 14-15 (Chow, pg 383)

$H = 5'$

$Z = 1355.5 + H - 1335.5 = 25.0'$

$V_1 = 35$ fps

Calculate d_1

$$d_2 = -\frac{d_1}{2} + \sqrt{\frac{d_1^2}{4} + \frac{2V_1 d_1}{g}}$$

$$10 = -0.5d_1 + \sqrt{0.25d_1^2 + 76.1d_1}$$

$d_1 = 1.5'$

Calculate F_1

$$F_1 = \frac{V_1}{\sqrt{gd_1}} = \frac{35}{\sqrt{(32.2)(1.5)}} = 5$$

Estimate L

· Figure 6 (USBR, pg 13)

$F_1 = 5$

$\frac{L}{d_1} = 40$: $\underline{L = 60'}$

Designed by: Checked by:

OPEN-CHANNEL HYDRAULICS

VEN TE CHOW, Ph.D.

Professor of Hydraulic Engineering
University of Illinois

McGRAW-HILL BOOK COMPANY

New York Toronto London

1959

relationship between the actual velocity and a theoretical value.[1] From the results of this study, a chart (Fig. 14-15) was prepared to show the actual velocity at the toe of spillways under various heads, falls, slopes from 1 on 0.6 to 1 on 0.8, and the condition of average surface roughness. It is felt that this chart is sufficiently accurate for preliminary-design

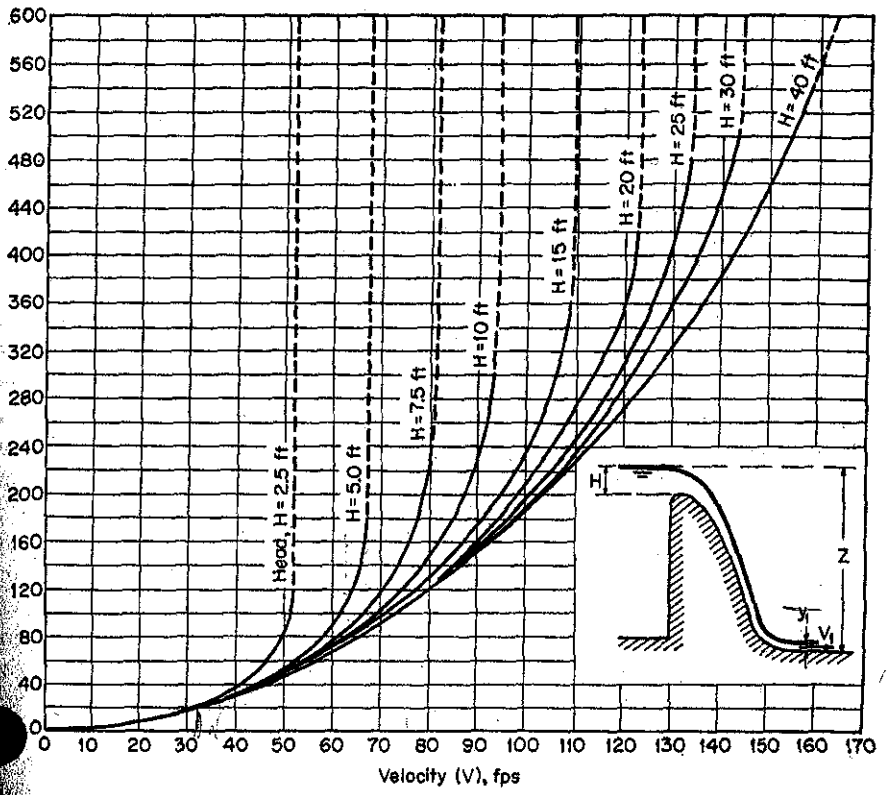


Fig. 14-15. Curves for determination of velocity at the toe of spillways with slopes 1 on 0.6 to 0.8.

purposes, although it can be refined by additional experimental information which may become available in the future.

Experiments by Bauer [30] indicate that friction losses in accelerating the flow down the face of a spillway may be considerably less than the normal friction loss in flow with well-developed turbulence. Therefore, the friction loss is not significant on steep slopes, but it would become important if the slope were small. For this reason, the chart in Fig.

[1] The theoretical velocity defined by the Bureau is $V_1 = \sqrt{2g(Z - 0.5H)}$.

A WATER RESOURCES TECHNICAL PUBLICATION

Engineering Monograph No. 25

Hydraulic Design of Stilling Basins and Energy Dissipators

By A. J. PETERKA

Denver, Colorado

United States Department of the Interior

BUREAU OF RECLAMATION

opening. The extreme case involved a discharge of 0.14 c.f.s. and a value of D_1 of 0.032 foot, for $F_1=8.9$, which is much smaller than any discharge or value of D_1 used in the present experiments. Thus, it is reasoned that as the gate opening decreased, in the 6-inch-wide flume, frictional resistance in the channel downstream increased out of proportion to that which would have occurred in a larger flume or a prototype structure. Thus, the jump formed in a shorter length than it should. In laboratory language, this is known as "scale effect," and is construed to mean that prototype action is not faithfully reproduced. It is quite certain that this was the case for the major portion of curve 1. In fact, Bahkmeteff and Matzke were somewhat dubious concerning the small-scale experiments.

To confirm the above conclusion, it was found that results from Flume F, which was 1 foot wide, became erratic when the value of D_1 approached 0.10. Figures 6 and 7 show three points obtained with a value of D_1 of approximately 0.085. The three points are given the symbol ⊠ and fall short of the recommended curve.

The two remaining curves, labeled "3" and "4," on Figure 7, portray the same trend as the recommended curve. The criterion used by each experimenter for judging the length of the jump is undoubtedly responsible for the displacement. The curve labeled "3" was obtained at the Technical University of Berlin on a flume ½ meter wide by 10 meters long. The curve labeled "4" was determined from experiments performed at

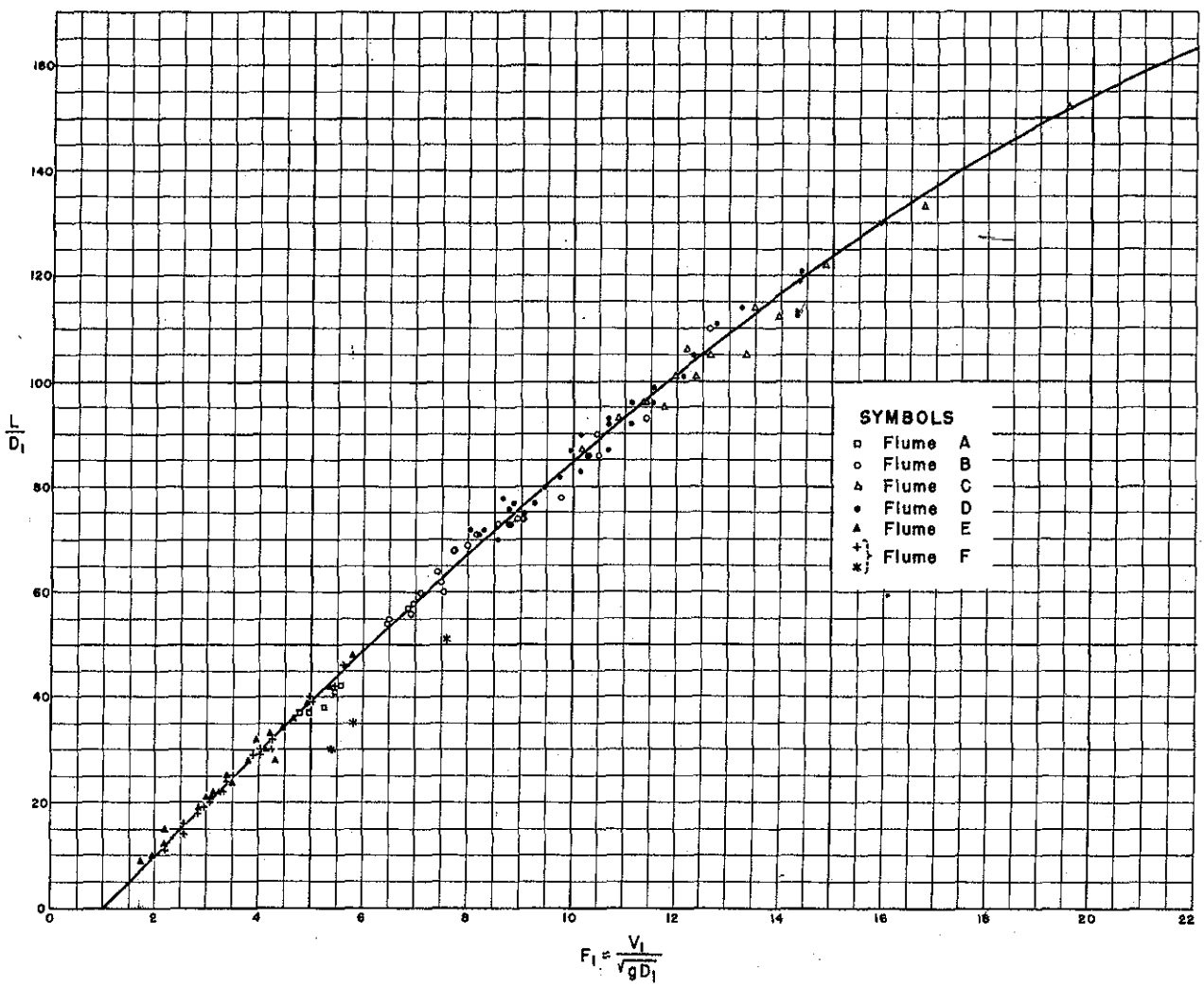


FIGURE 6.—*Length of jump in terms of D_1 (Basin I).*

Table F-1
McMicken Dam outlet channel levee freeboard

				Existing Condition			Proposed Condition		
Levee Station	River Station miles	Minimum Channel Elevation feet	Levee Crest Elevation feet	100-Year Peak Flow cfs	Water Surface Elevation feet	Levee Freeboard feet	100-Year Peak Flow cfs	Water Surface Elevation feet	Levee Freeboard feet
10+30	79.29	1,324.70	1,341.87	4,250	1,340.46	1.41	5,150	1,341.12	0.75
11+41	78.17	1,326.35	1,341.79	4,250	1,340.41	1.38	5,150	1,341.06	0.73
13+56	76.05	1,326.57	1,341.82	4,250	1,340.43	1.39	5,150	1,341.08	0.74
15+83	73.75	1,326.67	1,341.72	4,250	1,340.31	1.41	5,150	1,340.94	0.78
19+17	70.42	1,325.84	1,341.48	4,250	1,340.17	1.31	5,150	1,340.77	0.71
22+12	67.46	1,325.70	1,341.37	4,250	1,340.09	1.28	5,150	1,340.67	0.70
25+42	64.16	1,325.93	1,341.26	4,250	1,339.99	1.27	5,150	1,340.55	0.71
27+49	62.09	1,326.02	1,341.20	4,250	1,339.93	1.27	5,150	1,340.47	0.73
29+52	60.05	1,325.80	1,341.06	4,250	1,339.85	1.21	5,150	1,340.37	0.69
32+78	56.80	1,326.12	1,340.92	4,250	1,339.72	1.20	5,150	1,340.21	0.71
35+79	53.79	1,325.91	1,340.28	4,250	1,339.61	0.67	5,150	1,340.07	0.21
39+05	50.53	1,325.86	1,340.12	4,250	1,339.50	0.62	5,150	1,339.92	0.20
41+76	47.82	1,325.56	1,339.51	4,250	1,339.42	0.09	5,150	1,339.86	**-0.35**
45+19	44.39	1,325.66	1,339.34	4,250	1,339.30	0.04	5,150	1,339.72	**-0.38**
48+15	41.43	1,325.13	1,339.66	4,250	1,339.18	0.48	5,150	1,339.52	0.14
49+31	40.27	1,325.53	1,340.20	4,250	1,339.14	1.06	5,150	1,339.47	0.73
51+30	38.29	1,325.17	1,339.62	4,250	1,339.00	0.62	5,150	1,339.28	0.34
54+19	35.40	1,324.99	1,340.51	4,250	1,338.88	1.63	5,150	1,339.13	1.38
57+11	32.45	1,325.21	1,340.29	4,250	1,338.74	1.55	5,150	1,338.93	1.36
60+20	29.38	1,325.43	1,340.34	4,250	1,338.56	1.78	5,150	1,338.67	1.67
61+45	28.13	1,325.73	1,339.74	4,250	1,338.49	1.25	5,150	1,338.55	1.19
62+10	27.48	1,325.86	1,342.02	4,250	1,338.43	3.59	5,150	1,338.47	3.55
	27.30	U.S. 60 Bridge							
62+64	26.94	1,325.83	1,342.91	4,250	1,338.36	4.55	5,150	1,338.36	4.55
64+59	24.99	1,324.98	1,340.06	4,250	1,338.26	1.80	5,150	1,338.22	1.84
	24.70	BNSF Bridge							
65+09	24.50	1,324.72	1,341.02	4,250	1,337.95	3.07	5,150	1,338.07	2.95
67+09	22.48	1,324.55	1,342.41	4,250	1,337.83	4.58	5,150	1,337.88	4.53
68+64	14.711	1,325.23	1,339.69	7,850	1,337.82	1.87	7,850	1,337.82	1.87
69+42	20.15	1,324.85	1,339.82	7,850	1,337.71	2.11	7,850	1,337.71	2.11
90+13	14.289	1,323.32	1,338.72	7,850	1,335.31	3.41	7,850	1,335.31	3.41
107+40	13.962	1,322.33	1,337.11	7,850	1,333.67	3.44	7,850	1,333.67	3.44
119+76	13.728	1,320.55	1,334.99	7,850	1,332.83	2.16	7,850	1,332.83	2.16
132+44	13.487	1,320.00	1,334.23	7,850	1,331.31	2.92	7,850	1,331.32	2.91
147+04	13.211	1,319.27	1,333.21	7,850	1,329.06	4.15	7,850	1,329.09	4.12
149+69	13.161	1,319.21	1,332.94	7,850	1,328.92	4.02	7,850	1,328.96	3.98
161+60	12.935	1,317.38	1,331.93	7,850	1,328.11	3.82	7,850	1,328.17	3.76
175+89	12.665	1,316.50	1,330.24	7,850	1,327.41	2.83	7,850	1,327.50	2.74
186+51	12.463	1,316.39	1,329.08	9,900	1,326.61	2.47	10,150	1,326.70	2.38
205+57	12.102	1,313.98	1,329.03	9,900	1,324.52	4.51	10,150	1,324.61	4.42
220+23	11.825	1,312.28	1,328.07	9,900	1,323.57	4.50	10,150	1,323.67	4.40
234+48	11.555	1,312.10	1,326.31	9,900	1,322.46	3.85	10,150	1,322.56	3.75
243+91	11.376	1,311.01	1,326.16	9,900	1,321.62	4.54	10,150	1,321.72	4.44

Table F-1
McMicken Dam outlet channel levee freeboard

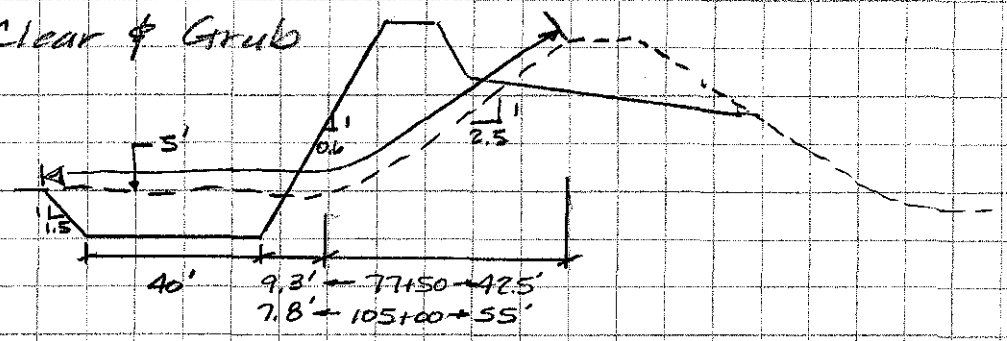
				Existing Condition			Proposed Condition		
Levee Station	River Station miles	Minimum Channel Elevation feet	Levee Crest Elevation feet	100-Year Peak Flow cfs	Water Surface Elevation feet	Levee Freeboard feet	100-Year Peak Flow cfs	Water Surface Elevation feet	Levee Freeboard feet
249+54	11.270	1,309.85	1,326.61	9,900	1,320.92	5.69	10,150	1,321.02	5.59
264+18	10.992	1,309.17	1,324.82	9,900	1,319.77	5.05	10,150	1,319.87	4.95
272+95	10.826	1,307.89	1,322.88	9,900	1,319.05	3.83	10,150	1,319.15	3.73
282+94	10.637	1,307.55	1,321.69	9,900	1,318.76	2.93	10,150	1,318.86	2.83
293+54	10.436	1,306.65	1,321.78	9,900	1,318.45	3.33	10,150	1,318.55	3.23
304+43	10.230	1,306.22	1,321.74	9,900	1,317.83	3.91	10,150	1,317.93	3.81
316+56	10.000	1,304.65	1,315.27	9,900	1,314.07	1.20	10,150	1,314.15	1.12

Stantec

WITTMAN ADSMU
Quantity Estimation
Dam Rehab. Alternative

Station 77+50 to 105+00 : Earth Fissure Risk Zone

• Clear & Grub



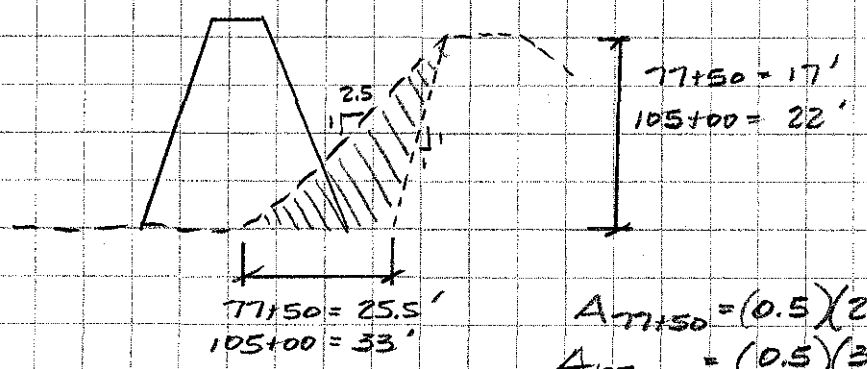
$Width_{77+50} = 7.5 + 40 + 9.3 + 45.8 = 102.6'$

$Width_{105+00} = 7.5 + 40 + 7.8 + 59.3 = 114.6'$

$Area = \left(\frac{102.6 + 114.6}{2}\right) 2{,}750 = 298{,}650^{SF} = \underline{6.8^{AC}}$

• Excavation (Existing embankment & holocene soils)

- Embankment



$A_{77+50} = (0.5)(25.5)(17) = 216.75^{SF}$

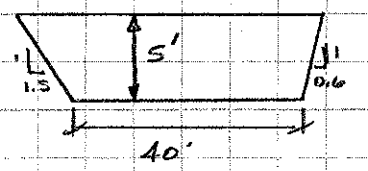
$A_{105+00} = (0.5)(33)(22) = 363^{SF}$

$V = \left(\frac{216.75 + 363}{2}\right) 2{,}750 = 797{,}156.3^{SF} = \underline{29{,}524^{CY}}$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

- Holocene Soils

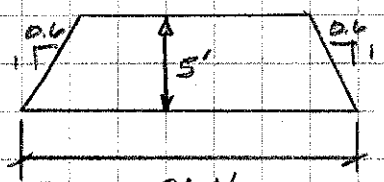
• Apron



$A = (40)(5) + (0.5)(25)(2.1)$

$A = 226.3^{SF}$

• Soil Cement Structure



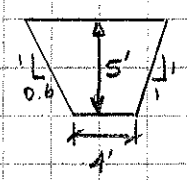
$A_{77+50} = (34.4)(5) - (25)(0.6)$

$= 157^{SF}$

$A_{105+00} = (40.4)(5) - (25)(0.6)$

$= 187^{SF}$

• Wedge



$A = (4)(5) + (0.5)(25)(1.6) = 40^{SF}$

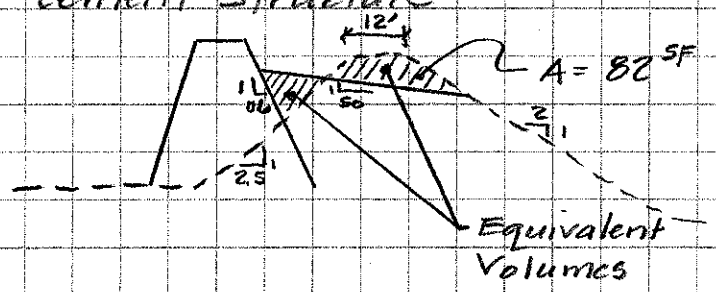
• $A_{77+50} = 226.3 + 157 + 40 = 423.3^{SF}$

