REGIONAL FLOOD CONTROL DISTRICT

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October 22, 2010

Mr. Eric Simmons, CFM
National Flood Insurance Program
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

SUBJECT: LEVEE DOCUMENTATION PACKAGE: LEVEE #2100 – EQUESTRIAN LEVEE, CITY OF HENDERSON, NEVADA

Dear Mr. Simmons:

I am pleased to present this Technical Support Data Notebook (TSDN) for the Equestrian Levee (Levee ID #2100) located in the City of Henderson, Nevada. On January 8, 2009, the Clark County Regional Flood Control District (the District) entered into an Agreement for Professional Services with PBS&J to prepare a levee documentation package for this levee structure.

The development of this levee documentation package was a collaborative effort between the District, the City of Henderson (COH), and the Consultant Team – JE Fuller & Geomorphology, Inc. and Kleinfelder. Multiple reports, meetings, surveys, and site visits were necessary in order to present you with a complete and accurate submittal for the levee structure. Please refer to the cover letters from COH and the Consultant Team on the following pages for information about their roles and responsibilities related to this effort.

The Equestrian Levee is eligible for District operation and maintenance funding because it is identified on the District's master plan of flood control facilities. Each year, CNLV executes a Maintenance Work Program interlocal funding contract and identifies this levee structure, among many others, for inspection and maintenance. The Operation and Maintenance manual and associated contract with COH are provided in the appendix for your review.

District acknowledges that currently there is very little development on the public land upstream of the RWD. District in coordination with the levee owner (COH) and other involved local communities (Clark County) will be responsible for monitoring development that occurs upstream of the levee to ensure that future changes in the watershed do not adversely impact the functionality of the levee or the analysis presented in the TSDN.

Based on the COH cover letter (which follows) and the information provided in the TSDN, reconstruction of a small portion of the Equestrian levee embankment in the vicinity of an SNWA waterline crossing has been recommended. This

REGIONAL FLOOD CONTROL DISTRICT

recommendation was the result of a lack of construction documentation and inability to conclusively determine that the previously completed waterline construction will not provide a preferred seepage path in the levee embankment.

COH entered into a contract with PBS&J to complete the design work for this levee embankment reconstruction effort on June 17, 2010. Funding for this project is being provided by the District through our Maintenance Work Program. We have included project documentation and the 70% Design Plans and Specifications for the Equestrian Detention Basin Levee Reconstruction Project in Appendix XII of the TSDN for your review.

The purpose of including the 70% Design Plan and Specifications in Appendix XII is to receive your concurrence with the design plan and a conditional levee accreditation acknowledging that the levee will be accredited once the reconstruction is complete. We need to have your concurrence and acknowledgement of this approach prior to bid advertisement and construction of the project. Please note that you and I previously discussed this issue and the proposed plan in email correspondence dated April 26th and 27th, 2010.

Because of the PAL timeline and the time required to complete all phases of the levee reconstruction project (advertisement, bid, contract negotiations, construction phase, documentation, etc), we hope to receive your feedback on this levee documentation package and the design plans as soon as possible. If you concur with the plan, we will move forward accordingly with the construction project and submit final design plans, grading reports, and construction testing documentation after construction is complete.

As a community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed the attached technical report and appendix. Based upon the review, we recommend that the structure should continue to be accredited as providing protection from the base flood after the recommended reconstruction is complete in the vicinity of the SNWA waterline penetration.

Sincerely,

Kevin Eubanks, P.E., CFM
Assistant General Manager

KE:sa

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CITY OF HENDERSON
240 Water Street
P. O. Box 95050
Henderson, NV 89009

October 22, 2010

Mr. Eric Simmons, CFM
National Flood Insurance Program
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: **Levee Documentation Package: Levee #2100 – Equestrian Levee, City of Henderson, Nevada**

Dear Mr. Simmons,

This Technical Support Data Notebook (TSDN) has been prepared to show that the Equestrian Levee (Levee #2100) has been evaluated based on the criteria set forth in Section 65.10 of the National Flood Insurance Program (NFIP) regulations. Please refer to the attached cover letter and documentation that has been prepared by the Consultant Team for more detailed information.

Each year, the City of Henderson (the City) enters into contract with the Clark County Regional Flood Control District (CCRFCD) to inspect and maintain flood control improvements within the city. The Equestrian Levee is one of the many facilities that are included in the maintenance program. The inspection and maintenance for this structure will continue to be performed in accordance with standards set forth in the CCRFCD Operations and Maintenance Manual.

As described in Kleinfelder's Geotechnical Evaluation Report provided in Appendix VIII of the TSDN, there is a 30-inch diameter Southern Nevada Water Authority (SNWA) waterline that crosses the Equestrian levee at two locations (approximate levee stations 78+00 and 165+00). The construction of the waterline occurred in 2003, after the levee had been in place for 7 years, and consisted of removing and replacing sections of the levee embankment at the two crossing locations. Refer to the Kleinfelder's geotechnical report for additional information regarding construction of the waterline.

During this levee documentation and evaluation project, a thorough search and review of the SNWA waterline construction documentation was performed by Kleinfelder. Although none of the construction details for the waterline penetration were found to be in conflict with established levee guidelines, there was no evidence on the plans or in the construction records that the reconstructed embankment was benched into the existing levee fill or that special compaction equipment or methods were utilized in the areas where the levee was breached.

Because of the lack of construction documentation, Kleinfelder was unable to conclusively determine that the previously completed waterline construction will not result in a preferred seepage path in the levee embankment. Therefore, Kleinfelder recommended that reconstruction of the levee embankment be performed for the two portions of the levee that were disturbed by the waterline construction.
The City concurs with Kleinfelder's recommendation to reconstruct the levee embankment at the northern waterline crossing location (at levee station 78+00). The levee embankment in this area is approximately 15 feet high (waterside) with a waterside slope of 3:1 (H:V). The 100-year flow impacting the northern crossing is 1,438 cfs with a 100-year flow depth of 4.6 ft. The SNWA waterline is nearly perpendicular to the levee at this crossing location and reconstruction of the levee embankment can be performed without significant complications and be cost effective.

At the southern waterline crossing location (levee station 165+00), the City has decided not to proceed with Kleinfelder's recommendation to reconstruct the levee embankment. The City understands that Kleinfelder does not have sufficient construction documentation or supporting geotechnical evidence to be able to verify that the levee materials surrounding the waterline penetration do not provide a potential path for unwanted seepage through the levee embankment. However, there are several reasons why the City feels that remediation or reconstruction of the levee embankment at the southern waterline crossing is neither necessary nor beneficial, including:

- Observations from the field inspections performed by the City and the Consultant Team indicate that the levee and associated channel in the vicinity of the waterline crossing are in good condition. No signs of embankment instability were evident. In fact, the levee at this location is riprap lined to protect against potential embankment erosion.
- The questions and uncertainties related to the SNWA waterline construction methods arise from a lack of documentation and evidence, not necessarily from field observations or conflicts with established levee guidelines. SNWA follows sound construction practices and has provided a letter stating that the waterline is in good condition and continually monitored.
- The 100-year flow impacting the levee at the crossing location is relatively minor. The total 100-year flow is less than 190 cfs, the total tributary area contributing to this location is less than 0.2 square miles, and the 100-year flow depth impacting the levee is less than 1.7 feet.
- This portion of the levee embankment disturbed by the waterline construction is at the far upstream end of the levee and is less than 75 feet in length compared to the total levee length of approximately 1.9 miles.
- The levee embankment geometry at the southern crossing location is relatively wide and flat. The landside levee slope is approximately 6:1 (H:V) and the waterside slope is approximately 5:1 (H:V). The levee crest width is greater than 16 feet and the total levee bottom width is greater than 100 feet. The 100-year water surface elevation in the channel is less

than 1 foot higher in elevation than the landside toe elevation of the levee at the crossing location.

- Because of the levee geometry and the relatively insignificant 100-year flow and depth impacting the levee, it is highly unlikely that formation of a preferential seepage path would cause a levee embankment failure during a short-duration storm typical of the Las Vegas Valley.
- Reconstruction of the levee embankment at the southern crossing location would provide minimal benefits at a high cost. The reconstruction costs would include removing, stockpiling, and replacing riprap in the area, protecting the nearby SNWA pull box and test station, and coordinating the excavation/reconstruction of a section of the River Mountain Loop Trail and required detour routes. These economic considerations make the reconstruction undesirable to the City based on limited resources available at the current time.
- Inspection and maintenance will continue to be performed for this structure with available maintenance funding in accordance with standards set forth in CCRFCD's Operations and Maintenance Manual.

Based on the considerations listed above, the City believes that reconstruction of the Equestrian Levee Embankment at the southern SNWA waterline crossing will not be necessary for levee accreditation to proceed.

The City entered into a contract with PBS&J to complete the design work for the levee embankment reconstruction effort on June 17, 2010. We directed PBS&J to prepare design plans and specifications at the northern crossing location only. Funding for this project is being provided by the District through our Maintenance Work Program. Refer to the 70% Design Plans and Specifications for the Equestrian Detention Basin Levee Reconstruction Project that are included in Appendix XII of this levee documentation package for more information.

We have received and reviewed this levee documentation package. This levee is currently designated as a Provisionally Accredited Levee (PAL) based on a letter from FEMA dated January 29, 2009. We hereby submit to FEMA before the designated 2-year deadline (December 16, 2010) and recommend that the structure should continue to be accredited as providing protection from the base flood once the recommended improvements are complete.

Sincerely,

Robert A. Murnane, P.E.
Public Works Director

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

October 19, 2010

Mr. Eric Simmons, CFM
National Flood Insurance Program
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: Levee # 2100 - Equestrian Levee, City of Henderson, Nevada

Dear Mr. Simmons,

This letter and accompanying Equestrian Levee Technical Support Data Notebook (TSDN) provide data and documentation to show that the Equestrian Levee (Levee ID #2100) has been evaluated based on the criteria set forth in Section 65.10 of the National Flood Insurance Program (NFIP) and is recommended for accreditation by the Federal Emergency Management Agency (FEMA). This levee is currently designated as a Provisionally Accredited Levee (PAL) based on a letter from FEMA dated September 17, 2008.

The Equestrian Levee is located within the City of Henderson (COH), NV, approximately 0.7 mile east of the intersection of Wagon Wheel Drive and US-93. The Equestrian Levee is an earthen diversion structure approximately ranging in height form 7 to 16 feet and extending about 1.9 miles in a northerly direction from high ground adjacent to US-93. The levee geometry has a 12-foot wide crest and side slopes of 2.2:1 to 18.6:1 on the landside (west) and 2.9:1 to 7.3:1 on the waterside (east). Constructed in conjunction with the levee project is an earthen channel that runs adjacent to the waterside toe-of-levee; therefore, the levee embankment also serves as the channel's left bank while looking in the downstream direction.

Design and construction of the Equestrian Levee took place in 1994 and 1996, respectively. The levee-channel system reduces flood hazards to downstream developed areas (west of the levee) by intercepting flow from the mountainous areas to the east and re-directing the runoff to the north where it eventually outfalls at the Equestrian Detention Basin. The Equestrian Levee and associated diversion channel are owned, maintained, and operated by the COH.

In coordination with PBS&J, Kleinfelder, Clark County Regional Flood Control District (CCRFCD), and the COH, JE Fuller Hydrology & Geomorphology, Inc. (JEF) provided technical services for the research, review, and development of the attached supporting documentation for Levee #2100. These services included data collection and review, hydraulic and hydrologic analysis, and sediment transport/erosion analysis. Kleinfelder worked in close coordination with JEF on this project and was responsible for the geotechnical aspects related to the levee evaluation.

The attached TSDN discusses in-depth the FEMA levee requirements from Section 65.10 and includes summary descriptions of all relevant requirements. TSDN appendices include supporting documentation such as FEMA correspondence, certified as-built plans, maintenance manuals/documentation, hydrologic and hydraulic analyses, geotechnical data, and sediment transport/erosion analysis.

Based on review of the as-built plans, the current on site conditions, and the technical analyses presented in the attached TSDN, this levee system does, as of the date of this letter, meet the minimum criteria set forth in paragraph *(b)(1)Freeboard* in the Code of Federal Regulations (44 CFR 65.10). Based on the analyses presented in the attached TSDN, and the analyses conducted by Kleinfelder showing that that the eroded levee geometry provided by JEF is stable for the temporary condition, this levee system does, as of the date of this letter, meet the minimum criteria set forth in paragraph *(b)(3)Embankment Protection* in the Code of Federal Regulations (44 CFR 65.10).

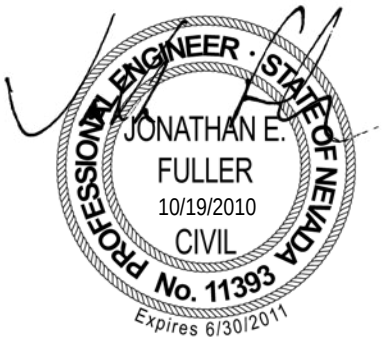
Refer to the attached cover letter from Kleinfelder for information about the geotechnical data and documentation related to the levee criteria described in paragraphs *(b)(4)Embankment and foundation stability* and *(b)(5)Settlement*. It should be noted that the other criteria described in paragraphs *(b)(2)Closures, (b)(6)Interior Drainage,* and *(b)(7)Other Design Criteria* are not applicable to this levee system.

It should be understood that this letter does not constitute any warranty or guarantee of performance, expressed or implied. Rather, it is a statement that the data presented in the attached TSDN is accurate to the best of the Project Team's knowledge.

The design and construction of the Equestrian Levee, and the subsequent review of all available technical data, was completed in accordance with sound engineering practices and with a standard of care that is commensurate with industry practices. The submitted documentation is for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and does not represent a determination by JEF as to how the Equestrian Levee structure or system will perform during any flood event.

The COH is the levee owner and is responsible for proper maintenance of the levee to ensure the stability, height, and overall integrity of the levee and its associated structures and systems.

Sincerely,



Jonathan Fuller, P.E., CFM
Principal
JE Fuller Hydrology & Geomorphology, Inc.

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October 19, 2010

Mr. Eric Simmons, CFM
National Flood Insurance Program
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: Levee #2100 – Equestrian Levee, Henderson, Nevada

Dear Mr. Simmons,

This letter and the accompanying Appendix VIII of the Equestrian Levee Technical Support Data Notebook (TSDN) provide geotechnical data and documentation to show that the Equestrian Levee (Levee #2100) has been evaluated based on the criteria set forth in Section 65.10 of the National Flood Insurance Program (NFIP) regulations. In coordination with the Clark County Regional Flood Control District (CCRFCD), the City of Henderson (COH), JE Fuller / Hydrology and Geomorphology, Incorporated (JE Fuller), and PBS&J, Kleinfelder provided geotechnical exploration and analyses of the Equestrian Levee and was responsible for geotechnical aspects of the levee evaluation and compliance determination.

As described in Appendix VIII, Kleinfelder recommends that reconstruction of the portions of the levee disturbed by two waterline penetrations be performed and scheduled maintenance be completed. The location of the penetrations corresponds to approximate Equestrian Levee Station 78+10 and 165+00. Geotechnical recommendations to support the design of the reconstruction were provided to PBS&J in our letter dated October 8, 2010 (Kleinfelder Project No. 112973). Kleinfelder has also reviewed the 70 percent Plans and Specifications for the Equestrian Detention Basin Levee Reconstruction Project prepared by PBS&J, dated October 11, 2010. Geotechnical recommendations for levee reconstruction, as well as the results of our plan and specification review, are presented in Appendix XII of the TSDN. It is our understanding that the purpose of this submittal to Federal Emergency Management Agency (FEMA) is to provide details of the analyses performed and the 70 percent design for the reconstruction for FEMA review and approval, prior to proceeding with the recommended reconstruction and finalizing certification documentation.

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Based on review of the as-built plans, the current on-site conditions, the technical analyses presented in Appendix VIII of the attached TSDN, Equestrian Levee meets the minimum criteria set forth in paragraphs *(4)Embankment and Foundation Stability* and *(5)Settlement*, with the exception of the scheduled maintenance to be performed and the existing penetrations. Our analyses also show that the eroded levee geometry provided by JE Fuller is stable for the temporary condition. The Equestrian Levee, therefore, can be recommended for accreditation by FEMA once the scheduled maintenance has been performed and the recommended reconstruction at the waterline penetrations has been completed.

It is our understanding that the Owner, COH, has elected to only reconstruct Equestrian Levee at the penetration located at approximate Station 78+10 and not reconstruct the levee at the penetration located at approximate Station 165+00. It is also our understanding that scheduled maintenance will be performed following the reconstruction. If the reconstruction at approximate Station 165+00 is not completed, the limits of Kleinfelder's analysis for the minimum criteria set forth in paragraphs *(4)Embankment and Foundation Stability* and *(5)Settlement* and Kleinfelder's recommendation for accreditation would terminate at Station 164+00. This station is 50 feet from the previous construction limits as represented on the waterline as-built drawings and 300 feet from the upstream end of the levee.

This letter does not constitute any warranty or guarantee of performance, expressed or implied. Rather, it is a statement that the data presented in Appendix VIII of the attached TSDN is accurate to the best of Project Team's knowledge.

The review of available technical data associated with the design and construction of this levee was completed in accordance with sound engineering practices and with a standard of care that is commensurate with industry practices. The submitted documentation is for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and does not represent a determination by Kleinfelder, JE Fuller or PBS&J as to how a structure or system will perform during any flood event.

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The City of Henderson is the levee owner and is responsible for proper maintenance of the levee to ensure the stability, height, and overall integrity of the levee and its associated structures and systems are maintained.

Sincerely,

KLEINFELDER



Ann L. Backstrom, P.E.
Principal Professional

10/19/2010

Steven M. Myers, P.G.
Desert Southwest Regional Manager

ALB/jrs

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Equestrian Levee

Technical Support Data Notebook
Levee ID #2100, Clark County, Nevada

Prepared for

Clark County Regional Flood Control District
600 South Grand Central Parkway, Suite 300
Las Vegas, Nevada 89106-4511

Prepared by

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
8400 South Kyrene Road, Suite 201
Tempe, AZ 85284

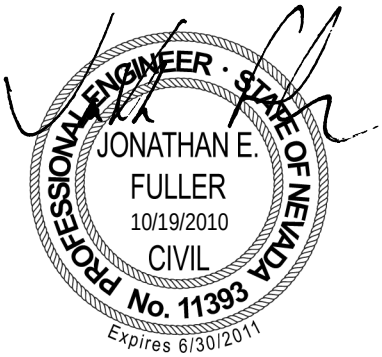
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6380 South Polaris Avenue
Las Vegas, NV 89118

Levee Data and Documentation for the
National Flood Insurance Program

October 2010

JE Fuller/ Hydrology & Geomorphology, Inc.

DATE: October 19, 2010



TO: Federal Emergency Management Agency, Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FROM: JE Fuller/Hydrology & Geomorphology, Inc.
Contact: Jon Fuller, P.E. or Brian Schalk, P.E.
8400 S. Kyrene Road, Suite 201
Tempe, AZ 85284

RE: **Summary Report for FEMA Accreditation of Equestrian Levee Located in Clark County, Henderson, Nevada**

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X. CCRFCD Maintenance Work Program
XI. Lateral Erosion Analysis*
XII . Equestrian Detention Basin Levee Reconstruction Project Documentation

*NOTE: Because of substantial amounts of data and documentation, all Appendix material is included electronically on a disc provided at the end of this report. Appendices III, VIII, and XI are the only appendices printed in hard copy format and are included at the end of the report for reference. An electronic version (PDF file) of the entire report is also included on the disc.

Acronyms and Abbreviations

CFR 65.10	Title 44, Chapter 1 of the Code of Federal Regulations, Section 65.10, Mapping of Areas Protected by Levees
CCRFCD	Clark County Regional Flood Control District
CFR	Code of Federal Regulations
cfs	Cubic feet per second
COH	City of Henderson, Nevada
EDB	Equestrian Detention Basin
EDC	Equestrian Drive Channel
EL	Equestrian Levee
ELC	Equestrian Levee Channel
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map feet feet GIS Geographic Information System
HEC-RAS	Hydrologic Engineering Centers River Analysis System
JEF	JE Fuller/Hydrology & Geomorphology, Inc.
LOMR	Letter of Map Revision (FEMA)
MWP	Maintenance Work Program (CCRFCD)
NFIP	National Flood Insurance Program
O&M	Operations and Maintenance
PAL	Provisionally Accredited Levees
TSDN	Technical Support Data Notebook

1. PROJECT PURPOSE

This Technical Support Data Notebook (TSDN) discusses the procedures and results of technical analyses conducted by JE Fuller/Hydrology & Geomorphology, Inc. (JEF) and Kleinfelder to evaluate compliance of the Equestrian Levee (EL) to selected criteria as outlined in 44 CFR Section 65.10 (65.10). As part of the National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) is tasked with assuring that all levee systems provide protection from the base flood by meeting design, operation, and maintenance minimum standards as outlined in 65.10. The purpose of this document is to demonstrate that the Equestrian Levee meets the minimum standards and should be considered for FEMA accreditation.

2. PROJECT DESCRIPTION

2.1. Project Area

2.1.1. Regional

The EL, Equestrian Levee Channel (ELC), and subsequent Equestrian Detention Basin (EDB) are part of a regional flood control system as defined in the *Clark County Regional Flood Control Master Plan.*

2.1.2. Local

The EL is a 1.9 mile structure beginning near the intersection of U.S. Highway 93 (Boulder Highway) and East Paradise Drive, within the City of Henderson (COH), Nevada (Figure 1). The purpose of the EL is to divert runoff flows from a portion of the eastern River Mountains north of U.S. Highway 93 to the EDB. The flows are routed to the EDB via the ELC immediately east of the EL.

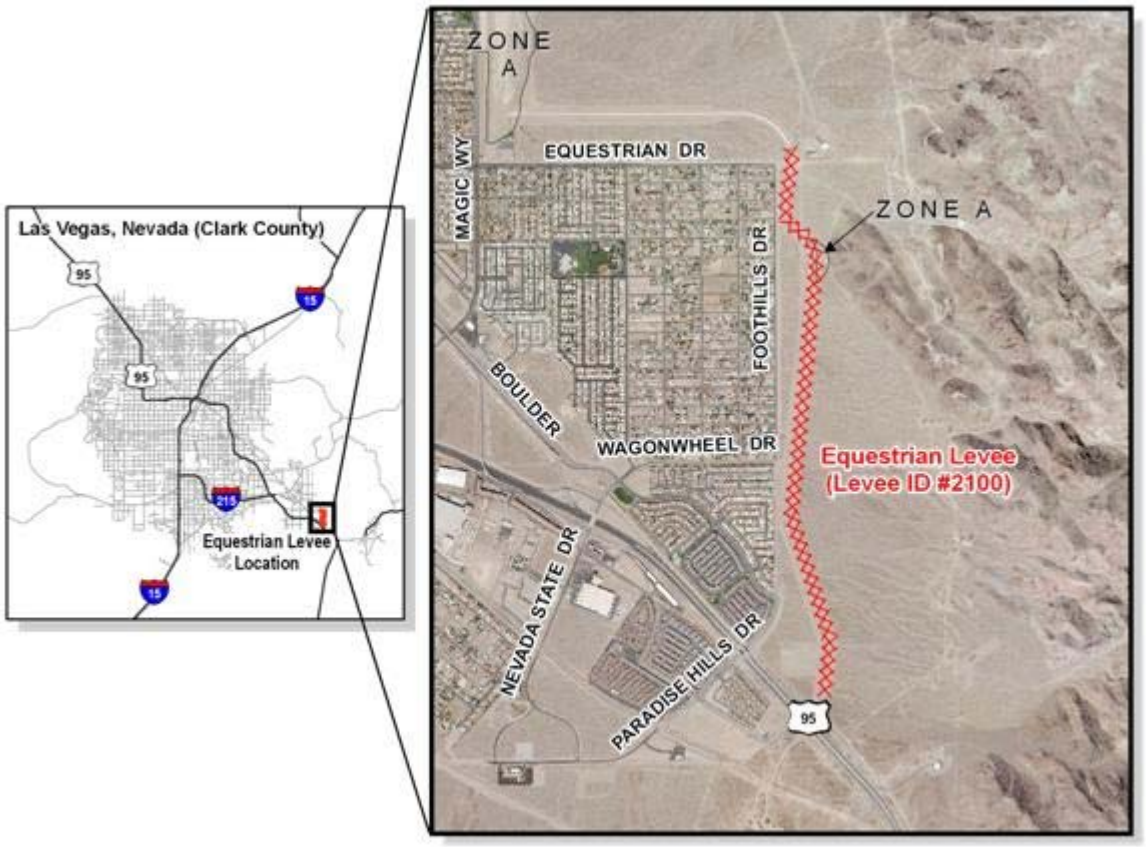


Figure 1. Vicinity Map

2.2. Previous Studies

2.2.1. Effective LOMR

Revised FEMA FIRM Panels (32003C2615D, 32003C2620D and 32003C2975D) reflecting the EDB Regional Flood Control Project were accepted by FEMA July 18, 2001 per LOMR Case Number 99-09-623P. Currently, effective FIRM Panels reflecting the EL alignment are shown on FIRM Panels 32003C2620E and 32003C2975E, both having a map revision date of September 27, 2002. It should be noted that the levee structure alignment, shown on both the 2001 and 2002 revised FIRM Panels, is not designated as a "Levee". Rather, the levee structure alignment has been designated as a "Diversion Channel". As shown on the FIRM Panels, the "Diversion Channel" provides protection from a relatively small Zone A flood hazard approximately located between as-built Levee Stations 080+00 and 085+00. FEMA's LOMR acceptance letter and effective FIRM Panels (in a FIRMette format) are provided in Appendix I.

3. LEVEE SYSTEM ANALYSIS

3.1. Levee Description

FEMA has indicated that the EL is a levee in Clark County warranting accreditation. FEMA has assigned a Levee Identification Number of 2100 to the EL. The EL is owned, maintained, and operated by the COH, Nevada.

In a letter dated September 17, 2008, FEMA authorized the COH to receive a Provisionally Accepted Levee (PAL) designation for the EL. The COH signed the PAL agreement and submitted it to FEMA with the required attachments on December 4, 2008. FEMA accepted the agreement and confirmed the PAL status. A copy of the PAL agreement form is included in Appendix II, and a summary of the important milestones and dates for accreditation of this levee is provided below in Table 1.

Table 1. Key Milestones for EL Reaccreditation

Date	Milestone
9/17/2008	Date of FEMA PAL offer letter
12/9/2008	Date that the community/levee owner signed the PAL Agreement
12/11/2008	Date that FEMA received the signed PAL Agreement
12/16/2008	90-day deadline of PAL offer period and start date of 2-year PAL period
12/16/2009	1-year deadline for submitting progress report to FEMA
12/16/2010	2-year deadline for submitting all 44 CFR 65.10 data to FEMA

The EL was designed and constructed (1994 and 1996, respectively) in conjunction with the EDB and Equestrian Drive Channel EDC (the EDC is a concrete, trapezoidal channel that outfalls at the EDB). These flood control facilities, located within an arid geographic region that experiences an annual average precipitation of less than 4.5 inches, were built to protect development from ephemeral flows originating in the mountainous terrain to the east. Design and construction of these three facilities was authorized under the EDB Regional Flood Control Project, funded by the Clark County Regional Flood Control District (CCRFCD).

The EL is an earthen embankment that extends in a northerly direction from high ground adjacent to US-93 to the upstream end of the EDC. Typical levee characteristics, based on as-built plans, are provided below in Table 2. In addition, EL as-built drawings are provided in Appendix III.

Table 2. Typical EL Characteristics

Levee Characteristic	Description
Cross-Section	Trapezoidal
Length	Approximately 1.9 miles
Height	Approx. 4 to 16 feet
Levee Top Width	Approximately 12 feet (includes approximate 5-foot asphalt path)
Side Slope (landside)	2.2H:1V to 18.6H:1V
Side Slope (waterside)	2.9H:1V to 7.3H:1V
Embankment Armoring	Upstream-most 300 feet only

Constructed in conjunction with the EL, the ELC is an earthen channel that runs adjacent to the waterside toe-of-levee; therefore, the embankment also serves as the channel's left bank when looking in the downstream direction. Typical ELC characteristics, based on as-built plans, are provided below in
Table 3.

Table 3. Typical ELC Characteristics

Channel Characteristic	Description
Cross-Section	Trapezoidal
Bottom Width	Approximately 20 feet
Side Slope (left bank)	3H:1V to 5H:1V
Side Slope (right bank)	4H:1V
Channel Bottom Lateral Slope	Flat to 5%
Longitudinal Slope	0.55% to 2.45%
Embankment Armoring	None

3.2. CFR 65.10 (B) DESIGN CRITERIA

3.2.1. CFR 65.10 (B)(1) Freeboard

(b)(1)(i). Riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.

Hard copy output for subcritical HEC-RAS modeling of the ELC was collected with the EDB LOMR (Appendix IV). Although HEC-RAS workmaps were not included with the LOMR data, a comparison of levee as-built stationing and HEC-RAS river stationing, as well as as-built elevations and HEC-RAS top- and toe-of-levee elevations, confirms the LOMR's intent to hydraulically model flow conditions within the recently constructed ELC. However, for the purpose of freeboard criteria evaluation, it was determined that the most accurate means of assessing the hydraulic characteristics of the levee structure and channel system was to use supplemental survey data recently collected by PBS&J. The purpose of the supplemental survey was to collect cross-section geometry at locations that approximate various LOMR HEC-RAS river station locations. The survey was conducted by PBS&J on September 8, 2009.

Using this supplemental survey data, both a subcritical and supercritical HEC-RAS model (EquestrianLeveeChan.prj) were developed to reflect the hydraulics associated with the EL and ELC under current conditions, rather than using the LOMR HEC-RAS results. Both the subcritical and supercritical HEC-RAS model output are included in Appendix VII.

The results of the subcritical HEC-RAS model indicate the EL meets or exceeds the minimum freeboard requirements at all but one river station location, River Station (RS) 167+00. Subcritical HEC-RAS modeling results, as they pertain to FEMA freeboard criteria, are presented in Table 4. Additional discussion regarding freeboard at RS 167+00 is provided in Section 3.2.1.1.

Table 4. Freeboard Criteria (Subcritical HEC-RAS Modeling)

River Station	Q Total	Top of Levee	W.S. Elev.	Freeboard	FEMA Freeboard Criteria
	(cfs)	(feet)	(feet)	(feet)	(feet)
16700	189	2382.31	2380.40	1.9	3.5*
16550	189	2380.38	2376.20	4.2	3
16500	189	2379.24	2373.84	5.4	3
16400	189	2377.65	2372.22	5.4	3
16300	189	2375.2	2369.95	5.3	3
16200	189	2373.2	2369.38	3.8	3
16150	915	2373.2	2368.14	5.1	3
16000	915	2370.3	2364.91	5.4	3
15950	915	2369.6	2363.54	6.1	3
15500	915	2360.55	2351.91	8.6	3
15000	1046	2347.83	2339.92	7.9	3
14700	1046	2340.19	2332.91	7.3	3
14500	1046	2335.59	2327.88	7.7	3
14000	1046	2323.93	2316.07	7.9	3
13800	1046	2318.58	2310.52	8.1	3
13250	1315	2304.48	2297.20	7.3	3
13000	1315	2299.64	2291.61	8.0	3
12700	1315	2292.4	2284.81	7.6	3
12500	1315	2289.17	2280.97	8.2	3
12000	1315	2281.29	2272.44	8.8	3
11500	1315	2274.01	2264.91	9.1	3
11000	1315	2266.67	2257.61	9.1	3
10500	1315	2259.3	2250.28	9.0	3
10000	1315	2251.44	2242.73	8.7	3
9500	1315	2244.26	2234.95	9.3	3
9000	1315	2236.53	2227.78	8.8	3
8600	1315	2233.32	2223.06	10.3	3
8500	1315	2233.17	2221.51	11.7	3
8200	1438	2231.42	2220.78	10.6	3
8150	1438	2230.47	2220.77	9.7	3
7800	1438	2229.44	2218.72	10.7	3
7450	1494	2226.42	2216.06	10.4	3
7423	1494	2224.85	2215.90	8.9	3
7350	1494	2222.18	2215.91	6.3	3
7238	1494	2221.57	2214.89	6.7	3
7100	1494	2220.96	2214.61	6.3	3
7000	1494	2220.46	2213.31	7.2	3
6700	1494	2219.06	2212.80	6.3	3
6500	1494	2217.36	2212.45	4.9	3
6400	1494	2217.18	2212.39	4.8	3
6200	1494	2215.64	2210.35	5.3	3.5**

*An additional 0.5 feet required at the upstream end of the levee
**An additional 0.5 feet required upstream of a bridge structure

3.2.1.1. Freeboard Exceptions

(b)(1)(ii). Occasionally, exceptions to the minimum riverine freeboard requirement described in paragraph (b)(1)(i) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood elevation profile and include, but not necessarily be limited to an assessment of statistical confidence limits of the 100-year discharge; changes in stage-discharge relationships; and the sources, potential, and magnitude of debris, sediment, and ice accumulation. It must be also shown that the levee will remain structurally stable during the base flood when such additional loading considerations are imposed. Under no circumstances will freeboard of less than two feet be accepted.