• $A_{105+00} = 226.3 + 187 + 40 = 453.3^{SF}$

• $V = (438.3)(2{,}750) = 1{,}205{,}325^{CF} = \underline{44{,}642^{CY}}$

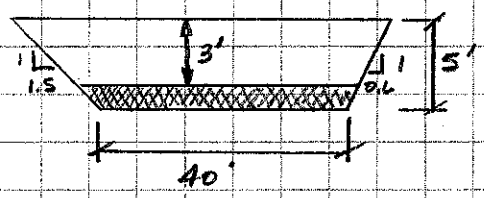
Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

- Mass Grading (Random Fill)
  - Void between existing structure and soil cement structure



$V = (82)(2{,}750) = 225{,}000^{CF} = \underline{8{,}352^{CY}}$

  - Apron

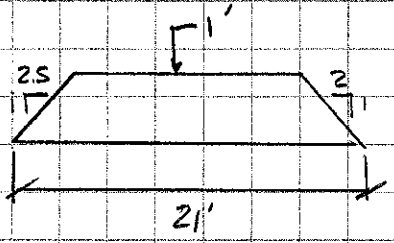


$A = (44.2)(3) + (0.5)(9)(2.1)$

$A = 142.1^{SF}$

$V = (142.1)(2{,}750) = 390{,}775^{CF} = \underline{14{,}473^{CY}}$

- Structural Fill (FRZR dam extension freeboard raise)



$A = 21 - (0.5)(4.5) = 18.75'$

$V = (18.75)(1{,}500)$

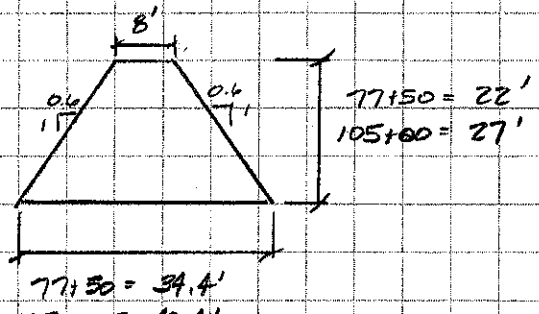
$= 28{,}125^{CF}$

$= \underline{1{,}042^{CY}}$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

Stantec

- Soil Cement



$A_{77+50} = (8)(22) + (22^2)(0.6)$

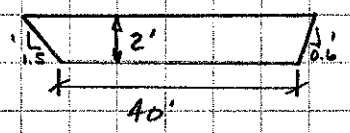
$= 466.4^{SF}$

$A_{105+00} = (8)(27) + (27^2)(0.6)$

$= 653.4^{SF}$

$V = \left(\frac{466.4 + 653.4}{2}\right) 2{,}750 = 1{,}539{,}725^{CF} = \underline{57{,}027^{CY}}$

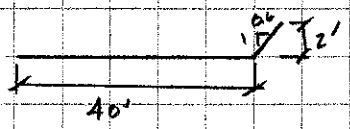
- Apron



$A = (40)(2) + (0.5)(4)(2.1) = 84.2^{SF}$

$V = (84.2)(2{,}750) = 231{,}550^{CF} = \underline{8{,}576^{CY}}$

- Geotextile



$L = 40 + 2.3' = 42.3'$

$A = (42.3')(2{,}750) = 116{,}325^{SF} = \underline{12{,}925^{SY}}$

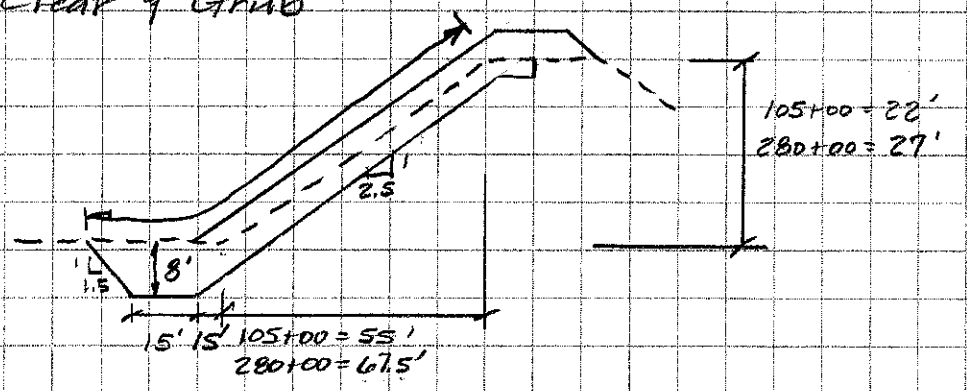
Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

Stantec

Station 105+00 to 280+00: Embankment Cracking Zone

- Average embankment raise = 2.25'
- Length = 17,500'

- Clear & Grub



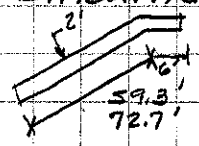
$$Width_{105+00} = 12' + 15' + 15' + 59.3' = 101.3'$$

$$Width_{280+00} = 12' + 15' + 15' + 72.7' = 114.7$$

$$Area = \left(\frac{101.3 + 114.7}{2}\right) 17{,}500 = 1{,}890{,}000^{SF} = \underline{43.4^{AC}}$$

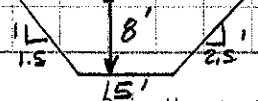
- Excavation (Existing Embankment & Holocene Soils)

- Embankment $\quad V = \left(\frac{65.3 + 78.7}{2}\right)(2)(17{,}500) = 2{,}520{,}000^{CF}$



$$= \underline{93{,}333^{CY}}$$

- Holocene Soils $\quad A = (15)(8) + (0.5)(64)(4) = 248^{SF}$

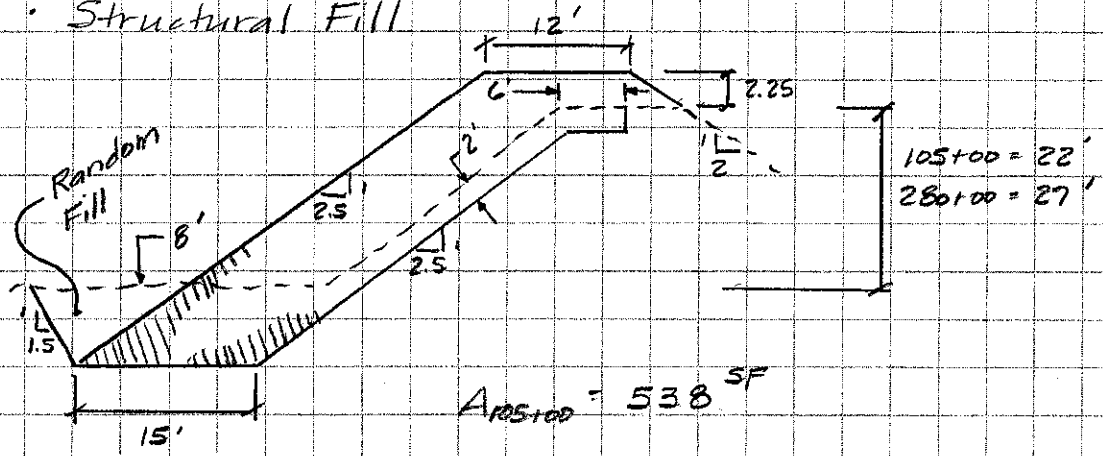


$$V = (248)(17{,}500) = 4{,}340{,}000^{CF} = \underline{160{,}741^{CY}}$$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

Stantec

- Structural Fill

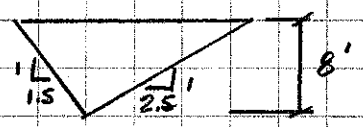


$A_{105+00} = 538^{SF}$

$A_{280+00} = 605^{SF}$

$$V = \left(\frac{538 + 605}{2}\right) 17{,}500 = 10{,}001{,}250^{CF} = \underline{370{,}417^{CY}}$$

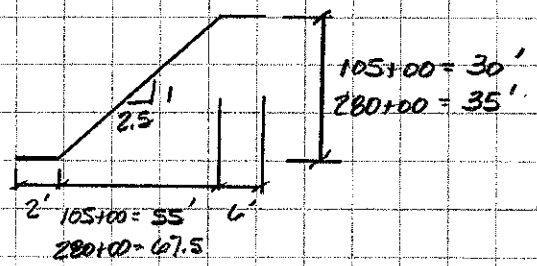
- Random Fill



$A = (0.5)(64)(4) = 128^{SF}$

$V = (128)(17{,}500) = 2{,}240{,}000^{CF} = \underline{82{,}963^{CY}}$

- Geomembrane / Geotextile



$Width_{105+00} = 2 + 62.6 + 6 = 70.6'$

$Width_{280+00} = 2 + 76 + 6 = 84'$

$$A = \left(\frac{70.6 + 84}{2}\right) 17{,}500$$

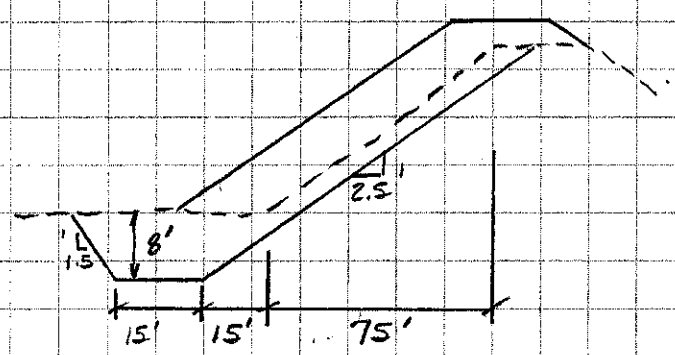
$$= \underline{1{,}352{,}750^{SF}}$$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

Station 280+00 to 350+00 : Embankment Cracking Zone

- Average embankment raise = 1.9'
- Average height of existing dam = 30'
- Length = 7,000'

- Clear & Grub



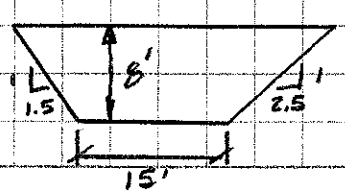
Area = (12 + 15 + 15 + 80.8) 7,000 = 859,600 SF = 19.7 AC

- Excavation (Existing embankment & holocene soils)

  - Embankment

    V = (80.8+6)(2)(7,000) = 1,215,200 CF = 45,007 CY

  - Holocene Soils

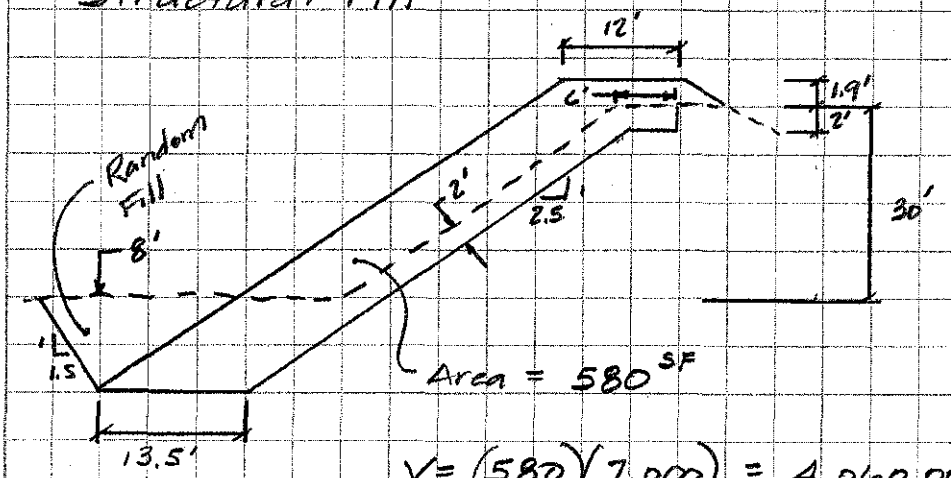


A = 248 SF

V = (248)(7,000) = 1,736,000 CF = 64,296 CY

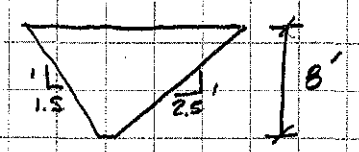
Designed by: MCG 28 Apr 05 Checked by: 5/13/05

- Structural Fill



$V = (580)(7{,}000) = 4{,}060{,}000^{CF} = \underline{150{,}370^{CY}}$

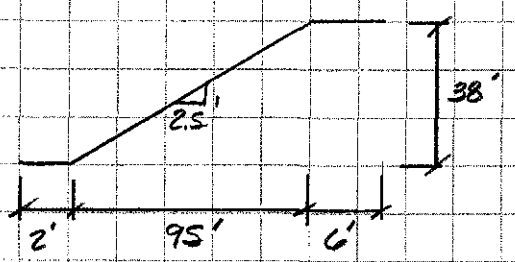
- Random Fill



$A = (1.5)(8) + (0.5)(4)(4) = 140^{SF}$

$V = (140)(7{,}000) = 980{,}000^{CF} = \underline{36{,}296^{CY}}$

- Geomembrane / Geotextile



$A = (2 + 102 + 6)\,7{,}000 = \underline{770{,}000^{SF}}$

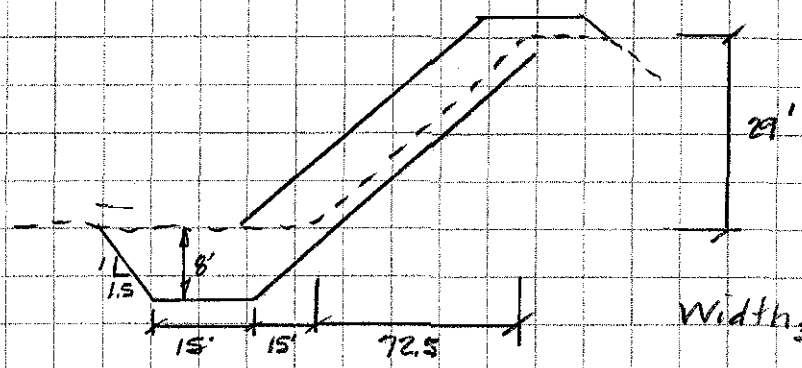
Designed by: MCG 28 Apr 05 Checked by: 5/13/05

Stantec

Station 350+00 to 460+00 : Embankment Cracking Zone

- Embankment raise at sta 350+00 = 1.6'
- Embankment raise at sta 460+00 = 0'
- Average height of existing dam = 29'
- Length = 11,000'

- Clear & Grub



$Width_{350+00} = 12+15+15+72.5 = 114.5'$

$Width_{460+00} = 72.5'$

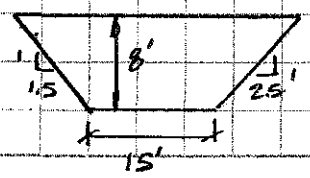
$A = \left(\frac{72.5+114.5}{2}\right)11{,}000 = 1{,}028{,}500^{SF} = \underline{23.6^{AC}}$

- Excavation (Existing Embankment & Holocene Soils)

  - Embankment

$V = (78.1+6)(2)11{,}000 = 1{,}850{,}200^{CF} = \underline{68{,}525^{CY}}$

  - Holocene Soils



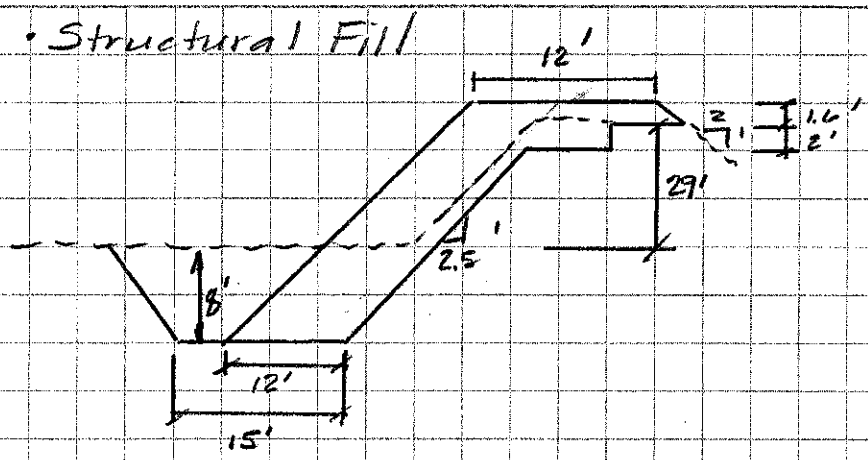
$A = 248^{SF}$

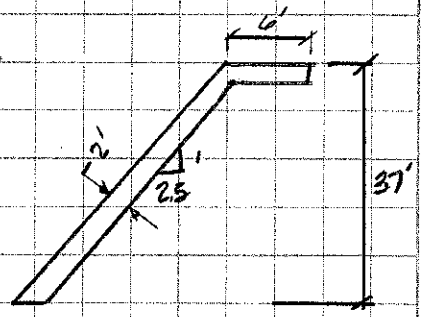
$V = (248)(11{,}000) = 2{,}728{,}000^{CF} = \underline{101{,}037^{CY}}$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

Stantec

• Structural Fill

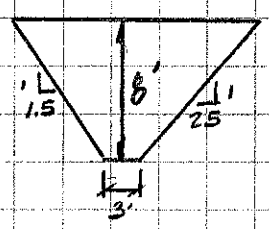




$A_{350+00} = 508^{SF}$ $\qquad$ $A_{460+00} = (106)(2) = 212^{SF}$

$$V = \left(\frac{508 + 212}{2}\right) 11{,}000 = 3{,}960{,}000^{CF} = \underline{146{,}667^{CY}}$$

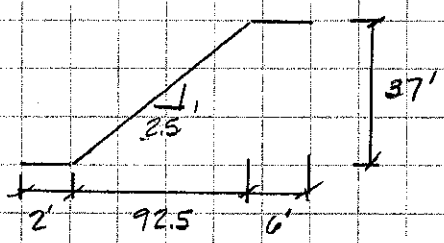
• Random Fill



$A = (3)(8) + (0.5)(64)(4) = 152^{SF}$

$V = (152)(11{,}000) = 1{,}672{,}000^{CF} = \underline{61{,}926^{CY}}$

• Geomembrane / Geotextile



$A = (2 + 100 + 6)\,11{,}000 = \underline{1{,}188{,}000^{SF}}$

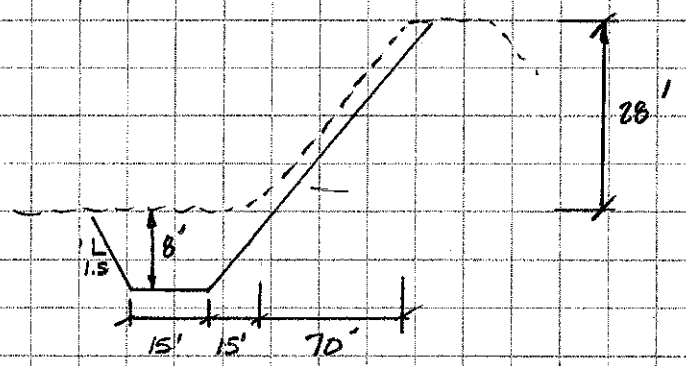
Designed by: MCG 28 Apr 05 $\qquad$ Checked by: 5/13/05

Stantec

Station 460+00 to 480+00 : Embankment Cracking Zone

- No embankment raise required
- Average height of existing dam = 28'
- Length = 2,000'