As shown above in Table 4, the EL does not meet freeboard criteria at River Station 167+00. This lack of required freeboard at the upstream limit is discussed in the FEMA-accepted LOMR Letter Report. The LOMR Letter Report and FEMA acceptance letter are provided in Appendix I. According to the LOMR Letter Report (Item #10, Page 6 of 10):

"Freeboard: The berm is designed to provide a minimum of 3 feet of freeboard. This includes all areas subject to sediment deposition. The only exception to this is at the very beginning of the channel where the total flow being collected is 189 CFS and the basin contributing to this location is only 0.185 square miles."

In addition to the relatively low peak discharge and small contributing area discussed in the LOMR Letter Report, this freeboard deficiency should be quantified based on the following overall hydraulic data and levee design parameters at River Station 167+00:

- The portion of levee not meeting the freeboard criteria is less than 150 feet in length (total levee length approximately 1.9 miles) and is located at the upper end of the levee where the flow is less than 200 cfs.
- Hydraulic depth is 1.1 feet (subcritical HEC-RAS model).
- Bank protection is properly sized for the velocity of 8.9 feet/second (supercritical HEC-RAS model).
- Observations from the general field inspection indicate the existing riprap and channel are in satisfactory condition. No signs of embankment erosion or overtopping flow were evident.

It should be noted that there are presently two types of bank protection in place between River Stations 167+00 and 165+50. The EL embankment is protected by a short segment of concrete lining at River Station 167+00 and by "Heavy Riprap 3 feet Thick" as called-out in the as-built drawings (see Figure 2 and Figure 3). The rip-rap protection begins approximately 100 feet downstream of River Station 167+00 and extends downstream for approximately 150 feet. The as-built

drawings do not specify the D_{50} diameter size of the rip-rap, only that the thickness is "3 feet Thick". However, typically a riprap thickness of 3 feet implies a D_{50} of approximately 18 inches.

Equation 732 of the CCRFCD *Hydrologic Criteria and Drainage Design Manual*[1] is a standard criterion for sizing rip-rap when velocity is used as the primary design parameter. Given the shallow depth of flow (1.1 feet per the HEC-RAS subcritical model) and relatively high velocity (8.9 feet/second per supercritical HEC-RAS model) at River Station 167+00, the velocity can be assumed to be the primary design parameter. Equation 732 is shown below.

$$n = 0.0395 (D_{50})^{1/6} \qquad \text{(Eqn. 732)}$$

n = Manning's roughness
D_{50} = mean stone size (feet)

Using Equation 732 and the HEC-RAS model n-value at RS 167+00 (n = 0.040), a D_{50} of 12 inches is recommended. Based on field inspection, the installed riprap has a D_{50} of 12 inches or larger and provides adequate protection of the levee embankment (see Figure 2 and Figure 3).

Given the above freeboard quantifiers, and previous FEMA review and acceptance of the levee design and LOMR package, it is recommended that this freeboard condition be assumed satisfactory to FEMA and no corrective action required.

3.2.1.2. Coastal Levees and Exceptions (b)(1)(iii)

For coastal levees, the freeboard must be established at one foot above the height of the one percent wave or the maximum wave run-up (whichever is greater) associated with the 100-year stillwater surge elevation at the site. (b)(1)(iv). Occasionally, exceptions to the minimum coastal levee freeboard requirement described in paragraph (b)(1)(iii) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood loading conditions. Particular emphasis must be placed on the effects of wave attack and overtopping on the stability of the levee. Under no circumstances, however, will a freeboard of less than two feet above the 100-year still water surge elevation be accepted.

This requirement is not applicable to the EL or ELC.

3.2.1.3. Summary

The results of the CFR 65.10 (B)(1) Freeboard analysis indicates:

[1] Current versions adopted August 12, 1999

- The EL is approximately 1.9 miles in length and meets minimum freeboard requirements, except at River Station 167+00 which is the most upstream limit of the levee.
- The base flood discharge at River Station 167+00 is only 189 cfs. Associated supercritical flow velocity at River Station 167+00 is 8.9 feet per second (supercritical HEC-RAS). Associated subcritical flow depth at River Station 167+00 is 1.1 feet (subcritical HEC-RAS).
- The EL embankment is protected by concrete lining and "Heavy Riprap 3 feet Thick" between River Stations 167+00 and 165+50. A field inspection conducted on February 18, 2009 indicated the existing rip-rap was conservative in size, was in satisfactory condition, and no evidence of embankment erosion was observed.
- According to the, CCRFCD *Hydrologic Criteria and Drainage Design Manual* (Table 703), the maximum permissible mean channel velocity for channels lined with loose riprap is 10.0 feet/second, greater than the computed supercritical velocity of the EL at River Station 167+00 (8.9 feet/second).

Based on the above freeboard discussion in Section 3.2.1, JEF recommends the Equestrian Levee for FEMA accreditation.

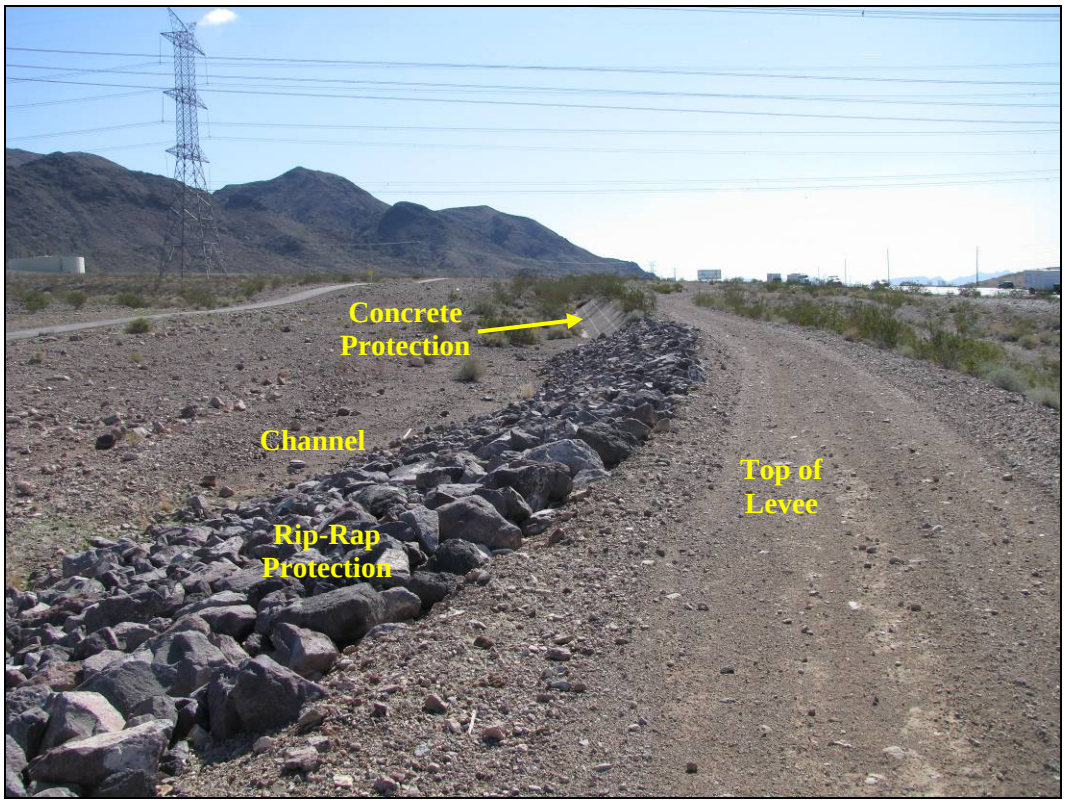


Figure 2. Bank protection. View upstream near River Station 165+50.



Figure 3. Bank protection. View downstream near River Station 165+50.

3.2.2. CFR 65.10 (B)(2) Closures

(b)(2). All openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

This requirement is not applicable to the EL.

3.2.3. CFR 65.10 (B)(3) Embankment Protection

(b)(3). Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.

The EL embankment is constructed of earthen material with concrete and riprap protection at the upstream limit. HEC-RAS model results (EquestrianLeveeChan.prj) indicate that most of the flow within the EL channel is supercritical, with flow velocities ranging between 4.6 feet/second and 12.4 feet/second (see Appendix VII). According to the CCRFCD *Hydrologic Criteria and Drainage Design Manual* (Table 703) the maximum permissible velocity for non-lined, alluvial channels is 1.50 feet/second to 6.0 feet/second; and therefore, erosion of the EL embankment is anticipated. Although embankment erosion is anticipated, based on engineering analyses and field reconnaissance, such erosion does not exclude the EL from meeting minimum freeboard criteria as outlined in 65.10. The following sub-sections discuss this point.

3.2.3.1. Embankment Design Calculations Submitted with Original LOMR Letter Report

As discussed in the original FEMA-accepted LOMR Letter Report dated December 18, 1998, the issue of embankment protection is discussed under Items #10 and #12 (pages 6 and 8 of 10, respectively). According to LOMR Item #10,

"Embankment Protection: The channel and levee are not lined, but have been designed to limit velocities to 10 FPS or less. The erosion of the levees is limited by the erosion–deposition cycle analyzed."

In addition, as discussed in the original LOMR Letter Report, a sediment transport model (HEC-6) was developed as part of the EL and EDB design to address scour and sedimentation. According to LOMR Item #12,

"The channel design is based on sediment deposition in the channel from the off- channel upstream flow areas. Potential erosion of the berms is canceled by the deposition. The two exceptions to this is between (1)

Stations 132+00 and 168+50, where the erosion is 0.16 acre feet or approximately 7000 feet^3 and (2) Stations 127+00 and 132+00 50, where the erosion is 0.92 acre feet or approximately 40,000 feet^3. The HEC-6 predicts this erosion to be along the full length of the reaches.

Reach 132+00 to 168+50 results in erosion of 1.9 feet^3 per foot of length, a negligible amount. The worst case scour in this reach is 17.5 feet near station 150+00. At this location, where the depth of flow is 4.12 feet and the channel depth is 12 feet, the channel is mostly set into the existing landform. Lateral erosion of 17.5 feet, though unlikely, will reduce the berm height by only 0.7 feet, which still provides more than the 3 foot of freeboard required. At this location, the top of the flow is also below the existing landform on the levee side of the channel.

Reach 127+00 to 132+00 results in erosion of 80 feet^3 per foot of length, not a negligible amount. The active portion of the channel at this location would approximate 67.5 feet for a depth of 1.2 feet. The worst case scour in this reach is 15.7 feet near station 132+500. At this location, where the depth of flow is 4.52 feet and the channel depth is 12 feet, the channel is mostly set into the existing landform. Lateral erosion of 15.7 feet, though unlikely, will reduce the berm height by only 0.3 feet, which still provides more than the 3 foot of freeboard required. At this location, the top of the flow is at the existing land form elevation on the levee side of the channel.

The erosion/deposition calculations appear to be the correct interpretation of the hydrologic-erosion-deposition cycle in the channel. The owning and maintaining agencies, the City of Henderson and the Regional Flood Control District, inspect these facilities on a yearly basis and after major storm events. Any major erosion or deposition is addressed by the governmental maintenance forces, which use funding provided by the Regional Flood Control District."

It should be noted that verification by JEF of the design-based, LOMR-submitted sediment transport modeling and embankment erosion estimates was attempted, but not possible, due to the lack of available documentation at the time of this EL TSDN submittal to FEMA. Therefore, JEF performed an independent analysis to determine compliance with freeboard criteria under potential bank erosion conditions (see Appendix XI). This independent analysis indicates that given the likely supercritical flow velocities within the EL channel, erosion of the EL embankment may occur; however, the loss of EL embankment from erosion alone would not result in the loss of required freeboard per 65.10 criteria. It should be stressed that this independent embankment erosion analysis was performed to evaluate freeboard alone and was not used to evaluate deficient geotechnical characteristics of the EL embankment that may occur as a result of flow-induced erosion (see Appendix VIII for geotechnical stability assessment of the embankment).

3.2.3.2. Existing Conditions Assessment of EL Embankment

Field Investigation
A general field investigation of the EL was conducted by JEF on February 18, 2009. The investigation focused on apparent, surficial levee and channel conditions that relate to potential FEMA accreditation of the EL system. Observations from the investigation indicate that the levee is in overall satisfactory condition. In addition, minor embankment deficiencies identified during the field investigation have been corrected by the COH, which includes correction of local erosion of the embankment toe. Minor erosion of this type in the future should be corrected through standard maintenance activities (see Appendix IX). Adherence to the adopted maintenance plan will help mitigate potential embankment erosion.

Independent Embankment Erosion Analysis
As discussed above, JEF conducted an independent embank erosion analysis to estimate the likelihood of a sediment deficit or surplus within the ELC at each HEC-RAS River Station. At cross-sections showing sediment deficit, the predicted maximum erosion varied from 6 feet to 30 feet. Lateral erosion estimates were based on sediment transport capacity of the HEC-RAS cross-section, sediment transport capacity of the upstream HEC-RAS cross-section, HEC-RAS reach length between subject cross-sections, levee embankment height and slope (per as-built drawings), and the angle of repose for embankment material (per geotechnical testing). Calculations for the EL embankment's predicted erosion are attached in Appendix XI.

As with any hydraulic and sediment transport analyses, the uncertainties inherent in the input data and calculations/computations require a level of safety to be incorporated into the recommendations. This need for a level of safety is also shown to be warranted given the range of estimated lateral erosion at each levee river station (see Appendix XI for erosion estimate calculations). Therefore, it is recommended that the potential for lateral erosion of the EL embankment be taken as the maximum estimated lateral erosion from the toe-of-levee for each section of levee defined by the change in typical embankment slope, as shown below in Table 5.

Table 5. Potential Erosion of Equestrian Levee Embankment

Levee Stations	Typical Embankment Slope	Predicted Maximum Erosion From Toe-of-Levee
64+00 to 70+00	5H:1V	6 feet
70+00 to 125+00	3H:1V	24 feet
125+00 to 165+00	5H:1V	30 feet
165+00 to 167+00	4H:1V	13 feet
Note: See attached supporting EL embankment erosion estimate tables in Appendix XI.		

Based on the above embankment erosion analysis, the levee embankment's predicted maximum erosion varies; however, it has been determined that if maximum erosion of the embankment were to occur, the eroded sections of levee

would still meet the freeboard criteria per 44CFR65.10, paragraph (B)(1). It should be stressed that this embankment erosion analysis was performed to evaluate freeboard alone and was not used to evaluate deficient geotechnical characteristics of the EL embankment that may occur as a result of flow-induced erosion. Therefore, it is recommended that a geotechnical analysis of the EL embankment be performed, based on the results and recommendations of this embankment erosion analysis, to determine if the EL satisfies the geotechnical criteria of 44CFR65.10, paragraph (B)(3).

The entire embankment erosion analysis report and all supporting documentation is included in Appendix XI.

Levee and Channel As-Built Condition Versus Existing Condition
A comparison of channel and levee as-built and existing condition geometries was completed using supplemental survey data. The purpose of the supplemental survey was to collect cross-section geometry at locations that approximate various LOMR HEC-RAS river station locations. The survey was conducted by PBS&J on September 8, 2009. The survey map is included in Appendix V. The graphical results of the comparison are included in Appendix VI. The comparison yielded the following results:

- No significant channel degradation or aggradation has occurred in the ELC since construction.
- No significant erosion of the EL embankment has occurred since construction.

3.2.3.3. Emergency Embankment Stabilization Funding

The CCRFCD Operations and Maintenance (O&M) Manual includes a contingency for emergency funding procedures[2] following a flood event. Operations and Maintenance of the EL is discussed in detail in section 3.4 and excerpted below:

"A principal role of the District shall be to support the member entities efforts to: (1) secure funding from state, federal, member entity reserves and private sources; and (2) facilitate required immediate repairs to regional flood control facilities without delay."

If embankment erosion of the EL were to occur during a flood event, funding would be immediately available for embankment restoration and/or protection.

3.2.3.4. Summary

The results of the CFR 65.10 (B)(3) Embankment Protection evaluation indicates:

[2] CCRFCD O&M Manual, Chapter 5: Emergency Funding Procedures, pp.5-1.

- Engineering analyses submitted in the FEMA-approved LOMR indicated that potential erosion of the embankment would be offset by sediment deposition.
- An independent EL embankment erosion analysis, as it relates to 65.10 freeboard criteria alone, was performed for this EL TSDN submittal, which shows that although embankment erosion is likely, sufficient freeboard would be maintained. This embankment erosion analysis, as it relates to freeboard, did not include any evaluation of any geotechnical deficiencies that may result from embankment erosion (see Section 3.2.4 for geotechnical stability assessment of the embankment).
- Both a field investigation and comparison of existing and as-built conditions indicate that the EL and ELC have experienced relatively minor erosion over its 14 year performance history.
- Future erosion deficiencies are to be corrected by the COH per the adopted Operation and Maintenance Manual (see Section 3.3). In addition, Clark County has available emergency funding for correcting flood-induced erosion deficiencies, with funding made available immediately if post-flood rehabilitation of the EL is required.
- Potential erosion of the Equestrian Levee due to currents, waves, wind and wave action, ice loading, and impacts of debris is not applicable.

Based on the above evaluation regarding embankment erosion, as it pertains to freeboard alone, the EL is in compliance with the embankment protection criteria per 65.10. Additional discussion regarding embankment protection is provided in the Geotechnical Summary Report located in Appendix VIII.

3.2.4. CFR 65.10 (B)(4) Embankment and Foundation Stability

(b)(4). Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers (COE) manual, ‘‘Design and Construction of Levees’’ (EM 1110–2–1913, Chapter 6, Section II), may be used. The factors that shall be addressed in the analyses include: Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).

See Geotechnical Summary Report in Appendix VIII.

3.2.5. CFR 65.10 (B)(5) Settlement

(b)(5). Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that

freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition, detailed settlement analysis using procedures such as those described in the COE manual, ''Soil Mechanics Design—Settlement Analysis'' (EM 1100–2–1904) must be submitted.

See Geotechnical Summary Report in Appendix VIII.

3.2.6. CFR 65.10 (B)(6) Interior Drainage

(b)(6). An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.

This requirement is not applicable to the EL or ELC.

3.2.7. CFR 65.10 (B)(7) Other Design Criteria

(b)(7). In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analyses be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA will also provide the rationale for requiring this additional information.

This requirement is not applicable to the EL or ELC.

3.3. CFR 65.10 (C) OPERATIONS PLANS AND CRITERIA

3.3.1. CFR 65.10 (C)(1) Closures

(c)(1). Operation plans for closures must include the following:

(c)(1)(i). Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure.

(c)(1)(ii). A formal plan of operation including specific actions and assignments of responsibility by individual name or title.

(c)(1)(iii). Provisions for periodic operation, at not less than one-year intervals, of the closure structure for testing and training purposes.

This requirement is not applicable to the EL or ELC.

3.3.2. CFR 65.10 (C)(2) Interior Drainage Systems

(c)(2). Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. These drainage

systems will be recognized by FEMA on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:

(c)(2)(i). Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system.

(c)(2)(ii). A formal plan of operation including specific actions and assignments of responsibility by individual name or title.

(c)(2)(iii). Provision for manual backup for the activation of automatic systems.

(c)(2)(iv). Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes. No more than one year shall elapse between either the inspections or the operations.

This requirement is not applicable to the EL or ELC.

3.3.3. CFR 65.10 (C)(3) Other Operation Plans and Criteria

(c)(3). Other operating plans and criteria may be required by FEMA to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be based.

See Section 3.4.

3.4. CFR 65.10 (D) MAINTENANCE PLANS AND CRITERIA

(d). For levee systems to be recognized as providing protection from the base flood, the maintenance criteria must be as described herein. Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner. All maintenance activities must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance. This plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.

The COH has officially adopted the CCRFD's Operation and Maintenance (O&M) Manual, (adopted September 9, 2010) for maintaining the EL system (Appendix IX). An annual Maintenance Work Program (MWP) and funding contract is executed early- to-mid-June, to coincide with the Fiscal Year calendar. The annual Maintenance Contract between the COH and CCRFCD lists facilities to be maintained and responsible party for maintenance activities. The adopted MWP was included in the Provisional Accredited Levee submittal to FEMA and is attached to this report in Appendix X and includes contracts between the CCRFCD and the COH showing annual maintenance for the EDB

system for Fiscal Year 2010-2011. The EL is in compliance with CFR 65.10 (D) upon COH's completion of annual scheduled maintenance and maintenance following major flood events.

3.4.1. Maintenance Jurisdiction

The CCRFCD provides Operation and Maintenance funding to the COH for the EDB system on an annual Fiscal Year schedule (see Appendix IX).

3.4.2. Maintenance Activities

3.4.2.1. Frequency

The EDB system (which includes the EL and ELC) is inspected and maintained on an annual basis and after major flood events per the MWP between the COH and the CCRFCD (see Appendix X). Annual maintenance activities include those outlined in the CCRFCD Operations and Maintenance Manual (see Appendix IX).

3.4.3. Responsible Party

The responsible party for annual maintenance of the EDB system is the following:
Robert Murnane, P.E., Director of Public Works
Albert J. Jankowiak, P.E., CFM, Project Engineer II - Public Works
City of Henderson Public Works
240 Water Street
Henderson, NV 89009

3.4.4. Summary

Given that EL will be maintained per the adopted O&M Manual as discussed above, the EL is in compliance with the maintenance plans criteria per 65.10.

4. COMPLIANCE DETERMINATION SUMMARY

The data and documentation presented in this report show that the Equestrian Levee complies with the structural requirements set forth in CFR 65.10 paragraph (b)(1) and portions of (b)(3). The report has been sealed by the professional engineer responsible for its development (refer to cover letter at the beginning of the report). The remainder of compliance requirements as set forth in CFR 65.10 are either not applicable to the Equestrian Levee, or have been assessed by others (see Table 6). The compilation, review, and assessment of all necessary levee data and documentation were performed in close coordination with CCRFCD staff and other representatives from COH. The CCRFCD has reviewed this TSDN and concurs with the compliance determination.

Table 6. CFR 65.10 compliance summary table

44 CFR 65.10 Section No.	Criteria Description	Not Applicable	Meets FEMA Criteria		Not Meeting FEMA Criteria
			Per JEF	Per Kleinfelder	
Design Criteria (b)					
(b)(1)	3-ft minimum freeboard above BFE		X*		
(b)(1)	Additional 1-ft freeboard within 100-ft of structures/constrictions		X		
(b)(1)	Additional 0.5-ft freeboard at upstream end of levee (tie-in)		X*		
(b)(2)	All openings protected with closure devices	X			
(b)(3)	Embankment erosion protection analysis		X	X**	
(b)(4)	Embankment and foundation stability analysis			X**	
(b)(5)	Settlement analysis			X**	
(b)(6)	Interior drainage analysis	X			
(b)(7)	Other design criteria and analyses (unique situations)	X			
Operation Plans and Criteria (c)					
Closures					
(c)(1)(i)	Documentation of flood warning system	X			
(c)(1)(ii)	Formal plan of operation	X			
(c)(1)(iii)	Provisions for periodic operation for testing/training (at least annual)	X			
Interior Drainage Systems					
(c)(2)(i)	Documentation of interior drainage flood warning system	X			
(c)(2)(ii)	Formal plan of operation for interior drainage	X			
(c)(2)(iii)	Provisions for manual backup for activation of automatic systems	X			
(c)(2)(iv)	Provisions for periodic operation for testing/training (at least annual)	X			
(c)(3)	Other operation plans and criteria required in specific situations	X			
Maintenance Plans and Criteria (d)					
(d)	Levee system maintained in accordance with officially adopted plan		X		
(d)	Copy of maintenance plan provided to FEMA		X		
(d)	Maintenance under jurisdiction of Federal/State/Community in NFIP		X		
(d)	Plan documents formal procedure to ensure structural integrity		X		
(d)	Plan specifies type of activities, frequency, and person responsible		X		
Certification Requirements (e)					
(e)	Certified as-built plans		X		

*Exception requested as described above in the Equestrian Levee TSDN.

**Accreditation conditional on reconstruction of the levee at the utility penetration locations and scheduled maintenance as described in the Geotechnical Summary Report.

APPENDIX I

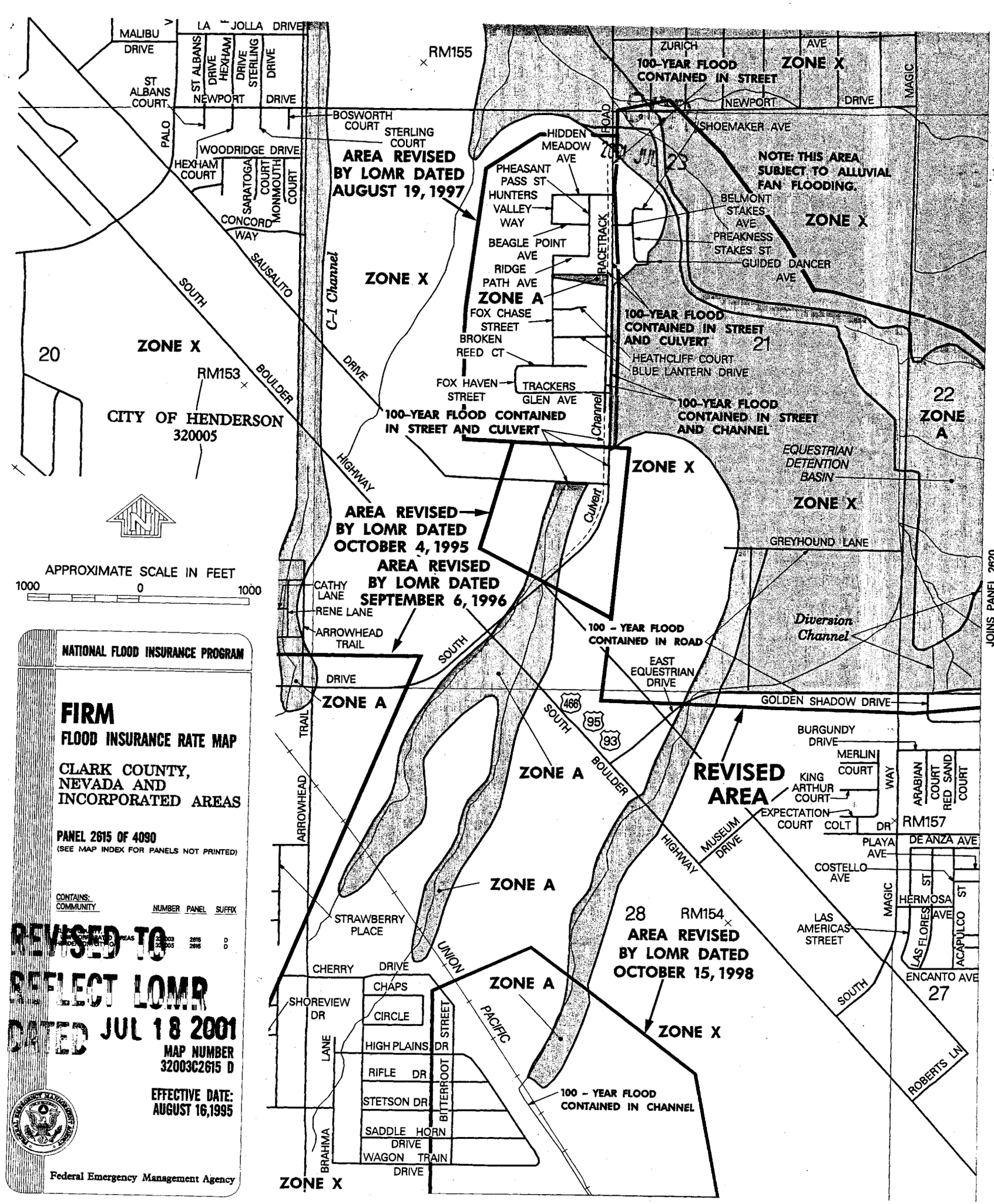
FEMA FIRMettes

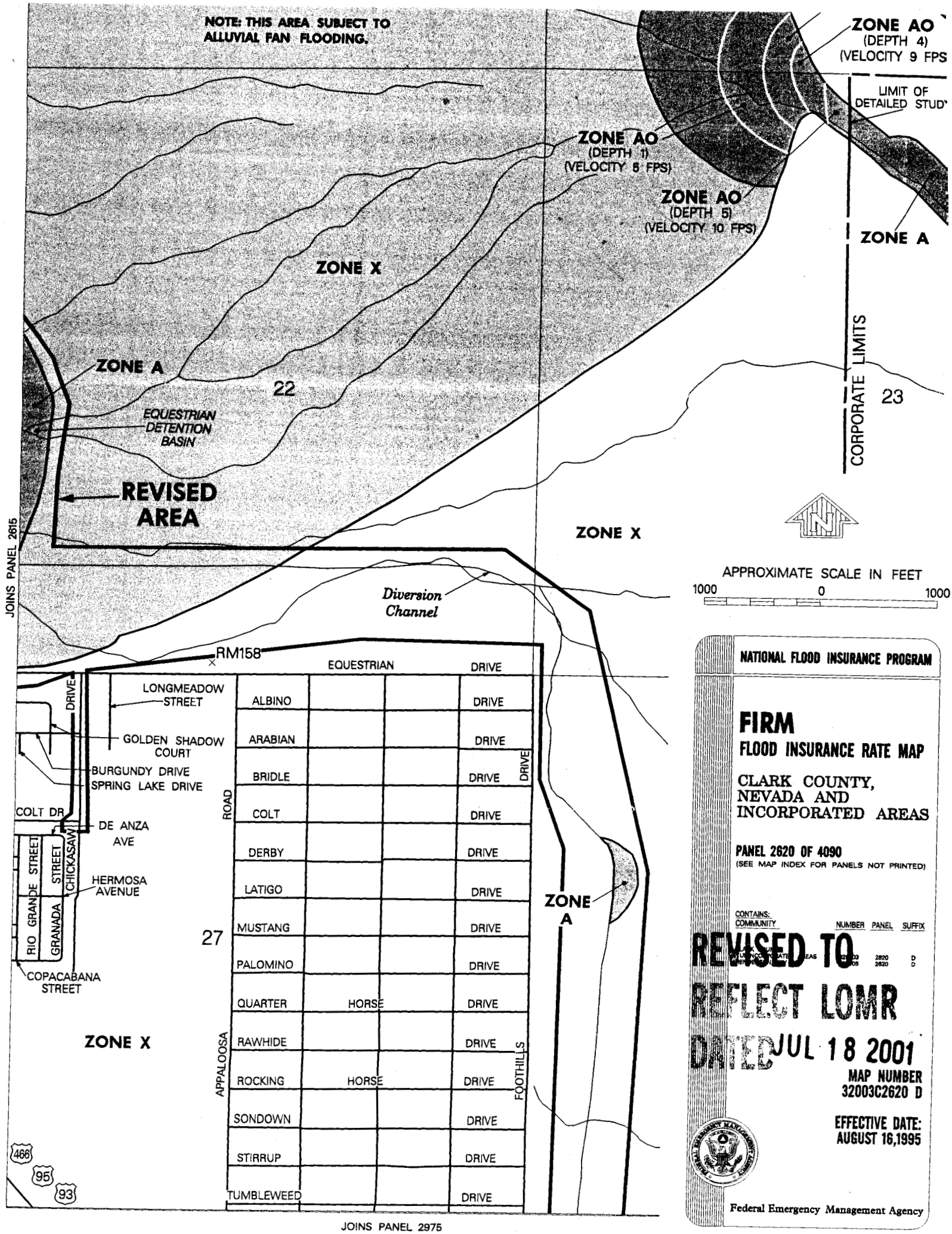
and

FEMA LOMR Acceptance Letter

and

FEMA LOMR Letter Report


LA JOLLA DRIVE
MALIBU DRIVE
ST ALBANS COURT
ST ALBANS DRIVE
HEXHAM DRIVE
STERLING DRIVE
NEWPORT DRIVE
PALO
BOSWORTH COURT
STERLING COURT
WOODRIDGE DRIVE
HEXHAM COURT
SARATOGA COURT
MONMOUTH COURT
CONCORD WAY
SAUSALITO
SOUTH BOULDER DRIVE
HIGHWAY
RM155
RM153
RM154
RM157
20
21
22
27
28
CITY OF HENDERSON
320005
ZONE X
ZONE A
C-1 Channel
AREA REVISED BY LOMR DATED AUGUST 19, 1997
ZURICH AVE
100-YEAR FLOOD CONTAINED IN STREET
NEWPORT DRIVE
MAGIC ROAD
SHOEMAKER AVE
HIDDEN MEADOW AVE
PHEASANT PASS ST
HUNTERS VALLEY WAY
BEAGLE POINT AVE
RIDGE PATH AVE
FOX CHASE STREET
BROKEN REED CT
FOX HAVEN STREET
TRACKERS GLEN AVE
RACETRACK
NOTE: THIS AREA SUBJECT TO ALLUVIAL FAN FLOODING.
BELMONT STAKES AVE
PREAKNESS STAKES ST
GUIDED DANCER AVE
100-YEAR FLOOD CONTAINED IN STREET AND CULVERT
HEATHCLIFF COURT
BLUE LANTERN DRIVE
100-YEAR FLOOD CONTAINED IN STREET AND CHANNEL
100-YEAR FLOOD CONTAINED IN STREET AND CULVERT
Channel
Culvert
EQUESTRIAN DETENTION BASIN
AREA REVISED BY LOMR DATED OCTOBER 4, 1995
AREA REVISED BY LOMR DATED SEPTEMBER 6, 1996
GREYHOUND LANE
CATHY LANE
RENE LANE
ARROWHEAD TRAIL
100 - YEAR FLOOD CONTAINED IN ROAD
Diversion Channel
EAST EQUESTRIAN DRIVE
GOLDEN SHADOW DRIVE
466
95
93
BURGUNDY DRIVE
MERLIN COURT
KING ARTHUR COURT
EXPECTATION COURT
COLT DR
ARABIAN COURT
RED SAND COURT
WAY
REVISED AREA
PLAYA AVE
DE ANZA AVE
COSTELLO AVE
MUSEUM DRIVE
HIGHWAY
MAGIC ST
HERMOSA AVE
LAS FLORES ST
ACAPULCO ST
ENCANTO AVE
LAS AMERICAS STREET
ROBERTS LN
STRAWBERRY PLACE
ARROWHEAD TRAIL
CHERRY DRIVE
CHAPS CIRCLE
SHOREVIEW DR
HIGH PLAINS DR
RIFLE DR
STETSON DR
SADDLE HORN DRIVE
WAGON TRAIN DRIVE
BRAHMA LANE
BITTERFOOT STREET
UNION PACIFIC
100 - YEAR FLOOD CONTAINED IN CHANNEL
AREA REVISED BY LOMR DATED OCTOBER 15, 1998
JOINS PANEL 2620
APPROXIMATE SCALE IN FEET
1000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS
PANEL 2615 OF 4090
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
320003 2615 D
320005 2615 D
REVISED TO REFLECT LOMR DATED JUL 18 2001
MAP NUMBER 32003C2615 D
EFFECTIVE DATE: AUGUST 16,1995
Federal Emergency Management Agency



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 2620 OF 4090

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
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[illegible]	2620		D

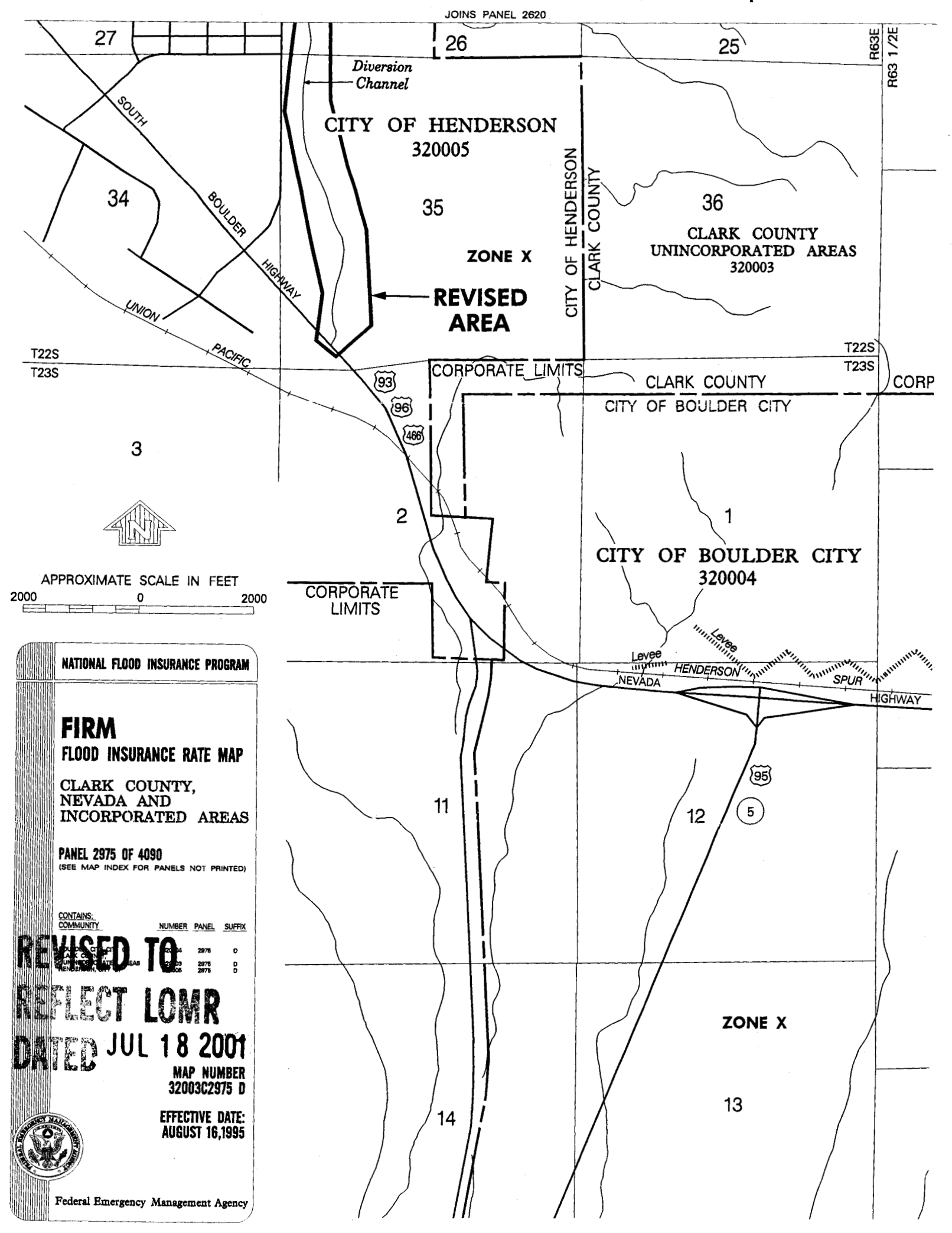
REVISED TO REFLECT LOMR

DATE JUL 18 2001

MAP NUMBER 32003C2620 D

EFFECTIVE DATE: AUGUST 16,1995

Federal Emergency Management Agency



NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 2975 OF 4090

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
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[illegible]	[illegible]	2975	D
HENDERSON, CITY OF	320005	2975	D

REVISED TO REFLECT LOMR DATED JUL 18 2001

MAP NUMBER
32003C2975 D

EFFECTIVE DATE:
AUGUST 16,1995

Federal Emergency Management Agency

Federal Emergency Management Agency
Washington, D.C. 20472

CCRFED
2001 JUL 23 PM 2:35

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 99-09-623P

The Honorable James Gibson
Mayor, City of Henderson
240 South Water Street
Henderson, NV 89015

Community: City of Henderson, NV
Community No.: 320005
Panels Affected: 32003C2615 D, 2620 D, and 2975 D
Effective Date of This Revision: JUL 18 2001

102-I-C

Dear Mayor Gibson:

This responds to a request that the Federal Emergency Management Agency (FEMA) revise the effective Flood Insurance Rate Map (FIRM) for Clark County, Nevada and Incorporated Areas (the effective FIRM for your community), in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated March 18, 1999, Mr. Stephen L. Weatherman, P.E., Chief Flood Control Engineer, Poggemeyer Design Group, Inc., requested that FEMA revise the FIRM to show the effects of construction of the Equestrian Detention Basin (EDB) and a diversion channel that intercepts runoff from drainage areas to the north and east of the EDB. This request follows up on a Conditional Letter of Map Revision issued on February 19, 1997.

All data required to complete our review of this request were submitted with letters from Mr. Weatherman.

We have completed our review of the submitted data and the flood data shown on the effective FIRM. We have revised the FIRM to modify the floodplain boundary delineations and zone designations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) along an unnamed tributary to C-1 Channel from Newport Drive to East Horizon Drive. As a result of the modifications, the width of the Special Flood Hazard Area (SFHA), the area that would be inundated by the base flood, for the unnamed tributary increased in some areas and decreased in other areas. The modifications are shown on the enclosed annotated copies of FIRM Panels 32003C2615 D, 32003C2620 D, and 32003C2975 D. This Letter of Map Revision (LOMR) hereby revises the above-referenced panels of the effective FIRM dated August 16, 1995.

The modifications are effective as of the date shown above. The map panels as listed above and as modified by this letter will be used for all flood insurance policies and renewals issued for your community.

A review of the determination made by this LOMR and any requests to alter this determination should be made within 30 days. Any request to alter the determination must be based on scientific or technical data.

We are preparing a revised FIRM and Flood Insurance Study (FIS) report for Clark County; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the revised FIRM and FIS

report will be distributed for review in approximately 4 months. We will incorporate the modifications made by this LOMR into the Preliminary copies of the revised FIRM before it is distributed, and the modifications will be included when the revised FIRM become effective.

This LOMR is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the SFHA. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

The basis of this LOMR is, in whole or in part, a channel-modification project. NFIP regulations, as cited in Paragraph 60.3(b)(7), require that communities ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management regulations. Consequently, the ultimate responsibility for maintenance of the modified channel rests with your community.

Because this LOMR will not be printed and distributed to primary users, such as local insurance agents and mortgage lenders, your community will serve as a repository for these new data. We encourage you to disseminate the information reflected by this LOMR throughout the community, so that interested persons, such as property owners, local insurance agents, and mortgage lenders, may benefit from the information. We also encourage you to prepare a related article for publication in your community's local newspaper. This article should describe the changes that have been made and the assistance that officials of your community will give to interested persons by providing these data and interpreting the NFIP maps.

This determination has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and is in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed minimum NFIP criteria. These criteria are the minimum and do not supersede any State or local requirements of a more stringent nature. This includes adoption of the effective FIRM to which the regulations apply and the modifications made by this LOMR. Our records show that your community has met this requirement.

A Consultation Coordination Officer (CCO) has been designated to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Jack Eldridge
Chief, Community Mitigation Programs Branch
Federal Emergency Management Agency, Region IX
The Presidio of San Francisco, Building 105
San Francisco, CA 94129-1250
(415) 923-7184

If you have any questions regarding floodplain management regulations for your community or the NFIP in general, please call the CCO for your community at the telephone number cited above. If you have any questions regarding this LOMR, please call our Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

Sincerely,

Max H. Yuan, P.E., Project Engineer
Hazards Study Branch
Hazard Mapping Division

For: Matthew B. Miller, P.E., Chief
Hazards Study Branch
Hazard Mapping Division

Enclosures

cc: Mr. Curt Chandler, P.E.
Land Development Manager
Department of Public Works
City of Henderson

Mr. Kevin L. Eubanks, P.E.
Assistant General Manager
Clark County Regional Flood
Control District

Mr. Stephen L. Weatherman, P.E.
Chief Flood Control Engineer
Poggemeyer Design Group, Inc.

DRAINAGE STUDY INFORMATION FORM

Name of Development: EQUESTRIAN DENTATION BASIN LOMR Date: 21-Dec-98

Location of Development: a) Descriptive Southwest corner of Cameron St. and Reno St.
b) Sect. 23,24, 25,35 Twn. 22 S Rng. 63 E

Name of Owner: City of Henderson Assessors Parcel No: N\A

Contact Person-Name: Stephen L. Weatherman P.E. Telephone No: (702) 255-8100

Firm: POGGEMEYER DESIGN GROUP, INC.

Address: 2601 North Tenaya Way - Las Vegas, Nevada 89128

Type of Land Development/Land Disturbance Process:

- ☐ Rezoning
- ☐ Parcel Map
- ☐ Large Parcel Map
- ☐ Subdivision Map
- ☐ Planned Unit Development
- ☐ Building Permit
- ☐ Clearing and Grading Only
- ☒ Other (Please specify below) LOMR

1. Total Owned Land Area: At Site: 77 Acres Being Developed/Disturbed: 77 Acres

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? (YES*) NO

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? (YES*) NO

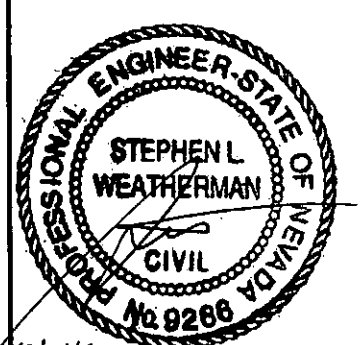
4. Proposed type of development (Residential, Commercial, Etc.)? DETENTION BASIN

5. Approximate upstream land area which drains to the subject site? 9.75 SM

6. Has the site drainage been evaluated in the past? (YES) NO If yes, please identify documentation:

7. If known, please briefly identify the proposed discharge points(s) of runoff from the site:
Discharge towared C1 Channel

8. Briefly describe your proposed schedule for the subject project: Construction complete



12/21/98 Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

* Review and concurrence of the Clark County Regional flood Control District is required.

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

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Basin Design 7.47 SM
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Unlined Channel Scour Calculations
Scour Sections
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Basin Section Map
BOULDER HIGHWAY CULVERTS ..... Appendix J
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Culvert As Built Map
Culvert Calculations
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LEVEE CONSTRUCTION SPECIFICATIONS ..... Appendix L
WAGON WHEEL INTERCHANGE ..... Appendix M
EAST C1 DETENTION BASIN DESIGN MANUAL ..... Appendix N
EQUESTRIAN DRIVE DRAINAGE STUDY AND PLANS ..... Appendix O
EQUESTRIAN DETENTION BASIN RECORD DRAWINGS ..... Appendix P
REFERENCE LOMR's & CLOMR's ..... Appendix Q
CD WITH ALL CALCULATIONS ..... Appendix R

LETTER REPORT

INTRODUCTION

This submission is in response to the comments received concerning Case No. 96-09-943R for the Equestrian Detention Basin (EDB). The EDB was constructed by the City of Henderson through funding from the Clark County Regional Flood Control District. The project was designed by Poggemeyer Design Group, who also performed construction management for the basin.

On July 1, 1996, VTN Nevada submitted a CLOMR request for the basin as a consultant to the City of Henderson. VTN submitted Forms 1, 2, 3, 4, 5, 6, and 11. Also included was a proposed FIRM Map, the Design Memorandum for the EDB, and the Supplemental Design Calculations for the EDB. FEMA issued a CLOMR on February 19, 1997 with the conditions and comments as outlined in your letter of February 19, 1997. Poggemeyer Design Group (PDG) is responding to the comments with additional supporting information as a consultant for the City of Henderson.

PROJECT SUMMARY

The EDB is part of an overall regional flood control system as shown in the Clark County Regional Flood Control Master Plan. The EDB is designed to only collect the flows from the east or north side of the Boulder Highway in the ultimate condition. A future channel, on the west side of the Boulder Highway, north of the Wagon Wheel Interchange, is proposed to convey all flow west of Boulder Highway to the C1 channel. This channel is located approximately 4,000 feet north of the Wagon Wheel Interchange. The project is also designed to only collect the flows south of the "under construction" East C1 detention basin.

The interim conditions as described in the Design Memorandum and Supplemental Design Calculations for the EDB, included areas west of the Boulder Highway contributing to the basin inflow. Also included is a portion of the fan flow from the East C1 Detention Basin upstream area (C4C). The EDB's spillway was designed to pass the flows from west of the Boulder Highway and the flow from the East C1 area (C4C). The two HEC-1 evaluations were not linked and were evaluated separately.

This submission includes two HEC-1 evaluations. The first is an overall HEC-1 that includes areas west of the Boulder Highway and the area west of the "Under Construction" East C-1 Detention Basin. It does not include Basin C4C. This HEC-1 is a combination of the original EDB evaluation and the LOMR application/approval for Heritage II 97-09-105P. The run also includes as-built information concerning the EDB collection channel, new drop inlets at the Magic Way and Equestrian intersection, and the culverts under the Boulder Highway. This HEC-1 has an area of 9.75 square miles when the C4C basin is removed; an SDN of 5 was used to approximate the 97-09-105P LOMR.

The second HEC-1 is ultimate conditions with only one culvert crossing the Boulder Highway contributing flow to the basins. This area is 7.47 square miles, and an SDN of 3 was used. The evaluation matches the original design calculations, but includes as-built information, and new drop inlets at the Magic Way and Equestrian intersection. This flow was assumed to be the worst case conditions and was used to evaluate the eastern collection channel for sediment collection, erosion, and flow rate. A sub-critical HEC-RAS run was used to evaluate the unlined portions of the collection channel.

Overall sediment transport was covered in the EDB Design Memorandum and Supplemental Design Calculations. These calculations clearly indicated that there was deposition in the collection channel in the unlined portions. We have evaluated the possible scour and have compared it to the expected deposition. The sediment deposition in the basin was evaluated by determining the velocity of flow toward the outlet as the flow entered the detention basin. The deposition location was determined by sections across the basin using HEC-1 time steps, flow rates, and sediment transport data.

The outfall conditions were evaluated using aerial photography and topography obtained for the project. The new topography clearly identifies the location of the outlet flow path and its relationship to the existing housing on both sides of the flow path. A HEC-RAS was developed to analyze the flow conditions downstream from the basin low flow outlet. The width of impact is shown on the mapping, as is the depth of flow at each section. The velocity is 8.4 FPS maximum and averaging under 5 FPS, which has limited erosion potential. The existing flow path is under-laid by caliche, which has been exposed at several locations and also limits the potential for erosion.

1. *Detailed application and certification forms, which were used in processing this request, must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Revision Requester and Community Official Form," and Form 2, entitled "Certification by Registered Professional Engineer and/or Land Surveyor," must be included. (Copies of these forms are enclosed.)*

   Application and certification forms have been completed and are submitted with this addendum. Note that the original Consultant Submitter, VTN, has been replaced with Poggemeyer Design Group, Inc. All of the submitted information has been developed under the supervision of a Nevada-licensed Engineer. This is while preparing the original design notebooks for the Equestrian Detention Basin, the construction phase of the project, and the additional information and calculations submitted in support of this addendum.

2. *The detailed application and certification forms listed below may be required if as-built conditions differ from the preliminary plans. If required, please submit new forms (copies of which are enclosed) or annotated copies of the previously submitted forms showing the revised information.*

   Form 3, entitled "Hydrologic Analysis Form"

   Form 4, entitled "Riverine Hydraulic Analysis Form"

   Form 5, entitled "Riverine/Coastal Mapping Form"

   Form 6, entitled "Channelization Form"

   Form 11, entitled "Dam Form"

   Hydraulic analyses for as-built conditions, of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood), and the flood having a 0.2-percent chance of being equaled or exceeded in any given year, must be submitted with Form 4, and a topographic work map showing the revised floodplain boundaries must be submitted with Form 5.

   The above forms have been completed, including the required supporting information. An overall HEC-1 has been prepared providing a hydraulic analysis for as-built conditions of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood). These HEC-1's are located in Appendix B. Topographic work maps have been provided in Appendices B and G.

3. *Effective October 1, 1996, FEMA revised the fee schedule for reviewing and processing requests for modifications to published flood information and maps. Under this schedule, FEMA established flat review and processing fees for most types of requests. All requests dated October 1, 1996, or later will be processed under this new schedule. The fee for your map revision request will be $2,300 and must be received before we can begin processing your request. Payment of this fee shall be made in the form of a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card. The payment must be forwarded to the following address:*

   Federal Emergency Management Agency
   Fee-Collection System Administrator
   P.O. Box 3173
   Merrifield, VA 22116-3173

   The required fee is being submitted by the City of Henderson.

4. *As-built plans, certified by a registered professional engineer, of all proposed project elements.*

   As-built plans, certified by a registered professional engineer, of all proposed project elements are included in this submission and are included in the following Appendices:

Equestrian Detention Basin Record Drawings	Appendix P
Wagon Wheel Interchange As-Built Drawings	Appendix M
Equestrian & Magic Way Drop Inlets	Appendix E

5. *Community acknowledgement of the map revision request.*

   Community acknowledgment of the map revision request is provided from the City of Henderson and the Clark County Regional Flood Control District. See Appendix C.

6. *An officially adopted maintenance and operation plan for the EDB and the diversion channel. This plan, which may be in the form of a written statement from the community Chief Executive Officer, an ordinance, or other legislation, must describe the nature of the maintenance activities, the frequency with which they will be performed, and the title of the local community official who will be responsible for ensuring that the maintenance activities are accomplished.*

   The officially adopted maintenance and operation plan for the Equestrian Detention Basin and diversion channel is included with this submission. See Appendix D.

7. *The submittal included the following five HEC-1 computer models of the base flood discharge entering the detention basin from contributory drainage basins north of South Boulder Highway and east of South Magic Way: "100-Year Design Model," dated April 6, 1994, and 100-Year HEC-1 Model Including Sub-basin C4C," dated April 13, 1994, both prepared by Poggemeyer Design Group, Inc., and "100-Year Clearwater Inflow, 5 Minute Interval, Inflow Hydrograph, Unmodified Volume," "100-Year Clearwater Inflow, 5-Minute Interval, Modified Volume," and "100-Year Clearwater Inflow, 7-Minute Interval, Modified Volume," all prepared by Poggemeyer Design Group, Inc., and dated October 4, 1995.*

   In addition, the undated report included with this submittal, entitled "Supplemental Design Calculations for The Equestrian Detention Basin," prepared by Poggemeyer Design Group, Inc., included a HEC-1 model, entitled "Runoff Evaluation for Flow Interception at Equestrian Drive," dated October 5, 1994, which analyzed the discharge entering the EDB at the Magic Way inlet.

It is unclear from the submitted hydrologic models how much discharge will flow west along East Equestrian Drive to South Magic Way during the base flood. It is also unclear what effect, if any, the discharge entering the basin at the Magic Way inlet will have on the detention basin outflow. Please submit a single hydrologic analysis which includes all drainage basins contributory to the EDB. Please also submit a topographic map showing the contributing watershed and delineations of all drainage basins used in the hydrologic model.

A single overall HEC-1 analysis is located in Appendix B. The HEC-1 incorporates all areas that contribute to the collection channel, the basin, and the flows crossing the Boulder Highway and concentrating at the inlets at the Equestrian and Magic Way intersection. The HEC-1 does not include flows from offsite Basin C4C. This area contributes to the new under-construction East C1 detention basin. The outfall from the basin is directed north in the new under-construction levee. The design notebook for the basin and levee are included under Appendix N.

The HEC-1 also indicates the flows continuing south in Magic Way toward the north. These flows combine with the flows from Wellington Manor (Basin OFF-24) directly west of the EDB. These flows then leave Magic Way near Greyhound Lane and travel southwest as they do in the existing condition. Please see Appendix B for the overall Basin Map.

8. *The HEC-1 model entitled "Runoff Evaluation for Flow Interception at Equestrian Drive" included several diversions of flow to the north across South Boulder Highway. Please submit analyses of all culvert and weir flows to the north across South Boulder Highway included in the hydrologic analysis requested in Item 7. Please also submit as-built plans, certified by a registered professional engineer, for all reaches of South Boulder Highway and culverts included in the model. The as-built culvert plans should include, at a minimum, inlet and outlet elevations, culvert lengths, slopes, and entrance geometries.*

   The information submitted in support of the Boulder Highway System is included in Appendices J and M. This information includes a reference study for the Wagon Wheel interchange, as-built plans from Nevada DOT for the Wagon Wheel interchange, and field survey of the other existing culverts used in the overall HEC-1 analysis.

9. *The report entitled "Supplemental Design Calculations for The Equestrian Detention Basin" stated that a peak flow of 850 cubic feet per second will be conveyed in an earthen channel along the east side of South Magic Way to the Magic Way inlet. The report further stated that this channel has been constructed as part of the Wellington Manor development. Please submit a hydraulic analysis of the flow in the earthen channel, as-built channel plans certified by a registered professional engineer, and a topographic map showing revised floodplain*

boundary delineations. The revised floodplain boundary delineations must tie into those shown on the effective FIRM at the upstream and downstream ends of the revised reach. The scale and topographic definition of the map must be sufficient to provide reasonable accuracy, and the map must be certified by a registered professional engineer.

This component of the system was not constructed as planned. The earthen channel was not constructed to collect and convey the flow to the Equestrian and Magic Way intersections. Both Magic Way and Equestrian Drive have been constructed as full curb and gutter roadways and collect the flow from the Boulder Highway crossings. This flow is now collected in catch basins at the intersection and crossroad vane grate inlets. The overall HEC-1 incorporates these features. The as-built plans and drainage calculations for the catch basins are included in Appendices E and O.

10. *The plans entitled "Equestrian Detention Basin, Contract No. 95-96-02" show a berm along the west side of the proposed diversion channel. Before we can revise the FIRM based on the effects of this proposed berm, we must receive documentation that demonstrates the berm meets the requirements of Section 65.10 of the NFIP regulations. If the berm is not designed to provide protection from the base flood for property west of the channel, please revise the hydrologic analysis requested in Item 7 and submit hydraulic analyses of the westward flow with and without the proposed berm. Also, please submit a topographic map, as described in Item 9, showing revised floodplain boundary delineations.*

The berm noted above is designed to meet the requirements of 65.10 of the NFIP regulations.

Freeboard: The berm is designed to provide a minimum of 3 feet of freeboard. This includes all areas subject to sediment deposition. The only exception to this is at the very beginning of the channel where the total flow being collected is 189 CFS and the basin contributing to this location is only 0.185 square miles.

Closures: None

Embankment Protection: The channel and levee are not lined, but have been designed to limit velocities to 10 FPS or less. The erosion of the levees is limited by the erosion-deposition cycle analyzed. See additional information in Item 12 below.

Embankment and Foundation Stability: The levees have been designed according to the requirements of Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual. The maximum slope of the water side of the levee is 3 horizontal to 1 vertical. On the downstream side of the levee the slope is

8 horizontal to 1 vertical. The levee is constructed on in-place soils compacted to 90% maximum density. The levee was constructed by benching into the native soil with 2 feet tall benches and the soil placed for compaction was no more than 8" thick.

The soil report is included in this submission in Appendix K, and to paraphrase the report. Slopes of 3:1 constructed per the construction specification having a factor of safety greater than 2. Under rapid draw down, the factor of safety is greater than 1.5. The permeability of the soil mass was estimated as 0.00002 cm per second, or 6.1 X 10^{-7} feet per second. The maximum time that the levee will retain water is 19.4 hours, which will allow the levee to be penetrated by 1.4 cm.

Settlement: The existing soils are thick, dense alluvial beds and the settlement of the levee is expected to be 0.25% for the levee (1/3 inch), and ½ inch due to the foundation.

Interior Drainage: The drainage of the area behind the levee drains directly to the detention basin in the collection channel. No flow is detained or ponded.

Operation Plans and Criteria & Maintenance Plans and Criteria: The City of Henderson and the Regional Flood Control District operate and maintain the channel and levee. The operation and maintenance manual is included in Appendix D.

11. *The request included a WSPG hydraulic computer model of flow in the EDB diversion channel, entitled "Equestrian Detention Basin, Model Headwater to Basin, Typical Channel Sections Used," prepared by Poggemeyer Design Group, Inc., dated July 10, 1995. A comparison of this model to the plans entitled "Equestrian Detention Basin, Contract No. 95-96*02," indicates that a number of the typical channel sections used in the WSPG model are not representative of the proposed channel geometry. Please submit a revised hydraulic model based on representative as-built channel sections. We note that many of the computed water-surface elevations in the WSPG model are based on supercritical flow. FEMA accepts supercritical hydraulic models in concrete-lined, engineered channels only. Because the upstream reach of the proposed diversion channel will be unlined, the hydraulic analysis for this portion of the channel must be based on sub-critical modeling. Critical depth is the minimum depth that can be used to map the base floodplain in the channel.*

The channel has been designed to operate in super-critical mode, but we understand the requirement noted above. A revised analysis of the unlined portion of the channel has been prepared using HEC-RAS with a sub-critical model. (See Appendix F.)

12. *The WSPG model mentioned in Item 11 indicates velocities within the diversion channel as high as 27.71 feet per second. Please provide documentation, including typical cross sections and calculations, demonstrating that erosion of the unlined portion of the east channel bank and erosion of the proposed berms will not occur.*

The channel design is based on sediment deposition in the channel from the off-channel upstream flow areas. Potential erosion of the berms is canceled by the deposition. The two exceptions to this is between (1) Stations 132+00 and 168+50, where the erosion is 0.16 acre feet or approximately 7000 ft^3 and (2) Stations 127+00 and 132+00 50, where the erosion is 0.92 acre feet or approximately 40,000 ft^3. The HEC-6 predicts this erosion to be along the full length of the reaches.

Reach 132+00 to 168+50 results in erosion of 1.9 ft^3 per foot of length, a negligible amount. The worst case scour in this reach is 17.5 feet near station 150+00. At this location, where the depth of flow is 4.12 feet and the channel depth is 12 feet, the channel is mostly set into the existing landform. Lateral erosion of 17.5 feet, though unlikely, will reduce the berm height by only 0.7 feet, which still provides more than the 3 foot of freeboard required. At this location, the top of the flow is also below the existing landform on the levee side of the channel.

Reach 127+00 to 132+00 results in erosion of 80 ft^3 per foot of length, **not** a negligible amount. The active portion of the channel at this location would approximate 67.5 feet for a depth of 1.2 feet. The worst case scour in this reach is 15.7 feet near station 132+500. At this location, where the depth of flow is 4.52 feet and the channel depth is 12 feet, the channel is mostly set into the existing landform. Lateral erosion of 15.7 feet, though unlikely, will reduce the berm height by only 0.3 feet, which still provides more than the 3 foot of freeboard required. At this location, the top of the flow is at the existing land form elevation on the levee side of the channel.

The erosion/deposition calculations appear to be the correct interpretation of the hydrologic-erosion-deposition cycle in the channel. The owning and maintaining agencies, the City of Henderson and the Regional Flood Control District, inspect these facilities on a yearly basis and after major storm events. Any major erosion or deposition is addressed by the governmental maintenance forces, which use funding provided by the Regional Flood Control District. The calculations are provided in Appendix H.

13. *Please submit documentation demonstrating that all water and sediment flows to the west along the north side of South Boulder Highway will enter the diversion channel at its south end. If all flow will not enter the diversion channel, but will instead continue westward, please revise the hydrologic analysis requested in Item*

7 to account for this additional flow. Please submit as-built plans, certified by a registered professional engineer, of the existing berm along South Boulder Highway shown on Sheet CI-10 of the channel plans.

The basin map and overall HEC-1 have been revised based on field verification, as-builts, and new flow pathways. The area contributing to the channel has been revised slightly. The field verified and certified as-built of the existing channel are included in Appendix H.

14. *Please submit documentation demonstrating that sediment or debris will not obstruct the detention basin outlet works and that sediment deposition in the EDB will not affect the detention basin outflow rate. If sediment deposition will affect the detention basin outflow rate, please submit an analysis of the effects of this deposition. The effects of sediment deposition over time on the storage capacity and outflow rate of a detention basin should also be addressed in the maintenance and operation plan mentioned in Item 6.*

A spreadsheet analysis is included with this submission in Appendix I. The spreadsheet evaluates the incoming flow rate, the incoming sediment transport, stage of storage in the basins, and flow velocity and deposition location based on velocity. The evaluation is based on 7-minute increments obtained from the HEC-1 evaluation of the basin sediment flow. See previous Supplemental Design Calculations for EDB.