- Clear & Grub

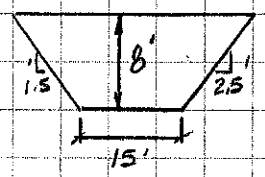


$A = (12 + 15 + 15 + 70)\,2{,}000 = 224{,}000^{SF} = \underline{5.1^{AC}}$

- Excavation (Existing embankment & holocene soils)
  - Embankment

$V = (75 + 6)(2)(2{,}000) = 324{,}000^{CF} = \underline{12{,}000^{CY}}$

  - Holocene Soils



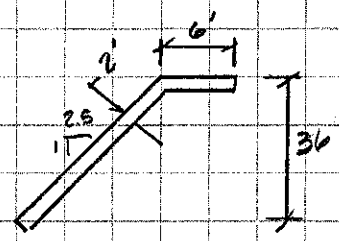
$A = 248^{SF}$

$V = (248)(2{,}000) = 496{,}000^{CF} = \underline{18{,}370^{CY}}$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

Stantec

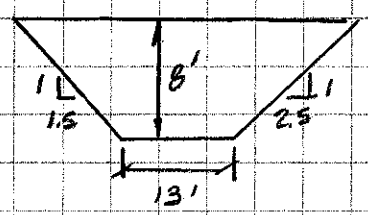
- Structural Fill



$V = (97+6)(2)(2{,}000) = 412{,}000^{CF}$

$= \underline{15{,}259^{CY}}$

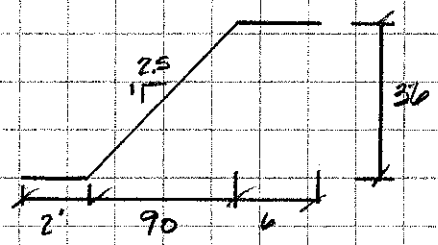
- Random Fill



$A = (13)(8) + (0.5)(64)(4) = 232^{SF}$

$V = (232)(2{,}000) = 464{,}000 = \underline{17{,}185^{CY}}$

- Geomembrane / Geotextile



$A = (2+97+6)(2000) = \underline{210{,}000^{SF}}$

Designed by: MCG 28 Apr 05 Checked by: 5/13/05

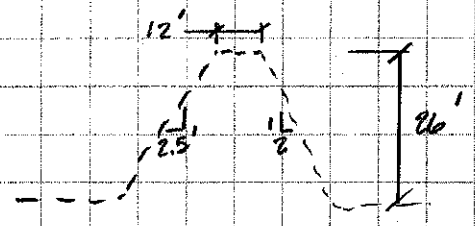
Stantec

Emergency Spillway

- Average height of existing dam = 26'
- Length = 2,250'

- Clear & Grub

  - Embankment



Width = 12 + 70 + 58 = 140

$A = (140)(2{,}250) = 315{,}000^{SF} = \underline{7.2}$

  - Shooting Ranges: A = 40

- Excavation of lead contaminated Soils

  - Max Range
    - Assume removal of top 6" of soil over half the sites

$V = (0.5)\left(\frac{40}{2}\right) = 10^{AC} = \underline{16{,}133^{CY}}$

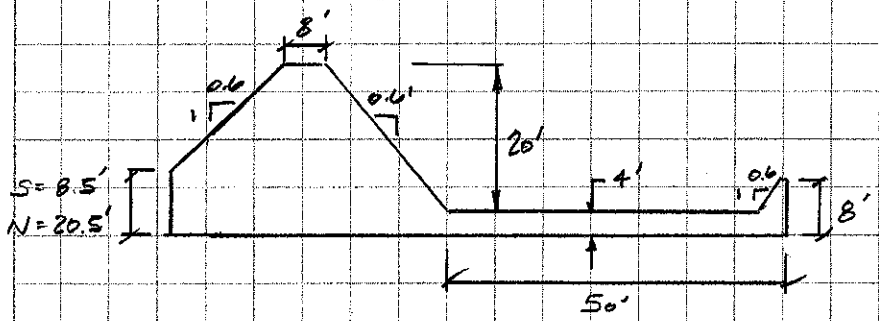
    - Disposal

Use 125 lb/cf for lead contaminated soil

$$\frac{(16{,}133^{CY})(27^{CF/CY})(125^{lb/CF})}{2{,}000} = \underline{27{,}224^{tons}}$$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

- RCC Structure



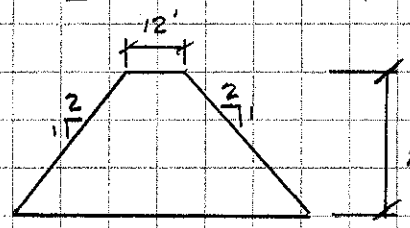
$A_S = 722^{SF}$

$A_N = 629^{SF}$

$V = \left(\frac{722+629}{2}\right) 2{,}250 = 1{,}519{,}875^{CF} = \underline{56{,}292^{CY}}$

End of Dam Segment and Training Dike

- Training Dike : L = 300'



$H_1 = 32'$

$H_2 = 20'$

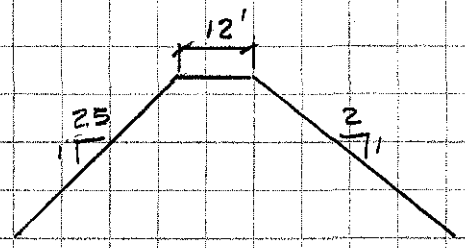
$A_1 = (12)(32) + (2)(32^2) = 2{,}432^{SF}$

$A_2 = (12)(20) + (2)(20^2) = 1{,}040^{SF}$

$V = \left(\frac{2{,}432+1{,}040}{2}\right) 300 = 520{,}800^{CF} = \underline{19{,}289^{CY}}$

Designed by: MCG 28 Apr 05 Checked by: 5/13/05

- End of Dam Segment
  - Length = 2,000'
  - Height = 22'



  - Clear & Grub

$$A = (2{,}000)(12 + 22(4.5)) = 222{,}000^{SF} = \underline{5^{AC}}$$

  - Excavation of Holocene Soils

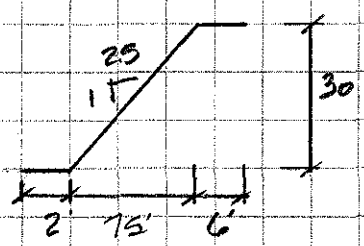
$$V = (8)(12 + 22(4.5))(2{,}000) = 1{,}776{,}000^{CF} = \underline{65{,}778^{CY}}$$

  - Structural Fill

$$V = \left[(12)(30) + (0.5)(30^2)(4.5)\right](2{,}000) = 4{,}770{,}000^{CF}$$

$$= \underline{176{,}666^{CY}}$$

  - Geotextile / Geomembrane



$$A = (2 + 81 + 6)(2{,}000) = \underline{178{,}000^{SF}}$$

Designed by: MCG 28 Apr 05 Checked by: [illegible] 5/13/05

- Min. Range (Provided by District)
  - Cyclone Separation of lead from soil
  - Assumptions
    - Process is only 90% effective
    - Unit weight for soil is approx. 110 lb/cf
    - Unit weight for lead contaminated soil approx. 125 lb/cf
    - Unit weight for lead is approx. 700 lb/cf
    - Lead accounts for 3.6% of weight

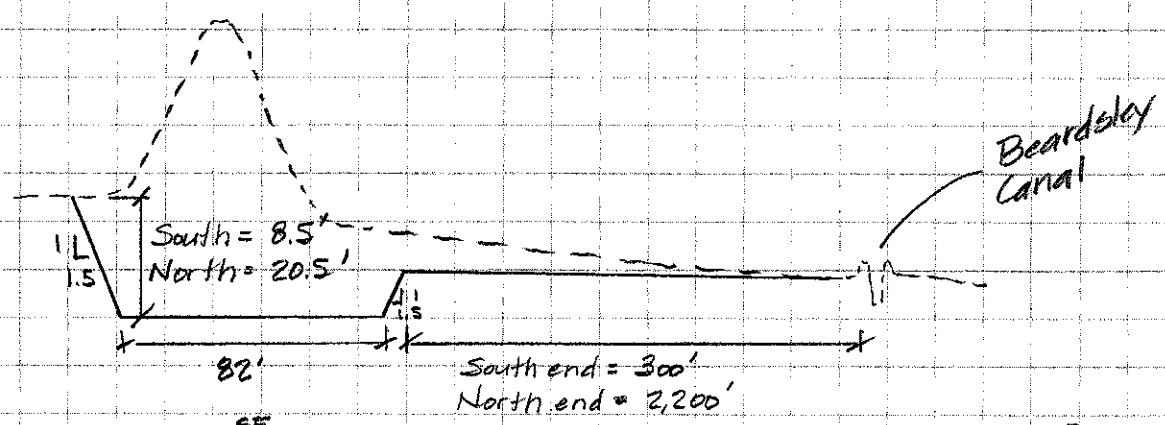
$$110 + 700X = 125$$

$$X = \frac{25}{700} = 0.036$$

- $0.036(27{,}224^{tons}) = 58^{tons}$ of lead
- 90% effective ⇒ $\underline{52^{tons}}$

Emergency Spillway Outlet Channel

- Excavation of embankment and outlet



$Area_S = 3{,}155^{SF}$

$Area_N = 9{,}975^{SF}$

$$V = \left(\frac{3{,}155 + 9975}{2}\right)2{,}250 = 14{,}771{,}250^{CF} = \underline{547{,}083^{CY}}$$

Designed by: MCG 28 Apr 05 Checked by: 5/13/05

APPENDIX G

DAM DECOMMISSIONING ALTERNATIVE SUPPORTING CALUTIONS

Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Section A-A: Exist
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	000170	ft/ft
Discharg	,900.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.048	
Water Surface Elev.	1,351.22	ft
Elevation Range	40.00 to 1,362.00	
Flow Area	3,617.5	ft²
Wetted Perimeter	588.77	ft
Top Width	584.90	ft
Actual Depth	11.22	ft
Critical Elevation	1,342.63	ft
Critical Slope	0.024783	ft/ft
Velocity	1.35	ft/s
Velocity Head	0.03	ft
Specific Energy	1,351.24	ft
Froude Number	0.10	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	17+65	0.070
17+65	20+00	0.035
20+00	22+15	0.070

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	1,360.00
11+90	1,358.00
13+75	1,356.00
15+10	1,354.00
16+00	1,352.00
16+08	1,350.00
17+65	1,348.00
17+70	1,346.00
17+78	1,344.00
17+82	1,342.00
17+84	1,340.00

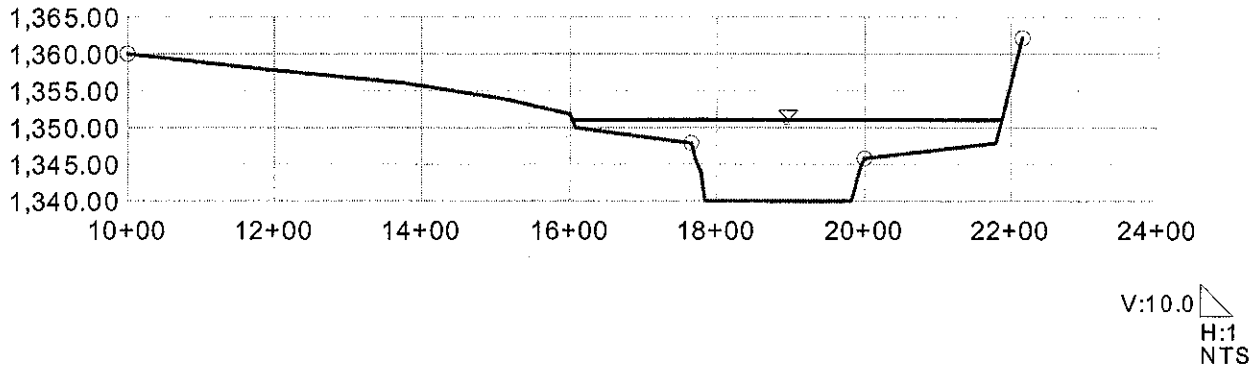
Worksheet
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
19+84	1,340.00
19+89	1,342.00
19+93	1,344.00
20+00	1,346.00
21+80	1,348.00
22+15	1,362.00

Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	Section A-A: Exist
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.048	
Slope	0.000170	ft/ft
Water Surface Elev	1,351.22	ft
Elevation Range	40.00 to 1,362.00	
Discharge	4,900.00	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Section A-A: Prop
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	000164	ft/ft
Discharg	,900.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.046	
Water Surface Elev	1,351.13	ft
Elevation Range	40.00 to 1,360.00	
Flow Area	3,443.2	ft²
Wetted Perimeter	548.36	ft
Top Width	544.74	ft
Actual Depth	11.13	ft
Critical Elevation	1,342.63	ft
Critical Slope	0.022244	ft/ft
Velocity	1.42	ft/s
Velocity Head	0.03	ft
Specific Energy	1,351.16	ft
Froude Number	0.10	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	17+65	0.070
17+65	20+00	0.035
20+00	21+64	0.070

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	1,360.00
11+90	1,358.00
13+75	1,356.00
15+10	1,354.00
16+00	1,352.00
16+08	1,350.00
17+65	1,348.00
17+70	1,346.00
17+78	1,344.00
17+82	1,342.00
17+84	1,340.00

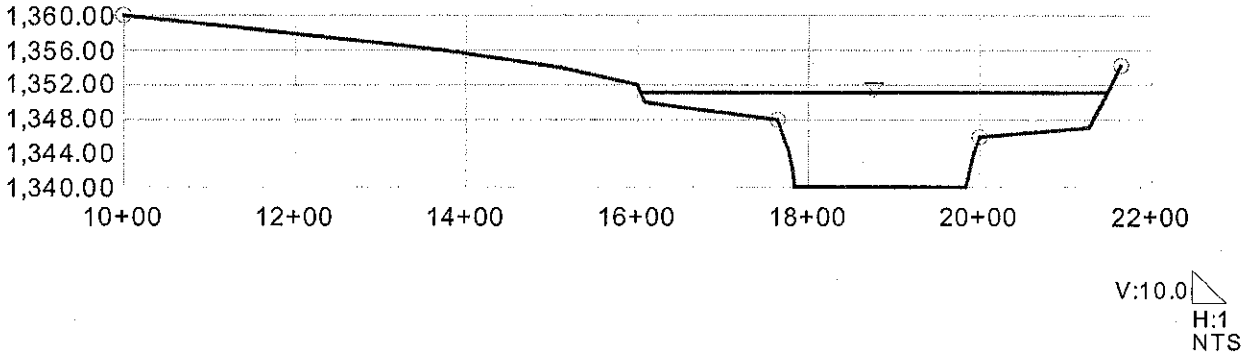
Worksheet
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
19+84	1,340.00
19+89	1,342.00
19+93	1,344.00
20+00	1,346.00
21+27	1,347.00
21+64	1,354.20

Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	Section A-A: Prop
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.046	
Slope	0.000164	ft/ft
Water Surface Elev	1,351.13	ft
Elevation Range	40.00 to 1,360.00	
Discharge	4,900.00	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Section B-B: Exist
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	000280	ft/ft
Discharge	,900.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.035	
Water Surface Elev.	1,340.46	ft
Elevation Range	32.00 to 1,362.00	
Flow Area	2,519.9	ft²
Wetted Perimeter	519.31	ft
Top Width	518.32	ft
Actual Depth	8.46	ft
Critical Elevation	1,334.68	ft
Critical Slope	0.013489	ft/ft
Velocity	1.94	ft/s
Velocity Head	0.06	ft
Specific Energy	1,340.52	ft
Froude Number	0.16	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	21+45	0.070
21+45	24+65	0.035
24+65	26+90	0.070

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	1,350.00
12+70	1,348.00
15+70	1,346.00
17+45	1,344.00
19+95	1,342.00
21+45	1,340.00
21+53	1,338.00
21+75	1,336.00
21+83	1,334.00
22+10	1,332.00
23+90	1,332.00

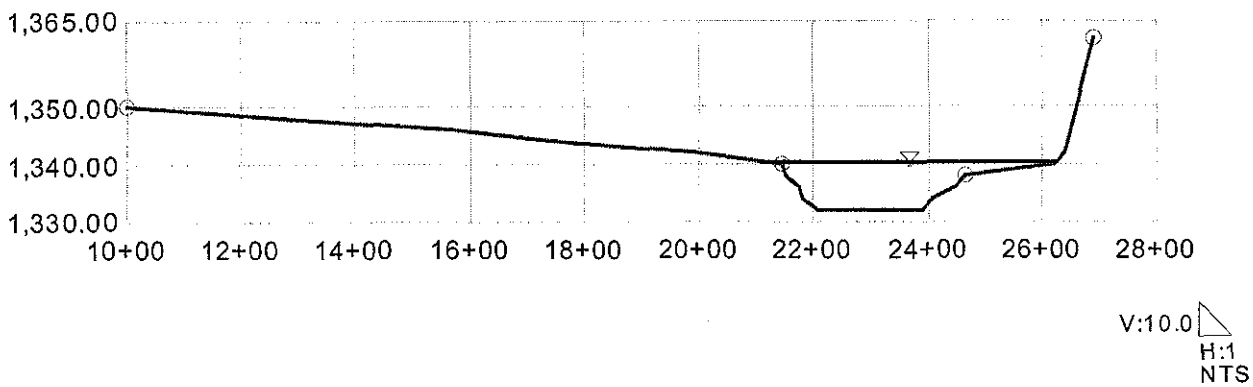
Worksheet
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
24+10	1,334.00
24+50	1,336.00
24+65	1,338.00
26+25	1,340.00
26+40	1,342.00
26+90	1,362.00

Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	Section B-B: Exist
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficiei	0.035	
Slope	0.000280	ft/ft
Water Surface Elev.	1,340.46	ft
Elevation Range	32.00 to 1,362.00	
Discharge	4,900.00	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Section B-B: Prop
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	000300	ft/ft
Discharg	,900.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.045	
Water Surface Elev	1,340.97	ft
Elevation Range	32.00 to 1,350.00	
Flow Area	3,018.0	ft²
Wetted Perimeter	632.08	ft
Top Width	631.12	ft
Actual Depth	8.97	ft
Critical Elevation	1,334.51	ft
Critical Slope	0.022424	ft/ft
Velocity	1.62	ft/s
Velocity Head	0.04	ft
Specific Energy	1,341.01	ft
Froude Number	0.13	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	21+45	0.070
21+45	24+65	0.035
24+65	26+58	0.070

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	1,350.00
12+70	1,348.00
15+70	1,346.00
17+45	1,344.00
19+95	1,342.00
20+07	1,340.00
21+45	1,339.00
21+53	1,338.00
21+75	1,336.00
21+83	1,334.00
22+10	1,332.00

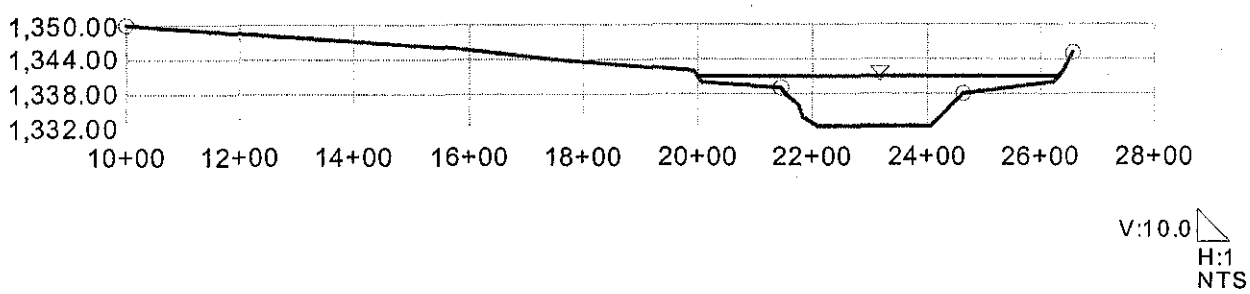
Worksheet
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
24+10	1,332.00
24+65	1,338.00
26+25	1,340.00
26+40	1,342.00
26+58	1,345.00

Cross Section
Cross Section for Irregular Channel

Project Description	
Worksheet	Section B-B: Prop
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.045	
Slope	0.000300	ft/ft
Water Surface Elev.	1,340.97	ft
Elevation Range	32.00 to 1,350.00	
Discharge	4,900.00	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Section C-C: Prop
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.000393	ft/ft
Discharg	3,000.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.044	
Water Surface Elev	110.41	ft
Elevation Range	.00 to 115.00	
Flow Area	10,293.9	ft²
Wetted Perimeter	1,266.28	ft
Top Width	1,264.67	ft
Actual Depth	10.41	ft
Critical Elevation	104.54	ft
Critical Slope	0.020392	ft/ft
Velocity	2.72	ft/s
Velocity Head	0.11	ft
Specific Energy	110.53	ft
Froude Number	0.17	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	14+92	0.035
14+92	23+20	0.060