The majority of the sands and gravels drop out at the upstream end of the basin. Some of the sands and much of the silts appear to remain in suspension and exit the basin through the low flow outlet. Some of these may deposit at the downstream end of the basin. The outlet of the basin will not be blocked because any of the small diameter fractions of sediment settling near the outlet will be conveyed out of the basin by virtue of the velocity of the flow in the area of the outlet. Those too large to be moved by this velocity will have been deposited upstream of the outlet as the particles enter the basin.

15. *Please submit documentation demonstrating that outflow from the detention basin will not create a Special Flood Hazard Area (SFHA), the area that would be inundated by the base flood, immediately downstream of the EDB, or submit a hydraulic analysis of the area downstream of the detention basin and a topographic map showing revised base floodplain delineations, as described in Item 9.*

A topographic map and HEC-RAS are included in this submission. The HEC-RAS indicates that the outlet flows are more than 1 foot deep for the first 924 feet where the flow widens and the depth is less than 1 foot deep. The flow pathway is an

existing wash that has been substantially modified by several residential projects. The flow pathway widens and narrows as it flows downstream.

16. *Please submit documentation demonstrating that the release of clearwater from the EDB will not result in scouring or head cutting of the downstream unnamed wash.*

The outfall conditions were evaluated using aerial photography and topography obtained for the project. The new topography clearly identifies the location of the outlet flow path and its relationship to the existing housing on both sides of the flow path. A HEC-RAS was developed to analyze the flow conditions downstream from the basin low flow outlet. The outlet is grouted riprap lined and discharges into an existing wash that meanders between two housing developments before discharging toward the existing C1 Channel. The width of impact is shown on the mapping, as is the depth of flow at each section. The velocity is 8.4 FPS maximum and averaging under 5 FPS, which has limited erosion potential. The existing flow path is under-laid by caliche, which has been exposed at several locations, which also limits the potential for erosion.

17. *Please submit a computer diskette containing the input and output files for all computer models used in your hydrologic, hydraulic, and sediment analyses.*

A recordable Compact Diskette has been prepared and is enclosed with this submission under Appendix Q.

APPENDIX A

FORMS

Form 1 ..... Revision Requestor and Community Official Form

Form 2 ..... Certification by Registered Professional Engineer and/or Land Surveyor Form

Form 3 ..... Hydrologic Analysis Form

Form 4 ..... Riverine Hydraulic Analysis Form

Form 5 ..... Riverine/Coastal Mapping Form

Form 6 ..... Channelization Form

Form 11 ..... Dam Form

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM**	*FEMA USE ONLY*	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. OVERVIEW

1. The basis for this revision request is (are): *(check all that apply)*
   - [X] Physical change
     - [X] Existing
     - [ ] Proposed
   - [ ] Improved methodology
   - [ ] Improved data
   - [ ] Floodway revision
   - [X] Other Completed Detention Basin

   Explain _____

2. Flooding Source: Unnamed Wash
3. Project Name/Identifier: Equestrian Detention Basin
4. FEMA zone designations affected: A

   (example: A, AH, AO, A1-A30, A99, AE, V, V1-30, VE, B, C, D, X)

5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	County	State	Map No.	Panel No.	Effective Date
EX: 480301	Katy,City	Harris, Fort Bend	TX	480301	0005D	02/08/83
480287	Harris County	Harris	TX	48201C	0220G	09/28/90
32005	City of Henderson	Clark	NV	32003C	2620D	08/16/95
32005	City of Henderson	Clark	NV	32003C	2615D	08/16/95

6. The area of revision encompasses the following types of flooding, structures, and associated disciplines: *(check all that apply)*

Types of Flooding	Structures	Disciplines*
[X] Riverine	[X] Channelization	[X] Water Resources
[ ] Coastal	[ ] Levee/Floodwall	[X] Hydrology
[ ] Alluvial Fan	[ ] Bridge/Culvert	[X] Hydraulics
[ ] Shallow Flooding *(e.g. Zones AO and AH)*	[X] Dam	[X] Sediment Transport
[ ] Lakes	[ ] Coastal	[ ] Interior Drainage
Affected by wind/wave action	[ ] Fill	[ ] Structural
[ ] Yes	[ ] Pump Station	[ ] Geotechnical
[ ] No	[ ] None	[ ] Land Surveying
	[ ] Channel Relocation	[ ] Other *(describe)*
	[ ] Excavation	
	[ ] Other *(describe)*	

[ ] Other(describe) _____ _____ _____

*** Attach completed "Certification by Registered Professional Engineer and/or Land Surveyor" Form for each discipline checked. (Form 2)**

2. FLOODWAY INFORMATION

7. Does the affected flooding source have a floodway designated on the effective FIRM or FBFM? [ ] Yes [X] No
8. Does the revised floodway delineation differ from that shown on the effective FIRM or FBFM [ ] Yes [X] No

   If yes, give reason: _____

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

Attach copy of either a public notice distributed by the community stating the community's intent to revise the floodway or a statement by the community that it has notified all affected property owners and affected adjacent jurisdictions.

9. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP? ☐ Yes ☒ No

If yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

3. PROPOSED ENCROACHMENTS

10. With floodways:

    a. Does the revision request involve fill, new construction, substantial improvement, or other development in the floodway? ☐ Yes ☐ No

    b. If yes, does the development cause the 100-year water surface elevation to increase at any location by more than 0.000 feet? ☐ Yes ☐ No

11. Without floodways:

    a. Does the revision request involve fill, new construction, substantial improvement, or other development in the 100-year floodplain? ☒ Yes ☐ No

    b. If yes, does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the 100-year water surface elevation to increase at any location by more than one foot (*or other surcharge limit if community or state has adopted more stringent criteria*)? ☐ Yes ☒ No

If the answer to either Items 10b or 11b is yes, please provide documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

4. REVISION REQUESTOR ACKNOWLEDGMENT

12. Having read NFIP Regulations, 44 CFR Ch. I, parts 59, 60, 61, and 72, I believe that the proposed revision ☐ is ☐ is not in compliance with the requirements of the aforementioned NFIP Regulations.

5. COMMUNITY OFFICIAL ACKNOWLEDGMENT

13. Was this revision request reviewed by the community for compliance with the community's adopted floodplain management ordinances? ☒ Yes ☐ No

14. Does this revision request have the endorsement of the community? ☒ Yes ☐ No

If no to either of the above questions, please explain: _____

Please note that community acknowledgment and /or notification is required for all requests as outlined in Paragraph 65.4(b) of the NFIP Regulations.

6. OPERATION AND MAINTENANCE

15. Does the physical change involve a flood control structure (e.g., levees, floodwalls, channelization, basins, dams)? ☒ Yes ☐ No

If yes, please provide the following information for each of the new flood control structures:

A. Inspection of the flood control project will be conducted periodically by City of Henderson (entity) _____ with a maximum interval of 12 months between inspections.

B. Based on the results of scheduled periodic inspections, appropriate maintenance of the flood control facilities will be conducted by _____ (entity) to ensure the integrity and degree of flood protection of the structure.

C. A formal plan of operation, including documentation of the flood warning system, specific actions and assignments of responsibility by individual name or title, and provisions for testing the plan at intervals not less than 1 year, ☐ has ☐ has not been prepared for the flood control structure.

D. The community is willing to assume responsibility for ☒ performing ☐ overseeing compliance with the maintenance and operation plans of the Equestrian Detention Basin (Name)

flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal Government.

Attach operation and maintenance plans

7. REQUESTED RESPONSE FROM FEMA

16. After examining the pertinent NFIP regulations and reviewing the document entitled "Appeals, Revisions, and Amendments to National Flood Insurance Program Maps, A Guide for Community Officials," dated December 1993, this request is for a:

_____a.	CLOMR	A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision *(LOMR or PMR)*, or proposed hydrology changes *(see 44 CFR Ch. I, Parts 60, 65, and 72)*.
XX b.	LOMR	A letter from FEMA officially revising the current NFIP map to show changes to floodplains, floodways, or flood elevations. LOMRs typically depict decreased flood hazards. *(See 44 CFR Ch. I Parts 60 and 65.)*
_____c.	PMR	A reprinted NFIP map incorporating changes to floodplains, floodways, or flood elevations. Because of the time and cost involved to change, reprint, and redistribute an NFIP map, a PMR is usually processed when a revision reflects increased flood hazards or large-scope changes. *(See 44 CFR Ch. I, Parts 60 and 65.)*
_____d.	Other:	Describe_____

8. FORMS INCLUDED

17. Form 2 entitled, "Certification By Registered Professional Engineer and/or Land Surveyor" must be submitted.

The following forms should be included with this request if (check the included forms):

• Hydrologic analysis for flooding source differs from that used to develop FIRM	☒ Hydrologic Analysis Form (Form 3)
• Hydraulic analysis for riverine flooding differs from that used to develop FIRM	☒ Riverine Hydraulic Analysis Form (Form 4)
• The request is based on updated topographic information or a revised floodplain or floodway delineation is requested	☐ Riverine /Coastal Mapping Form (Form 5)
• The request involves any type of channel modification	☒ Channelization Form (Form 6)
• The request involves new bridge or culvert or revised analysis of an existing bridge or culvert	☐ Bridge/Culvert Form (Form 7)
• The request involves a new revised levee/floodwall system	☐ Levee/Floodwall System Analysis Form (Form 8)
• The request involves analysis of coastal flooding	☐ Coastal Analysis Form (Form 9)
• The request involves coastal structures credited as providing protection from the 100-year flood	☐ Coastal Structures (Form 10)
• The request involves an existing, proposed, or modified dam	☒ Dam Form (Form 11)
• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	☐ Alluvial Fan Flooding Form (Form 12)

9. INITIAL REVIEW FEE

18. Has the minimum initial review fee for the appropriate request category been included? ☒ Yes ☐ No

Initial fee amount: $ _____

Check or money order only. Make check or money order payable to : **National Flood Insurance Program.** If paying by Visa or Mastercard please refer to the credit card information form which follows this form.

or

19. Is this request for a project that is for public benefit and is primarily intended for flood loss reduction to insurable structures in identified flood hazard areas which were in existence prior to the commencement of construction of the flood control project? ☒ Yes ☐ No

or

20. Is this request to correct map errors, to include the effects of natural changes within the areas of special flood hazard, or solely to provide more detailed data? ☐ Yes ☐ No

Note: I understand that my signature indicates that all information submitted in support of this request is correct.

Signature of Revision Requester

Stephen L. Weatherman, P.E.
Chief Flood Control Engineer

Printed Name and Title of Revision Requester

Poggemeyer Design Group

Company Name

(702) 255-8100

Telephone No: Date

Note: Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.

Signature of Community Official

Curt Chandler, Land Development Mgr.

Printed Name and Title of Community Official

City of Henderson

Community Name

Date

Does this request impact any other communities? ☐ Yes ☒ No

If yes, attach letters from all affected jurisdictions acknowledging the revision request and approving the changes to the floodway, if applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

FEDERAL EMERGENCY MANAGEMENT AGENCY
CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM

FEMA USE ONLY

O.M.B. No. 3067-0148
Expires July 31, 1997

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average . 23 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. This certification is in accordance with 44 CFR Ch. I, Section 65.2
2. I am licensed with expertise in Hydrology, Hydraulics, Sediment Transport
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)** structural, geotechnical, land surveying.]
3. I have 12 years experience in the expertise listed above.
4. I have ☒ prepared and ☒ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and /or designs, is/are being certified:
   To remove the Zone A based on a physical change.
7. Based on the following review, the modifications in place have been constructed in general accordance with plans and specifications.

   Basis for above statement: (check all that apply)
   a. ☐ Viewed all phases of actual construction.
   b. ☒ Compared plans and specifications with as-built survey information.
   c. ☒ Examined plans and specifications and compared with completed projects.
   d. ☐ Other *(Specify)*
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Stephen L. Weatherman, P.E.
(please print or type)

Title: Chief Flood Control Engineer
(please print or type)

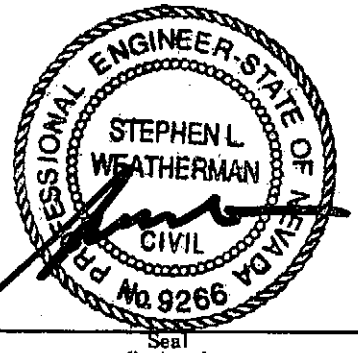
Registration No. 9266 Expiration Date: 6/30/2000

State Nevada

Type of License Civil Engineering

Signature

12/18/98
Date



Seal
(Optional)

*Specify Subdiscipline

Note: Insert not applicable (N/A) if statement does not apply.

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS



FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS FORM**	*FEMA USE ONLY*	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.67 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash
(One form for each flooding source)

Project Name /Identifier: Equestrian Detention Basin

1. HYDROLOGIC ANALYSIS IN FIS

☒ Approximate study stream (Zone A)
☐ Detailed study stream (briefly explain methodology)_____

2. REASON FOR NEW HYDROLOGIC ANALYSIS

☐ No existing analysis
☐ Improved data *(see data revision on page 3)*
☒ Changed physical conditions of watershed *(explain)* Construction of Flood Control Facility in the watershed, the Equestrian Detention Basin
☐ Alternative methodology *(justify why the revised model is better than model used in the effective FIS)*
☐ Evaluation of proposed conditions (CLOMRs only) (explain)_____
☐ Other_____

If a computer program/model was used in revising the hydrologic analysis, please provide a diskette with the input files for the 10-, 50-, 100 - and 500-year recurrence intervals.

Only the 100-year recurrence interval need be included for SFHAs designated as Zone A.

3. APPROVAL OF ANALYSIS

☒ Approval of hydrologic analysis, including the resulting peak discharge value (s) has been provided by the appropriate local, state, or Federal Agency. (i.e., City of Henderson, Clark County Regional Flood Control District, Division of Water Resources, Dam Safety)
Attach evidence of approval.
☐ Approval of the hydrologic analysis is not required by any local, State, or Federal Agency.

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4. REVIEW OF RESULTS

Stream: Unnamed Wash

Comparison of 100-year Flood Discharges

Location	Drainage area (Sq mi.)	FIS (cfs):	Revised (cfs):
Equestrian Detention Basin	9.75±	3300±	250±

Note: When revised discharges are not significantly different than FIS discharges, FEMA may require a confidence limits analysis on attachment D at a later date to complete the review.

As is often the case with revision requests, only a portion of a stream may actually be revised or affected by a revision. Therefore, transition to the unrevised portion is important to maintain the continuity of the study. NFIP regulations stipulate that such a transition must be assured. What is the transition from the proposed discharges to the effective discharges? Please explain how the transition was made *(attach separate sheet if necessary)*

With the construction of the Equestrian Detention Basin, the Zone A floodplain has been reduced and is confined to the existing washes downstream of the Detention Basin.

Attach a completed "review of results" page for each flooding source.

Is the new hydrologic analysis being developed solely to revise the flow values presented in the FIS *(i.e. no changed hydraulic conditions)*? ☐ Yes ☒ No

If yes, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No

Note: FEMA does not normally revise NFIP maps solely due to flow changes when changes in 100-year water surface elevation are less than 1.0 foot.

5. HISTORICAL FLOODING INFORMATION

Is historical data available for the flooding source? ☐ Yes ☒ No

If yes, provide the following:

Location along flooding source: _____

Maximum peak discharge: _____ cfs

Second highest peak discharge: _____ cfs

Source of information: _____

6. GAGE RECORD INFORMATION

Location of nearest gage to project site *(along flooding source or similar watershed; specify)*

N/A

Gaging Station: _____

Drainage area at gage: _____ mi^2

Number of years of data: _____

7. DATA REVISION

Please use the following table to list all the data and/or parameters affected by this request and identify them as new data (*New*) or as revising existing data (*Revised*). *(If necessary, attach a separate sheet.)*

Data Parameter	New	Revised	Data Source
Hydrology Analysis	☒	☐	Clark County Regional Flood Control
Hydrology/Hydraulic Analysis	☒	☐	City of Henderson
Hydrology/Hydraulic Analysis	☒	☐	Nevada Dept. of Transportation
Hydrology/Hydraulic/Sediment Analysis	☒	☐	Poggemeyer Design Group
	☐	☐	

- The data source can be a Federal, State, or local government agency, or a private source. Some State and local governments may have less strict data requirements than Federal agencies, in which case the hydrologic data may not be accepted by FEMA unless it is demonstrated that the data give a better estimate of the flood discharge.
- Attach documentation corroborating each data source *(i.e., certified statement, report, bibliographical reference to a published document)*. In the case of a published document or a government report, providing copies of the cover and pertinent pages may be helpful.

8. METHODOLOGY FOR NEW ANALYSIS

☐ Statistical Analysis of Gage Records *(use Attachment A)*

☐ Regional Regression Equations *(use Attachment B)*

☒ Precipitation/Runoff Model *(use Attachment C)*

☐ Other *(specify; attach backup computations and supporting data)* _____

ATTACHMENT A: STATISTICAL ANALYSIS OF GAGE RECORDS

Gaging Station: N/A

Gage Location (latitude and longitude): _____

	FIS:	Revised:
1. Number of years of data		
Systematic		
Historical		
2. Homogeneous data?	☐ Yes ☐ No	☐ Yes ☐ No
3. Data adjustments?	☐ Yes ☐ No	☐ Yes ☐ No
4. Number of high outliers		
Low outliers		
Zero events		
5. Generalized skew		
6. Station skew		
7. Adopted skew		
8. Probability distribution used (justify if log-Pearson III was not used)		
9. Transfer equations to ungaged sites		☐ Yes ☐ No

If yes, specify method

_____

_____

_____

10. Expected probability* ☐ Yes ☐ No

11. Comparison of results with other analyses ☐ Yes ☐ No

If yes, describe comparison

_____

_____

_____

*FEMA does not accept expected probability analyses for the purpose of reflecting flood hazard information in a FIS.

If any data are not available, indicate with "N/A".

Attach analysis including plot of flood frequency curve.

1. Bibliographical Reference:

_____

_____

_____

(Attach a copy of title page, table of contents, and pertinent pages including equations.)

2. Gaged or ungaged stream: _____

3. Hydrologic region(s): _____
Attach backup map.

4. Provide parameters, values, and source of data used to define parameters.

_____

_____

_____

		FIS		Revised	
5.	Urbanized conditions calculations?	☐ Yes	☐ No	☐ Yes	☐ No
6.	Percent of watershed urbanization	_____		_____	
7.	Is the watershed controlled?	☐ Yes	☐ No	☐ Yes	☐ No
8.	Comparison with other analyses?	☐ Yes	☐ No	☐ Yes	☐ No

If the answer to questions 5, 7, or 8 is yes, explain methodology in Comments.

If data are not available, indicate with "N/A".

9. Comments

_____

_____

_____

_____

Attach computation and supporting maps delineating the watershed boundary and drainage area divides.

ATTACHMENT C: PRECIPITATION/RUNOFF MODEL

		FIS:	Revised
1.	Method or model used:	Unknown	HEC-1
	Version:	"	410
	Date:	"	3/23/93
2.	Source of rainfall depth:	"	NOAA Atlas II
3.	Source of rainfall distribution:	"	NSACE
4.	Rainfall duration:	"	6 hr
5.	Areal adjustment to precipitation (%):	"	Varies
6.	Maximum overland flow length	"	5001
7.	Hydrograph development method:	"	SCS
8.	Loss rate method:	"	SCS
	Source of soils information:	"	USDA Soil Survey
	Source of land use information	"	Current Zoning
9.	Channel routing method:	"	Kinematic
10.	Reservoir routing:	☐ Yes ☒ No	☒ Yes ☐ No
11.	Baseflow considerations:	☐ Yes ☒ No	☐ Yes ☒ No

If yes, explain how baseflow was determined:

12.	Snowmelt considerations?	☐ Yes ☐ No	☐ Yes	☒ No
13.	Model calibration?	☐ Yes ☐ No	☐ Yes	☒ No

If yes, explain how calibration was performed

14.	Future land use conditions?	☒ Yes ☐ No

If yes, explain why

Because this Detention Basin is a Clark County Regional Flood Control District Master Plan Facility; the Facility was designed using ultimate land use conditions.

NOTE: FEMA policy is to base flooding on existing conditions.
If data are not available, indicate with "N/A".

Attach precipitation/runoff model, hydrologic model schematic, curve number calculations, time of concentration calculations, and supporting maps, delineating the watershed boundary and drainage area divides.

ATTACHMENT D: CONFIDENCE LIMITS EVALUATION

Stream: N/A

Selected location for Confidence Limits Evaluation (*describe location*): _____

_____

Discharges for selected location:

Exceedance Probability		FIS	Revised
10%	(10-year)	_____ cfs	_____ cfs
2%	(50-year)	_____ cfs	_____ cfs
1%	(100-year)	_____ cfs	_____ cfs
0.2%	(500-year)	_____ cfs	_____ cfs

1% (100-year) Flood Confidence Intervals

90% Confidence Interval: 5% limit _____ cfs

95% limit _____ cfs

50% Confidence Interval: 25% limit _____ cfs

75% limit _____ cfs

If the value of the 100-year frequency flood in the FIS is beyond the 50% confidence interval but within the 90% confidence interval, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No

Note: An example of confidence limits analysis can be found in Appendix 9 of Bulletin 17B.

Attach Confidence Limits Analysis.

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS FORM**	**FEMA USE ONLY**	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash
(One form for each flooding source)

Project Name/Identifier: Equestrian Detention Basin

1. REACH TO BE REVISED

Downstream limit: Cl/Drake Channel

Upstream limit: Equestrian Detention Basin

2. EFFECTIVE FIS

☐ Not studied

☒ Studied by approximate methods

Downstream limit of study _____

Upstream limit of study _____

☐ Studied by detailed methods

Downstream limit of detailed study _____

Upstream limit of detailed study _____

☐ Floodway delineated

Downstream limit of Floodway _____

Upstream limit of Floodway _____

3. HYDRAULIC ANALYSIS

Why is the hydraulic analysis different from that used to develop the FIRM. *(Check all that apply)*

☒ Not studied in FIS

☐ Improved hydrologic data/analysis. Explain: _____

☐ Improved hydraulic analysis. Explain: _____

☒ Flood control structure. Explain: Construction of the Equestrian Detention Basin and Appurtenant

☐ Other. Explain: _____

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

For areas which have detailed flooding:

Full input and output listings along with files on diskette (if available) for each of the models listed below (items 1, 2, 3, 4, and 5) and summary of the source of input parameters used in the models must be provided. The summary must include a complete description of any changes made from model to model (e.g. duplicate effective model to corrected effective model) At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.

For areas which do not have detailed flooding:

Only the 100-year flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

If hydraulic models are not developed, hydraulic analyses for existing or pre-project conditions and revised or post-project conditions must be submitted. All calculations must be submitted for these analyses. (See Item 6 below.)

1. Duplicate Effective Model — Natural ☐ Floodway ☐

Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models *(10-, 50-, 100-, and 500-year multi-profile runs and the floodway run)* must be obtained and then reproduced on the requestor's equipment to produce the duplicate effective model. This is required to assure that the effective model input data has been transferred correctly to the requestor's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model — Natural ☐ Floodway ☐

The corrected effective model is the model that corrects any errors that occur in the duplicate effective model, adds any additional cross sections to the duplicate effective model, or incorporates more detailed topographic information than that used in the currently effective model. The corrected effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model — Natural ☒ Floodway ☐

The duplicate effective model or corrected effective model is modified to produce the existing or pre-project conditions model to reflect any modifications that have occurred within the floodplain since the date of the effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the corrected effective model or duplicate effective model.

4. Revised or Post-Project Conditions Model — Natural ☐ Floodway ☐

The existing or pre-project conditions model *(or duplicate effective model or corrected effective model, as appropriate)* is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for proposed project this model must reflect proposed conditions.

5. Other: Please attach a sheet describing all other models submitted. — Natural ☒ Floodway ☐

6. Hydraulic Analyses (Only if Hydraulic Models are not developed)

Attach all calculations for the existing or pre-project conditions and the revised or post-project conditions. Proceed to Form 5, "Riverine/Coastal Mapping Form".

5. MODEL PARAMETERS *(from model used to revise 100-year water surface elevation)*

1. Discharges:

	Upstream Limit	Downstream Limit
10-year		
50-year		
100-year	Boulder Hwy. & Foothills Drive	Equestrian Detention Basin
500-year		

Attach diagram showing changes in 100-year discharge

2. Explain how the starting water surface elevations were determined the water surface elevations were determined using the revised HEC-1 flow rates.

3. Give range of friction loss coefficients (*Manning's "N"*) Channel ..... .015 .025

Overbanks ..... .015 .025

If friction loss coefficients are different anywhere along the revised reach from those used to develop the FIRM, give location, value used in the effective FIS, and revised values and an explanation as to how the revised values were determined.

Location	FIS	Revised

Explain:

4. Describe how the cross section geometry data were determined *(e.g., field survey, topographic map, taken from previous study)* and list cross sections that were added.

From Design Drawing as-builts of the project.

5. Were natural channel banks selected as the location of the left and right channel banks in the model?

☐ Yes ☒ No If no, explain why not: Because this is a man-made channel and all of the flow is contained in the channel.

6. Explain how reach lengths for channel and overbanks were determined:

From Construction Plans for the Channel see Design Calculation Notebook.

6. RESULTS (from model used to revise 100-year water surface elevations)

1. Do the results indicate:

a. Water surface elevations higher than end points of cross sections? ☐ Yes ☒ No

b. Supercritical depth? ☐ Yes ☒ No

c. Critical depth? ☒ Yes ☐ No

d. Other unique situations ☒ Yes ☐ No

If yes to any of the above, attach an explanation that discusses the situation and how it is presented on the profiles, tables, and maps.

2. What is the maximum change in energy gradient between cross-sections? 0.00986 ft/ft

Specify location 163+00 - 162+00

3. What is the distance between the cross-sections in 2 above? 100 ft.

4. What is the maximum distance between cross-sections? 500

Specify location several

5. Floodway determination

a. What is the maximum surcharge allowed by the community or State? N/A foot

b. What is the maximum surcharge for the revised conditions? N/A foot

Specify location N/A

c. What is the maximum velocity? 34 fps

Specify location

d. Are there any negeative surcharge values at any cross-section? ☐ Yes ☒ No

If yes, the floodway may need to be widened. If it is not widened, please explain and indicate the maximum negative surcharge.

Explain: The unlined run was developed as sub-critical. The actual physical condition resulted in critical depth as the calculated flow elevation.

6. Is the discharge value used to determine the floodway anywhere different from that used to determine the natural 100-year flood elevations? ..... ☒ Yes ☐ No

If Yes, explain:

No Channel at this location for 100-year flood elevations new construction.

7. Do 100-year water surface elevations increase at any location? ..... ☐ Yes ☒ No

If yes, please attach a list of the locations where the increases occur, state whether or not the increases are located on the requestor's property, and provide an explanation of the reason for the increases. *(For example: State if the increase is due to fill placed within the floodway fringe or placed within the currently adopted floodway limits)*

Attach a completed comparison table entitled: Water Surface Elevation Check (see page 6)

7. REVISED FIRM/FBFM AND FLOOD PROFILES

8. The revised water surface elevations tie into those computed by the effective FIS Model *(10-, 50-, 100-, and 500-year)*, downstream of the project at cross-section_____ within_____feet *(vertical)* and upstream of the project at cross section_____within_____feet *(vertical)*.

9. The revised floodway elevations tie into those computed by the effective FIS model, dowstream of the project at cross section_____within_____feet *(vertical)* and upstream of the project at cross section_____ within_____feet *(vertical)*.

10. Attach profiles, at the same vertical and horizontal scale as the profiles in the effective FIS report, showing stream bed and profiles of all floods studied (without encroachment). Also, label all cross sections, road crossings (including low chord and top-of-road data), culverts, tributaries, corporate limits, and study limits. If channel distance has changed, the stationing should be revised for all profile sheets.

11. Attach a Floodway Data Table showing data for each cross section listed in the published Floodway Data Table in the FIS report.

Proceed to Riverine /Coastal Mapping Form (Form 5)

FEDERAL EMERGENCY MANAGMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	FLOODIND SOURCE	PROJECT NAME /IDENTIFIER

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]

COMMENTS:

1-100-year (natural) Water Surface Elevation 2-Encroachment (floodway) Water Surface Elevation 3-Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses.

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE/COASTAL MAPPING FORM**	*FEMA USE ONLY*	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

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You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash

Project Name/Identifier: Equestrian Detention Basin

1. MAPPING CHANGES

1. A topographic work map of suitable scale, contour interval, and planimetric definition must be submitted showing *(indicate N/A when not applicable)*:

		Included					
A.	Revised approximate 100-year floodplain boundaries (Zone A)?	☒	Yes	☐	No	☐	N/A
B.	Revised detailed 100- and 500-year floodplain boundaries?	☐	Yes	☐	No	☒	N/A
C.	Revised 100-year floodway boundaries?	☐	Yes	☒	No	☐	N/A
D.	Location and alignment of all cross sections used in the revised hydraulic model with stationing control indicated?	☒	Yes	☐	No	☐	N/A
E.	Stream alignments, road and dam alignments?	☒	Yes	☐	No	☐	N/A
F.	Current community boundaries?	☐	Yes	☐	No	☒	N/A
G.	Effective 100- and 500-year floodplain and 100-year floodway boundaries from the FIRM/FBFM reduced or enlarged to the scale of the topographic work map?	☒	Yes	☐	No	☐	N/A
H.	Tie-ins between the effective and revised 100- and 500-year floodplains and 100-year floodway boundaries?	☐	Yes	☐	No	☒	N/A
I.	The requestor's property boundaries and community easements?	☐	Yes	☐	No	☒	N/A
J.	The signed certification of a registered professional engineer?	☒	Yes	☐	No	☐	N/A
K.	Location and description of reference marks?	☒	Yes	☐	No	☐	N/A
L.	Vertical datum (example: NGVD, NAVD etc.)?	☒	Yes	☐	No	☐	N/A
M.	Coastal zone designations tie into adjacent areas not being revised?	☐	Yes	☐	No	☒	N/A
N.	Location and alignment of all coastal transects used to revise the coastal analyses?	☐	Yes	☐	No	☒	N/A

If any of the items above are marked no or N/A, please explain: B&C Detail boundaries are not included on the FIRM map. F. Community boundaries have not been changed. H. N/A M. & N. Coastal Zones N/A

2. What is the source and date of the updated topographic information *(example: orthophoto maps, July 1985; field survey, May 1979, beach profiles, June 1987, etc.)*? Air Photo 3-1-98

3. What is the scale and contour interval of the following workmaps?

   a. Effective FIS N/A scale N/A Contour interval

   b. Revision Request 1"=200' scale 4' Contour interval

NOTE: Revised topographic information must be of equal or greater detail.

4. Attach an annotated FIRM and FBFM at the scale of the effective FIRM and FBFM showing the revised 100- and 500-year floodplain and the 100-year floodway boundaries and how they tie into those shown on the effective FIRM and FBFM downstream and upstream of the revisions or adjacent to the area of revision for coastal studies Attach additional pages if needed

PLEASE REFER TO THE INSTRUCTION FOR THE APPROPRIATE MAILING ADDRESS

5. Flood Boundaries and 100-year water surface elevations:

a. Has the 100-year floodplain been shifted or increased or the 100-year water surface elevation increased at any location on property other than the requestor's or community's? ☐ Yes ☒ No

If yes, please give the location of shift or increase and an explanation for the increase.

b. Have the affected property owners been notified of this shift or increase and the effect it will have on their property? ..... ☐ Yes ☐ No

If yes, please attach letters from these property owners stating they have no objections to the revised flood boundaries if a LOMR is being requested.

c. What is the number of insurable structures that will be impacted by this shift or increase? _____

6. Have the floodway boundaries shifted or increased at any location compared to those shown on the effective FBFM or FIRM? ..... ☐ Yes ☒ No

If yes, explain:

7. If a V- zone has been designated, has it been delineated to extend landward to the heel of the primary frontal dune? ☐ Yes ☐ No

If no, explain:

N/A

8. Manual or digital map submission:

☒ Manual

☐ Digital

Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance of submission as possible.

2. EARTH FILL PLACEMENT

1. The fill is: ☐ Existing ☐ Proposed N/A Fill has not been utilized to remove the site from a Zone A.

2. Has fill been placed/will be placed in the regulatory floodway? ..... ☐ Yes ☒ No
If yes, please attach completed Riverine Hydraulic Analysis Form. (Form 4)

3. Has fill been/will be placed in floodway fringe *(area between the floodway and 100-year floodplain boundaries)*? ..... ☐ Yes ☒ No

If yes, then complete A, B, C, and D below.

a. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? ..... ☐ Yes ☐ No

If yes, justify steeper slopes_____

b. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? *(Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)* ..... ☐ Yes ☐ No

If no, describe erosion protection provided_____

c. Has all fill placed in the revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? ☐ Yes ☐ No

d. Can structures conceivably be constructed on the fill at any time in the future? ☐ Yes ☐ No

If yes, provide certification of fill compaction (Item c. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer.

4. Has fill been placed/will be placed in a V-zone? ☐ Yes ☒ No

If yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall? ☐ Yes ☐ No

If yes, attach the coastal structures form.

FEDERAL EMERGENCY MANAGEMENT AGENCY **CHANNELIZATION FORM**	**FEMA USE ONLY**	*O.M.B. No. 3067-0148* *Expires July 31, 1997*

PUBLIC BURDEN DISCLOSURE NOTICE

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You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash

Project ~~Name~~/Identifier: Equestrian Detention Basin

1. EXTENT OF CHANNELIZATION

Downstream limit: _____

Upstream limit: _____

2. CHANNEL DESCRIPTION

1. **Describe the inlet to the channel** _____

2. **Briefly describe the shape of the channel** ***(both cross sectional and planimetric configuration)*** **and its lining** ***(channel bottom and sides)*** Trapezoidal concrete lined channel with a 25 ft. bottom width and :2:1:V side slopes. Unlined channel with varying channel bottom and side slopes.

3. **Describe the outlet from the channel** Equestrian Detention Basin

4. **The channelization includes:**

- ☐ **Levees** ***(Attach Levee /Floodwall system analysis Form)***
- ☐ **Drop structures**
- ☐ **Superelevated sections**
- ☒ **Transitions in cross sectional geometry**
- ☒ **Debris basin/detention basin**
- ☒ **Energy dissipater**
- ☐ **Other** _____

5. **Attach the following:**

a. Certified engineering drawings showing channel alignment and locations of inlet, outlet, and items checked in item 4

b. Typical cross sections and profiles of channel banks and invert

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. HYDRAULIC CONSIDERATIONS

1. What is the 100-year flood discharge? ..... 2,900± cfs
2. Do the cross sections in the hydraulic model match the typical cross sections in the plans? ☒ Yes ☐ No
3. Are the channel banks higher than the 100- year flood elevations everywhere? ..... ☒ Yes ☐ No
4. Are the channel banks higher than the 100-year flood energy grade lines everywhere? .. ☒ Yes ☐ No
5. Is the land on both sides of the channel above the adjacent 100-year flood elevation at all points along the channel? ..... ☐ Yes ☒ No
6. What is the range of freeboard? ..... 3 – 11.5 feet
7. What is the range of the 100-year flood velocities? ..... 10.1 – λ ft/sec
8. What is the lining type (both bottom and sides)? concrete bottom & sides to Station the channel with native material

   Explain how the channel lining prevents erosion and maintains channel stability *(attach documentation)*

   See Design Calculation Notebook.

9. What is the design elevation in the channel based on?

   ☒ Subcritical flow
   ☐ Critical flow
   ☒ Supercritical flow
   ☐ Energy grade line

   Is the 100-year flood profile based on the above type of flow? ..... ☐ Yes ☒ No

   If no, explain: Unlined portion of channel is evaluated as sub-critical; lined portion of channel is evaluated as super-critical.

10. Is there the potential for a hydraulic jump at the following locations:

    Inlet to channel? ..... ☐ Yes ☐ No
    Outlet of channel? ..... ☒ Yes ☐ No
    At Drop Structures? ..... ☐ Yes ☐ No
    At Transitions? ..... ☒ Yes ☐ No
    Other locations.? Explain:

    If the answer to any of the above is yes, please explain how the hydraulic jump is controlled and the effects of the hydraulic jump on the stability of the channel.

    Explain: Outlet of channel is into Equestrian Detention Basin which will control the depth of flow by the pool elevation. Minor jump occurs at junction where incoming flow impacts from west Station 162+00.

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. a. Is there any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year water surface elevations and/or the capacity of the channel? ..... ☒ Yes ☐ No

   b. Based on the conditions of the watershed and stream bed, is there a potential for sediment transport (including scour and deposition) to affect the 100-year water surface elevations and /or the capacity of the channel? ..... ☒ Yes ☐ No

2. If the answer to either 1A or 1B is yes:

   a. What is the estimated sediment (bed) load?
   _____cfs (attach gradation curve)

   Explain method used to estimate load See Design Calculation Notebook.

   b. Is the 100-year flood velocity anywhere within the channel less than the 100-year flood velocity of the inlet? ☐ Yes ☒ No

   c. Will sediment accumulate anywhere within the channel? ☒ Yes ☐ No

   d. Will deposition or scour occur at or near the inlet? ☐ Yes ☒ No

   e. Will deposition or scour occur at or near the outlet? ☐ Yes ☒ No

Attach documentation showing affects on the hydrologic and hydraulic analyses

FEDERAL EMERGENCY MANAGEMENT AGENCY **DAM FORM**	FEMA USE ONLY	O.M.B. No. 3067-0148 Expires July 31, 1997

PUBLIC BURDEN DISCLOSURE NOTICE

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You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Henderson

Flooding Source: Unnamed Wash

Project Name/Identifier: Equestrian Detention Basin

1. IDENTIFIER

Name of Dam: Equestrian Detention Basin

Location of dam along flood source (in terms of stream distance or cross section identifier):

Check one of the following:

- ☐ Existing dam
- ☒ New dam
- ☐ Modifications of existing dam (describe modifications)_____

Was the dam designed by: _____Federal agency _____State agency

_____Local government agency XX Private organization?

2. BACKGROUND

Does the dam have dedicated flood control storage? X☒ Yes ☐ No

Does the project involve revised hydrology? X☒ Yes ☐ No

If yes, complete Hydrologic Analysis Form (Form 3) and include calculations of the 100-year inflow flood hydrograph routed through the dam with the beginning pool at the normal pool elevation (spillway crest elevation for ungated spillway). Include any inflow hydrograph bulking by watershed sediment yield and provide necessary debris and sediment yield analysis.

Does the revised hydrology affect the 100-year water-surface elevation behind the dam or downstream of the dam? X☒ Yes ☐ No

If yes, complete the Riverine Hydraulic Analysis Form (Form 4) and complete the table shown on the following page.

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS.

	Stillwater Elevation Behind the Dam	
	FIS	Revised
10-year		
50-year		
100-year		2069
500-year		
Normal Pool Elevation		-0-

Was long term sediment accumulation taken into consideration in determining the normal pool elevation? ☒ Yes ☐ No

Was the dam designed to withstand the hydrostatic and hydrodynamic forces associated with floods greater than the 100-year flood? ☒ Yes ☐ No

If no, and the dam has a reasonable probability of failure during the 100-year flood, please attach dam break analysis.

Provide the following data on the dam:

Dimensional Height: 28 ft.
Crest Elevation of top of dam: 2076 ft
100-year flood storage capacity: 409 Ac-ft.
Freeboard (measured from 100-year water surface elevation): 7 ft.

Spillway(s):

Type: ☐ gated ☒ ungated

Dimensional Width: 900 ' Broad Crested Weir
Dimensional Height: 4.9
Crest Elevation of top of spillway: 2,069.00

Outlet(s):

Type: ☐ gated ☒ ungated

Width:
Height
Diameter: 48"
Invert Elevation: 2048

Explain flow regulation plan:

Are the project features, including the emergency spillway, designed to accommodate the 100-year flood discharge without overtopping the dam? ☒ Yes ☐ No

Was the dam designed in accordance with all currently applicable local, State, and Federal regulations? ☒ Yes ☐ No

If no, please provide explanation.

FEMA may request a list of regulations that have been complied with and supporting documentation demonstrating compliance with these regulations.

Attach copy of formal operation and maintenance plan

Answer N/A to any questions which are not applicable

APPENDIX B

HEC-1

EQUOAL1.HC1

HEC1 S/N: 1333000222 HMVersion: 6.40 Data File: equoal1.HC1

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  RUN DATE  12/11/1998  TIME  14:48:42 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104               *
*                                       *
*****************************************
```

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

```
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::                 by                 :::
:::        Haestad Methods, Inc.       :::
:::                                    :::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          *DIAGRAM
    1     ID  REPRODUCTION OF PBS&J RUN RACETRACK CONCEPTUAL STUDY
    2     ID  AND PDG EQUEST. DET. BASIN COMBINATION FOR NEW LOMR
    3     ID  FLOW EVALUATION INCLUDES NEW WAGON WHEEL INTERCHANGE AND CULVERTS CROSSING
    4     ID  BOLDER HIGHWAY AND NEW EQUESTRIAN & MAGIC WAY INLET
    5     ID  ASSUMES NEW CI-DETENTION BASIN IS COMPLETED
    6     ID  DOES NOT INCLUDE FLOWS NORTH IN RACETRACK
    7     ID  FILE NAME: EQUOALI.HC1
    8     ID  SDN 5 TOTAL BASIN AREA IS 9.75 SM
    9     ID  RAINFALL IS 3.43 WITH A DRAF OF .857 RESULTS IN A PB OF 2.94
   10     IT       5       0       0     300
   11     IO       5       0       0
   12     IN       5
   13     JR    PREC     1.0

   14     KK  OFF-16
   15     BA  0.1149
   16     PB    2.94
   17     PC    .000    .020    .059    .080    .110    .144    .150    .160    .168    .171
   18     PC    .180    .182    .187    .190    .197    .202    .210    .220    .230    .241
   19     PC    .250    .259    .265    .280    .290    .300    .305    .309    .310    .317
   20     PC    .321    .327    .333    .346    .361    .381    .408    .430    .477    .514
   21     PC    .561    .630    .710    .720    .731    .752    .779    .790    .795    .804
   22     PC    .810    .820    .826    .840    .859    .889    .910    .938    .966    .970
   23     PC    .974    .979    .981    .983    .985    .989    .990    .992    .993    .996
   24     PC    .997    .999   1.00
   25     LS       0      83
   26     UD   0.096

   27     KK    R-16
   28     RK    1000    .020    .035            TRAP      20       2

   29     KK  OFF-15
   30     BA  0.3274
   31     LS       0      87
   32     UD   0.323

   33     KK      C1
   34     HC       2

   35     KK    R-C1
   36     RK    4000   0.035   0.026            TRAP      40       2

   37     KK  OFF-14
   38     BA  0.2739
   39     LS       0      68
   40     UD   0.391

   41     KK    R-14
   42     RK    2500   0.030   0.025            TRAP      20       2
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  43      KK  OFF-10
  44      BA  0.4227
  45      LS       0      87
  46      UD   0.758

  47      KK  DIVERT
  48      KM   DIVERT1 FLOWS CONVEYED INTO CULVERT "A" STA 296+24
  49      DT  DIVER1
  50      DI       0      37     126     260     502
  51      DQ       0      10      20      30      40

  52      KK      C2
  53      HC       3

  54      KK    R-C2
  55      RK    2800   0.018   0.025            TRAP      70       2

  56      KK   OFF-9
  57      BA  0.1426
  58      LS       0      79
  59      UD   0.313

  60      KK     R-9
  61      RK    1900   0.021   0.025            TRAP      30       2

  62      KK   OFF-4
  63      BA  0.0837
  64      LS       0      88
  65      UD   0.359

  66      KK      C3
  67      HC       3

  68      KK    R-C3
  69      RK    1180   0.017   0.025            TRAP      70       2

  70      KK  OFF-13
  71      BA  0.5256
  72      LS       0      85
  73      UD   0.250

  74      KK    R-13
  75      RK    1000   0.030   0.035            TRAP      20       2

  76      KK   OFF-8
  77      BA  0.1315
  78      LS       0      79
  79      UD   0.257
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  80      KK      C4
  81      HC       2

  82      KK   OFF-3
  83      PB    3.29
  84      BA  0.1485
  85      LS       0      92
  86      UD   0.360

  87      KK      C5
  88      HC       3

  89      KK  DIVER2
  90      KM  DIVERT CULVERT AND BLDR. HWY. OVERFLOWS INTO MAGIC WAY 844+00, 843+52, 840+46
  91      DT  DIVER2
  92      DI       0    1255    2000
  93      DQ       0     116     900

  94      KK    R-C5
  95      KM  ROUTE COMBINATION 5 TO SUBBASIN OFF-2C
  96      RK    1300   0.010   0.025           TRAP      20       2

  97      KK  OFF-2C
  98      BA  0.0653
  99      LS       0      77
 100      UD   0.404

 101      KK      C6
 102      HC       2

 103      KK  DIVER3
 104      KM   DIVERT CULVERT FLOWS INTO SUBBASIN OFF-23 832+02, 825+52, 834+82
 105      DT  DIVER3
 106      DI       0    1171    2000
 107      DQ       0     217     900

 108      KK    R-C6
 109      RK    1300   0.011   0.025           TRAP      20       2

 110      KK  OFF-11
 111      PB    3.43
 112      BA  0.2168
 113      LS       0      85
 114      UD   0.328

 115      KK  OFF-12
 116      BA  0.0782
 117      LS       0      77
 118      UD   0.285
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  119     KK      C7
  120     HC       2

  121     KK    R-C7a
  122     RK      240  0.027   0.014          TRAP      10        0

  123     KK    R-C7b
  124     RK     1100  0.027   0.035          TRAP      20        2

  125     KK    OFF-6
  126     PB     3.29
  127     BA   0.0336
  128     LS        0      77
  129     UD    0.180

  130     KK      C8
  131     HC       2

  132     KK    R-C8a
  133     RK     2700  0.024   0.035          TRAP      30        2

  134     KK   OFF-2B
  135     BA   0.1359
  136     LS        0      77
  137     UD    0.404

  138     KK      C9
  139     HC       2

  140     KK     C10
  141     HC       2

  142     KK   DIVER4
  143     KM    DIVERT CULVERT FLOWS AND BOULDER HIGHWAY OVERFLOWS INTO SUBBASIN OFF-21
  144     KM   816+22, 819+84
  145     DT   DIVER4
  146     DI        0    1234    2000
  147     DQ        0     111    1000

  148     KK    R-C10
  149     RK     1200  0.010   0.025          TRAP      20        2

  150     KK   OFF-2A
  151     BA   0.0747
  152     LS        0      77
  153     UD    0.380

  154     KK     C11
  155     HC       2
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  156     KK  DIVER5
  157     KM   DIVERT CULVERT FLOWS INTO SUBBASIN OFF-19 807+37
  158     DT  DIVER5
  159     DI       0     798    2000
  160     DQ       0      70     970

  161     KK  OFF-21
  162     BA  0.0435
  163     LS       0      85
  164     UD   0.197

  165     KK    RET4
  166     DR  DIVER4

  167     KK     CD4
  168     HC       2

  169     KK    R-21
  170     RK    1700   0.005   0.016          TRAP     100       1

  171     KK  OFF-23
  172     BA  0.0587
  173     LS       0      85
  174     UD   0.250

  175     KK    RET3
  176     DR  DIVER3

  177     KK     CD3
  178     HC       2

  179     KK     C17
  180     HC       2

  181     KK   C5CAb
  182     BA  1.1309
  183     LS       0      68
  184     UD    0.28

  185     KK   QSPLT
  186     DT  DIVER9
  187     DI       0     148     200     300     400
  188     DQ       0       0      52     152     252

  189     KK    RET1
  190     DR  DIVER1

  191     KK   RDIV1
  192     RK    1200   0.004   0.016          TRAP       0      50
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  193     KK     CC1
  194     HC       2

  195     KK   C5CAa
  196     BA  0.3541
  197     LS       0      85
  198     UD   0.558

  199     KK    RET2
  200     DR  DIVER2

  201     KK     CD2
  202     HC       2

  203     KK     C19
  204     HC       2

  205     KK  DIVER7
  206     KM   DIVERT FLOW INTO DET BASIN AT EQUESTRIAN DRIVE MAGIC WAY INLET SYSTEM
  207     DT  DIVER7
  208     DI       0    1151
  209     DQ       0     488

  210     KK     C20
  211     HC       2

  212     KK    C5FD
  213     BA  0.1851
  214     PB    2.97
  215     LS       0      85
  216     UD   0.285

  217     KK    C5FB
  218     RK     500  0.015    0.25          TRAP      35       3

  219     KK    C5FA
  220     BA  0.5380
  221     LS       0      88
  222     UD    0.23

  223     KK    C5FB
  224     RK    4100 0.0615   0.040          TRAP     200       2

  225     KK    C5FB
  226     BA  0.1707
  227     LS       0      68
  228     UD    0.35

  229     KK    C5FB
  230     HC       3
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

231       KK     100
232       RK    1500   0.015   0.030          TRAP      35       3

233       KK    C5FC
234       BA  0.1906
235       LS       0      79
236       UD    0.30

237       KK     100
238       HC       2       0

239       KK    C5EA
240       RK    1300   0.015   0.030          TRAP      35       3

241       KK    C5EA
242       BA  0.5191
243       LS       0      86
244       UD    0.62

245       KK    C5EA
246       HC       2

247       KK    C5EC
248       RK    2500   0.015   0.030          TRAP      35       3

249       KK    C5EB
250       BA  0.5885
251       LS       0      73
252       UD    0.64

253       KK    C5EC
254       RK    2000    0.05    0.40          TRAP     200       3

255       KK    C5EC
256       BA  0.2648
257       LS       0      73
258       UD    0.25

259       KK     200
260       HC       3

261       KK     300
262       RK    2100   0.005   0.030          TRAP      35       3

263       KK    C5ED
264       BA  0.1474
265       LS       0      80
266       UD    0.17
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  267     KK     300
  268     HC       2

  269     KK     400
  270     RK    1000   0.005   0.030          TRAP      35       3

  271     KK    C5DA
  272     BA  1.0241
  273     LS       0      86
  274     UD    0.40

  275     KK     400
  276     HC       2

  277     KK     500
  278     RK    1000    0.04    0.03          TRAP      35       6

  279     KK    C5DB
  280     BA  0.6505
  281     LS       0      85
  282     UD   0.515

  283     KK     500
  284     HC       2

  285     KK   BASIN
  286     RK    3000   0.015   0.015          TRAP      20       2

  287     KK    C5DC
  288     BA  1.0180
  289     LS       0      69
  290     UD   0.685

  291     KK   BASIN
  292     HC       2

  293     KK    RET9
  294     DR  DIVER9

  295     KK    C5CB
  296     BA  0.1654
  297     LS       0      58
  298     UD    0.49

  299     KK   BASIN
  300     HC       4

  301     KK     DET
  302     KO       1       1       0       0      21
  303     RS       1    STOR       0
  304     SV       0       2      13      31      61      97     118     140     171     200
  305     SV     229     261     290     315     344     379     409     437     470     504
  306     SE    2048    2050    2052    2054    2056    2058    2059    2060    2061    2062
  307     SE    2063    2064    2065    2066    2067    2068    2069    2070    2071    2072
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  308     SQ      0     37     80    117    142    163    173    182    191    198
  309     SQ    206    213    221    228    235    242    248   2755   7761  14467
  310     SS   2069    900    3.0    1.5

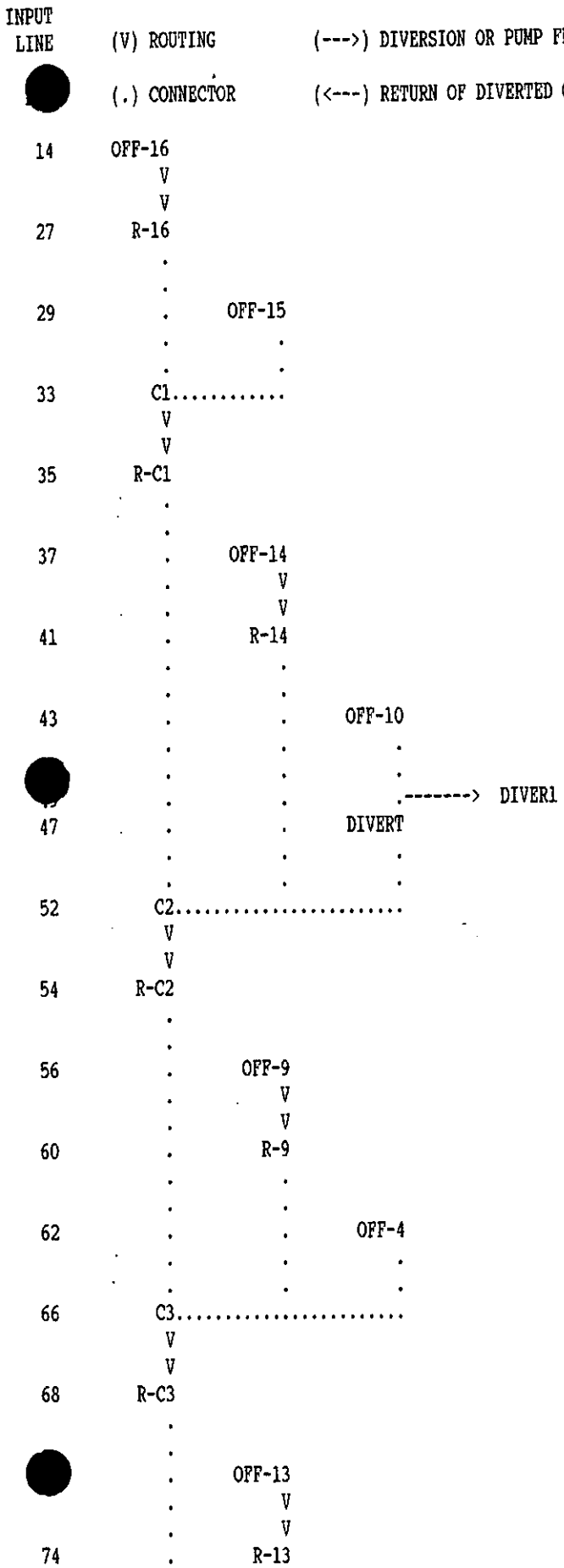
  311     KK  OFF-24
  312     BA  0.0581
  313     LS      0     85
  314     UD  0.183

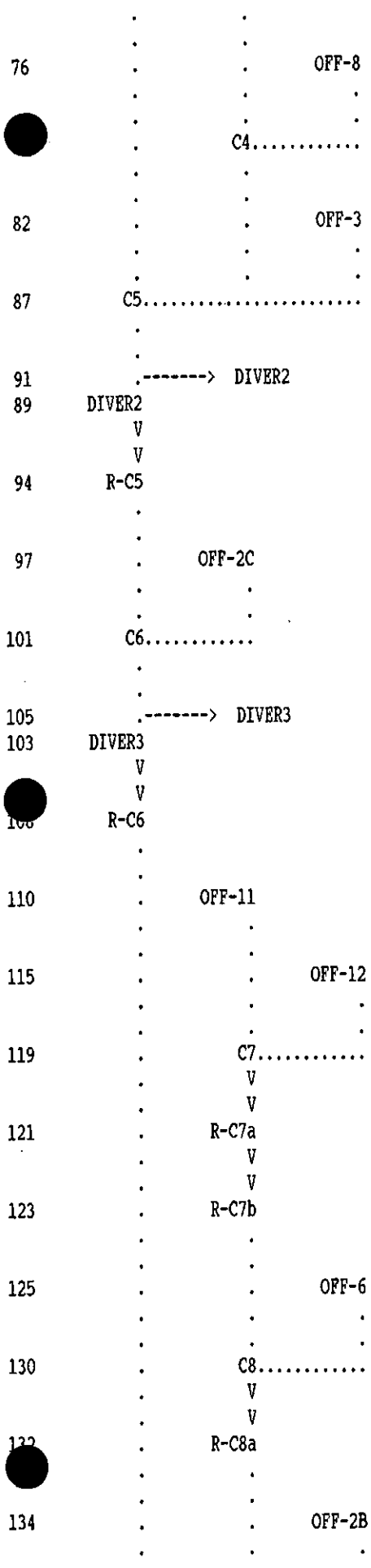
  315     KK   RET7
  316     DR  DIVER7

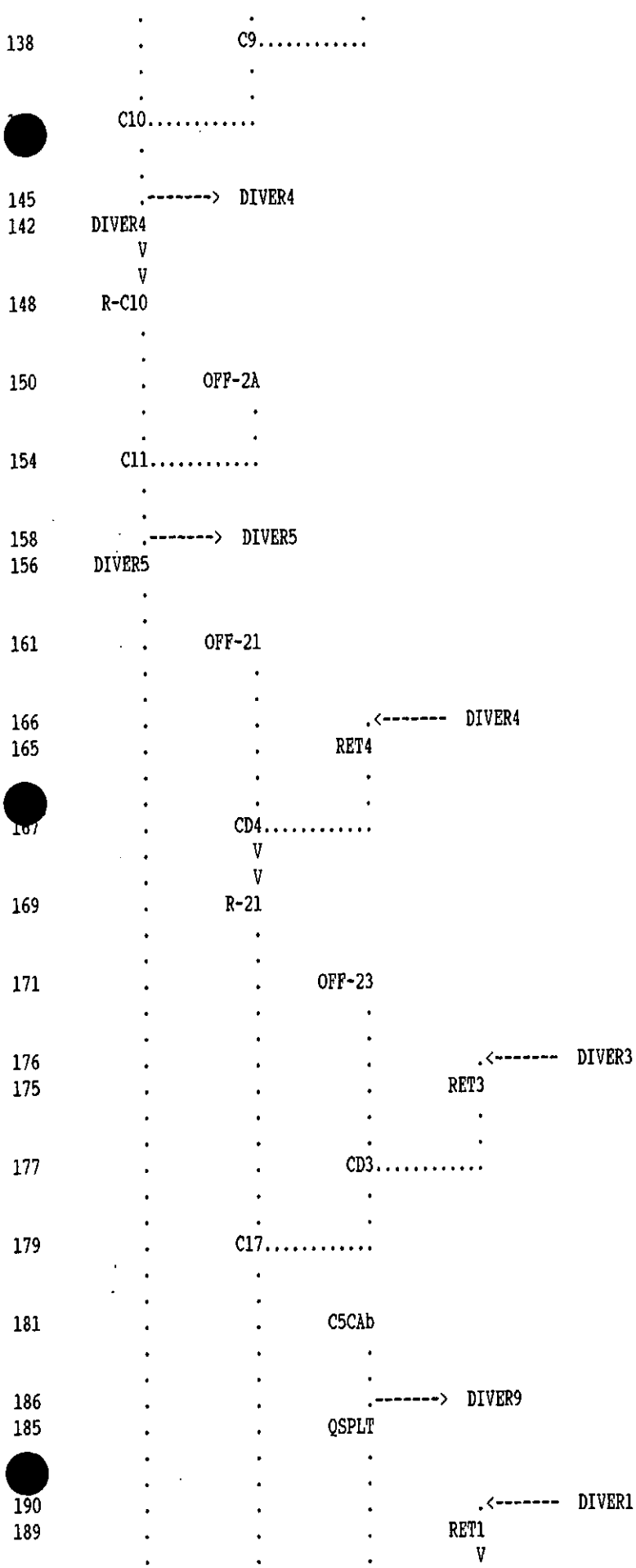
  317     KK    R24
  318     RK    500  0.012  0.020          TRAP    100       1

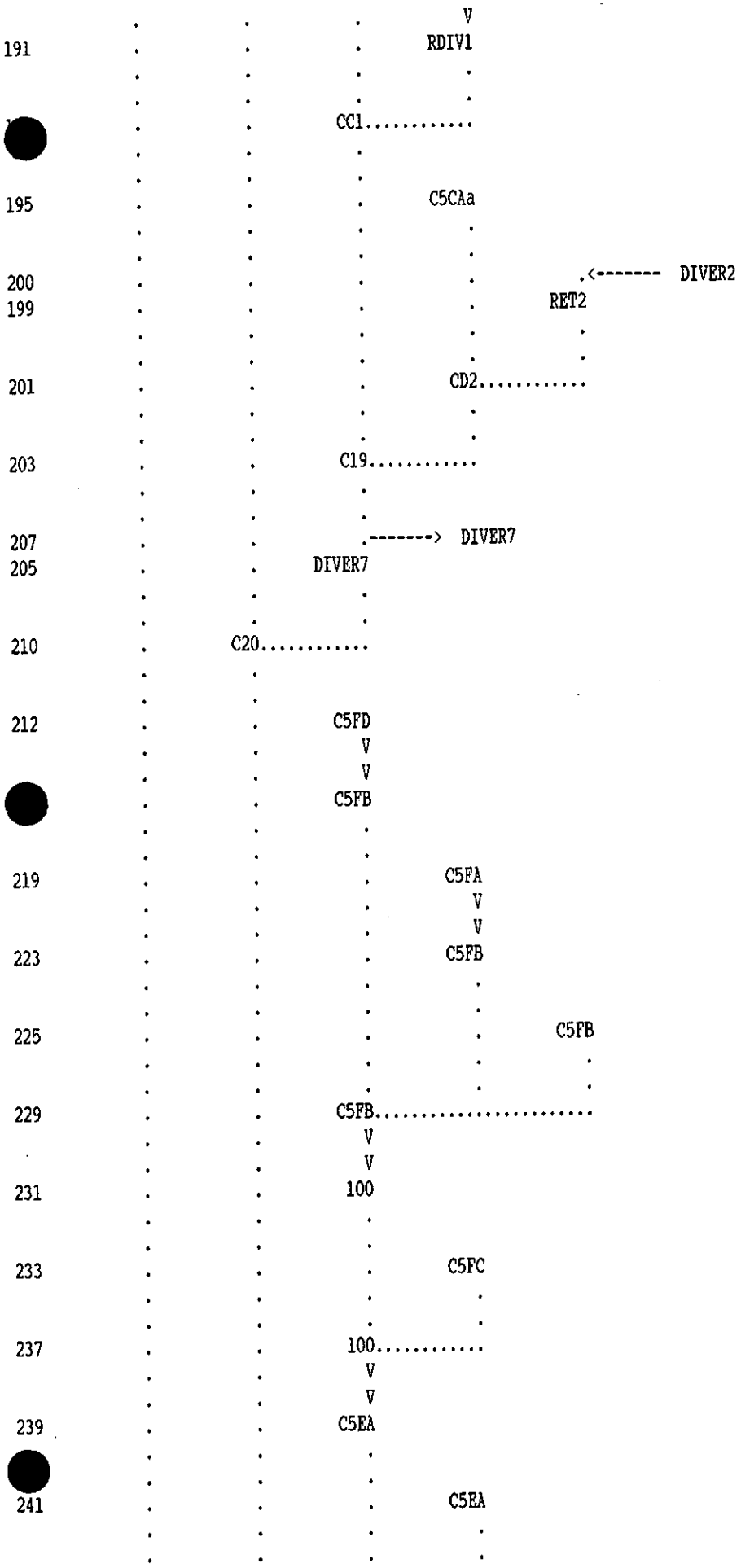
  319     KK  MAGIC
  320     HC      2
  321     ZZ
```

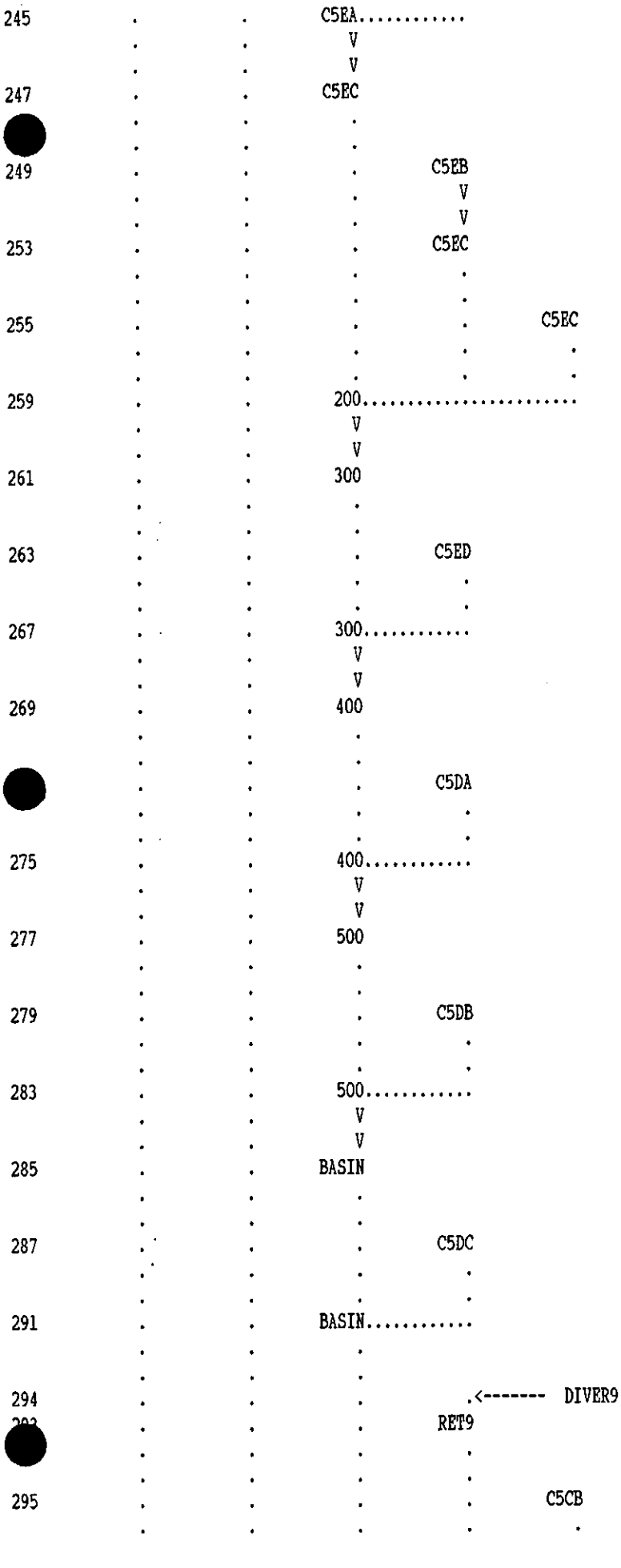
SCHEMATIC DIAGRAM OF STREAM NETWORK

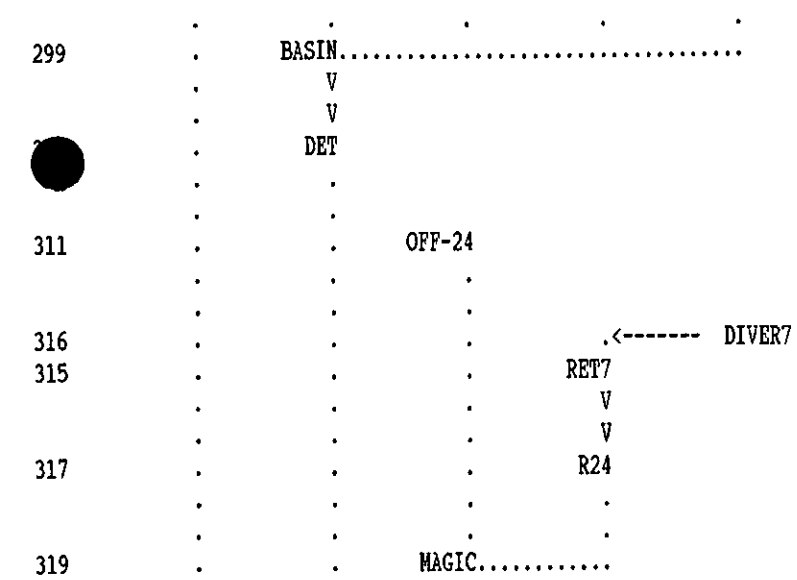



76 OFF-8
C4
82 OFF-3
87 C5
91 DIVER2
89 DIVER2
94 R-C5
97 OFF-2C
101 C6
105 DIVER3
103 DIVER3
R-C6
110 OFF-11
115 OFF-12
119 C7
121 R-C7a
123 R-C7b
125 OFF-6
130 C8
R-C8a
134 OFF-2B


138
C9
C10
145
DIVER4
142
DIVER4
148
R-C10
150
OFF-2A
154
C11
158
DIVER5
156
DIVER5
161
OFF-21
166
DIVER4
165
RET4
167
CD4
169
R-21
171
OFF-23
176
DIVER3
175
RET3
177
CD3
179
C17
181
C5CAb
186
DIVER9
185
QSPLT
190
DIVER1
189
RET1


V
191 RDIV1
CC1
195 C5CAa
200 .<------- DIVER2
199 RET2
201 CD2
203 C19
207 .-------> DIVER7
205 DIVER7
210 C20
212 C5FD
V
V
C5FB
219 C5FA
V
V
223 C5FB
225 C5FB
229 C5FB
V
V
231 100
233 C5FC
237 100
V
V
239 C5EA
241 C5EA


245
C5EA
247
C5EC
249
C5EB
253
C5EC
255
C5EC
259
200
261
300
263
C5ED
267
300
269
400
C5DA
275
400
277
500
279
C5DB
283
500
285
BASIN
287
C5DC
291
BASIN
294
DIVER9
RET9
295
C5CB



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*    OOD HYDROGRAPH PACKAGE  (HEC-1)    *
*          SEPTEMBER 1990               *
*           VERSION 4.0                 *
*                                       *
*  RUN DATE  12/11/1998  TIME  14:48:42 *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```


REPRODUCTION OF PBS&J RUN RACETRACK CONCEPTUAL STUDY
AND PDG EQUEST. DET. BASIN COMBINATION FOR NEW LOMR
FLOW EVALUATION INCLUDES NEW WAGON WHEEL INTERCHANGE AND CULVERTS CROSSING
BOLDER HIGHWAY AND NEW EQUESTRIAN & MAGIC WAY INLET
ASSUMES NEW CI-DETENTION BASIN IS COMPLETED
DOES NOT INCLUDE FLOWS NORTH IN RACETRACK
FILE NAME: EQUOALI.HC1
SDN 5 TOTAL BASIN AREA IS 9.75 SM
RAINFALL IS 3.43 WITH A DRAF OF .857 RESULTS IN A PB OF 2.94

11 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

R MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
1.00

*** ***