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	115.00
10+80	100.00
14+80	100.00
14+92	102.00
22+46	104.00
23+20	115.00

Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Section D-D: Prop
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	.000600 ft/ft
Discharge	9,000.00 cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.051	
Water Surface Elev	111.32	ft
Elevation Range	.00 to 115.00	
Flow Area	9,858.9	ft²
Wetted Perimeter	1,177.03	ft
Top Width	1,175.28	ft
Actual Depth	11.32	ft
Critical Elevation	105.36	ft
Critical Slope	0.027015	ft/ft
Velocity	2.94	ft/s
Velocity Head	0.13	ft
Specific Energy	111.45	ft
Froude Number	0.18	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	12+42	0.035
12+42	22+20	0.060

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	115.00
10+80	100.00
12+30	100.00
12+42	102.00
21+45	104.00
22+20	115.00

Worksheet
Worksheet for Irregular Channel

Project Description	
Worksheet	Section E-E: Prop
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	.000900	ft/ft
Discharg	2,000.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.054	
Water Surface Elev	111.27	ft
Elevation Range	.00 to 115.00	
Flow Area	9,592.8	ft²
Wetted Perimeter	1,176.45	ft
Top Width	1,174.70	ft
Actual Depth	11.27	ft
Critical Elevation	105.74	ft
Critical Slope	0.029772	ft/ft
Velocity	3.34	ft/s
Velocity Head	0.17	ft
Specific Energy	111.44	ft
Froude Number	0.21	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
10+00	11+72	0.035
11+72	22+20	0.060

Natural Channel Points

Station (ft)	Elevation (ft)
10+00	115.00
10+80	100.00
11+60	100.00
11+72	102.00
21+45	104.00
22+20	115.00

Worksheet
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Section F-F: Prop
Flow Element	Trapezoidal Chann
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.040	
Slope	.001910	ft/ft
Left Side Slope	6.00	H : V
Right Side Slope	6.00	H : V
Bottom Width	1,000.00	ft
Discharge	2,000.00	cfs

Results		
Depth	5.94	ft
Flow Area	6,150.9	ft²
Wetted Perim	1,072.25	ft
Top Width	1,071.27	ft
Critical Depth	3.15	ft
Critical Slope	0.016015	ft/ft
Velocity	5.20	ft/s
Velocity Head	0.42	ft
Specific Energ	6.36	ft
Froude Numb	0.38	
Flow Type	Subcritical	

CURRENT DATE: 02-15-2005 FILE DATE: 02-15-2005
CURRENT TIME: 13:29:02 FILE NAME: SVP-1

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 6.1 **********
****

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1337.50	1337.45	250.00	6 RCB	10.00	10.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

****

SUMMARY OF CULVERT FLOWS (cfs) FILE: SVP-1 DATE: 02-15-2005

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1344.90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1344.94	491.0	491.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1345.03	982.0	982.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1345.20	1473.0	1473.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1345.42	1964.0	1964.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1345.70	2455.0	2455.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1346.05	2946.0	2946.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1346.46	3437.0	3437.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1346.91	3928.0	3928.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1347.42	4419.0	4419.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1347.96	4910.0	4910.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1364.00	12894.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

****

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: SVP-1 DATE: 02-15-2005

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1344.90	0.000	0.00	0.00	0.00
1344.94	0.000	491.00	0.00	0.00
1345.03	0.000	982.00	0.00	0.00
1345.20	0.000	1473.00	0.00	0.00
1345.42	0.000	1964.00	0.00	0.00
1345.70	0.000	2455.00	0.00	0.00
1346.05	0.000	2946.00	0.00	0.00
1346.46	0.000	3437.00	0.00	0.00
1346.91	0.000	3928.00	0.00	0.00
1347.42	0.000	4419.00	0.00	0.00
1347.96	0.000	4910.00	0.00	0.00

****

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

****

CURRENT DATE: 02-15-2005 FILE DATE: 02-15-2005
CURRENT TIME: 13:29:02 FILE NAME: SVP-1

****

PERFORMANCE CURVE FOR CULVERT 1 - 6(10.00 (ft) BY 10.00 (ft)) RCB

****

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1344.90	0.00	7.40	0-NF	0.00	0.00	0.00	7.45	0.00	0.00
491.00	1344.94	2.21	7.44	3-M1t	3.05	1.28	7.45	7.45	1.10	0.00
982.00	1345.03	3.48	7.53	3-M1t	5.05	2.03	7.45	7.45	2.20	0.00
1473.00	1345.20	4.57	7.70	3-M1t	6.88	2.66	7.45	7.45	3.30	0.00
1964.00	1345.42	5.50	7.92	3-M2t	8.65	3.22	7.45	7.45	4.39	0.00
2455.00	1345.70	6.36	8.20	3-M2t	10.00	3.74	7.45	7.45	5.49	0.00
2946.00	1346.05	7.15	8.55	3-M2t	10.00	4.22	7.45	7.45	6.59	0.00
3437.00	1346.46	7.91	8.96	3-M2t	10.00	4.68	7.45	7.45	7.69	0.00
3928.00	1346.91	8.64	9.41	3-M2t	10.00	5.12	7.45	7.45	8.79	0.00
4419.00	1347.42	9.35	9.92	3-M2t	10.00	5.53	7.45	7.45	9.89	0.00
4910.00	1347.96	10.06	10.46	3-M2t	10.00	5.94	7.45	7.45	10.98	0.00

****

El. inlet face invert 1337.50 ft El. outlet invert 1337.45 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	1337.50 ft
OUTLET STATION	250.00 ft
OUTLET ELEVATION	1337.45 ft
NUMBER OF BARRELS	6
SLOPE (V/H)	0.0002
CULVERT LENGTH ALONG SLOPE	250.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	10.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

****

CURRENT DATE: 02-15-2005 FILE DATE: 02-15-2005
CURRENT TIME: 13:29:02 FILE NAME: SVP-1

****
********** TAILWATER **********
****
****

CONSTANT WATER SURFACE ELEVATION
1344.90

****
********** ROADWAY OVERTOPPING DATA **********
****

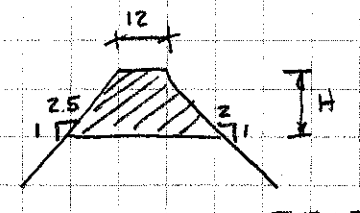
ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	1.00 ft
CREST LENGTH	1.00 ft
OVERTOPPING CREST ELEVATION	1364.00 ft

****

WITTMANN ADMSU
QUANTITY ESTIMATION
DAM DECOMMISSIONING ALT.

- WHITE TANK REACH
  - STATION 77+50 TO 280+00

    - EMBANKMENT GRADING (MASS GRADING)



STATION 77+50 H = 6'
120+00 H = 9.5'
280+00 H = 11.5'

$A_{77+50} = 12*6 + \frac{1}{2}*2.5*6^2 + \frac{1}{2}*2*6^2 = 153^{SF}$

$A_{120+00} = 12*9.5 + \frac{1}{2}*2.5*9.5^2 + \frac{1}{2}*2*9.5^2 = 317^{SF}$

$A_{280+00} = 12*11.5 + \frac{1}{2}*2.5*11.5^2 + \frac{1}{2}*2*11.5^2 = 436^{SF}$

$V = \left(\frac{153+317}{2}\right)(12000-7750) + \left(\frac{317+436}{2}\right)(28000-12000)$

$= 7{,}022{,}750^{CF}$

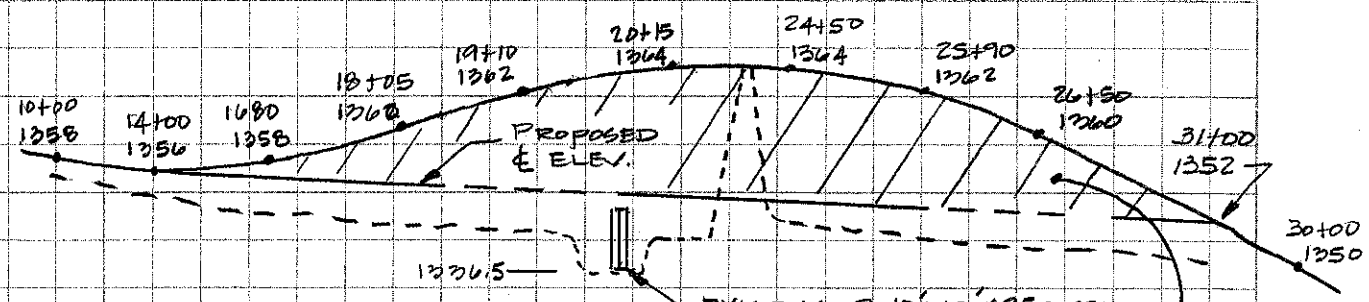
$= \underline{260{,}102^{CY}}$

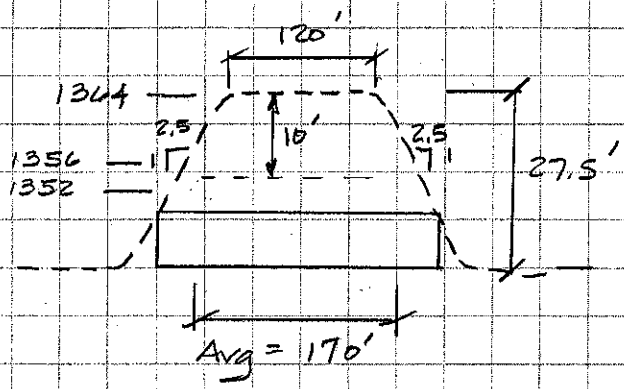
- SUN VALLEY PARKWAY RECONSTRUCTION
  - 4 - 10'x10'x250' CPDC WITH INLET AND OUTLET HEADWALLS

Designed by: MCG 8 May 05 Checked by: [illegible] 5/13/05

Stantec

· ROADWAY EMBANKMENT EXCAVATION

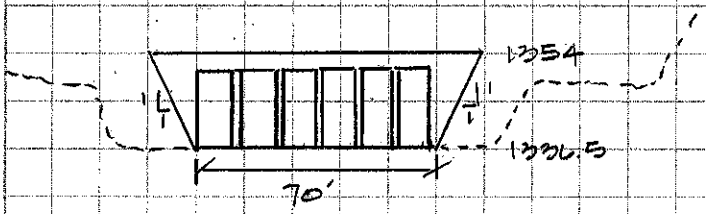




$A = 9{,}825^{SF}$

$V = (9{,}825)(170) = 1{,}670{,}250^{CF}$

$V = 61{,}861^{CY}$

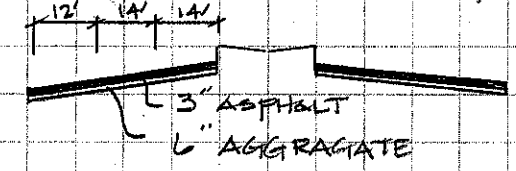


$A = 70 * 17.5 + 17.5^2 = 1{,}531^{SF}$

$V = (1{,}531)(250) = 382{,}750$

$V = 14{,}176^{CY}$

· ROADWAY PAVING



ASPHALT = $148^{\#/CF}$

AGGREGATE = $126^{\#/CF}$

$WEIGHT_{ASPHALT} = (80)(0.25)(3100-1400)\frac{148}{2000}$

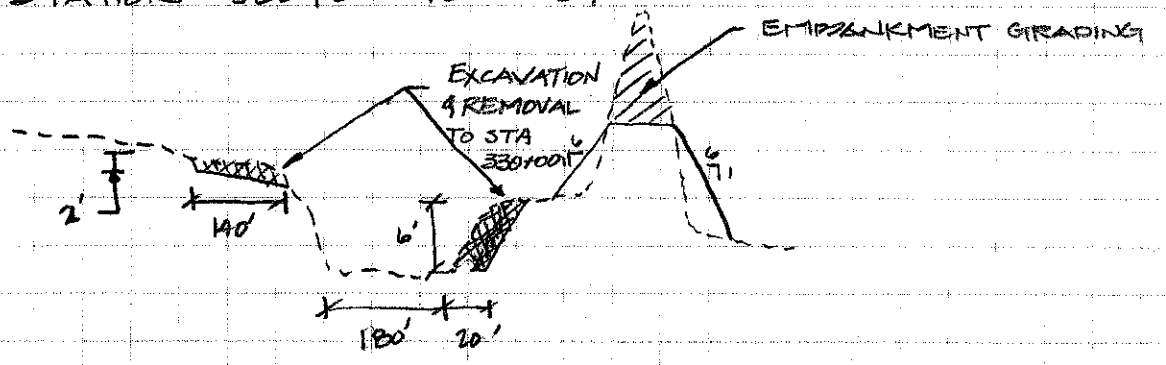
$= 2{,}516^{TONS}$

$WEIGHT_{AGG} = (80)(0.5)(3100-1400)\frac{126}{2000}$

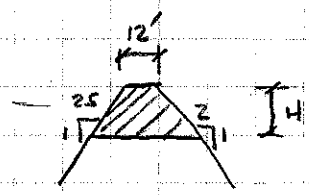
$= 4{,}284^{TONS}$

Designed by: MCG 8 May 05 Checked by: CH 5/13/05

- STATION 280+00 TO 355+00



- EMBANKMENT GRADING



STATION 280+00 $H = 13.5'$

355+00 $H = 17.0'$

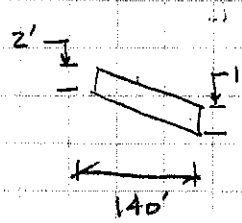
$$A_{280+00} = 12 * 13.5 + \tfrac{1}{2} * 2.5 * 13.5^2 + \tfrac{1}{2} * 2 * 13.5^2 = 572^{SF}$$

$$A_{355+00} = 12 + 17 + \tfrac{1}{2} * 2.5 * 17^2 + \tfrac{1}{2} * 2 * 17^2 = 854^{SF}$$

$$V = \left(\frac{572 + 854}{2}\right)(35500 - 28000) = 5{,}347{,}500^{CF}$$

$$\underline{V = 198{,}056^{CY}}$$

- EXCAVATION AND REMOVAL

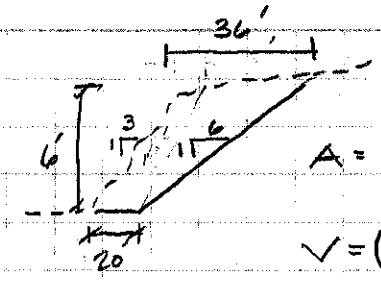


$$A = 140 + \tfrac{1}{2} * 140 = 210^{SF}$$

$$V = (210)(35500 - 28000) = 1{,}575{,}000^{CF}$$

$$\underline{V = 58{,}333^{CY}}$$

Designed by: MCG 8 May 05 Checked by: 5/13/05

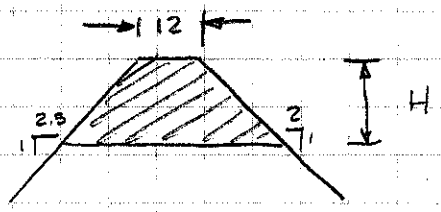


$A = 174^{SF}$

$V = (174)(35500 - 28000) = 1,305,000^{CF}$

$V = 48,333^{CY}$

- TRILBY WASH REACH
  - STATION 355+00 TO 477+50
    - EMBANKMENT GRADING (MASS GRADING)



STA 355+00 H = 17'
477+50 H = 21.5'

$A_{355+00} = 854^{SF}$

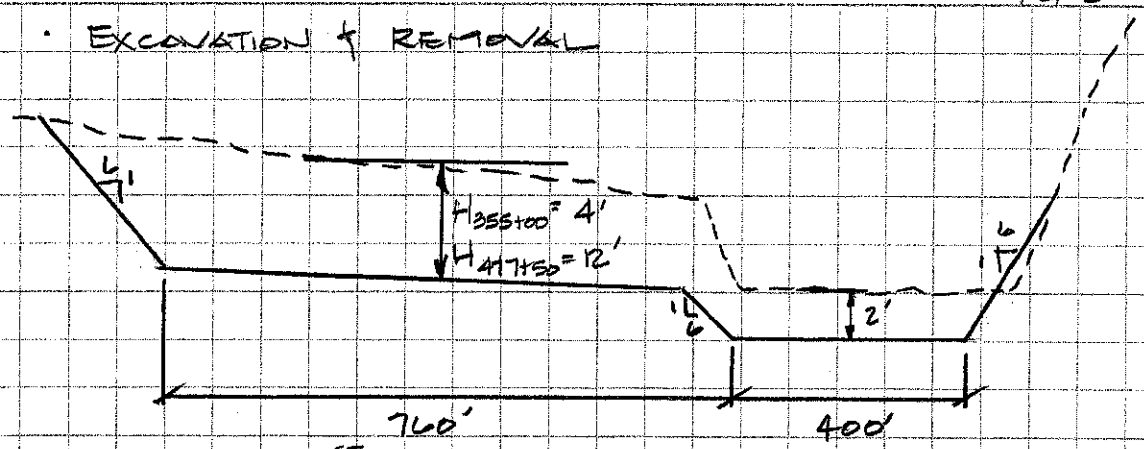
$A_{477+50} = 12 * 21.5 + \frac{1}{2} * 2.5 * 21.5^2 + \frac{1}{2} * 2 * 21.5^2 = 1,298^{SF}$

$V = \left(\frac{854 + 1,298}{2}\right)(477+50 - 355+00) = 13,181,000^{CF}$

$V = 488,185^{CY}$

Designed by: MCG 8 May 05 Checked by: 5/13/05

- EXCAVATION & REMOVAL



$A_{355+00} = 3{,}800^{SF}$

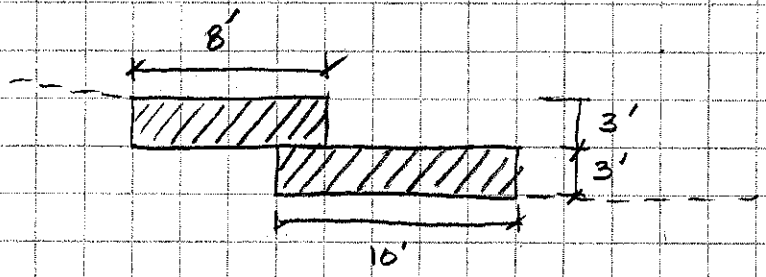
$A_{477+50} = 10{,}129^{SF}$

$$V = \left(\frac{3{,}800 + 10{,}129}{2}\right)(477+50 - 355+00)$$

$$= 85{,}315{,}125^{CF}$$

$$\underline{V = 3{,}159{,}125^{CY}}$$

- TRIBUTARY DROP STRUCTURES (3)
  - AVERAGE HEIGHT = 6'
  - TOTAL LINEAL FOOTAGE = 3,600'



$$A = (8)(3) + (10)(3) = 54^{SF}$$

$$V = (54)(3600) = 194{,}400^{CF} = \underline{7{,}200^{CY}}$$

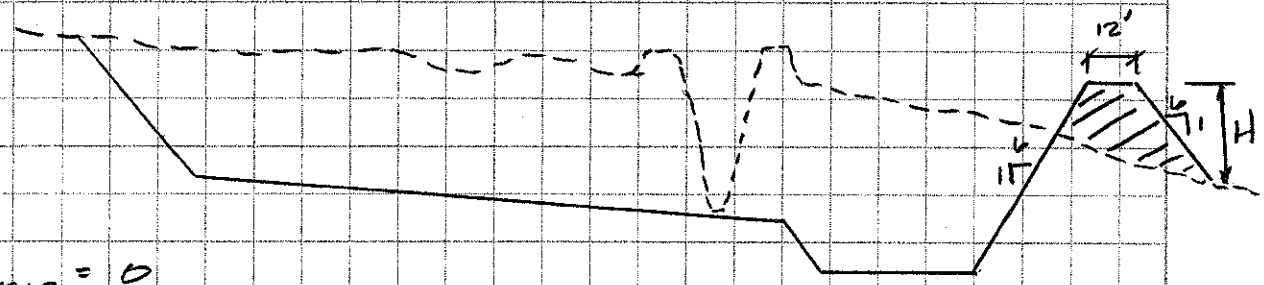
- DEMO P.O. : LUMP SUM

Designed by: MCG 8 May 05 Checked by: 5/13/05

Stantec

- POWER LINE REACH
  - STATION 477+50 TO 750+00

- LEVEE CONSTRUCTION (STRUCTURAL FILL)



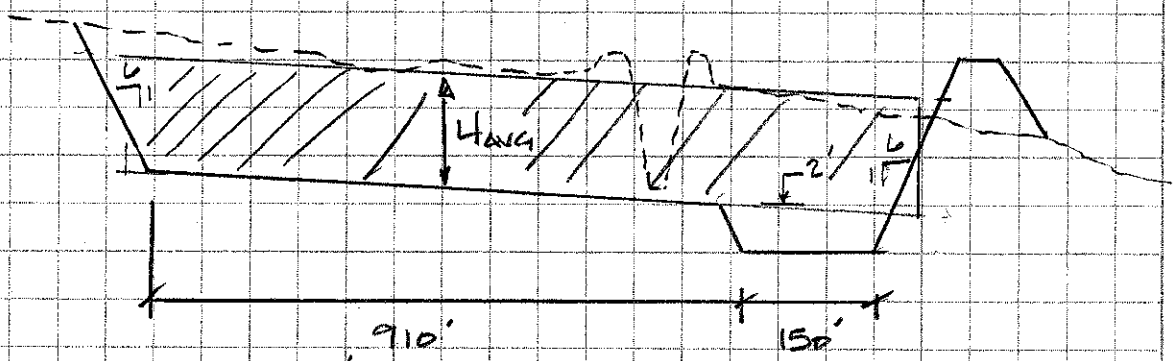
$H_{477+50} = 0$

$H_{570+00} = 8'$

$A_{570+00} = (12)(8) + (8^2)(6) = 480^{SF}$

$V = \left(\frac{480+0}{2}\right)(570+00 - 477+50) = 2,220,000^{CF} = \underline{82,222^{CY}}$

- CHANNEL EXCAVATION



STA 477+50 $H_{AVG} = 11'$

570+00 $H_{AVG} = 7'$

$A_{477+50} = 12,344^{SF}$

$A_{570+00} = 8,317^{SF}$

$V = \left(\frac{12,344 + 8,317}{2}\right)(570+00 - 477+50) = 95,557,125^{CF}$

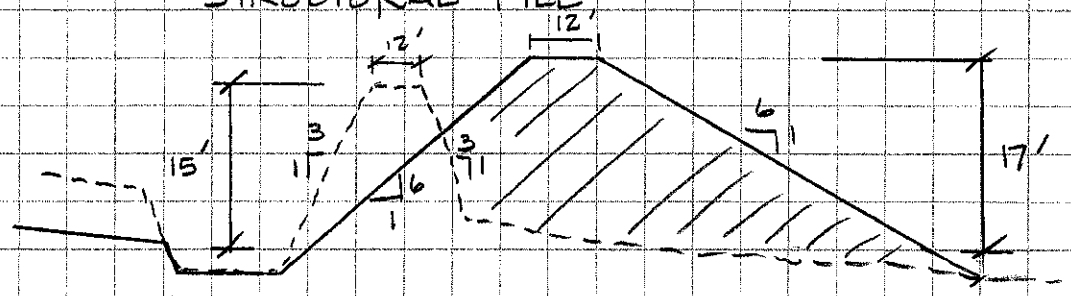
$\underline{V = 3,539,153^{CY}}$

Designed by: MCG 8 May 05 Checked by: 5/13/05

· EXCAVATION AND REMOVAL = 3,539,153 - 82,222 = 3,456,931 CY

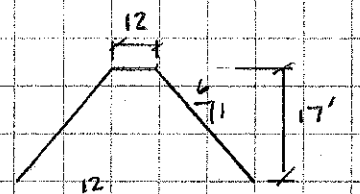
— STATION 570+00 TO 700+00

· STRUCTURAL FILL

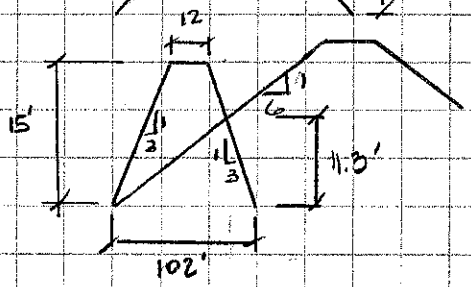


$A_{570+00} = 480^{SF}$ (PG. 6)

A_{700+00}



$A = (12)(17) + (17^2)(6) = 1{,}938^{SF}$



$A = (0.5)(102)(11.3) = 576.3^{SF}$

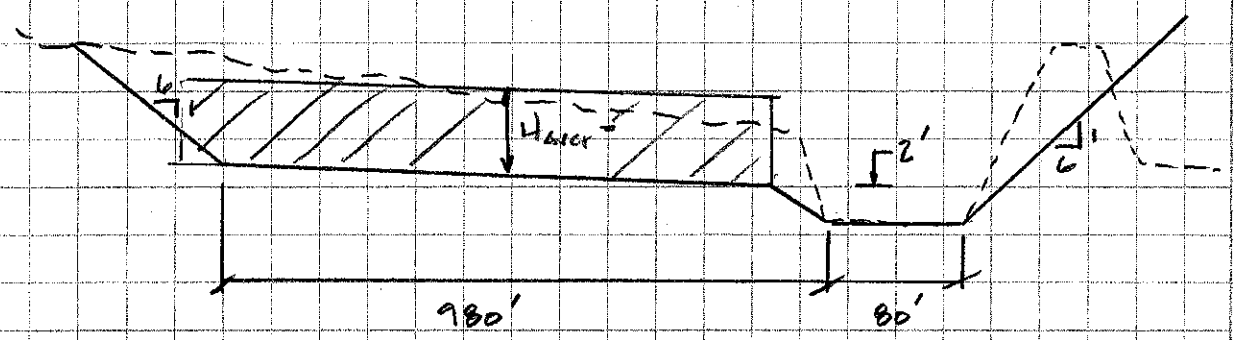
$A_{700+00} = 1362^{SF}$

$$V = \left(\frac{480 + 1{,}362}{2}\right)(700+00 - 570+00) = 11{,}973{,}000^{CF}$$

$V = 443{,}444^{CY}$

Designed by: MCG 8 May 05 Checked by: 5/13/05

· CHANNEL EXCAVATION



$A_{570+00} = 8,317^{SF}$ (PG 6)

$A_{700+00} = 6,434^{SF}$ ($H_{AVG} = 6.5'$)

$V = \left(\frac{8,317 + 6,434}{2}\right)(700+00 - 570+00) = 95,881,500^{CF}$

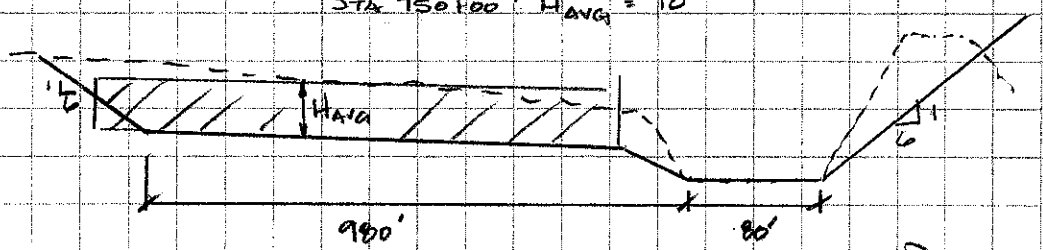
$V = 3,551,167^{CY}$

· EXCAVATION AND REMOVAL

$V = 3,551,167 - 443,444 = 3,107,723^{CY}$

- STATION 700+00 TO 750+00

STA 750+00 : $H_{AVG} = 10'$



$A_{700+00} = 6,434^{SF}$

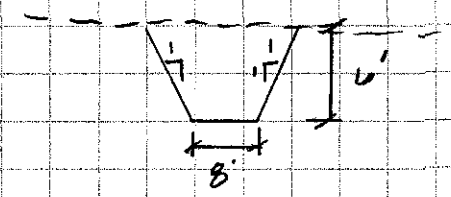
$A_{750+00} = 9,575^{SF}$

$V = \left(\frac{6,434 + 9,575}{2}\right)(750+00 - 700+00) = 40,022,500^{CF}$

$= 1,482,314^{CY}$

Designed by: MCG 8 May 05 Checked by: 5/13/05

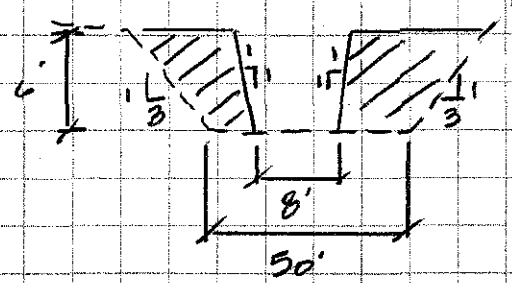
- BRIDGE U.S. 60 & BNSF
  - LINEAL FOOTAGE = 1,500'
- REALIGN BEARDSLEY CANAL
  - CLEAR AND GRUB
    - L = 1,450'
    - W = 100'
    - A = 145,000 SF = 3.3 AC
  - EXCAVATION



$A = (8)(6) + 6^2 = 84^{SF}$

$V = (84)(1450) = 121,800^{CF} = \underline{4,511^{CY}}$

  - SIPHON : L = 1,500'
  - STRUCTURAL FILL (BEARSLEY CANAL ALIGNMENT ALONG EXIST. OUTLET CHAN.)



$A = (50)(6) + (6^2)(3) - 84 = 324^{SF}$

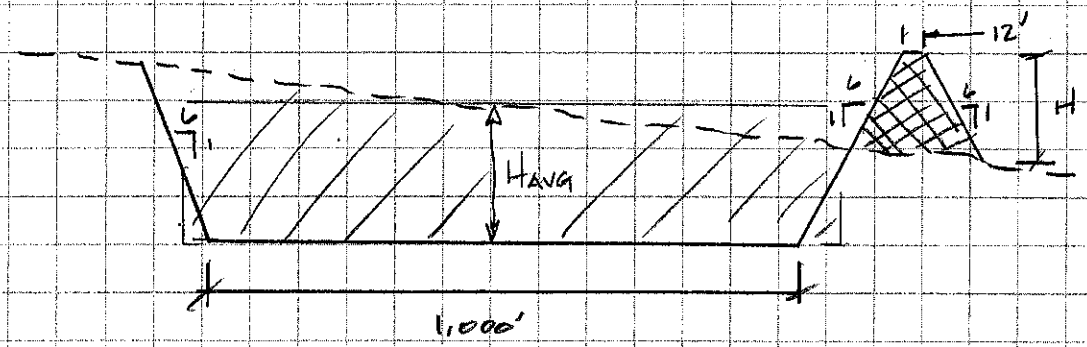
$V = (324)(3,520) = 1,140,480^{CF}$

$= \underline{42,240^{CY}}$

Designed by: MCG & May 05 Checked by: [illegible] 5/13/05

- OUTFALL REACH
  - STATION 750+00 TO 790+00

- STRUCTURAL FILL



$H_{750+00} = 7'$ $\quad A_{750+00} = (12)(7) + (7^2)(6) = 378^{SF}$

$H_{790+00} = 11'$ $\quad A_{790+00} = (12)(11) + (11^2)(6) = 858^{SF}$

$$V = \left(\frac{858+378}{2}\right)(790+00 - 750+00) = 2{,}472{,}000^{CF} = \underline{91{,}556^{CY}}$$

- CHANNEL EXCAVATION

  STA 790+00, $H_{AVG} = 5.5'$

  $A_{750+00} = 9{,}575^{SF}$ (PG 8)

  $A_{790+00} = 5{,}533^{SF}$

$$V = \left(\frac{9575+5533}{2}\right)(790+00 - 750+00) = 30{,}216{,}000^{CF} = \underline{1{,}119{,}111^{CY}}$$

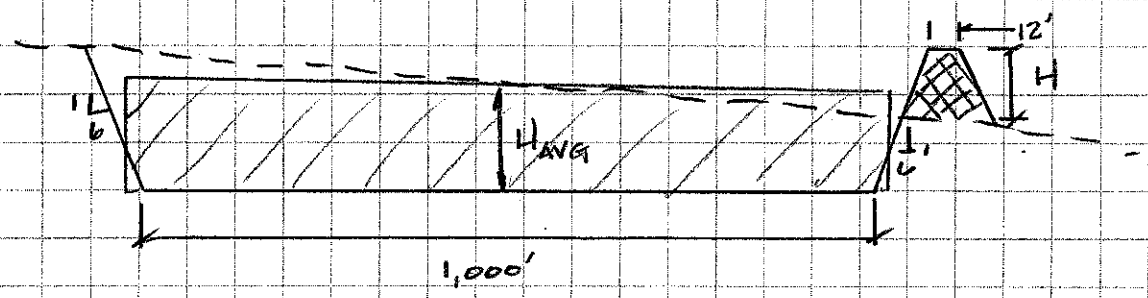
- EXCAVATION & REMOVAL

$V = 1{,}119{,}111 - 91{,}556$ $\underline{1{,}027{,}555^{CY}}$

Designed by: MCG 8 May 05 Checked by: CH 5/13/05

- STATION 790+00 TO 834+00

· STRUCTURAL FILL



$H_{834+00} = 4'$ $A = (12)(4) + (4^2)(6) = 144$

$A_{790+00} = 858^{SF}$

$V = \left(\frac{858+144}{2}\right)(834+00 - 790+00) = 2,204,400^{CF} = \underline{81,644^{CY}}$

· CHANNEL EXCAVATION

$A_{790+00} = 5,533^{SF}$

H_{AVG} 834+00 = 16' $A_{834+00} = 16,350^{SF}$

$V = \left(\frac{5,533+16,350}{2}\right)(834+00 - 790+00) = 48,142,600^{CF} = 1,783,059^{CY}$

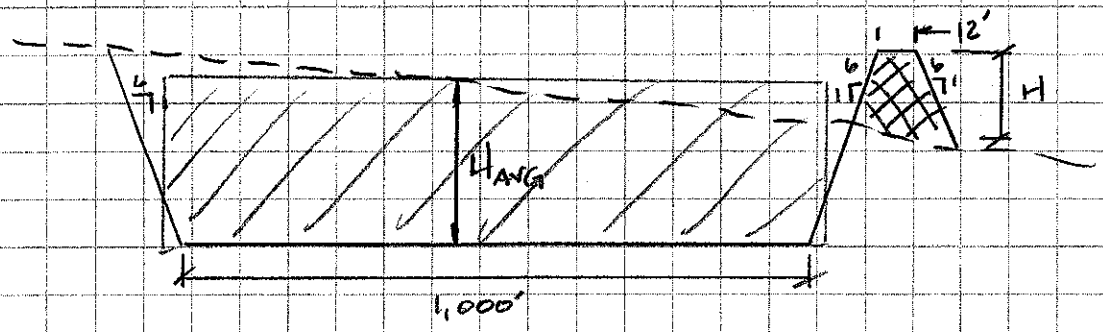
· EXCAVATION & REMOVAL =

$V = 1,783,059 - 81,644 = \underline{1,701,415^{CY}}$

Designed by: MCG 8 May 05 Checked by: 5/13/05

- STATION 834+00 TO 880+00

• STRULTURAL FILL



$A_{834+00} = 144^{SF}$

STA 880+00 : $H = 8$; $A_{880+00} = (12)(8) + (8^2)(6) = 480^{SF}$

$$V = \left(\frac{144 + 480}{2}\right)(880+00 - 834+00) = 1,435,200 = \underline{53,156^{CY}}$$

• CHANNEL EXCAVATION

$A_{834+00} = 16,350^{SF}$

STA 880+00 : $H_{AVG} = 9'$ $A_{880+00} = 9,432^{SF}$

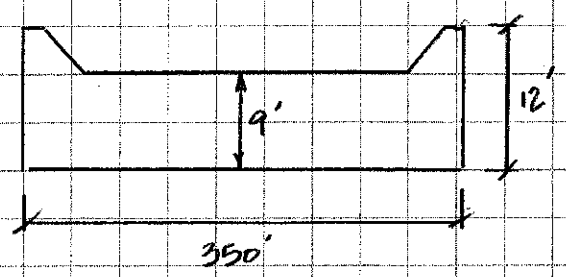
$$V = \left(\frac{16,350 + 9,432}{2}\right)(880+00 - 834+00) = 59,298,600^{CF} = \underline{2,196,244^{CY}}$$

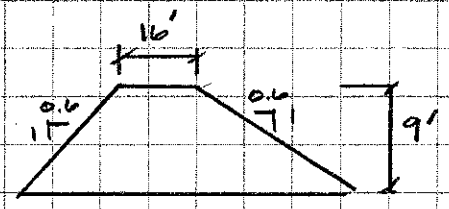
• EXCAVATION & REMOVAL

$V = 2,196,244 - 53,156 = \underline{2,143,088^{CY}}$

Designed by: MCG 8 May 05 Checked by: 5/13/05

- SIDEFLOW WEIR





$A = (16)(9) + (9^2)(0.6) = 193^{ST} \approx 200^{ST}$

$V = (200)(350) = \underline{2{,}592^{CY}}$

- LOOP 303 BRIDGE
  - LF = 1500'

- BAFFLE BLOCK DROP STRUCTURES
  - ASSUME WALL AND FLOOR THICKNESS = 1'
  - HEIGHT = 9'
  - L = 730'
  - WIDTH = 1000'
  - ADD 25% FOR BAFFLE BLOCKS AND TOE DOWN

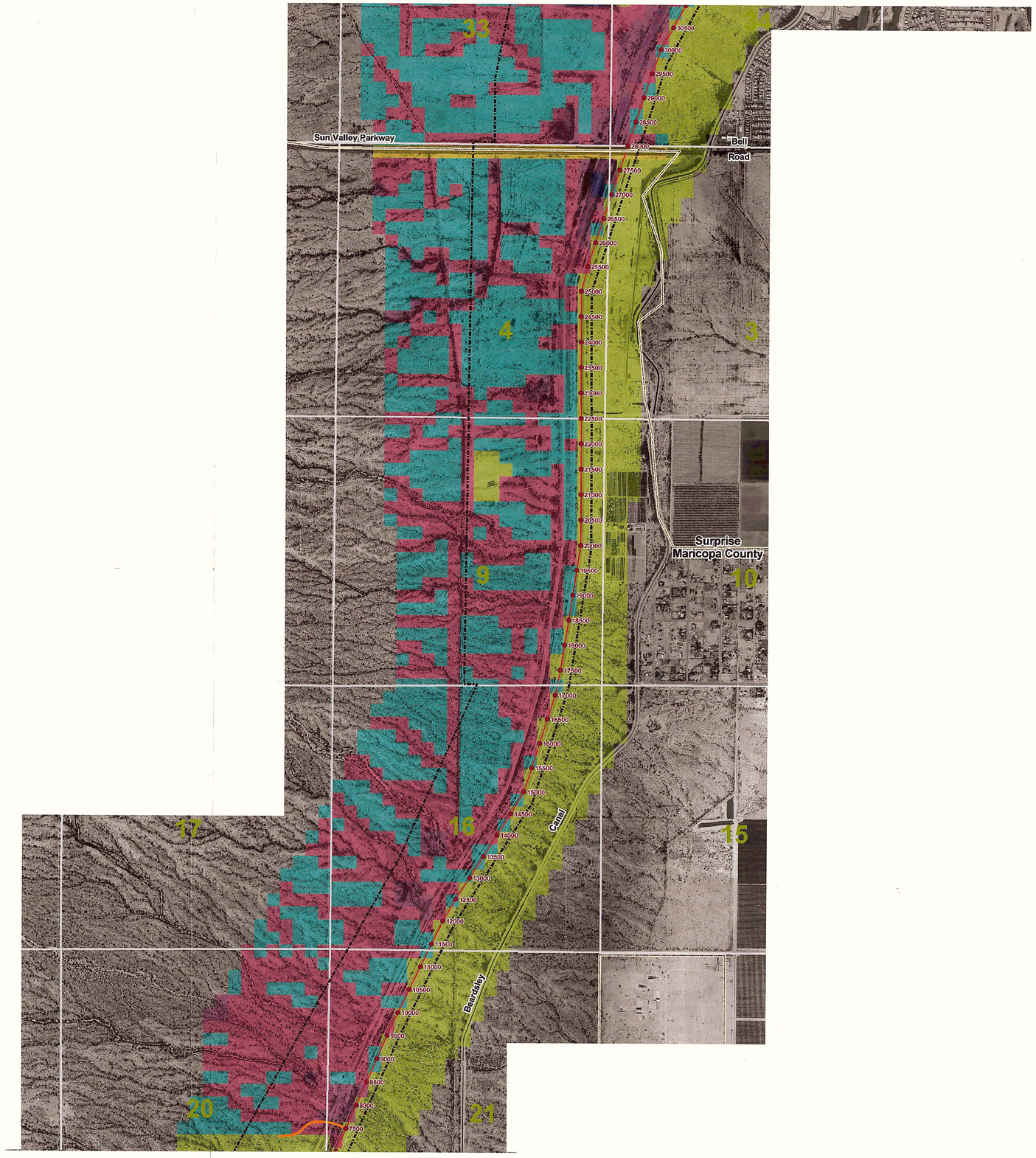
$V = (1000 + (2)(9))(730)/27 = 27{,}524^{CY}$