```
          **************
          *            *
301 KK    *       DET  *
          *            *
          **************
```

302 KO OUTPUT CONTROL VARIABLES

IPRNT	1	PRINT CONTROL
IPLOT	1	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	0	PUNCH COMPUTED HYDROGRAPH
IOUT	21	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
ISAV2	300	LAST ORDINATE PUNCHED OR SAVED
TIMINT	.083	TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

303 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	STOR	TYPE OF INITIAL CONDITION
RSVRIC	.00	INITIAL CONDITION
X	.00	WORKING R AND D COEFFICIENT

[illegible]V	STORAGE	.0	2.0	13.0	31.0	61.0	97.0	118.0	140.0	171.0	200.0
		229.0	261.0	290.0	315.0	344.0	379.0	409.0	437.0	470.0	504.0
306 SE	ELEVATION	2048.00	2050.00	2052.00	2054.00	2056.00	2058.00	2059.00	2060.00	2061.00	2062.00
		2063.00	2064.00	2065.00	2066.00	2067.00	2068.00	2069.00	2070.00	2071.00	2072.00
308 SQ	DISCHARGE	0.	37.	80.	117.	142.	163.	173.	182.	191.	198.
		206.	213.	221.	228.	235.	242.	248.	2755.	7761.	14467.

310 SS SPILLWAY

CREL	2069.00	SPILLWAY CREST ELEVATION
SPWID	900.00	SPILLWAY WIDTH
COQW	3.00	WEIR COEFFICIENT
EXPW	1.50	EXPONENT OF HEAD

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	2.00	13.00	31.00	61.00	97.00	118.00	140.00	171.00	200.00
OUTFLOW	.00	37.00	80.00	117.00	142.00	163.00	173.00	182.00	191.00	198.00
ELEVATION	2048.00	2050.00	2052.00	2054.00	2056.00	2058.00	2059.00	2060.00	2061.00	2062.00
STORAGE	229.00	261.00	290.00	315.00	344.00	379.00	409.00	437.00	470.00	504.00
OUTFLOW	206.00	213.00	221.00	228.00	235.00	242.00	248.00	2755.00	7761.00	14467.00
ELEVATION	2063.00	2064.00	2065.00	2066.00	2067.00	2068.00	2069.00	2070.00	2071.00	2072.00

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HYDROGRAPH AT STATION DET
PLAN 1, RATIO = 1.00

DA	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	0000	1	0.	.0	2048.0	1		0820	101	241.	374.0	2067.9	1		1640	201	204.	222.1	2062.8
1	0005	2	0.	.0	2048.0	1		0825	102	241.	372.4	2067.8	1		1645	202	204.	220.7	2062.7
1	0010	3	0.	.0	2048.0	1		0830	103	240.	370.9	2067.8	1		1650	203	203.	219.3	2062.7
1	0015	4	0.	.0	2048.0	1		0835	104	240.	369.3	2067.7	1		1655	204	203.	217.9	2062.6
1	0020	5	0.	.0	2048.0	1		0840	105	240.	367.7	2067.7	1		1700	205	203.	216.5	2062.6
1	0025	6	0.	.0	2048.0	1		0845	106	239.	366.1	2067.6	1		1705	206	202.	215.1	2062.5
1	0030	7	0.	.0	2048.0	1		0850	107	239.	364.5	2067.6	1		1710	207	202.	213.7	2062.5
1	0035	8	0.	.0	2048.0	1		0855	108	239.	362.9	2067.5	1		1715	208	201.	212.4	2062.4
1	0040	9	1.	.1	2048.1	1		0900	109	238.	361.4	2067.5	1		1720	209	201.	211.0	2062.4
1	0045	10	2.	.1	2048.1	1		0905	110	238.	359.8	2067.5	1		1725	210	201.	209.6	2062.3
1	0050	11	4.	.2	2048.2	1		0910	111	238.	358.2	2067.4	1		1730	211	200.	208.2	2062.3
1	0055	12	7.	.4	2048.4	1		0915	112	238.	356.6	2067.4	1		1735	212	200.	206.8	2062.2
1	0100	13	10.	.5	2048.5	1		0920	113	237.	355.0	2067.3	1		1740	213	200.	205.5	2062.2
1	0105	14	14.	.7	2048.7	1		0925	114	237.	353.4	2067.3	1		1745	214	199.	204.1	2062.1
1	0110	15	18.	1.0	2049.0	1		0930	115	237.	351.8	2067.2	1		1750	215	199.	202.7	2062.1
1	0115	16	21.	1.2	2049.2	1		0935	116	236.	350.2	2067.2	1		1755	216	198.	201.3	2062.0
1	0120	17	25.	1.4	2049.4	1		0940	117	236.	348.6	2067.1	1		1800	217	198.	200.0	2062.0
1	0125	18	29.	1.6	2049.6	1		0945	118	236.	347.0	2067.1	1		1805	218	198.	198.6	2062.0
1	0130	19	33.	1.8	2049.8	1		0950	119	235.	345.4	2067.0	1		1810	219	197.	197.3	2061.9
1	0135	20	37.	2.1	2050.0	1		0955	120	235.	343.8	2067.0	1		1815	220	197.	195.9	2061.9
1	0140	21	39.	2.6	2050.1	1		1000	121	235.	342.2	2066.9	1		1820	221	197.	194.6	2061.8
1	0145	22	42.	3.2	2050.2	1		1005	122	234.	340.6	2066.9	1		1825	222	196.	193.2	2061.8
1	0150	23	45.	4.0	2050.4	1		1010	123	234.	339.0	2066.8	1		1830	223	196.	191.8	2061.7
1	0155	24	48.	4.8	2050.5	1		1015	124	233.	337.4	2066.8	1		1835	224	196.	190.5	2061.7
1	0200	25	52.	5.8	2050.7	1		1020	125	233.	335.8	2066.7	1		1840	225	195.	189.2	2061.6
1	0205	26	56.	6.8	2050.9	1		1025	126	233.	334.3	2066.7	1		1845	226	195.	187.8	2061.6
1	0210	27	61.	8.1	2051.1	1		1030	127	232.	332.7	2066.6	1		1850	227	195.	186.5	2061.5
1	0215	28	66.	9.5	2051.4	1		1035	128	232.	331.1	2066.6	1		1855	228	194.	185.1	2061.5
1	0220	29	72.	11.0	2051.6	1		1040	129	231.	329.5	2066.5	1		1900	229	194.	183.8	2061.4
1	0225	30	78.	12.5	2051.9	1		1045	130	231.	327.9	2066.4	1		1905	230	194.	182.5	2061.4
1	0230	31	82.	14.0	2052.1	1		1050	131	231.	326.3	2066.4	1		1910	231	193.	181.1	2061.3
1	0235	32	85.	15.5	2052.3	1		1055	132	230.	324.8	2066.3	1		1915	232	193.	179.8	2061.3
1	0240	33	88.	17.0	2052.4	1		1100	133	230.	323.2	2066.3	1		1920	233	193.	178.5	2061.3
1	0245	34	91.	18.3	2052.6	1		1105	134	230.	321.6	2066.2	1		1925	234	192.	177.1	2061.2
1	0250	35	94.	19.7	2052.7	1		1110	135	229.	320.1	2066.2	1		1930	235	192.	175.8	2061.2
1	0255	36	96.	21.0	2052.9	1		1115	136	229.	318.5	2066.1	1		1935	236	192.	174.5	2061.1
1	0300	37	100.	22.5	2053.1	1		1120	137	228.	316.9	2066.1	1		1940	237	192.	173.2	2061.1
1	0305	38	103.	24.4	2053.3	1		1125	138	228.	315.4	2066.0	1		1945	238	191.	171.9	2061.0
1	0310	39	108.	26.8	2053.5	1		1130	139	228.	313.8	2066.0	1		1950	239	191.	170.5	2061.0
1	0315	40	115.	30.0	2053.9	1		1135	140	227.	312.2	2065.9	1		1955	240	190.	169.2	2060.9
1	0320	41	120.	34.5	2054.2	1		1140	141	227.	310.7	2065.8	1		2000	241	190.	167.9	2060.9
1	0325	42	125.	40.9	2054.7	1		1145	142	226.	309.1	2065.8	1		2005	242	190.	166.6	2060.9
1	0330	43	133.	50.1	2055.3	1		1150	143	226.	307.6	2065.7	1		2010	243	189.	165.3	2060.8
1	0335	44	143.	62.5	2056.1	1		1155	144	225.	306.0	2065.6	1		2015	244	189.	164.0	2060.8
1	0340	45	152.	78.5	2057.0	1		1200	145	225.	304.5	2065.6	1		2020	245	189.	162.7	2060.7
1	0345	46	163.	96.9	2058.0	1		1205	146	225.	302.9	2065.5	1		2025	246	188.	161.4	2060.7
1	0350	47	172.	116.5	2058.9	1		1210	147	224.	301.4	2065.5	1		2030	247	188.	160.1	2060.6
1	0355	48	180.	136.1	2059.8	1		1215	148	224.	299.9	2065.4	1		2035	248	187.	158.8	2060.6
1	0400	49	186.	155.0	2060.5	1		1220	149	223.	298.3	2065.3	1		2040	249	187.	157.5	2060.6
1	0405	50	191.	172.6	2061.1	1		1225	150	223.	296.8	2065.3	1		2045	250	187.	156.2	2060.5
1	0410	51	195.	188.7	2061.6	1		1230	151	222.	295.3	2065.2	1		2050	251	186.	155.0	2060.5
1	0415	52	199.	203.2	2062.1	1		1235	152	222.	293.7	2065.1	1		2055	252	186.	153.7	2060.4
1	0420	53	202.	216.3	2062.6	1		1240	153	222.	292.2	2065.1	1		2100	253	186.	152.4	2060.4

1	0425	54	206.	228.0	2063.0	*	1	1245	154	221.	290.7	2065.0	*	1	2105	254	185.	151.1	2060.4
1	0430	55	208.	238.7	2063.3	*	1	1250	155	221.	289.2	2065.0	*	1	2110	255	185.	149.9	2060.3
1	0435	56	210.	248.5	2063.6	*	1	1255	156	220.	287.7	2064.9	*	1	2115	256	184.	148.6	2060.3
1	0440	57	212.	258.0	2063.9	*	1	1300	157	220.	286.2	2064.9	*	1	2120	257	184.	147.3	2060.2
1	0445	58	215.	267.8	2064.2	*	1	1305	158	220.	284.7	2064.8	*	1	2125	258	184.	146.0	2060.2
1	0450	59	218.	278.4	2064.6	*	1	1310	159	219.	283.1	2064.8	*	1	2130	259	183.	144.8	2060.2
1	0455	60	221.	289.9	2065.0	*	1	1315	160	219.	281.6	2064.7	*	1	2135	260	183.	143.5	2060.1
1	0500	61	224.	302.3	2065.5	*	1	1320	161	218.	280.1	2064.7	*	1	2140	261	183.	142.3	2060.1
1	0505	62	228.	315.0	2066.0	*	1	1325	162	218.	278.6	2064.6	*	1	2145	262	182.	141.0	2060.0
1	0510	63	231.	327.4	2066.4	*	1	1330	163	217.	277.1	2064.6	*	1	2150	263	182.	139.8	2060.0
1	0515	64	234.	338.9	2066.8	*	1	1335	164	217.	275.7	2064.5	*	1	2155	264	181.	138.5	2059.9
1	0520	65	236.	349.2	2067.1	*	1	1340	165	217.	274.2	2064.5	*	1	2200	265	181.	137.3	2059.9
1	0525	66	238.	358.2	2067.4	*	1	1345	166	216.	272.7	2064.4	*	1	2205	266	180.	136.0	2059.8
1	0530	67	239.	365.9	2067.6	*	1	1350	167	216.	271.2	2064.4	*	1	2210	267	180.	134.8	2059.8
1	0535	68	241.	372.5	2067.8	*	1	1355	168	215.	269.7	2064.3	*	1	2215	268	179.	133.5	2059.7
1	0540	69	242.	378.0	2068.0	*	1	1400	169	215.	268.2	2064.2	*	1	2220	269	179.	132.3	2059.6
1	0545	70	243.	382.6	2068.1	*	1	1405	170	215.	266.8	2064.2	*	1	2225	270	178.	131.1	2059.6
1	0550	71	243.	386.4	2068.2	*	1	1410	171	214.	265.3	2064.1	*	1	2230	271	178.	129.8	2059.5
1	0555	72	244.	389.5	2068.4	*	1	1415	172	214.	263.8	2064.1	*	1	2235	272	177.	128.6	2059.5
1	0600	73	245.	392.1	2068.4	*	1	1420	173	213.	262.3	2064.0	*	1	2240	273	177.	127.4	2059.4
1	0605	74	245.	394.2	2068.5	*	1	1425	174	213.	260.9	2064.0	*	1	2245	274	176.	126.2	2059.4
1	0610	75	245.	395.8	2068.6	*	1	1430	175	213.	259.4	2064.0	*	1	2250	275	176.	125.0	2059.3
1	0615	76	246.	397.1	2068.6	*	1	1435	176	212.	258.0	2063.9	*	1	2255	276	175.	123.8	2059.3
1	0620	77	246.	398.0	2068.6	*	1	1440	177	212.	256.5	2063.9	*	1	2300	277	175.	122.6	2059.2
1	0625	78	246.	398.6	2068.7	*	1	1445	178	212.	255.0	2063.8	*	1	2305	278	174.	121.4	2059.2
1	0630	79	246.	398.9	2068.7	*	1	1450	179	211.	253.6	2063.8	*	1	2310	279	174.	120.2	2059.1
1	0635	80	246.	398.9	2068.7	*	1	1455	180	211.	252.1	2063.7	*	1	2315	280	173.	119.0	2059.0
1	0640	81	246.	398.6	2068.7	*	1	1500	181	211.	250.7	2063.7	*	1	2320	281	173.	117.8	2059.0
1	0645	82	246.	398.2	2068.6	*	1	1505	182	210.	249.2	2063.6	*	1	2325	282	172.	116.6	2058.9
1	0650	83	246.	397.6	2068.6	*	1	1510	183	210.	247.8	2063.6	*	1	2330	283	172.	115.4	2058.9
1	0655	84	246.	396.8	2068.6	*	1	1515	184	210.	246.3	2063.5	*	1	2335	284	171.	114.2	2058.8
1	0700	85	245.	396.0	2068.6	*	1	1520	185	209.	244.9	2063.5	*	1	2340	285	171.	113.0	2058.8
1	0705	86	245.	395.0	2068.5	*	1	1525	186	209.	243.5	2063.5	*	1	2345	286	170.	111.9	2058.7
1	0710	87	245.	393.9	2068.5	*	1	1530	187	209.	242.0	2063.4	*	1	2350	287	170.	110.7	2058.7
1	0715	88	245.	392.7	2068.5	*	1	1535	188	209.	240.6	2063.4	*	1	2355	288	169.	109.5	2058.6
1	0720	89	244.	391.5	2068.4	*	1	1540	189	208.	239.2	2063.3	*	2	0000	289	168.	108.4	2058.5
1	0725	90	244.	390.2	2068.4	*	1	1545	190	208.	237.7	2063.3	*	2	0005	290	168.	107.2	2058.5
1	0730	91	244.	388.8	2068.3	*	1	1550	191	208.	236.3	2063.2	*	2	0010	291	167.	106.1	2058.4
1	0735	92	244.	387.4	2068.3	*	1	1555	192	207.	234.9	2063.2	*	2	0015	292	167.	104.9	2058.4
1	0740	93	243.	386.0	2068.2	*	1	1600	193	207.	233.4	2063.1	*	2	0020	293	166.	103.8	2058.3
1	0745	94	243.	384.6	2068.2	*	1	1605	194	207.	232.0	2063.1	*	2	0025	294	166.	102.6	2058.3
1	0750	95	243.	383.1	2068.1	*	1	1610	195	206.	230.6	2063.0	*	2	0030	295	165.	101.5	2058.2
1	0755	96	243.	381.6	2068.1	*	1	1615	196	206.	229.2	2063.0	*	2	0035	296	165.	100.3	2058.2
1	0800	97	242.	380.1	2068.0	*	1	1620	197	206.	227.8	2063.0	*	2	0040	297	164.	99.2	2058.1
1	0805	98	242.	378.6	2068.0	*	1	1625	198	205.	226.3	2062.9	*	2	0045	298	164.	98.1	2058.1
1	0810	99	242.	377.1	2067.9	*	1	1630	199	205.	224.9	2062.9	*	2	0050	299	163.	97.0	2058.0
1	0815	100	241.	375.5	2067.9	*	1	1635	200	204.	223.5	2062.8	*	2	0055	300	162.	95.8	2057.9
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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
(CFS)	(HR)		6-HR	24-HR	72-HR	24.92-HR
246.	6.58	(CFS)	239.	194.	187.	187.
		(INCHES)	.316	1.022	1.022	1.022
		(AC-FT)	119.	384.	384.	384.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
(AC-FT)	(HR)	6-HR	24-HR	72-HR	24.92-HR
399.	6.58	367.	223.	215.	215.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
(FEET)	(HR)	6-HR	24-HR	72-HR	24.92-HR
2068.66	6.58	2067.66	2062.27	2061.75	2061.75

CUMULATIVE AREA = 7.05 SQ MI

*** FDKROT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION
OPERATION	STATION	AREA	PLAN		RATIO 1
					1.00
HYDROGRAPH AT	OFF-16	.11	1	FLOW	109.
				TIME	3.50
ROUTED TO	R-16	.11	1	FLOW	101.
				TIME	3.50
HYDROGRAPH AT	OFF-15	.33	1	FLOW	239.
				TIME	3.67
2 COMBINED AT	C1	.44	1	FLOW	312.
				TIME	3.58
ROUTED TO	R-C1	.44	1	FLOW	308.
				TIME	3.67
HYDROGRAPH AT	OFF-14	.27	1	FLOW	64.
				TIME	3.83
ROUTED TO	R-14	.27	1	FLOW	63.
				TIME	3.92
HYDROGRAPH AT	OFF-10	.42	1	FLOW	204.
				TIME	4.17
DIVERSION TO	DIVER1	.42	1	FLOW	26.
				TIME	4.17
HYDROGRAPH AT	DIVERT	.42	1	FLOW	178.
				TIME	4.17
3 COMBINED AT	C2	1.14	1	FLOW	474.
				TIME	3.83
ROUTED TO	R-C2	1.14	1	FLOW	473.
				TIME	3.83
HYDROGRAPH AT	OFF-9	.14	1	FLOW	74.
				TIME	3.67
ROUTED TO	R-9	.14	1	FLOW	73.
				TIME	3.75
HYDROGRAPH AT	OFF-4	.08	1	FLOW	61.
				TIME	3.75
3 COMBINED AT	C3	1.37	1	FLOW	601.
				TIME	3.83
ROUTED TO	R-C3	1.37	1	FLOW	600.

				TIME	3.83
HYDROGRAPH AT	OFF-13	.53	1	FLOW	395.
				TIME	3.67
ROUTED TO	R-13	.53	1	FLOW	393.
				TIME	3.67
HYDROGRAPH AT	OFF-8	.13	1	FLOW	75.
				TIME	3.67
2 COMBINED AT	C4	.66	1	FLOW	468.
				TIME	3.67
HYDROGRAPH AT	OFF-3	.15	1	FLOW	141.
				TIME	3.75
3 COMBINED AT	C5	2.17	1	FLOW	1153.
				TIME	3.75
DIVERSION TO	DIVER2	2.17	1	FLOW	107.
				TIME	3.75
HYDROGRAPH AT	DIVER2	2.17	1	FLOW	1046.
				TIME	3.75
ROUTED TO	R-C5	2.17	1	FLOW	1045.
				TIME	3.75
HYDROGRAPH AT	OFF-2C	.07	1	FLOW	33.
				TIME	3.83
2 COMBINED AT	C6	2.24	1	FLOW	1078.
				TIME	3.75
DIVERSION TO	DIVER3	2.24	1	FLOW	200.
				TIME	3.75
HYDROGRAPH AT	DIVER3	2.24	1	FLOW	878.
				TIME	3.75
ROUTED TO	R-C6	2.24	1	FLOW	874.
				TIME	3.75
HYDROGRAPH AT	OFF-11	.22	1	FLOW	182.
				TIME	3.67
HYDROGRAPH AT	OFF-12	.08	1	FLOW	51.
				TIME	3.67
2 COMBINED AT	C7	.30	1	FLOW	234.
				TIME	3.67
ROUTED TO	R-C7a	.30	1	FLOW	233.
				TIME	3.67
ROUTED TO	R-C7b	.30	1	FLOW	230.
				TIME	3.75
HYDROGRAPH AT	OFF-6	.03	1	FLOW	25.

				TIME	3.58
2 COMBINED AT	C8	.33	1	FLOW	249.
				TIME	3.67
ROUTED TO	R-C8a	.33	1	FLOW	248.
				TIME	3.75
HYDROGRAPH AT	OFF-2B	.14	1	FLOW	70.
				TIME	3.83
2 COMBINED AT	C9	.46	1	FLOW	317.
				TIME	3.75
2 COMBINED AT	C10	2.70	1	FLOW	1191.
				TIME	3.75
DIVERSION TO	DIVER4	2.70	1	FLOW	107.
				TIME	3.75
HYDROGRAPH AT	DIVER4	2.70	1	FLOW	1084.
				TIME	3.75
ROUTED TO	R-C10	2.70	1	FLOW	1075.
				TIME	3.75
HYDROGRAPH AT	OFF-2A	.07	1	FLOW	40.
				TIME	3.75
2 COMBINED AT	C11	2.78	1	FLOW	1115.
				TIME	3.75
DIVERSION TO	DIVER5	2.78	1	FLOW	307.
				TIME	3.75
HYDROGRAPH AT	DIVER5	2.78	1	FLOW	808.
				TIME	3.75
HYDROGRAPH AT	OFF-21	.04	1	FLOW	43.
				TIME	3.58
HYDROGRAPH AT	RET4	.00	1	FLOW	107.
				TIME	3.75
2 COMBINED AT	CD4	.04	1	FLOW	140.
				TIME	3.67
ROUTED TO	R-21	.04	1	FLOW	139.
				TIME	3.75
HYDROGRAPH AT	OFF-23	.06	1	FLOW	52.
				TIME	3.67
HYDROGRAPH AT	RET3	.00	1	FLOW	200.
				TIME	3.75
2 COMBINED AT	CD3	.06	1	FLOW	246.
				TIME	3.67
2 COMBINED AT	C17	.10	1	FLOW	385.

				TIME	3.75
HYDROGRAPH AT	C5CAb	1.13	1	FLOW	417.
				TIME	3.67
DIVERSION TO	DIVER9	1.13	1	FLOW	269.
				TIME	3.67
HYDROGRAPH AT	QSPLT	1.13	1	FLOW	148.
				TIME	3.42
HYDROGRAPH AT	RET1	.00	1	FLOW	26.
				TIME	4.17
ROUTED TO	RDIV1	.00	1	FLOW	26.
				TIME	4.25
2 COMBINED AT	CC1	1.13	1	FLOW	174.
				TIME	4.25
HYDROGRAPH AT	C5CAa	.35	1	FLOW	219.
				TIME	3.92
HYDROGRAPH AT	RET2	.00	1	FLOW	107.
				TIME	3.75
2 COMBINED AT	CD2	.35	1	FLOW	312.
				TIME	3.83
2 COMBINED AT	C19	1.49	1	FLOW	483.
				TIME	3.92
DIVERSION TO	DIVER7	1.49	1	FLOW	205.
				TIME	3.92
HYDROGRAPH AT	DIVER7	1.49	1	FLOW	278.
				TIME	3.92
2 COMBINED AT	C20	1.59	1	FLOW	654.
				TIME	3.75
HYDROGRAPH AT	C5FD	.19	1	FLOW	135.
				TIME	3.67
ROUTED TO	C5FB	.19	1	FLOW	132.
				TIME	3.75
HYDROGRAPH AT	C5FA	.54	1	FLOW	472.
				TIME	3.58
ROUTED TO	C5FB	.54	1	FLOW	460.
				TIME	3.67
HYDROGRAPH AT	C5FB	.17	1	FLOW	43.
				TIME	3.75
3 COMBINED AT	C5FB	.89	1	FLOW	633.
				TIME	3.75
ROUTED TO	100	.89	1	FLOW	632.

				TIME	3.75
HYDROGRAPH AT	C5FC	.19	1	FLOW	103.
				TIME	3.67
2 COMBINED AT	100	1.08	1	FLOW	732.
				TIME	3.75
ROUTED TO	C5EA	1.08	1	FLOW	726.
				TIME	3.75
HYDROGRAPH AT	C5EA	.52	1	FLOW	272.
				TIME	4.00
2 COMBINED AT	C5EA	1.60	1	FLOW	950.
				TIME	3.75
ROUTED TO	C5EC	1.60	1	FLOW	941.
				TIME	3.83
HYDROGRAPH AT	C5EB	.59	1	FLOW	157.
				TIME	4.08
ROUTED TO	C5EC	.59	1	FLOW	155.
				TIME	4.42
HYDROGRAPH AT	C5EC	.26	1	FLOW	112.
				TIME	3.67
3 COMBINED AT	200	2.46	1	FLOW	1027.
				TIME	3.83
ROUTED TO	300	2.46	1	FLOW	1023.
				TIME	3.83
HYDROGRAPH AT	C5ED	.15	1	FLOW	108.
				TIME	3.58
2 COMBINED AT	300	2.60	1	FLOW	1075.
				TIME	3.83
ROUTED TO	400	2.60	1	FLOW	1066.
				TIME	3.83
HYDROGRAPH AT	C5DA	1.02	1	FLOW	664.
				TIME	3.75
2 COMBINED AT	400	3.63	1	FLOW	1719.
				TIME	3.83
ROUTED TO	500	3.63	1	FLOW	1714.
				TIME	3.83
HYDROGRAPH AT	C5DB	.65	1	FLOW	359.
				TIME	3.92
2 COMBINED AT	500	4.28	1	FLOW	2069.
				TIME	3.83
ROUTED TO	BASIN	4.28	1	FLOW	2052.

				TIME	3.83
HYDROGRAPH AT	C5DC	1.02	1	FLOW	198.
				TIME	4.17
2 [redacted]INED AT	BASIN	5.30	1	FLOW	2208.
				TIME	3.92
HYDROGRAPH AT	RET9	.00	1	FLOW	269.
				TIME	3.67
HYDROGRAPH AT	C5CB	.17	1	FLOW	17.
				TIME	5.17
4 COMBINED AT	BASIN	7.05	1	FLOW	3057.
				TIME	3.83
ROUTED TO	DET	7.05	1	FLOW	246.
				TIME	6.58
			** PEAK STAGES IN FEET **		
			1	STAGE	2068.66
				TIME	6.58
HYDROGRAPH AT	OFF-24	.06	1	FLOW	51.
				TIME	3.58
HYDROGRAPH AT	RET7	.00	1	FLOW	205.
				TIME	3.92
RO[redacted] TO	R24	.00	1	FLOW	205.
				TIME	3.92
2 COMBINED AT	MAGIC	.06	1	FLOW	229.
				TIME	3.75

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= 1.00									
	R-16 MANE	.79	107.49	211.25	1.40	5.00	100.90	210.00	1.40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8569E+01 EXCESS= .0000E+00 OUTFLOW= .8582E+01 BASIN STORAGE= .1228E-05 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
	R-C1 MANE	1.68	309.85	219.23	1.61	5.00	308.44	220.00	1.61

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3804E+02 EXCESS= .0000E+00 OUTFLOW= .3809E+02 BASIN STORAGE= .1565E-03 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
	R-14 MANE	1.56	63.44	233.39	.60	5.00	62.95	235.00	.60

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8705E+01 EXCESS= .0000E+00 OUTFLOW= .8711E+01 BASIN STORAGE= .8139E-05 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
	R-C2 MANE	1.48	473.34	230.84	1.29	5.00	473.24	230.00	1.29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7834E+02 EXCESS= .0000E+00 OUTFLOW= .7838E+02 BASIN STORAGE= .4821E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
	R-9 MANE	1.39	73.78	222.97	1.15	5.00	73.39	225.00	1.15

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8707E+01 EXCESS= .0000E+00 OUTFLOW= .8717E+01 BASIN STORAGE= .1169E-04 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
	R-C3 MANE	.57	600.37	230.65	1.30	5.00	600.12	230.00	1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9495E+02 EXCESS= .0000E+00 OUTFLOW= .9496E+02 BASIN STORAGE= .3468E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
	R-13 MANE	.50	393.56	220.34	1.54	5.00	392.88	220.00	1.54

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4311E+02 EXCESS= .0000E+00 OUTFLOW= .4312E+02 BASIN STORAGE= .1054E-05 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