$V = 27{,}524 + 25\% = \underline{34{,}405^{CY}}$

Designed by: MLG 8 May 05 Checked by: 5/13/05

APPENDIX H

DIGITAL FILES



Flood Control District
of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus

2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Station
- Dam Extension
- McMicken Dam Center Line
- Section Line
- FCDMC Property Line
- Corporate Boundary

N-VALUES

- 0.025
- 0.04
- 0.06
- 0.07
- 0.08
- 0.09
- 0.1

N

File Name:	BGS	CVG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

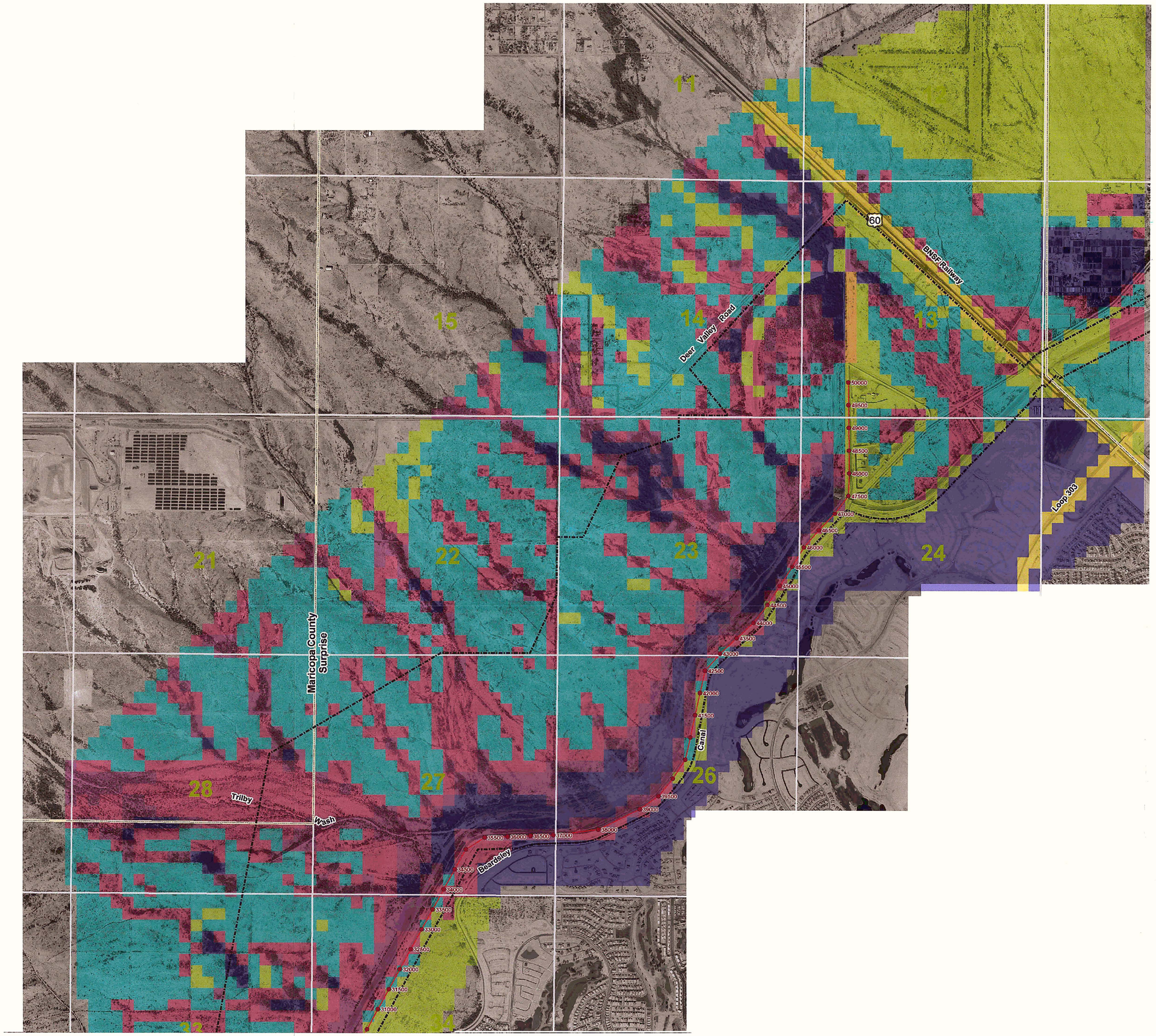
Title
EXHIBIT MA-1
ROUGHNESS COEFFICIENT

Project No.
82000267

Scale
0 500 1,000 2,000 3,000
Feet

Figure No.
1 of 2

v:\active\240\0267\plans\flowexhibit1
March 11, 2005



Flood Control District
of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus

2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Station
- Dam Extension
- McMicken Dam Center Line
- Section Line
- FCDMC Property Line
- Corporate Boundary

N-VALUES

- 0.025
- 0.04
- 0.06
- 0.07
- 0.08
- 0.09
- 0.1

N

File Name:	BGS	CVG	MOG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

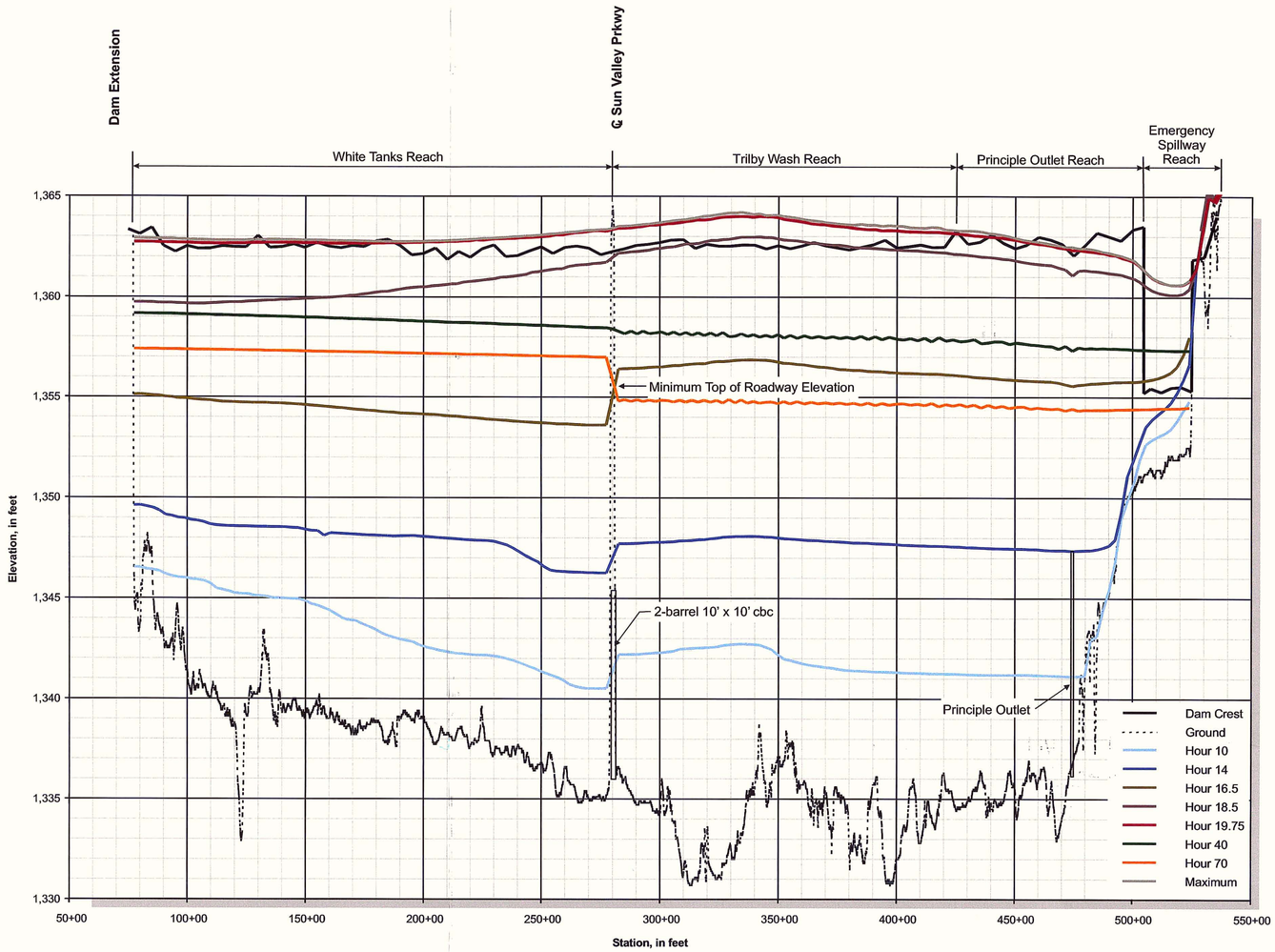
Title
EXHIBIT MA-1
ROUGHNESS COEFFICIENT

Project No.
82000267

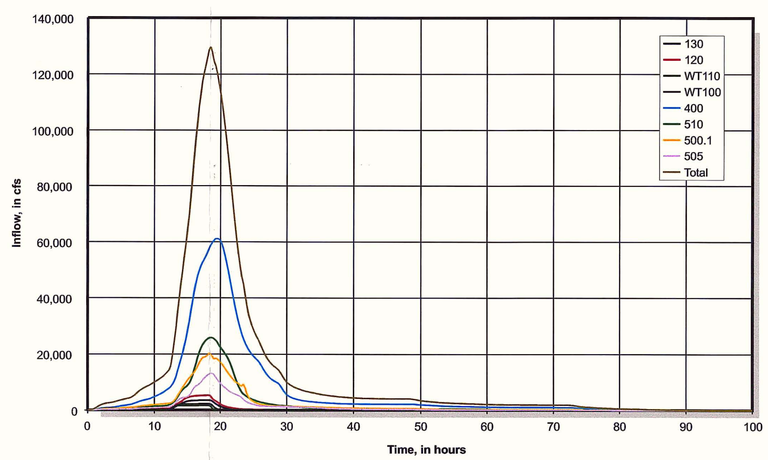
Scale
0 500 1,000 2,000 3,000
Feet

Figure No.
2 of 2

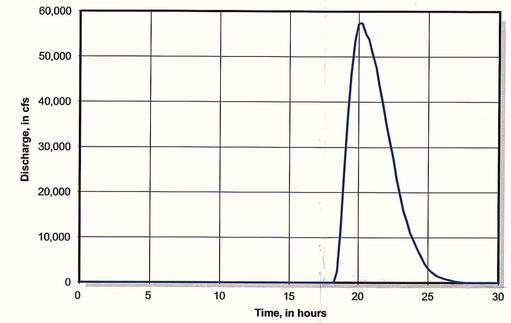
v:\clients\400207\gis\proj\flooexhibit1a.mxd
March 11, 2005



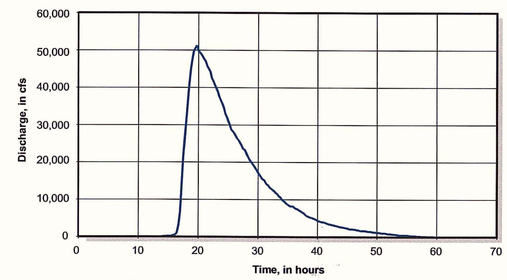
Water surface profiles along the low flow channel of the dam at select points in time during the PMF



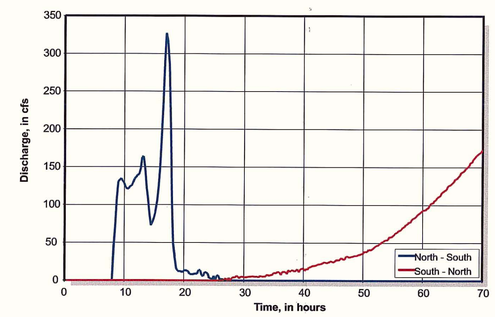
Inflow hydrographs for the 72-hour PMF with future condition land use



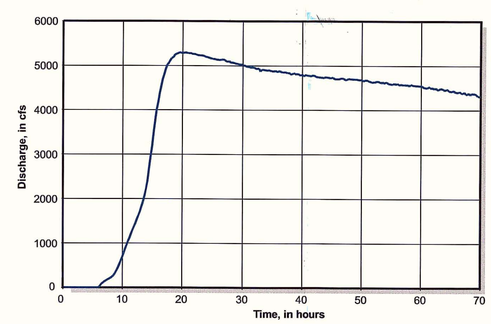
Dam Overtopping Hydrograph



Emergency Spillway Outlet Hydrograph



Sun Valley Parkway Culvert Hydrograph



Principle Outlet Hydrograph

Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th St., Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
www.entellus.com

WITTMANN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ U.S.A. 85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Notes

The maximum water surface profile shown represents the maximum water surface elevation for each grid along the face of the dam that occurred during the simulation.

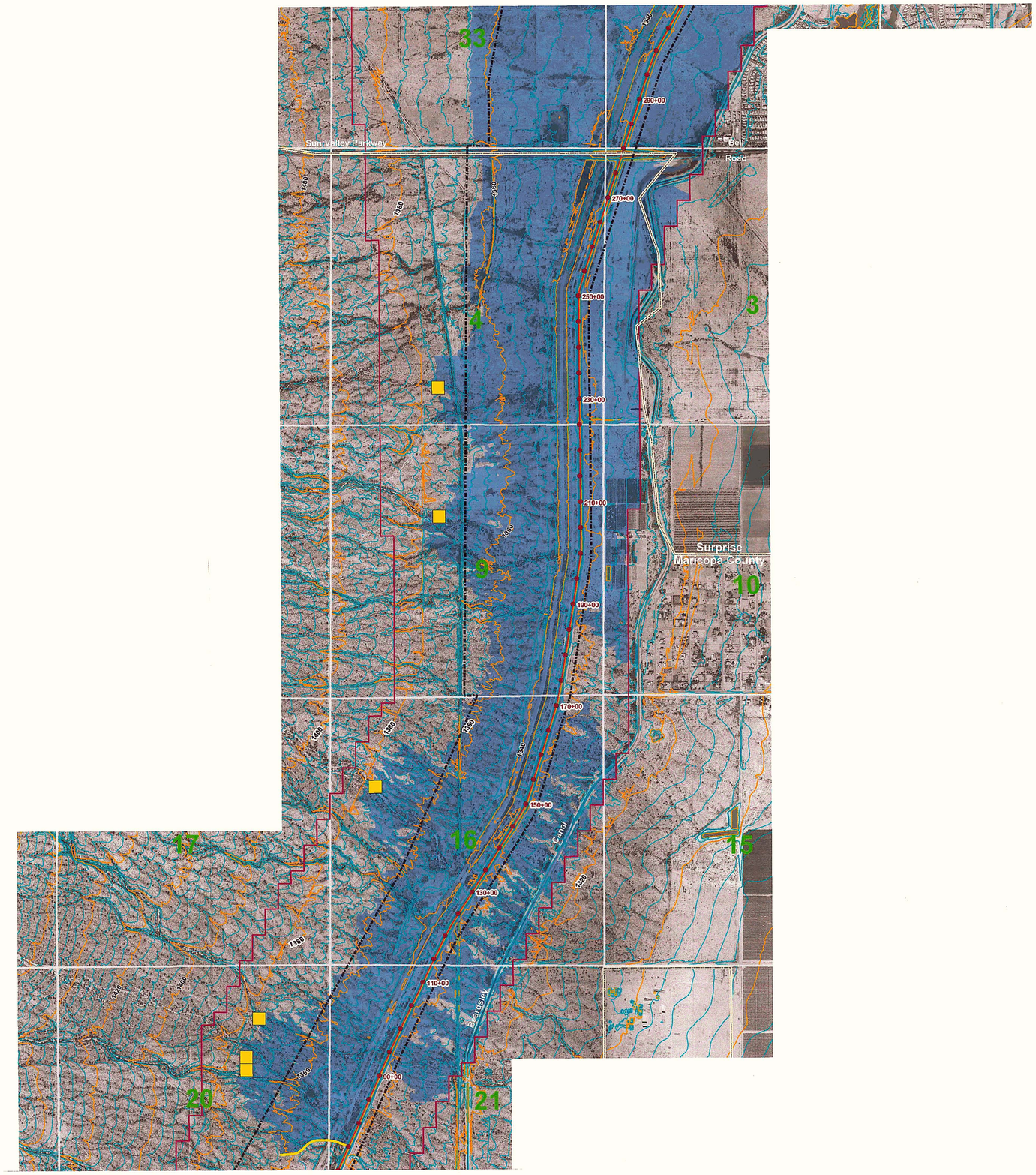
File Name: W:\active\82000267\images\mcmick.cdr	HAR	MCG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

Title

Exhibit MA-2
PMF Water Surface Elevation Profiles

Project No.
182000267

Sheet No.
1 of 1



Flood Control District
of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Station
- McMicken Dam Center Line
- Dam Extension
- Section Line
- Corporate Boundary
- FCDMC Property Line
- Study Limit
- Inflow Point
- Inundation Limit

File Name:	BGS	CVG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

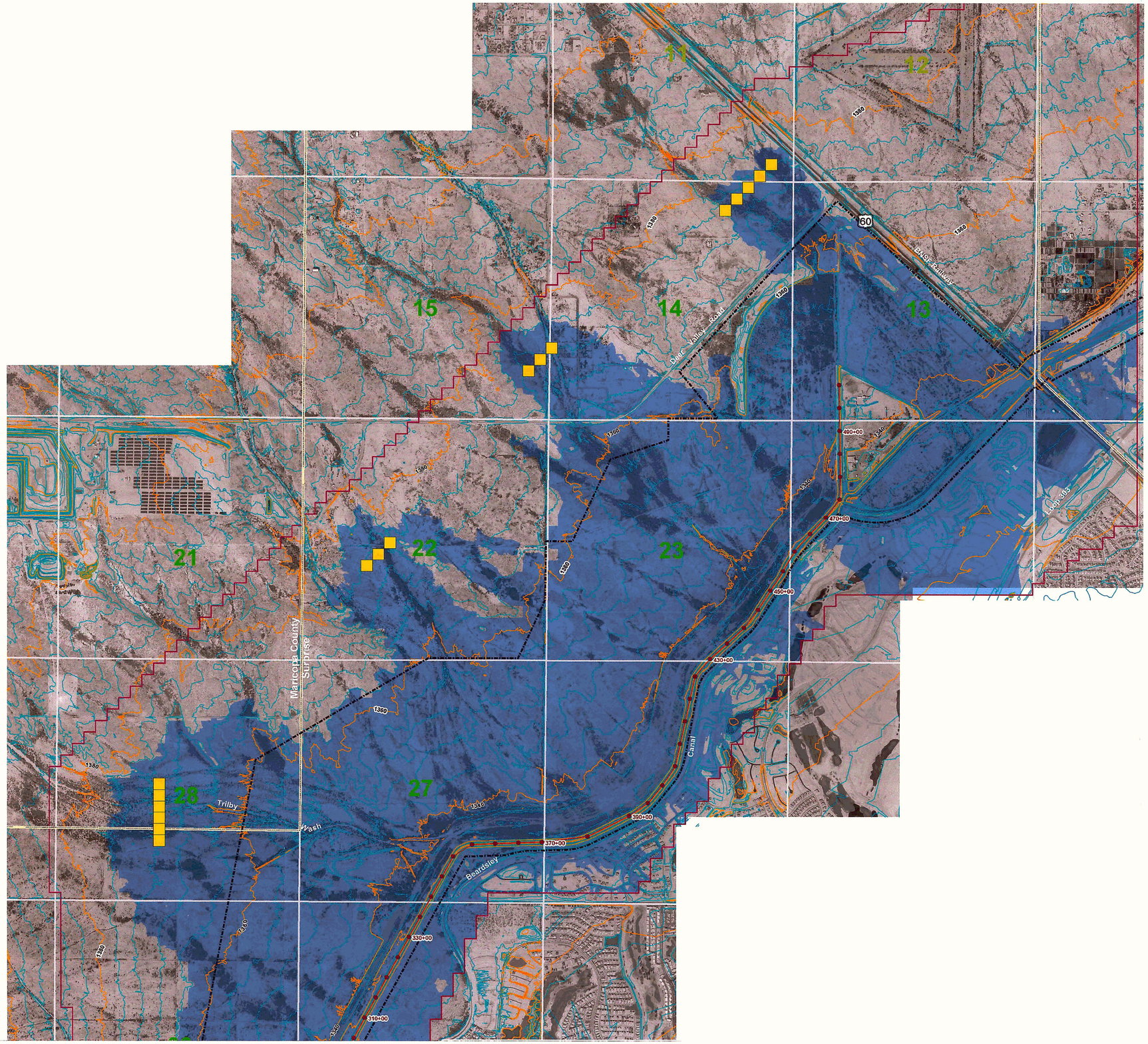
Title
Exhibit MA-4
PMF Inundation Limits