```
          R-C5  MANE          .48   1045.50    225.38      1.30      5.00   1044.88    225.00        1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1502E+03 EXCESS= .0000E+00 OUTFLOW= .1502E+03 BASIN STORAGE= .2219E-03 PERCENT ERROR=     .0

        FOR PLAN = 1  RATIO= 1.00
          R-C6  MANE          .48    877.97    225.95      1.06      5.00    873.72    225.00        1.06

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1260E+03 EXCESS= .0000E+00 OUTFLOW= .1260E+03 BASIN STORAGE= .2210E-03 PERCENT ERROR=     .0

        FOR PLAN = 1  RATIO= 1.00
          R-C7a  MANE         .10    233.40    220.20      1.80      5.00    233.07    220.00        1.80

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2836E+02 EXCESS= .0000E+00 OUTFLOW= .2836E+02 BASIN STORAGE= .5611E-07 PERCENT ERROR=     .0

        FOR PLAN = 1  RATIO= 1.00
          R-C7b  MANE         .60    232.97    221.20      1.80      5.00    230.02    225.00        1.80

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2837E+02 EXCESS= .0000E+00 OUTFLOW= .2837E+02 BASIN STORAGE= .2015E-05 PERCENT ERROR=     .0

        FOR PLAN = 1  RATIO= 1.00
          R-C8a  MANE        1.55    249.22    223.34      1.75      5.00    248.08    225.00        1.75

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3067E+02 EXCESS= .0000E+00 OUTFLOW= .3072E+02 BASIN STORAGE= .8389E-04 PERCENT ERROR=    -.1

        FOR PLAN = 1  RATIO= 1.00
          R-C10  MANE         .43   1082.35    226.04      1.05      5.00   1075.01    225.00        1.05

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1511E+03 EXCESS= .0000E+00 OUTFLOW= .1511E+03 BASIN STORAGE= .2301E-03 PERCENT ERROR=     .0

        FOR PLAN = 1  RATIO= 1.00
          R-21  MANE         1.80    139.37    224.84      8.28      5.00    139.26    225.00        8.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1919E+02 EXCESS= .0000E+00 OUTFLOW= .1921E+02 BASIN STORAGE= .3676E-03 PERCENT ERROR=    -.1

        FOR PLAN = 1  RATIO= 1.00
          RDIV1  MANE        2.33     25.81    253.61     -1.00      5.00     25.80    255.00       -1.00

        FOR PLAN = 1  RATIO= 1.00
          C5FB  MANE         1.68    134.46    223.30      1.57      5.00    131.76    225.00        1.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1543E+02 EXCESS= .0000E+00 OUTFLOW= .1546E+02 BASIN STORAGE= .2303E-04 PERCENT ERROR=    -.2
```

FOR PLAN = 1 RATIO= 1.00

C5FB	MANE	2.64	470.25	221.61	1.80	5.00	460.03	220.00	1.80

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5141E+02 EXCESS= .0000E+00 OUTFLOW= .5173E+02 BASIN STORAGE= .2045E-02 PERCENT ERROR= -.6

FOR PLAN = 1 RATIO= 1.00

100	MANE	.76	632.43	225.40	1.53	5.00	632.06	225.00	1.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7272E+02 EXCESS= .0000E+00 OUTFLOW= .7275E+02 BASIN STORAGE= .5282E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

C5EA	MANE	.64	729.30	225.76	1.46	5.00	725.65	225.00	1.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8464E+02 EXCESS= .0000E+00 OUTFLOW= .8467E+02 BASIN STORAGE= .5379E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

C5EC	MANE	1.04	947.77	227.60	1.52	5.00	940.59	230.00	1.52

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1300E+03 EXCESS= .0000E+00 OUTFLOW= .1301E+03 BASIN STORAGE= .1201E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00

C5EC	MANE	5.00	156.32	268.09	.84	5.00	155.44	265.00	.84

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2633E+02 EXCESS= .0000E+00 OUTFLOW= .2639E+02 BASIN STORAGE= .1483E-01 PERCENT ERROR= -.3

FOR PLAN = 1 RATIO= 1.00

300	MANE	1.29	1024.12	232.08	1.29	5.00	1022.70	230.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1683E+03 EXCESS= .0000E+00 OUTFLOW= .1684E+03 BASIN STORAGE= .4311E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

400	MANE	.66	1072.59	231.53	1.28	5.00	1065.81	230.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1780E+03 EXCESS= .0000E+00 OUTFLOW= .1780E+03 BASIN STORAGE= .2291E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

500	MANE	.32	1718.29	230.61	1.38	5.00	1714.41	230.00	1.38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2675E+03 EXCESS= .0000E+00 OUTFLOW= .2674E+03 BASIN STORAGE= .9974E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

BASIN	MANE	.53	2067.08	231.24	1.41	5.00	2052.08	230.00	1.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3218E+03 EXCESS= .0000E+00 OUTFLOW= .3218E+03 BASIN STORAGE= .2636E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

R24	MANE	.37	204.74	235.64	-1.00	5.00	204.67	235.00	-1.00

*** NORMAL END OF HEC-1 ***

APPENDIX B

HEC-1

EQUOAL4.HC1

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE (HEC-1)     *
*        SEPTEMBER 1990                 *
*         VERSION 4.0                   *
*                                       *
*  RUN DATE 12/11/1998 TIME 13:08:15    *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*        609 SECOND STREET              *
*      DAVIS, CALIFORNIA 95616          *
*         (916) 756-1104                *
*                                       *
*****************************************
```


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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::                 by                 :::
:::        Haestad Methods, Inc.       :::
:::                                    :::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          *DIAGRAM
    1     ID  EVALUATION OF ORIGIONAL DESIGN OF EQUESTRIAN BASIN USEING AS BUILT BASINS
    2     ID  THIS RUN IS USED TO EVALUATE THE CHANNEL FLOW AND BASIN BASED ON FINAL
    3     ID  FLOW DESIGN
    4     ID  FLOW EVALUATION DOES NOT INCLUDE NEW BOULDER HIGHWAY CULVERT
    5     ID  EVALUATION BUT DOES INLCUDE NEW EQUESTRIAN & MAGIC WAY INLET
    6     ID  ASSUMES NEW CI-DETENTION BASIN IS COMPLETED
    7     ID  DOES NOT INCLUDE FLOWS NORTH IN RACETRACK
    8     ID  FILE NAME: EQUOAL4.HC1
    9     IT      5       0       0     300
   10     IO      5       0       0
   11     IN      5
   12     JR    PREC     1.0

   13     KK  OFF-10
   14     BA  0.4227
   15     PB    3.05
   16     PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
   17     PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
   18     PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
   19     PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
   20     PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
   21     PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
   22     PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
   23     PC    .998    .999   1.00
   24     LS       0      87
   25     UD   0.758

   26     KK  DIVERT
   27     KM   DIVERT1 FLOWS CONVEYED INTO CULVERT "A" STA 296+24
   28     DT  DIVER1
   29     DI       0      37     126     260     502
   30     DQ       0      10      20      30      40

   31     KK  OFF-21
   32     BA  0.0435
   33     LS       0      85
   34     UD   0.197

   35     KK    R-21
   36     RK    1700   0.005   0.016            TRAP     100       1

   37     KK  OFF-23
   38     BA  0.0587
   39     LS       0      85
   40     UD   0.250

   41     KK     C17
   42     HC       2
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  43      KK   C5CAb
  44      BA  1.1309
  45      LS     0      68
  46      UD   0.28

  47      KK   QSPLT
  48      DT  DIVER9
  49      DI     0     148     200     300     400
  50      DQ     0       0      52     152     252

  51      KK    RET1
  52      DR  DIVER1

  53      KK   RDIV1
  54      RK    1200   0.004   0.016           TRAP       0       50

  55      KK     CC1
  56      HC       2

  57      KK   C5CAa
  58      BA  0.3541
  59      LS     0      85
  60      UD   0.558

  61      KK     C19
  62      HC       2

  63      KK  DIVER7
  64      KM   DIVERT FLOW INTO DET BASIN AT EQUESTRIAN DRIVE MAGIC WAY INLET SYSTEM
  65      DT  DIVER7
  66      DI       0    1151
  67      DQ       0     488

  68      KK     C20
  69      HC       2

  70      KK    C5FD
  71      BA  0.1851
  72      PB    2.97
  73      LS       0      85
  74      UD   0.285

  75      KK    C5FB
  76      RK     500   0.015    0.25           TRAP      35        3

  77      KK    C5FA
  78      BA  0.5380
  79      LS       0      88
  80      UD    0.23
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  81      KK    C5FB
  82      RK    4100  0.0615   0.040          TRAP     200       2

  83      KK    C5FB
  84      BA  0.1707
  85      LS       0      68
  86      UD    0.35

  87      KK    C5FB
  88      HC       3

  89      KK     100
  90      RK    1500   0.015   0.030          TRAP      35       3

  91      KK    C5FC
  92      BA  0.1906
  93      LS       0      79
  94      UD    0.30

  95      KK     100
  96      HC       2       0

  97      KK    C5EA
  98      RK    1300   0.015   0.030          TRAP      35       3

  99      KK    C5EA
 100      BA  0.5191
 101      LS       0      86
 102      UD    0.62

 103      KK    C5EA
 104      HC       2

 105      KK    C5EC
 106      RK    2500   0.015   0.030          TRAP      35       3

 107      KK    C5EB
 108      BA  0.5885
 109      LS       0      73
 110      UD    0.64

 111      KK    C5EC
 112      RK    2000    0.05    0.40          TRAP     200       3

 113      KK    C5EC
 114      BA  0.2648
 115      LS       0      73
 116      UD    0.25
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  117     KK     200
  118     HC       3

  119     KK     300
  120     RK    2100   0.005   0.030          TRAP      35       3

  121     KK    C5ED
  122     BA  0.1474
  123     LS       0      80
  124     UD    0.17

  125     KK     300
  126     HC       2

  127     KK     400
  128     RK    1000   0.005   0.030          TRAP      35       3

  129     KK    C5DA
  130     BA  1.0241
  131     LS       0      86
  132     UD    0.40

  133     KK     400
  134     HC       2

  135     KK     500
  136     RK    1000    0.04    0.03          TRAP      35       6

  137     KK    C5DB
  138     BA  0.6505
  139     LS       0      85
  140     UD   0.515

  141     KK     500
  142     HC       2

  143     KK   BASIN
  144     RK    3000   0.015   0.015          TRAP      20       2

  145     KK    C5DC
  146     BA  1.0180
  147     LS       0      69
  148     UD   0.685

  149     KK   BASIN
  150     HC       2

  151     KK    RET9
  152     DR  DIVER9
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  153     KK    C5CB
  154     BA  0.1654
  155     LS       0      58
  156     UD    0.49

  157     KK   BASIN
  158     HC       4

  159     KK     DET
  160     KO       1       1       0       0      21
  161     RS       1    STOR       0
  162     SV       0       2      13      31      61      97     118     140     171     200
  163     SV     229     261     290     315     344     379     409     437     470     504
  164     SE    2048    2050    2052    2054    2056    2058    2059    2060    2061    2062
  165     SE    2063    2064    2065    2066    2067    2068    2069    2070    2071    2072
  166     SQ       0      37      80     117     142     163     173     182     191     198
  167     SQ     206     213     221     228     235     242     248    2755    7761   14467
  168     SS    2069     900     3.0     1.5

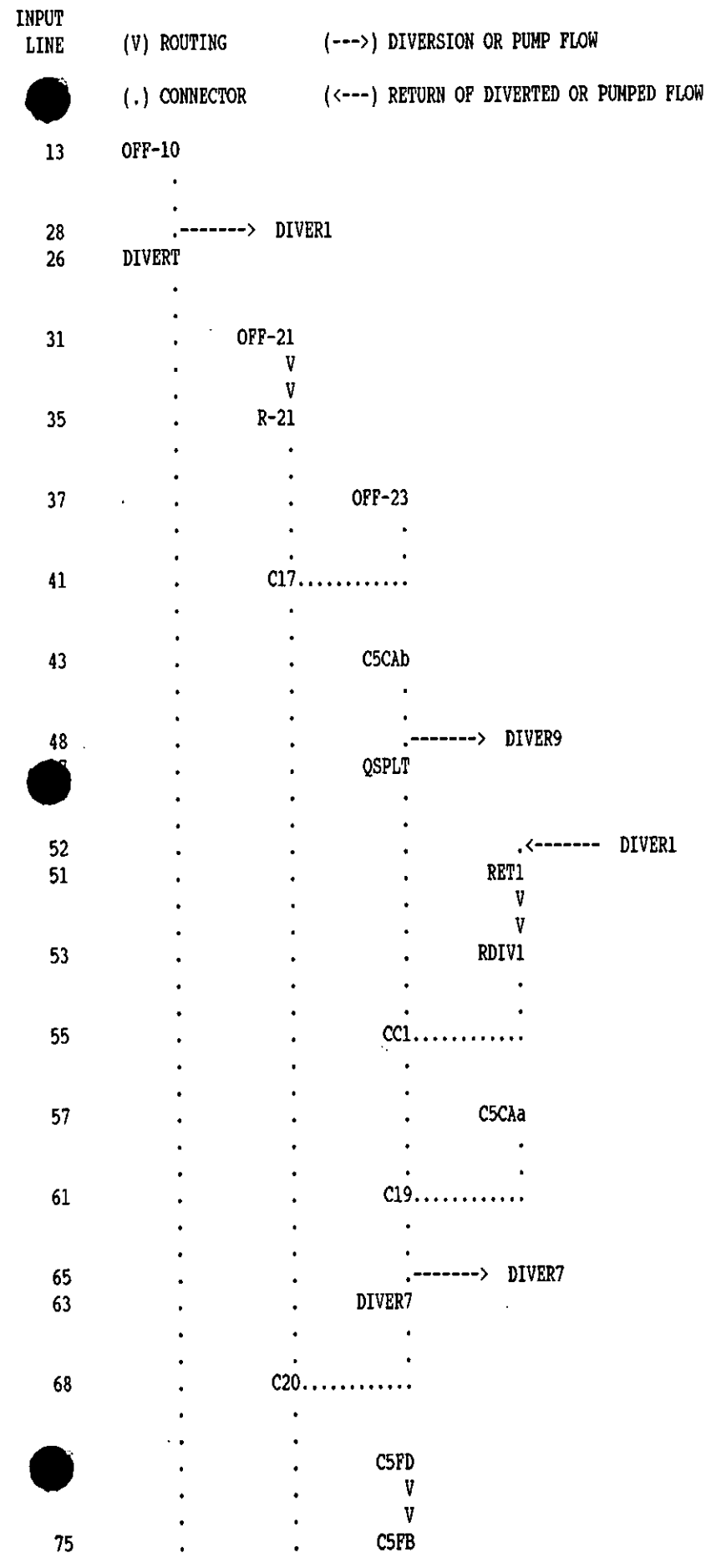
  169     KK  OFF-24
  170     BA  0.0581
  171     LS       0      85
  172     UD   0.183

  173     KK    RET7
  174     DR  DIVER7

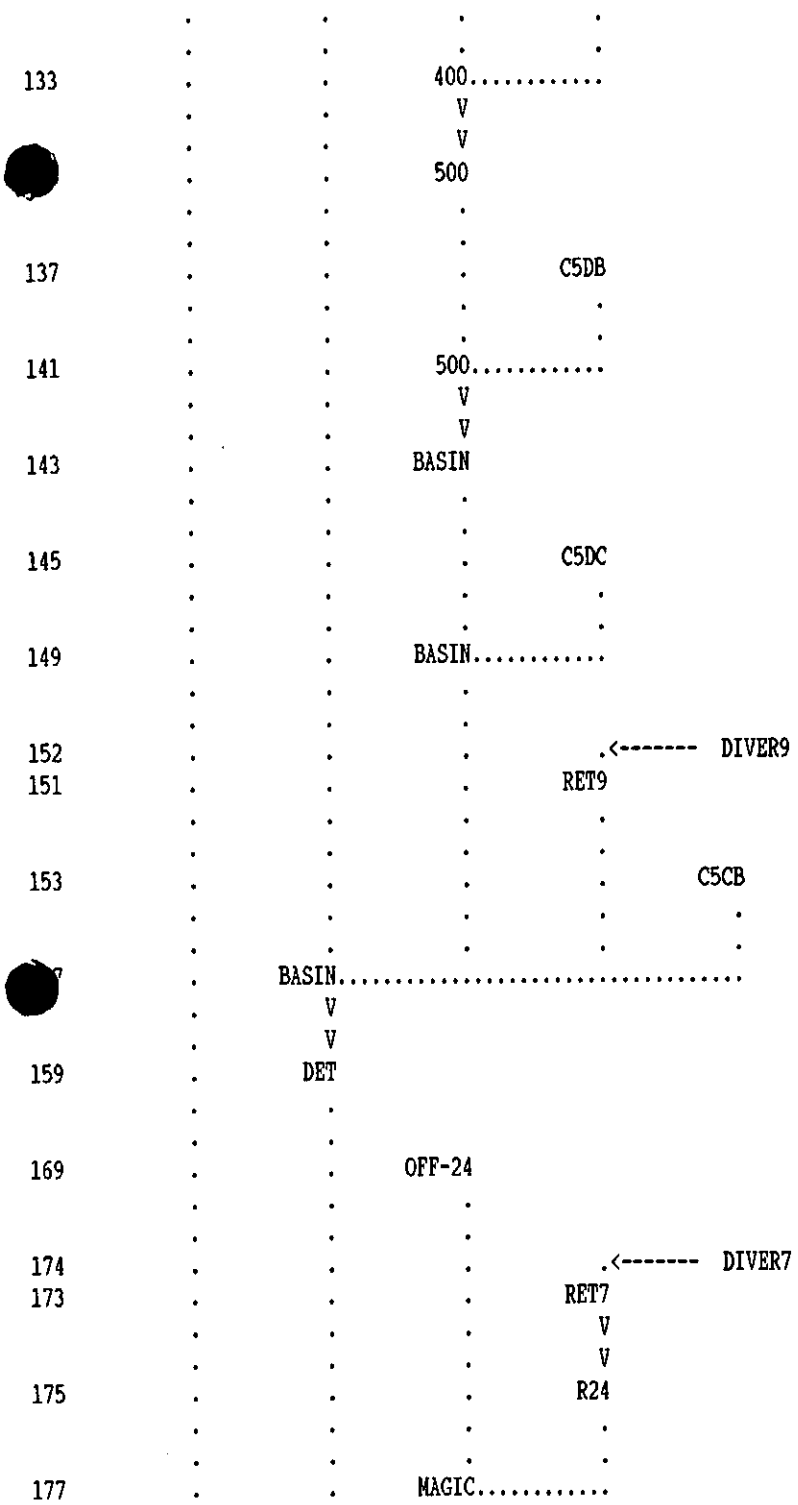
  175     KK     R24
  176     RK     500   0.012   0.020            TRAP     100       1

  177     KK   MAGIC
  178     HC       2
  179     ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK



```
                .       .       .
                .       .       .
77              .       .       .       C5FA
                .       .       .         V
                .       .       .         V
                .       .       .       C5FB
                .       .       .         .
                .       .       .         .
83              .       .       .         .       C5FB
                .       .       .         .         .
                .       .       .         .         .
87              .       .     C5FB.....................
                .       .       V
                .       .       V
89              .       .     100
                .       .       .
                .       .       .
91              .       .       .       C5FC
                .       .       .         .
                .       .       .         .
95              .       .     100.............
                .       .       V
                .       .       V
97              .       .     C5EA
                .       .       .
                .       .       .
99              .       .       .       C5EA
                .       .       .         .
                .       .       .         .
103             .       .     C5EA.............
                .       .       V
                .       .       V
105             .       .     C5EC
                .       .       .
                .       .       .
107             .       .       .       C5EB
                .       .       .         V
                .       .       .         V
111             .       .       .       C5EC
                .       .       .         .
                .       .       .         .
113             .       .       .         .       C5EC
                .       .       .         .         .
                .       .       .         .         .
117             .       .     200.....................
                .       .       V
                .       .       V
119             .       .     300
                .       .       .
                .       .       .
121             .       .       .       C5ED
                .       .       .         .
                .       .       .         .
125             .       .     300.............
                .       .       V
                .       .       V
                .       .     400
                .       .       .
                .       .       .
129             .       .       .       C5DA
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*    OOD HYDROGRAPH PACKAGE  (HEC-1)    *
*          SEPTEMBER 1990               *
*           VERSION 4.0                 *
*                                       *
*  RUN DATE  12/11/1998  TIME  13:08:15 *
*                                       *
*****************************************
```


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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```


EVALUATION OF ORIGIONAL DESIGN OF EQUESTRIAN BASIN USEING AS BUILT BASINS
THIS RUN IS USED TO EVALUATE THE CHANNEL FLOW AND BASIN BASED ON FINAL
FLOW DESIGN
FLOW EVALUATION DOES NOT INCLUDE NEW BOULDER HIGHWAY CULVERT
EVALUATION BUT DOES INLCUDE NEW EQUESTRIAN & MAGIC WAY INLET
ASSUMES NEW CI-DETENTION BASIN IS COMPLETED
DOES NOT INCLUDE FLOWS NORTH IN RACETRACK
FILE NAME: EQUOAL4.HC1

10 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME
ICENT		19	CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION

NPLAN	1	NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
1.00

*** ***

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          ***************
          *             *
159 KK    *       DET   *
          *             *
          ***************
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160 KO OUTPUT CONTROL VARIABLES

IPRNT	1	PRINT CONTROL
IPLOT	1	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	0	PUNCH COMPUTED HYDROGRAPH
IOUT	21	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
ISAV2	300	LAST ORDINATE PUNCHED OR SAVED
TIMINT	.083	TIME INTERVAL IN HOURS

HYDROGRAPH ROUTING DATA

161 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	STOR	TYPE OF INITIAL CONDITION
RSVRIC	.00	INITIAL CONDITION
X	.00	WORKING R AND D COEFFICIENT

162 SV	STORAGE	.0	2.0	13.0	31.0	61.0	97.0	118.0	140.0	171.0	200.0
		229.0	261.0	290.0	315.0	344.0	379.0	409.0	437.0	470.0	504.0
164 SE	ELEVATION	2048.00	2050.00	2052.00	2054.00	2056.00	2058.00	2059.00	2060.00	2061.00	2062.00
		2063.00	2064.00	2065.00	2066.00	2067.00	2068.00	2069.00	2070.00	2071.00	2072.00
166 SQ	DISCHARGE	0.	37.	80.	117.	142.	163.	173.	182.	191.	198.
		206.	213.	221.	228.	235.	242.	248.	2755.	7761.	14467.

168 SS SPILLWAY

CREL	2069.00	SPILLWAY CREST ELEVATION
SPWID	900.00	SPILLWAY WIDTH
COQW	3.00	WEIR COEFFICIENT
EXPW	1.50	EXPONENT OF HEAD

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	2.00	13.00	31.00	61.00	97.00	118.00	140.00	171.00	200.00
OUTFLOW	.00	37.00	80.00	117.00	142.00	163.00	173.00	182.00	191.00	198.00
ELEVATION	2048.00	2050.00	2052.00	2054.00	2056.00	2058.00	2059.00	2060.00	2061.00	2062.00
STORAGE	229.00	261.00	290.00	315.00	344.00	379.00	409.00	437.00	470.00	504.00
OUTFLOW	206.00	213.00	221.00	228.00	235.00	242.00	248.00	2755.00	7761.00	14467.00
ELEVATION	2063.00	2064.00	2065.00	2066.00	2067.00	2068.00	2069.00	2070.00	2071.00	2072.00

****

HYDROGRAPH AT STATION DET

PLAN 1, RATIO = 1.00

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	.0	2048.0	1		0820	101	230.	324.2	2066.3	1		1640	201	193.	180.1	2061.3
1		0005	2	0.	.0	2048.0	1		0825	102	230.	322.7	2066.3	1		1645	202	193.	178.8	2061.3
1		0010	3	0.	.0	2048.0	1		0830	103	229.	321.2	2066.2	1		1650	203	193.	177.4	2061.2
1		0015	4	0.	.0	2048.0	1		0835	104	229.	319.7	2066.2	1		1655	204	192.	176.1	2061.2
1		0020	5	0.	.0	2048.0	1		0840	105	229.	318.1	2066.1	1		1700	205	192.	174.8	2061.1
1		0025	6	0.	.0	2048.0	1		0845	106	228.	316.6	2066.1	1		1705	206	192.	173.5	2061.1
1		0030	7	0.	.0	2048.0	1		0850	107	228.	315.1	2066.0	1		1710	207	191.	172.2	2061.0
1		0035	8	0.	.0	2048.0	1		0855	108	228.	313.6	2065.9	1		1715	208	191.	170.8	2061.0
1		0040	9	0.	.0	2048.0	1		0900	109	227.	312.1	2065.9	1		1720	209	191.	169.5	2061.0
1		0045	10	0.	.0	2048.0	1		0905	110	227.	310.5	2065.8	1		1725	210	190.	168.2	2060.9
1		0050	11	0.	.0	2048.0	1		0910	111	226.	309.0	2065.8	1		1730	211	190.	166.9	2060.9
1		0055	12	0.	.0	2048.0	1		0915	112	226.	307.5	2065.7	1		1735	212	189.	165.6	2060.8
1		0100	13	0.	.0	2048.0	1		0920	113	225.	306.0	2065.6	1		1740	213	189.	164.3	2060.8
1		0105	14	0.	.0	2048.0	1		0925	114	225.	304.4	2065.6	1		1745	214	189.	163.0	2060.7
1		0110	15	1.	.0	2048.0	1		0930	115	225.	302.9	2065.5	1		1750	215	188.	161.7	2060.7
1		0115	16	1.	.1	2048.1	1		0935	116	224.	301.4	2065.5	1		1755	216	188.	160.4	2060.7
1		0120	17	1.	.1	2048.1	1		0940	117	224.	299.9	2065.4	1		1800	217	188.	159.1	2060.6
1		0125	18	1.	.1	2048.1	1		0945	118	223.	298.4	2065.3	1		1805	218	187.	157.8	2060.6
1		0130	19	2.	.1	2048.1	1		0950	119	223.	296.9	2065.3	1		1810	219	187.	156.5	2060.5
1		0135	20	2.	.1	2048.1	1		0955	120	222.	295.3	2065.2	1		1815	220	186.	155.3	2060.5
1		0140	21	4.	.2	2048.2	1		1000	121	222.	293.8	2065.2	1		1820	221	186.	154.0	2060.5
1		0145	22	5.	.3	2048.3	1		1005	122	222.	292.3	2065.1	1		1825	222	186.	152.7	2060.4
1		0150	23	8.	.4	2048.4	1		1010	123	221.	290.8	2065.0	1		1830	223	185.	151.4	2060.4
1		0155	24	12.	.6	2048.6	1		1015	124	221.	289.3	2065.0	1		1835	224	185.	150.1	2060.3
1		0200	25	16.	.9	2048.9	1		1020	125	220.	287.8	2064.9	1		1840	225	185.	148.9	2060.3
1		0205	26	20.	1.1	2049.1	1		1025	126	220.	286.3	2064.9	1		1845	226	184.	147.6	2060.2
1		0210	27	25.	1.3	2049.3	1		1030	127	220.	284.8	2064.8	1		1850	227	184.	146.3	2060.2
1		0215	28	29.	1.5	2049.5	1		1035	128	219.	283.3	2064.8	1		1855	228	183.	145.1	2060.2
1		0220	29	33.	1.8	2049.8	1		1040	129	219.	281.8	2064.7	1		1900	229	183.	143.8	2060.1
1		0225	30	37.	2.1	2050.0	1		1045	130	218.	280.3	2064.7	1		1905	230	183.	142.6	2060.1
1		0230	31	39.	2.6	2050.1	1		1050	131	218.	278.8	2064.6	1		1910	231	182.	141.3	2060.0
1		0235	32	41.	3.1	2050.2	1		1055	132	218.	277.3	2064.6	1		1915	232	182.	140.0	2060.0
1		0240	33	44.	3.8	2050.3	1		1100	133	217.	275.8	2064.5	1		1920	233	182.	138.8	2059.9
1		0245	34	47.	4.4	2050.4	1		1105	134	217.	274.4	2064.5	1		1925	234	181.	137.5	2059.9
1		0250	35	49.	5.2	2050.6	1		1110	135	216.	272.9	2064.4	1		1930	235	180.	136.3	2059.8
1		0255	36	52.	5.9	2050.7	1		1115	136	216.	271.4	2064.4	1		1935	236	180.	135.1	2059.8
1		0300	37	56.	6.8	2050.9	1		1120	137	215.	269.9	2064.3	1		1940	237	179.	133.8	2059.7
1		0305	38	59.	7.7	2051.0	1		1125	138	215.	268.4	2064.3	1		1945	238	179.	132.6	2059.7
1		0310	39	63.	8.8	2051.2	1		1130	139	215.	267.0	2064.2	1		1950	239	178.	131.4	2059.6
1		0315	40	68.	10.0	2051.5	1		1135	140	214.	265.5	2064.2	1		1955	240	178.	130.1	2059.6
1		0320	41	75.	11.7	2051.8	1		1140	141	214.	264.0	2064.1	1		2000	241	177.	128.9	2059.5
1		0325	42	83.	14.6	2052.2	1		1145	142	213.	262.6	2064.1	1		2005	242	177.	127.7	2059.4
1		0330	43	94.	19.6	2052.7	1		1150	143	213.	261.1	2064.0	1		2010	243	176.	126.5	2059.4
1		0335	44	112.	28.5	2053.7	1		1155	144	213.	259.7	2064.0	1		2015	244	176.	125.3	2059.3
1		0340	45	127.	42.5	2054.8	1		1200	145	212.	258.2	2063.9	1		2020	245	175.	124.0	2059.3
1		0345	46	142.	61.5	2056.0	1		1205	146	212.	256.7	2063.9	1		2025	246	175.	122.8	2059.2
1		0350	47	155.	84.0	2057.3	1		1210	147	212.	255.3	2063.8	1		2030	247	174.	121.6	2059.2
1		0355	48	168.	107.8	2058.5	1		1215	148	211.	253.8	2063.8	1		2035	248	174.	120.4	2059.1
1		0400	49	178.	131.3	2059.6	1		1220	149	211.	252.4	2063.7	1		2040	249	174.	119.2	2059.1
1		0405	50	186.	153.1	2060.4	1		1225	150	211.	250.9	2063.7	1		2045	250	173.	118.1	2059.0
1		0410	51	191.	172.8	2061.1	1		1230	151	210.	249.5	2063.6	1		2050	251	172.	116.9	2058.9
1		0415	52	196.	190.3	2061.7	1		1235	152	210.	248.0	2063.6	1		2055	252	172.	115.7	2058.9
1		0420	53	200.	205.8	2062.2	1		1240	153	210.	246.6	2063.6	1		2100	253	171.	114.5	2058.8
1		0425	54	203.	219.4	2062.7	1		1245	154	210.	245.2	2063.5	1		2105	254	171.	113.3	2058.8