Project No.
82000267

Scale
0 500 1,000 2,000 3,000
Feet

Figure No.
1 of 2

w:\active\-2400267\gis\proj\flexisamples\ka.mxd
March 11, 2005



Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Station
- McMicken Dam Center Line
- Dam Extension
- Section Line
- Corporate Boundary
- FCDMC Property Line
- Study Limit
- Inflow Point
- Inundation Limit

N

File Name:	BCS	CVG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

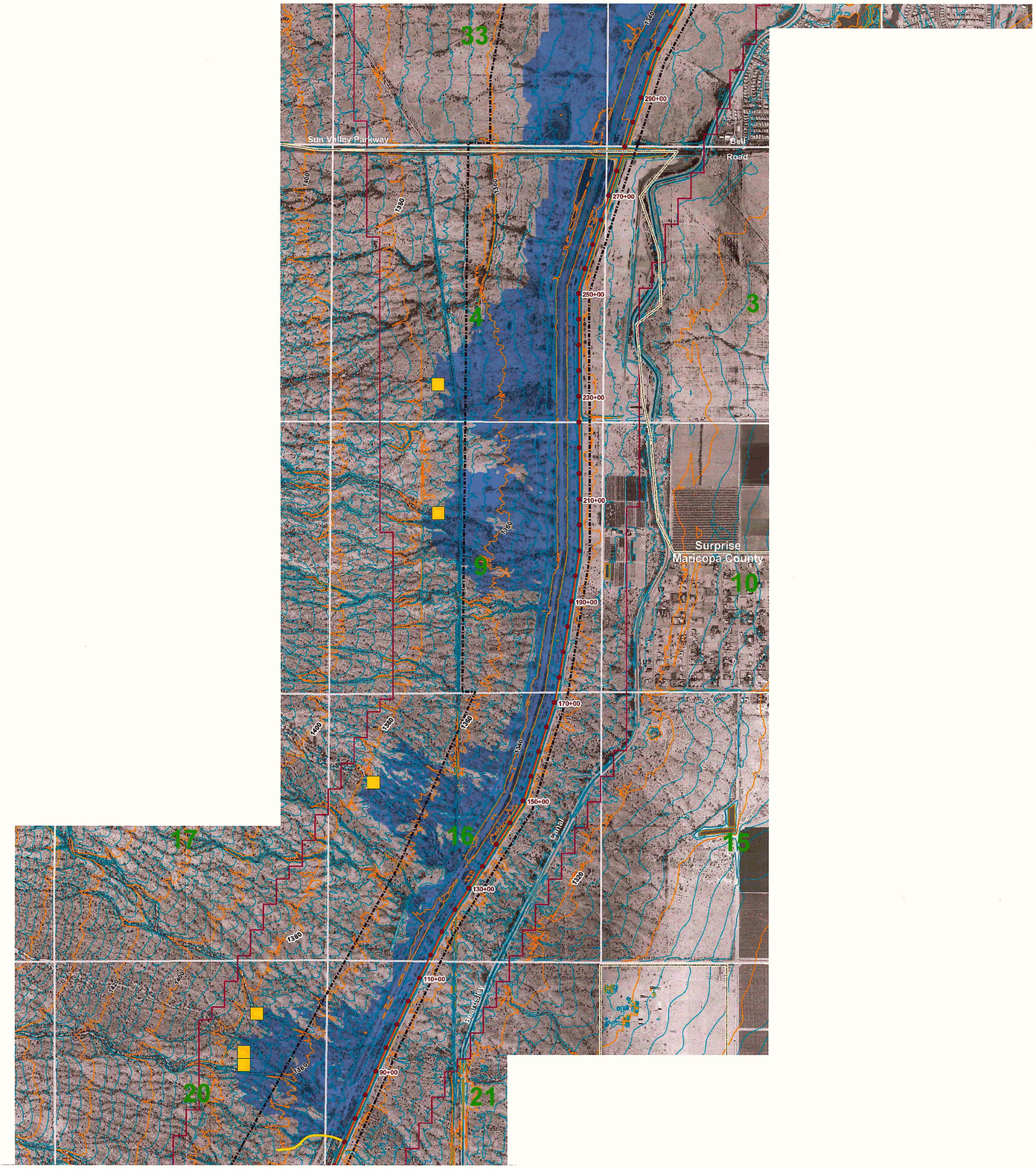
Title
Exhibit MA-4
PMF Inundation Limits

Project No.
82000267

Scale
0 500 1,000 2,000 3,000
Feet

Figure No.
2 of 2

\\vdatfile\24000267\gis\proj\flood\wittmanfloodmk4.mxd
March 11, 2005



Flood Control District
of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Station
- McMicken Dam Center Line
- Dam Extension
- Section Line
- Corporate Boundary
- FCDMC Property Line
- Study Limit
- Inflow Point
- Inundation Limit

N

File Name:	BGS	CVG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

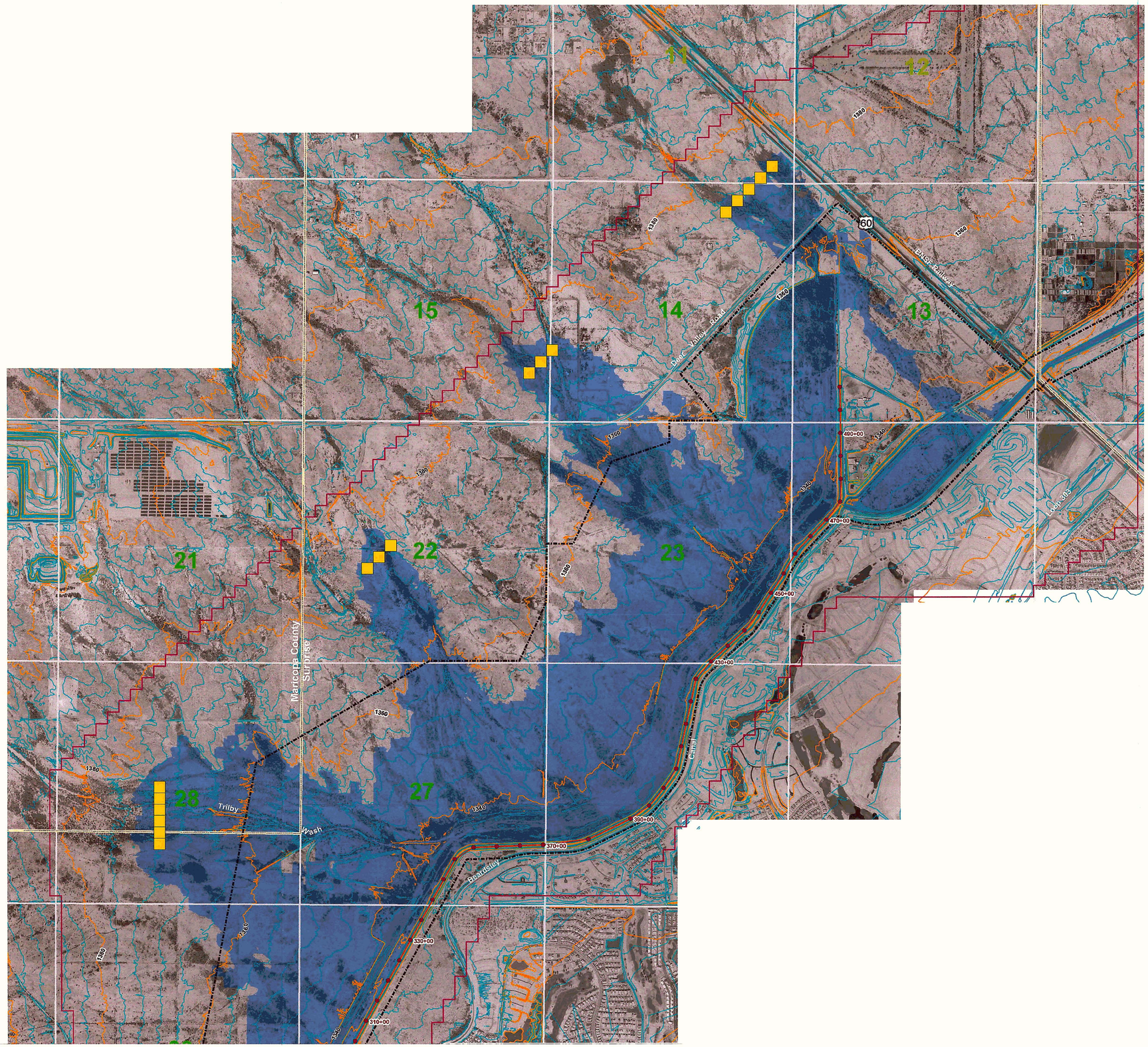
Title
Exhibit MA-5
100 Year Future Inundation Limits

Project No.
82000267

Scale
0 500 1,000 2,000 3,000
Feet

Figure No.
1 of 2

vrlactive:\82000267\gis\proj\files\AMADfa.mxd
March 11, 2005



Flood Control District
of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus

2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec

Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Station
- McMicken Dam Center Line
- Dam Extension
- Section Line
- Corporate Boundary
- FCDMC Property Line
- Study Limit
- Inflow Point
- Inundation Limit

N

File Name:	BGS	CVG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

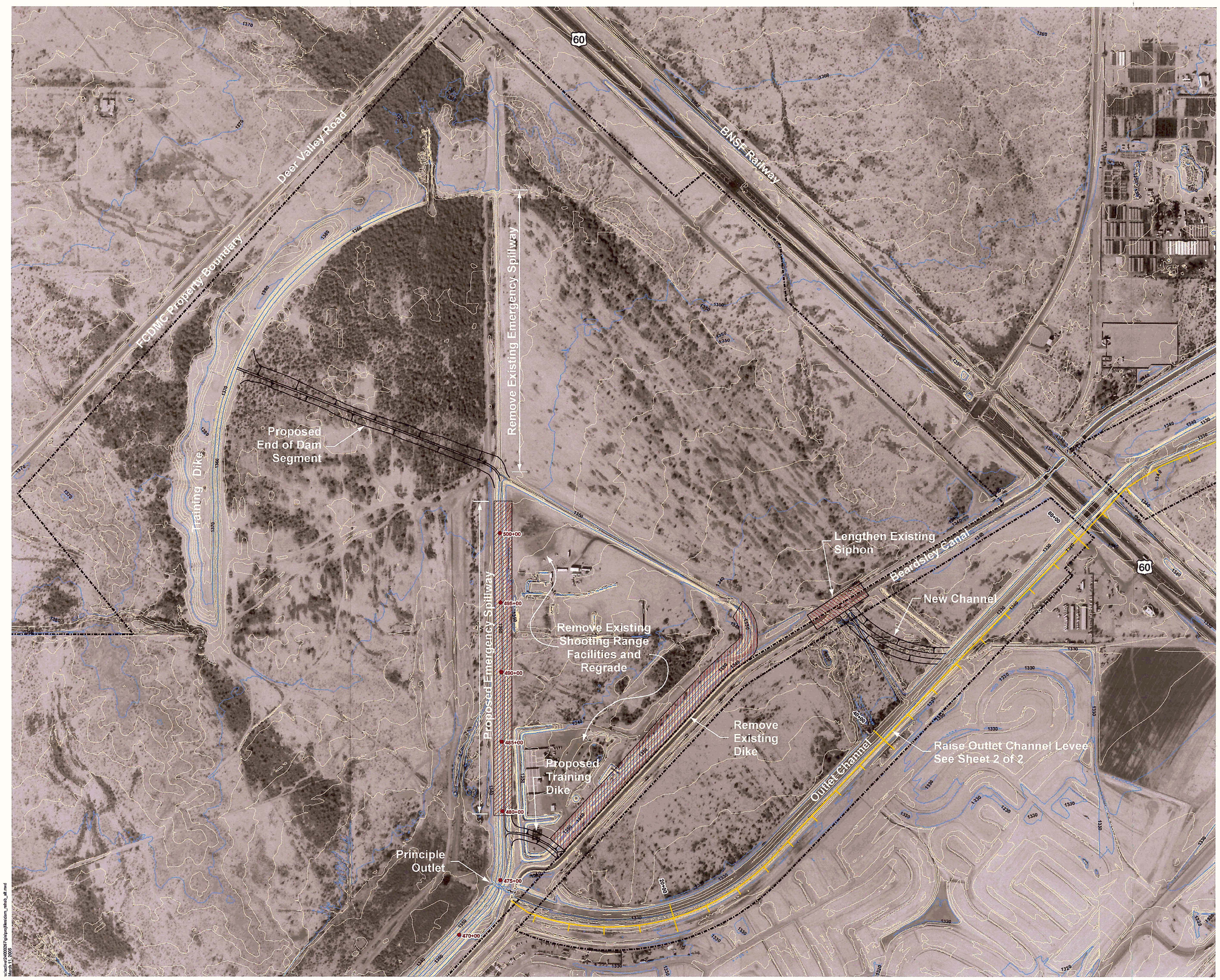
Title
Exhibit MA-5
100 Year Future Inundation Limits

Project No.
82000267

Scale
0 500 1,000 2,000 3,000
Feet

Figure No.
2 of 2

v:\work\82000267\gis\projfiles\AMMDS.mxd
March 11, 2005



Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By

Stantec
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- Dam Station
- Index Contour
- 2' Contour
- FCDMC Property

N

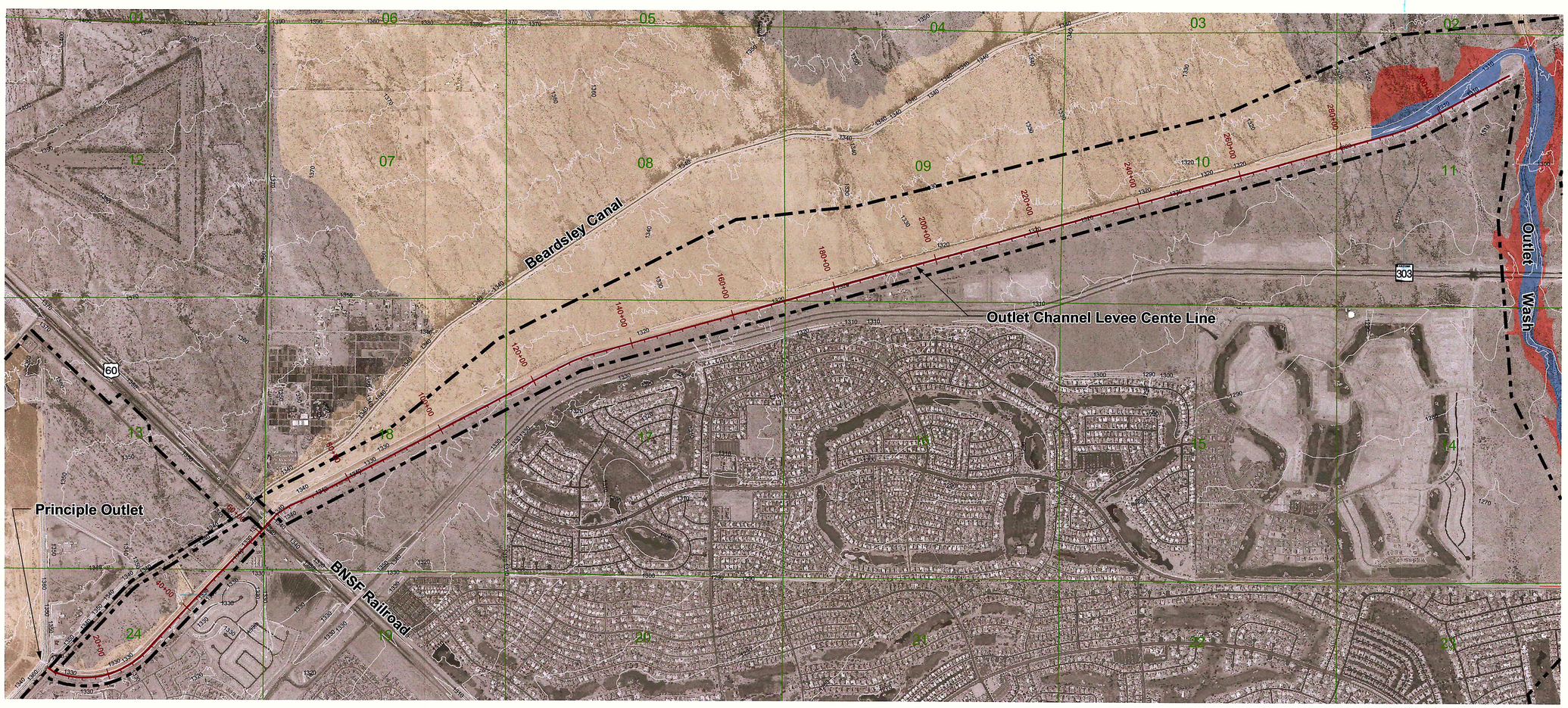
File Name:	BGS	CVG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

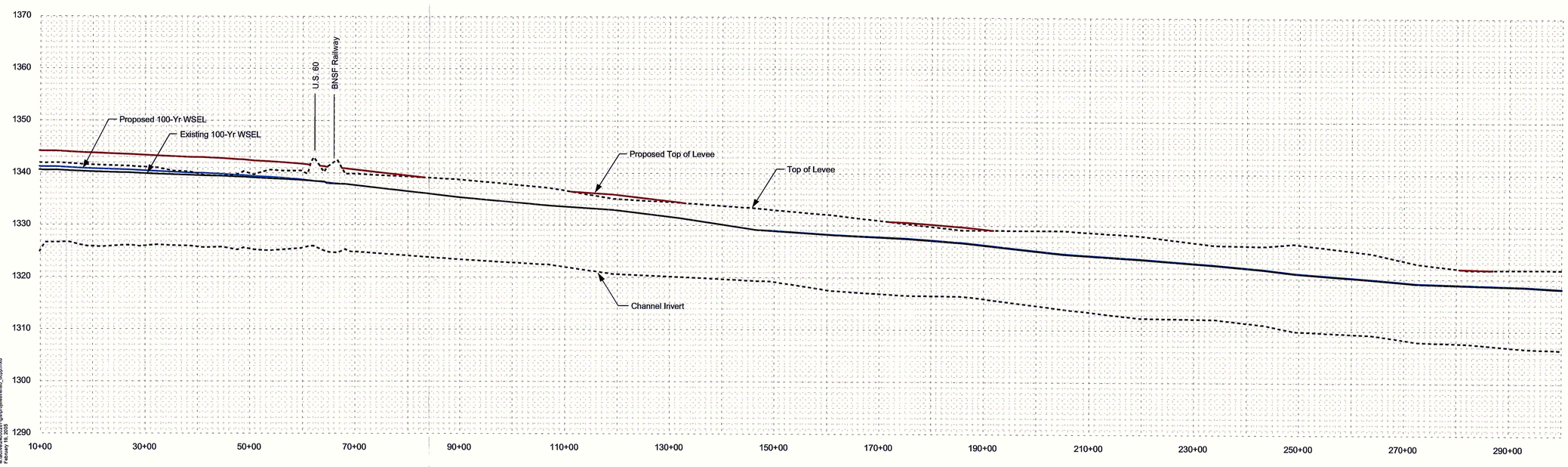
Title
Exhibit MA-11
Dam Rehabilitation Alternative

Project No.
82000267

Scale
0 150 300 600
1"=300'

Figure No.
1 of 2





Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By
Stantec
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- MCFCD Property Boundary
- Section Line

FEMA Zone

- A
- AE
- FW

N

File Name:	BGS	CVG	MCG	02.12.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

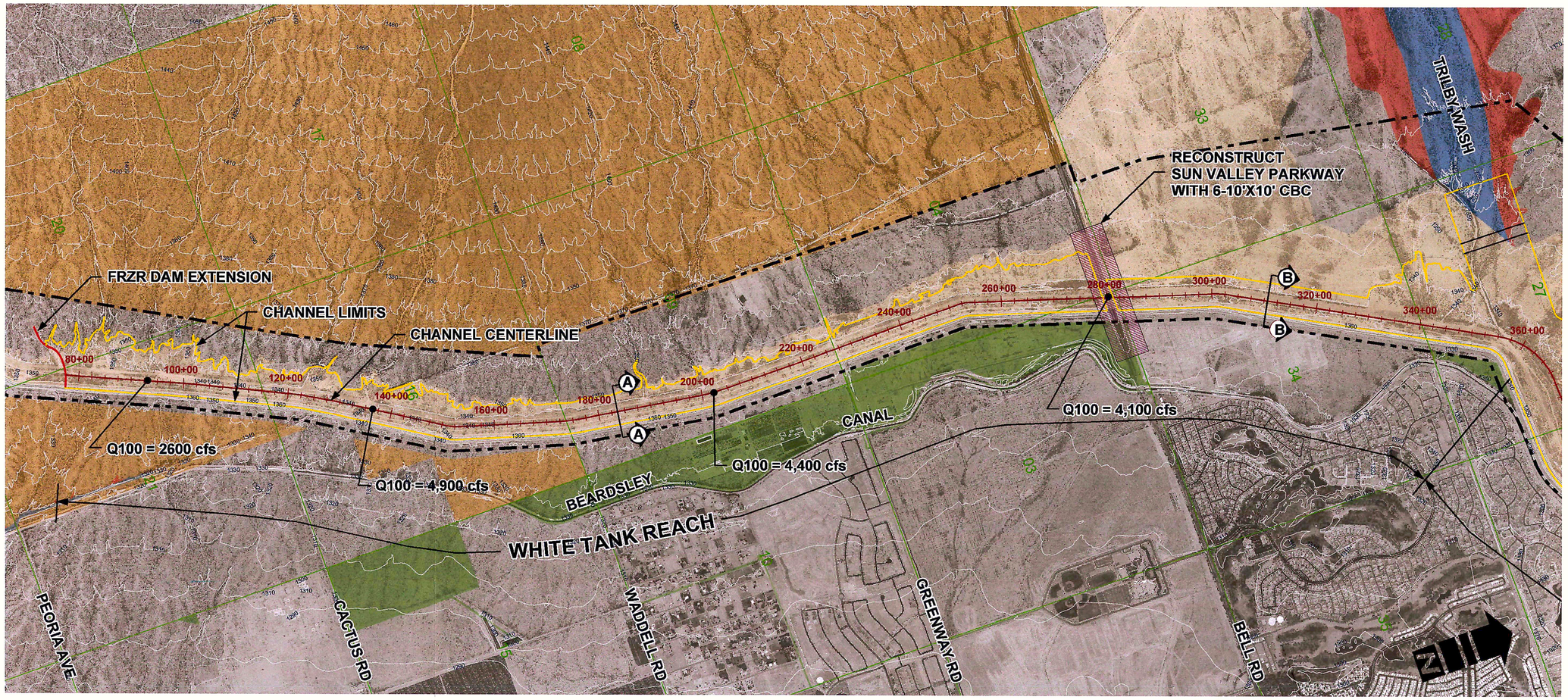
Title
Exhibit MA-11
Dam Rehabilitation Alternative

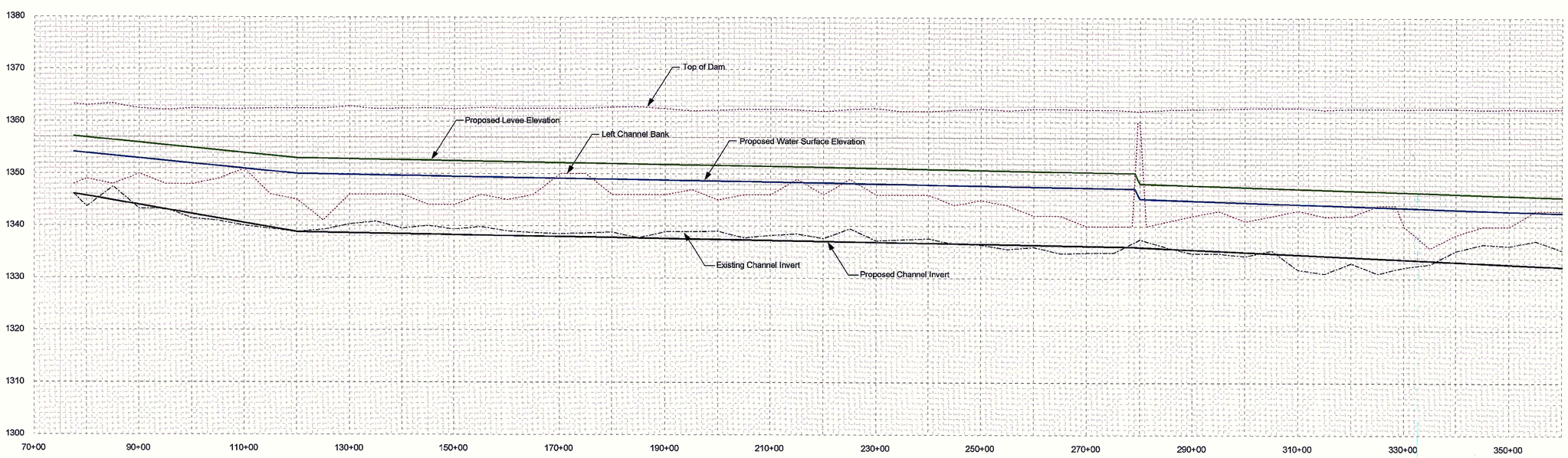
Project No.
82000267

Scale
0 500 1,000 2,000
1"=1000'

Sheet No.
2 of 2

\\corfiles\82000267\project\drawings\exhibits_acad.mxd
February 16, 2005





Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By
Stantec
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044

Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- MCFCD Property Boundary
- Section Line

FEMA Zone

- A
- AE
- FW

Land Owner

- ADOT
- APS
- ASLD
- BNSF
- COUNTY
- STATE TRUST

File Name:	BGS	CVG	MCG	02.28.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

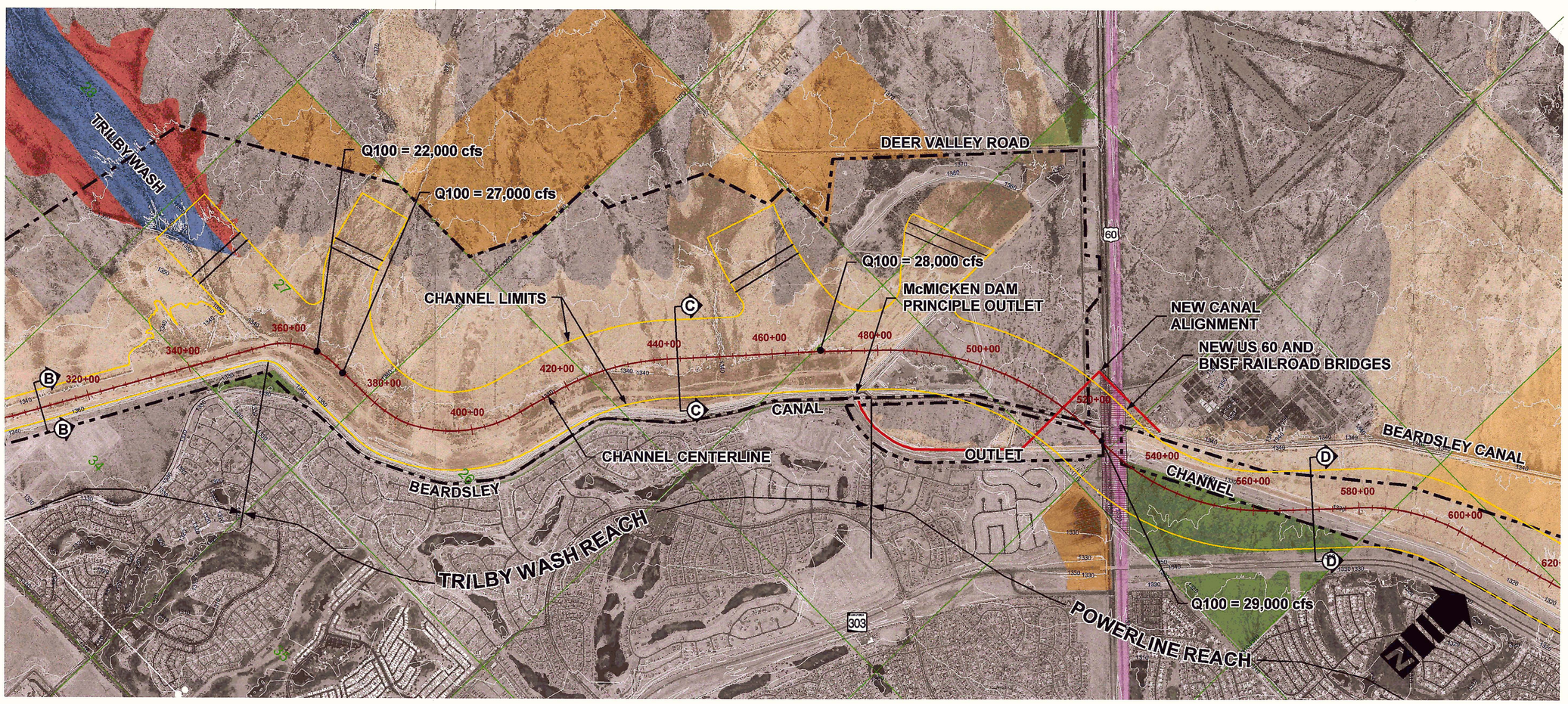
Title
Exhibit MA-12
Dam Decommission Alternative

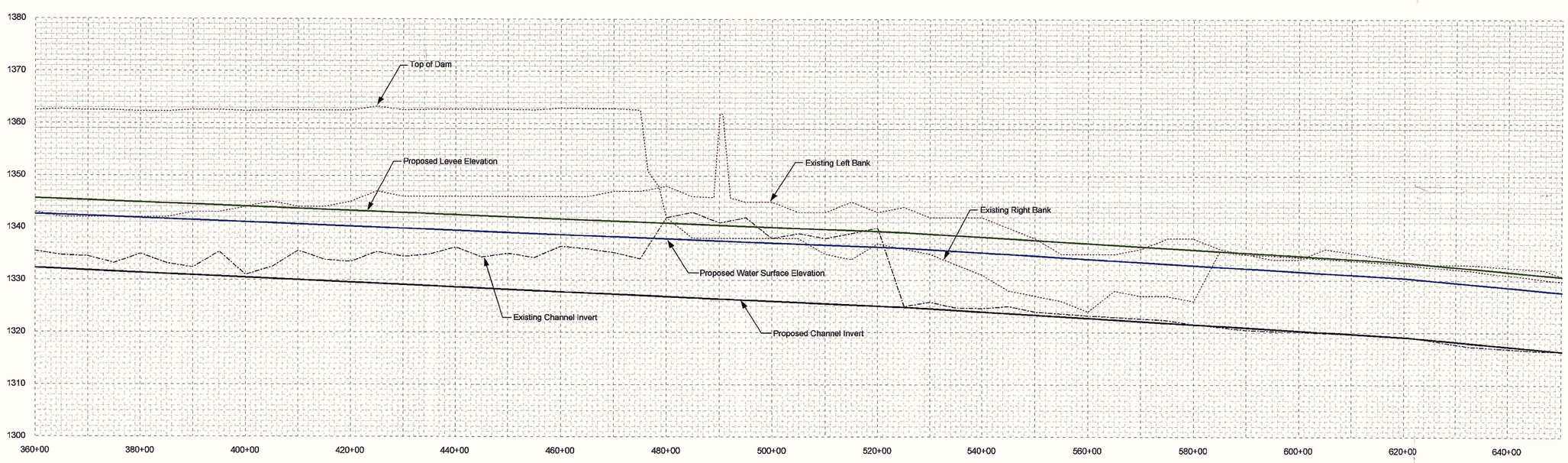
Project No.
82000267

Scale
0 500 1,000 2,000
1"=1000'

Sheet No.
1 of 3

w:\tech\82\82000267\engineering\floodcontrol_sheet1.mxd
March 11, 2005





Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By
Stantec
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend

- MCFCD Property Boundary
- Section Line

FEMA Zone

- A
- AE
- FW

Land Owner

- APS
- ASLD
- BNSF
- COUNTY
- STATE TRUST

File Name:	BGS	CVG	MCG	02.28.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

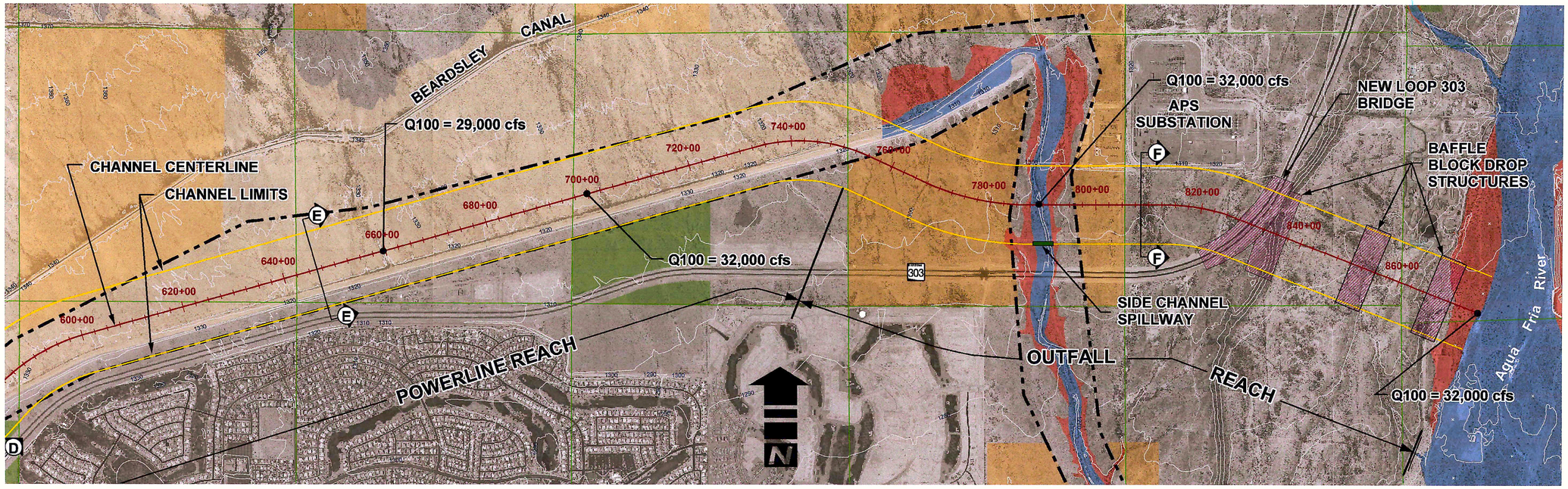
Title
Exhibit MA-12
Dam Decommission Alternative

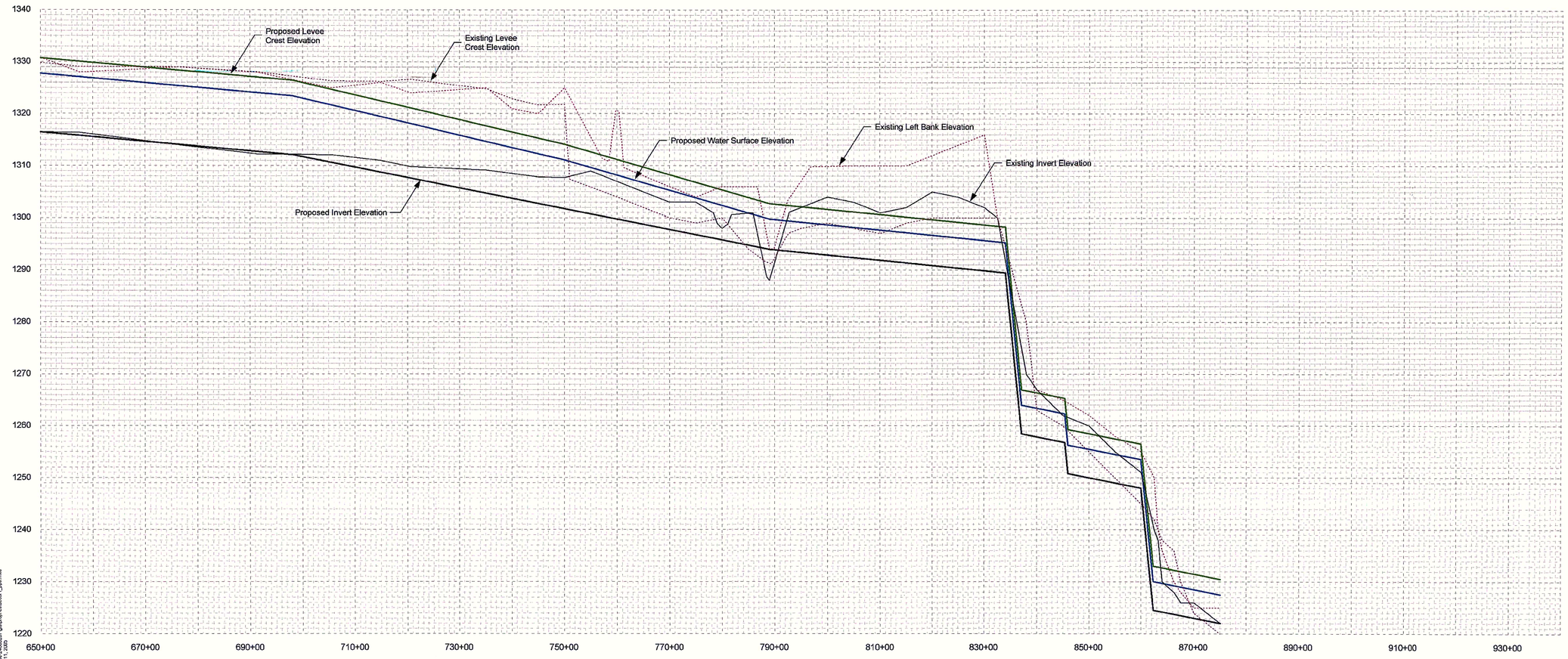
Project No.
82000267

Scale
0 500 1,000 2,000
1"=1000'

Sheet No.
2 of 3

w:\activ\82000267\highway\flood\decom_opts.mxd
February 28, 2005





Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009

Entellus
2355 N. 44th Street Suite 125
Phoenix AZ 85008.3276
Tel 602.244.2566
Fax 602.244.8917
Email: www.entellus.com

WITTMAN ADMSU
McMicken Dam Alternative Analysis

Maricopa County, AZ

Prepared By
Stantec
Stantec Consulting Inc.
8211 S. 48th Street
Phoenix, AZ U.S.A. 85044
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

Legend
- MCFCD Property Boundary
- Section Line

FEMA Zone
- A
- AE
- FW

Land Owner
- ADOT
- APS
- ASLD
- BNSF
- COUNTY
- STATE TRUST

File Name:	BGS	CVG	MCG	03.11.05
	Dwn.	Chkd.	Dsgn.	MM.DD.YY

Title
Exhibit MA-12
Dam Decommission Alternative

Project No.
82000267

Scale
0 500 1,000 2,000
1"=1000'

Sheet No.
3 of 3

w:\active\82000267\gis\profil ersdecom_pgs.mxd
March 11, 2005