1	0430	55	207.	231.6	2063.1	*	1	1250	155	209.	243.7	2063.5	*	1	2110	255	170.	112.1	2058.7
1	0435	56	209.	242.5	2063.4	*	1	1255	156	209.	242.3	2063.4	*	1	2115	256	170.	111.0	2058.7
1	0440	57	211.	252.6	2063.7	*	1	1300	157	209.	240.9	2063.4	*	1	2120	257	169.	109.8	2058.6
1	0445	58	213.	262.1	2064.0	*	1	1305	158	208.	239.4	2063.3	*	1	2125	258	169.	108.6	2058.6
1	0450	59	216.	271.3	2064.4	*	1	1310	159	208.	238.0	2063.3	*	1	2130	259	168.	107.5	2058.5
1	0455	60	218.	280.3	2064.7	*	1	1315	160	208.	236.6	2063.2	*	1	2135	260	167.	106.3	2058.4
1	0500	61	221.	289.2	2065.0	*	1	1320	161	207.	235.1	2063.2	*	1	2140	261	167.	105.2	2058.4
1	0505	62	223.	297.8	2065.3	*	1	1325	162	207.	233.7	2063.1	*	1	2145	262	166.	104.0	2058.3
1	0510	63	225.	306.0	2065.6	*	1	1330	163	207.	232.3	2063.1	*	1	2150	263	166.	102.9	2058.3
1	0515	64	228.	313.6	2065.9	*	1	1335	164	206.	230.9	2063.1	*	1	2155	264	165.	101.8	2058.2
1	0520	65	229.	320.5	2066.2	*	1	1340	165	206.	229.5	2063.0	*	1	2200	265	165.	100.6	2058.2
1	0525	66	231.	326.6	2066.4	*	1	1345	166	206.	228.0	2063.0	*	1	2205	266	164.	99.5	2058.1
1	0530	67	232.	331.8	2066.6	*	1	1350	167	205.	226.6	2062.9	*	1	2210	267	164.	98.4	2058.1
1	0535	68	233.	336.2	2066.7	*	1	1355	168	205.	225.2	2062.9	*	1	2215	268	163.	97.2	2058.0
1	0540	69	234.	339.8	2066.9	*	1	1400	169	205.	223.8	2062.8	*	1	2220	269	162.	96.1	2058.0
1	0545	70	235.	342.7	2067.0	*	1	1405	170	204.	222.4	2062.8	*	1	2225	270	162.	95.0	2057.9
1	0550	71	235.	345.1	2067.0	*	1	1410	171	204.	221.0	2062.7	*	1	2230	271	161.	93.9	2057.8
1	0555	72	236.	347.0	2067.1	*	1	1415	172	203.	219.6	2062.7	*	1	2235	272	161.	92.8	2057.8
1	0600	73	236.	348.4	2067.1	*	1	1420	173	203.	218.2	2062.6	*	1	2240	273	160.	91.7	2057.7
1	0605	74	236.	349.5	2067.2	*	1	1425	174	203.	216.8	2062.6	*	1	2245	274	159.	90.6	2057.6
1	0610	75	236.	350.2	2067.2	*	1	1430	175	202.	215.4	2062.5	*	1	2250	275	159.	89.5	2057.6
1	0615	76	236.	350.7	2067.2	*	1	1435	176	202.	214.0	2062.5	*	1	2255	276	158.	88.4	2057.5
1	0620	77	236.	350.9	2067.2	*	1	1440	177	201.	212.6	2062.4	*	1	2300	277	157.	87.3	2057.5
1	0625	78	236.	350.9	2067.2	*	1	1445	178	201.	211.3	2062.4	*	1	2305	278	157.	86.2	2057.4
1	0630	79	236.	350.7	2067.2	*	1	1450	179	201.	209.9	2062.3	*	1	2310	279	156.	85.1	2057.3
1	0635	80	236.	350.3	2067.2	*	1	1455	180	200.	208.5	2062.3	*	1	2315	280	155.	84.1	2057.3
1	0640	81	236.	349.7	2067.2	*	1	1500	181	200.	207.1	2062.2	*	1	2320	281	155.	83.0	2057.2
1	0645	82	236.	349.0	2067.1	*	1	1505	182	200.	205.8	2062.2	*	1	2325	282	154.	81.9	2057.2
1	0650	83	236.	348.1	2067.1	*	1	1510	183	199.	204.4	2062.2	*	1	2330	283	154.	80.9	2057.1
1	0655	84	236.	347.2	2067.1	*	1	1515	184	199.	203.0	2062.1	*	1	2335	284	153.	79.8	2057.0
1	0700	85	235.	346.2	2067.1	*	1	1520	185	198.	201.6	2062.1	*	1	2340	285	152.	78.8	2057.0
1	0705	86	235.	345.1	2067.0	*	1	1525	186	198.	200.3	2062.0	*	1	2345	286	152.	77.7	2056.9
1	0710	87	235.	343.9	2067.0	*	1	1530	187	198.	198.9	2062.0	*	1	2350	287	151.	76.7	2056.9
1	0715	88	235.	342.7	2067.0	*	1	1535	188	197.	197.6	2061.9	*	1	2355	288	151.	75.6	2056.8
1	0720	89	234.	341.4	2066.9	*	1	1540	189	197.	196.2	2061.9	*	2	0000	289	150.	74.6	2056.8
1	0725	90	234.	340.1	2066.9	*	1	1545	190	197.	194.8	2061.8	*	2	0005	290	149.	73.6	2056.7
1	0730	91	234.	338.7	2066.8	*	1	1550	191	196.	193.5	2061.8	*	2	0010	291	149.	72.6	2056.6
1	0735	92	233.	337.3	2066.8	*	1	1555	192	196.	192.1	2061.7	*	2	0015	292	148.	71.5	2056.6
1	0740	93	233.	335.9	2066.7	*	1	1600	193	196.	190.8	2061.7	*	2	0020	293	148.	70.5	2056.5
1	0745	94	233.	334.5	2066.7	*	1	1605	194	195.	189.5	2061.6	*	2	0025	294	147.	69.5	2056.5
1	0750	95	232.	333.1	2066.6	*	1	1610	195	195.	188.1	2061.6	*	2	0030	295	146.	68.5	2056.4
1	0755	96	232.	331.6	2066.6	*	1	1615	196	195.	186.8	2061.5	*	2	0035	296	146.	67.5	2056.4
1	0800	97	232.	330.1	2066.5	*	1	1620	197	194.	185.4	2061.5	*	2	0040	297	145.	66.5	2056.3
1	0805	98	231.	328.7	2066.5	*	1	1625	198	194.	184.1	2061.5	*	2	0045	298	145.	65.5	2056.2
1	0810	99	231.	327.2	2066.4	*	1	1630	199	194.	182.8	2061.4	*	2	0050	299	144.	64.5	2056.2
1	0815	100	231.	325.7	2066.4	*	1	1635	200	194.	181.4	2061.4	*	2	0055	300	143.	63.5	2056.1
						*							*						

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
236.	6.33	(CFS)	229.	179.	173.	173.
		(INCHES)	.302	.945	.945	.945
		(AC-FT)	114.	355.	355.	355.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	24.92-HR
351.	6.33	321.	186.	179.	179.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE

(FEET)	(HR)	6-HR	24-HR	72-HR	24.92-HR
2067.20	6.33	2066.16	2060.75	2060.28	2060.28

CUMULATIVE AREA = 7.05 SQ MI

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

					RATIOS APPLIED TO PRECIPITATION
OPERATION	STATION	AREA	PLAN		RATIO 1
					1.00
HYDROGRAPH AT	OFF-10	.42	1	FLOW	283.
				TIME	4.25
DIVERSION TO	DIVER1	.42	1	FLOW	31.
				TIME	4.25
HYDROGRAPH AT	DIVERT	.42	1	FLOW	252.
				TIME	4.25
HYDROGRAPH AT	OFF-21	.04	1	FLOW	53.
				TIME	3.58
ROUTED TO	R-21	.04	1	FLOW	52.
				TIME	3.67
HYDROGRAPH AT	OFF-23	.06	1	FLOW	67.
				TIME	3.67
2 COMBINED AT	C17	.10	1	FLOW	119.
				TIME	3.67
HYDROGRAPH AT	C5CAb	1.13	1	FLOW	473.
				TIME	3.75
DIVERSION TO	DIVER9	1.13	1	FLOW	325.
				TIME	3.75
HYDROGRAPH AT	QSPLT	1.13	1	FLOW	148.
				TIME	3.50
HYDROGRAPH AT	RET1	.00	1	FLOW	31.
				TIME	4.25
ROUTED TO	RDIV1	.00	1	FLOW	31.
				TIME	4.25
2 COMBINED AT	CC1	1.13	1	FLOW	179.
				TIME	4.25
HYDROGRAPH AT	C5CAa	.35	1	FLOW	266.
				TIME	4.00
2 COMBINED AT	C19	1.49	1	FLOW	442.
				TIME	4.00
DIVERSION TO	DIVER7	1.49	1	FLOW	187.
				TIME	4.00
HYDROGRAPH AT	DIVER7	1.49	1	FLOW	255.

				TIME	4.00
2 COMBINED AT	C20	1.59	1	FLOW	335.
				TIME	3.83
[redacted]GRAPH AT	C5FD	.19	1	FLOW	189.
				TIME	3.75
ROUTED TO	C5FB	.19	1	FLOW	188.
				TIME	3.75
HYDROGRAPH AT	C5FA	.54	1	FLOW	684.
				TIME	3.67
ROUTED TO	C5FB	.54	1	FLOW	672.
				TIME	3.75
HYDROGRAPH AT	C5FB	.17	1	FLOW	60.
				TIME	3.83
3 COMBINED AT	C5FB	.89	1	FLOW	915.
				TIME	3.75
ROUTED TO	100	.89	1	FLOW	901.
				TIME	3.75
HYDROGRAPH AT	C5FC	.19	1	FLOW	145.
				TIME	3.75
2 COMBINED AT	100	1.08	1	FLOW	1046.
[redacted]				TIME	3.75
ROUTED TO	C5EA	1.08	1	FLOW	1025.
				TIME	3.75
HYDROGRAPH AT	C5EA	.52	1	FLOW	366.
				TIME	4.08
2 COMBINED AT	C5EA	1.60	1	FLOW	1315.
				TIME	3.83
ROUTED TO	C5EC	1.60	1	FLOW	1300.
				TIME	3.83
HYDROGRAPH AT	C5EB	.59	1	FLOW	207.
				TIME	4.17
ROUTED TO	C5EC	.59	1	FLOW	204.
				TIME	4.50
HYDROGRAPH AT	C5EC	.26	1	FLOW	153.
				TIME	3.75
3 COMBINED AT	200	2.46	1	FLOW	1438.
				TIME	3.83
[redacted]D TO	300	2.46	1	FLOW	1408.
				TIME	3.92
HYDROGRAPH AT	C5ED	.15	1	FLOW	149.

				TIME	3.58
2 COMBINED AT	300	2.60	1	FLOW	1494.
				TIME	3.83
R[redacted] TO	400	2.60	1	FLOW	1478.
				TIME	3.92
HYDROGRAPH AT	C5DA	1.02	1	FLOW	933.
				TIME	3.83
2 COMBINED AT	400	3.63	1	FLOW	2402.
				TIME	3.83
ROUTED TO	500	3.63	1	FLOW	2385.
				TIME	3.92
HYDROGRAPH AT	C5DB	.65	1	FLOW	491.
				TIME	4.00
2 COMBINED AT	500	4.28	1	FLOW	2873.
				TIME	3.92
ROUTED TO	BASIN	4.28	1	FLOW	2867.
				TIME	3.92
HYDROGRAPH AT	C5DC	1.02	1	FLOW	258.
				TIME	4.25
2 COMBINED AT	BASIN	5.30	1	FLOW	3058.
				TIME	3.92
HYDROGRAPH AT	RET9	.00	1	FLOW	325.
				TIME	3.75
HYDROGRAPH AT	C5CB	.17	1	FLOW	17.
				TIME	4.08
4 COMBINED AT	BASIN	7.05	1	FLOW	3658.
				TIME	3.92
ROUTED TO	DET	7.05	1	FLOW	236.
				TIME	6.33

** PEAK STAGES IN FEET **

1	STAGE	2067.20
	TIME	6.33

HYDROGRAPH AT	OFF-24	.06	1	FLOW	71.
				TIME	3.58
HYDROGRAPH AT	RET7	.00	1	FLOW	187.
				TIME	4.00
ROUTED TO	R24	.00	1	FLOW	187.
				TIME	4.00
2 COMBINED AT	MAGIC	.06	1	FLOW	214.
				TIME	3.92

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= 1.00									
R-21	MANE	2.51	53.21	221.68	1.64	5.00	52.26	220.00	1.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3782E+01 EXCESS= .0000E+00 OUTFLOW= .3798E+01 BASIN STORAGE= .1714E-03 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= 1.00									
RDIV1	MANE	2.17	30.93	256.89	-1.00	5.00	30.92	255.00	-1.00
FOR PLAN = 1 RATIO= 1.00									
C5FB	MANE	1.55	188.35	226.45	1.56	5.00	187.79	225.00	1.56

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1543E+02 EXCESS= .0000E+00 OUTFLOW= .1545E+02 BASIN STORAGE= .3204E-04 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
C5FB	MANE	2.34	674.26	223.36	1.81	5.00	671.54	225.00	1.81

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5141E+02 EXCESS= .0000E+00 OUTFLOW= .5182E+02 BASIN STORAGE= .2102E-02 PERCENT ERROR= -.8

FOR PLAN = 1 RATIO= 1.00									
100	MANE	.67	911.56	226.11	1.53	5.00	900.74	225.00	1.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7282E+02 EXCESS= .0000E+00 OUTFLOW= .7286E+02 BASIN STORAGE= .5282E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
C5EA	MANE	.51	1045.08	226.06	1.47	5.00	1025.07	225.00	1.47

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8477E+02 EXCESS= .0000E+00 OUTFLOW= .8481E+02 BASIN STORAGE= .5258E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
C5EC	MANE	.97	1309.61	231.28	1.52	5.00	1300.35	230.00	1.52

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1302E+03 EXCESS= .0000E+00 OUTFLOW= .1303E+03 BASIN STORAGE= .1187E-02 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
C5EC	MANE	4.63	205.78	266.53	.84	5.00	204.46	270.00	.84

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2633E+02 EXCESS= .0000E+00 OUTFLOW= .2636E+02 BASIN STORAGE= .1475E-01 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= 1.00

300	MANE	1.10	1432.94	232.57	1.29	5.00	1408.48	235.00	1.29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1685E+03 EXCESS= .0000E+00 OUTFLOW= .1685E+03 BASIN STORAGE= .4279E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

400	MANE	.62	1492.76	231.37	1.28	5.00	1478.24	235.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1782E+03 EXCESS= .0000E+00 OUTFLOW= .1782E+03 BASIN STORAGE= .2247E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

500	MANE	.29	2401.42	230.67	1.38	5.00	2384.51	235.00	1.38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2677E+03 EXCESS= .0000E+00 OUTFLOW= .2677E+03 BASIN STORAGE= .9903E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

BASIN	MANE	.52	2870.24	235.51	1.41	5.00	2867.31	235.00	1.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3220E+03 EXCESS= .0000E+00 OUTFLOW= .3221E+03 BASIN STORAGE= .2550E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00

R24	MANE	.48	187.36	241.14	-1.00	5.00	186.75	240.00	-1.00

*** NORMAL END OF HEC-1 ***
NORMAL END OF HEC-1

This section is used to determine the flow split in basin C5Cab. The flow that stays in the south side of Equestrian splits to the Magic Way inlet where the remainder of the flow is conveyed to the detention basin.

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	EQUESTRIAN 1/2 ROW
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.020000	ft/ft
Water Surface Elevation	100.38	ft

Elevation range: 99.39 ft to 100.38 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	100.00	0.00	50.00	0.017
5.50	99.98			
5.50	99.39			
7.00	99.51			
7.00	99.55			
50.00	100.38			

Results		
Wtd. Mannings Coefficient	0.017	
Discharge	148.05	ft^3/s
Flow Area	21.38	ft^2
Wetted Perimeter	51.02	ft
Top Width	50.00	ft
Depth	0.99	ft
Critical Water Elev.	100.60	ft
Critical Slope	0.005057	ft/ft
Velocity	6.92	ft/s
Velocity Head	0.74	ft
Specific Energy	101.12	ft
Froude Number	1.87	
Full Flow Capacity	148.05	ft^3/s

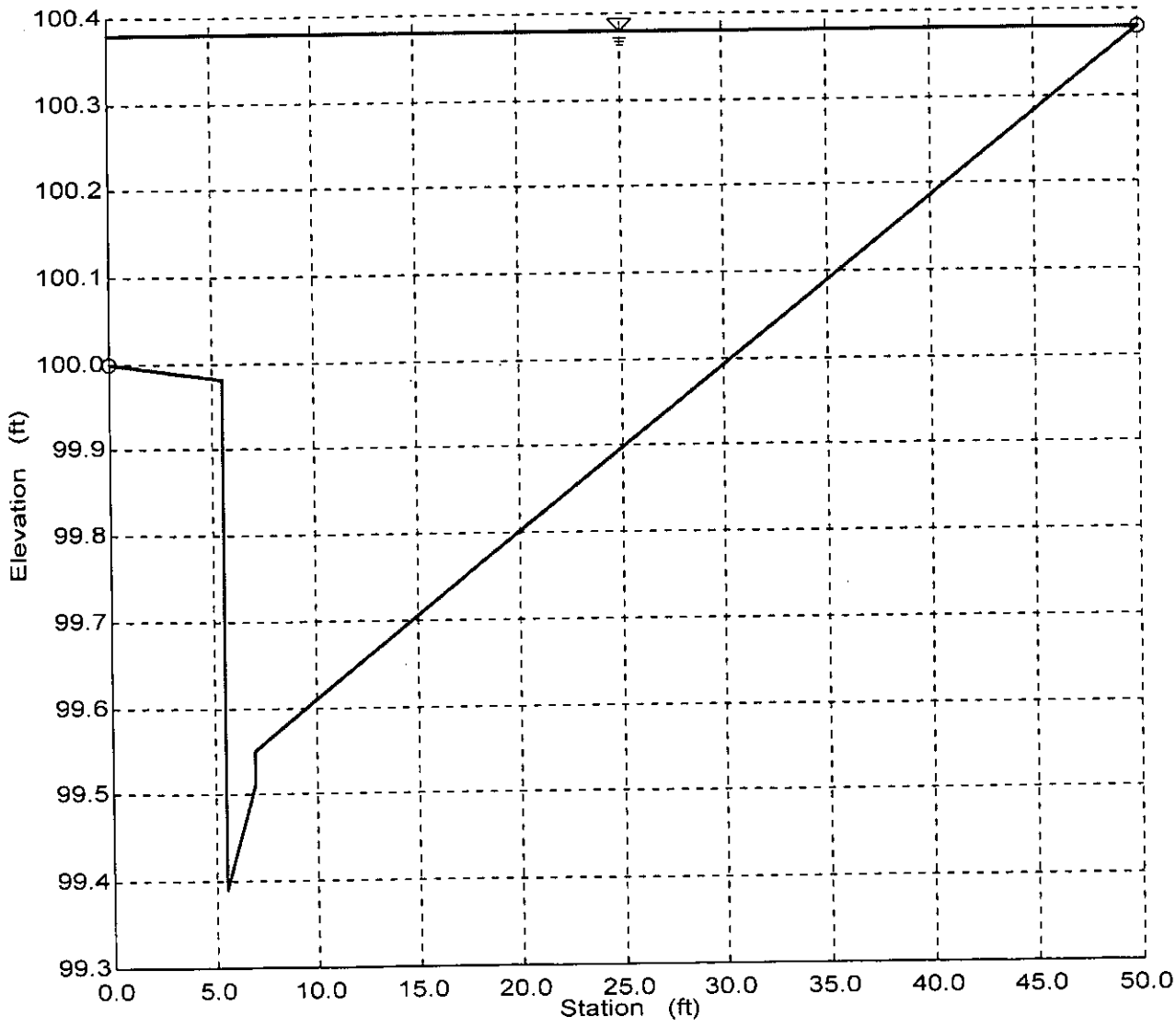
Flow is supercritical.

Water elevation exceeds lowest end station by 0.38 ft.

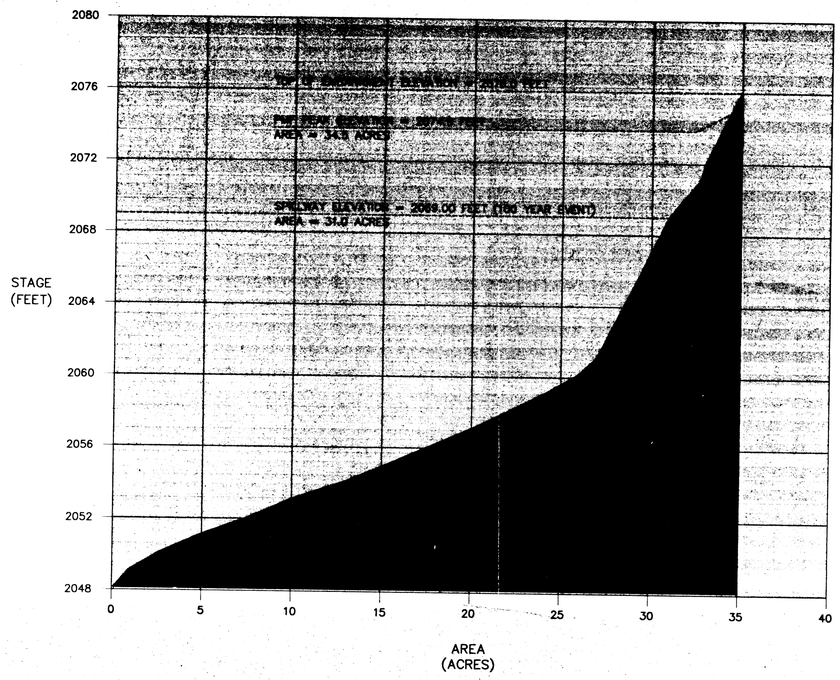
Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	EQUESTRIAN 1/2 ROW
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.020000	ft/ft
Water Surface Elevation	100.38	ft
Discharge	148.05	ft^3/s

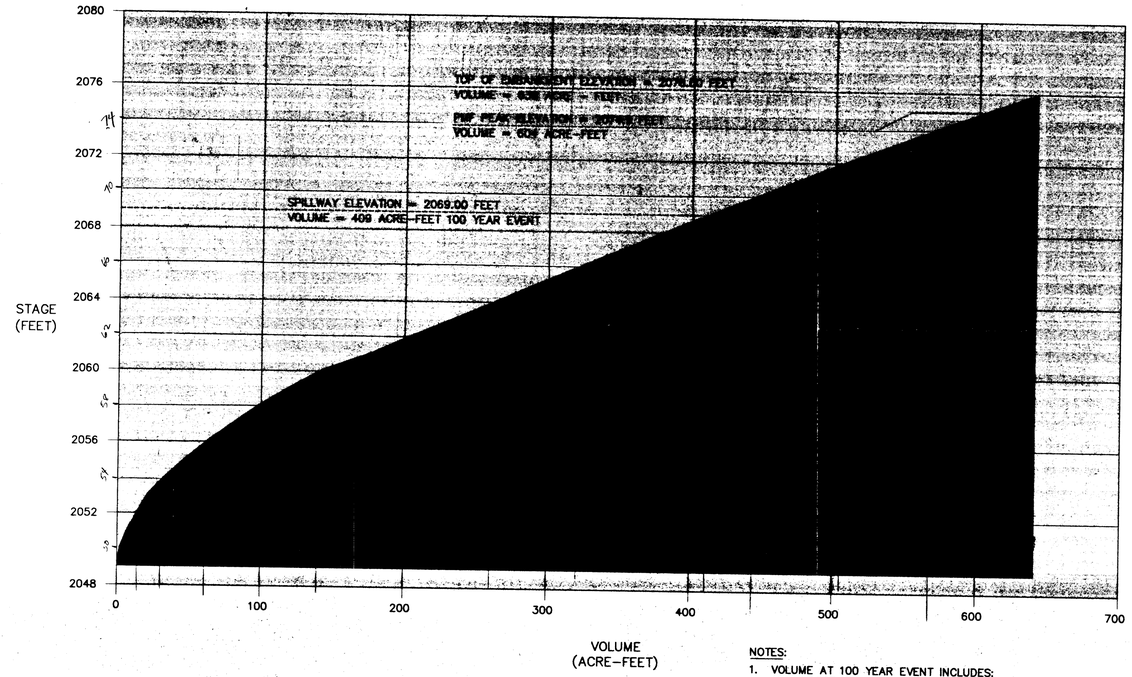


FILENAME: 184C-CA7.DWG



SCALE:
HORIZONTAL: 1" = 4 ACRES
VERTICAL: 1" = 4 FEET

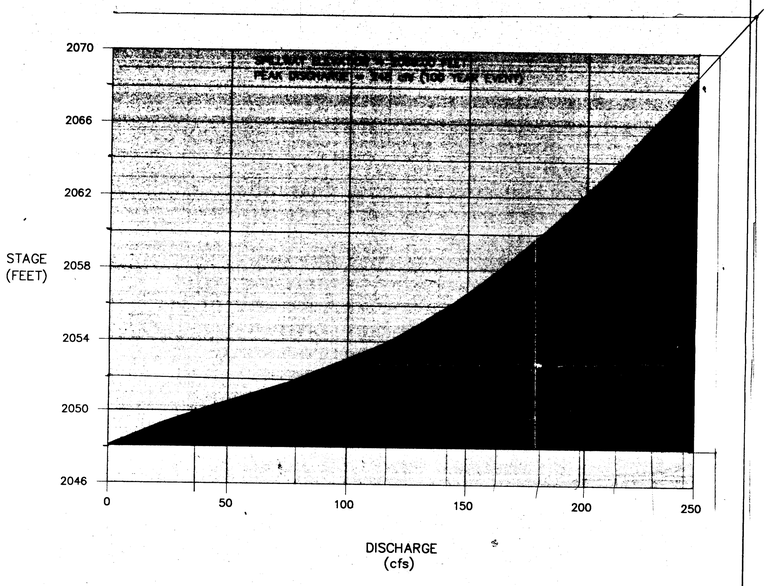
STAGE – AREA CURVE



SCALE:
HORIZONTAL: 1" = 50 ACRE - FEET
VERTICAL: 1" = 4 FEET

STAGE – VOLUME CURVE

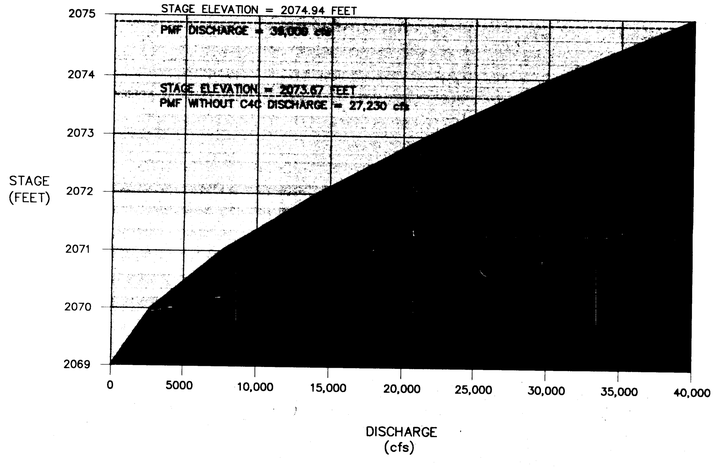
NOTES:
1. VOLUME AT 100 YEAR EVENT INCLUDES:
   16.74 ACRE-FEET INFLOW SEDIMENT (100 YEAR EVENT)
   25.45 ACRE-FEET ACCUMULATION OF 5 – 1 YEAR EVENTS
   367 ACRE-FEET CLEAR WATER STORAGE
2. PMF PEAK INCLUDES DRAINAGE BASIN C4C. PEAK PMF WITHOUT C4C; STAGE = 2073.5 FEET WITH STORAGE VOLUME OF 554 ACRE-FEET.



STAGE – DISCHARGE CURVE (100 YEAR EVENT) LOW LEVEL OUTLET (48 INCH RCP)

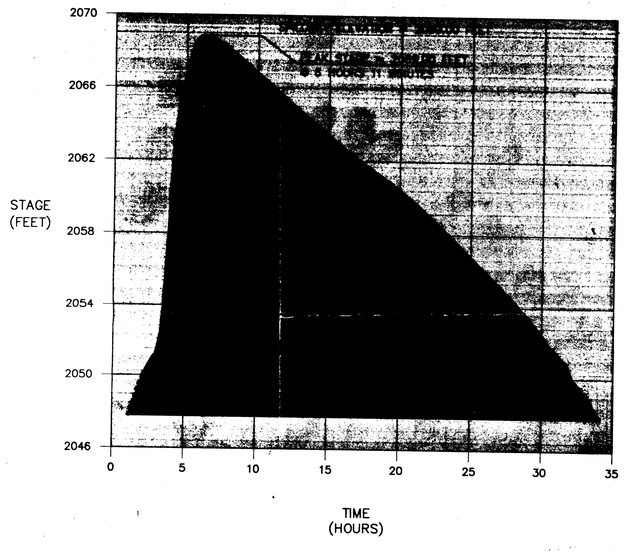
SCALE:
HORIZONTAL: 1" = 30 CUBIC FEET PER SECOND
VERTICAL: 1" = 4 FEET

NOTE:
STAGE AT PEAK IS BASED UPON CLEAR WATER FLOWS WITH BASIN VOLUMES MODIFIED BY PROPORTIONAL DISTRIBUTION OF 42 ACRE-FEET OF SEDIMENT STORAGE.



SPILLWAY RATING CURVE STAGE DISCHARGE – CURVE

SCALE:
HORIZONTAL: 1" = 5000 CUBIC FEET PER SECOND
VERTICAL: 1" = 1 FOOT



LOW LEVEL OUTLET (48 INCH RCP)

SCALE:
HORIZONTAL: 1" = 5 HOURS
VERTICAL: 1" = 4 FEET

NOTE:
STAGE AT PEAK IS BASED UPON CLEAR WATER FLOWS WITH BASIN VOLUMES MODIFIED BY PROPORTIONAL DISTRIBUTION OF 42 ACRE-FEET OF SEDIMENT STORAGE.

DATE	REVISION

ANY INFORMATION OR DATA ON THIS DRAWING IS NOT INTENDED TO BE SUITABLE FOR REUSE BY ANY PERSON ON EXTENSIONS OF THIS PROJECT OR FOR ANY OTHER PROJECT OR FOR ANY OTHER USE OR PURPOSE. ANY REUSE, ADAPTATION BY THE ENGINEER FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO THE ENGINEER.

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STAMP: ENGINEER'S SEAL OF NEVADA No. 5268 TIMOTHY E. POGGEMEYER CIVIL REGISTERED PROFESSIONAL

EQUESTRIAN DETENTION BASIN

BASIN CHARACTERISTICS STAGE: STORAGE, DISCHARGE, TIME, SPILLWAY RATING CURVE

JOB NUMBER	95184C
DESIGNED BY	JJD
DRAWN BY	JJD
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CA-7 OF

RECORD DRAWINGS

APPENDIX C

COMMUNITY ACKNOWLEDGEMENT

APPENDIX D

OFFICIALLY ADOPTED

MAINTENANCE AND

OPERATION PLAN

APPENDIX E

MAGIC WAY INLET

CALCULATIONS

AND PLANS

December 24, 1997

POGGEMEYER
DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS
LANDSCAPE ARCHITECTS

City of Henderson
240 Water Street
Henderson, NV 89105

ATTN: Mr. Saeed U. Ahmad, Project Manager

RE: MAGIC WAY COLLECTION INLET
EQUESTRIAN DETENTION BASIN
PDG PROJECT NO: 1002005

Dear Saeed:

Please find enclosed our initial evaluation of the Magic Way and Equestrian Drive intersection. We propose two transverse drainage structures. The first crossing Equestrian drive on the east side of the intersection and the second crossing Magic Way on the north side of the intersection. The transverse drainage structures outfall into 5 X 5 box culverts and then join together in a 5 X 7 box culvert . The design is planned to collect a minimum of 300 CFS at the intersection, allowing 65 CFS to flow north in Magic Way. Of the 65 CFS bypassing the transverse drainage structure, approximately 32 CFS will be collected by the new drop inlet to be constructed by the Equestrian / Appaloosa Road Improvement Plans.

We have performed a field survey of the intersection, researched the underground utility records and evaluated the Equestrian / Appaloosa Road Improvement Plans and drainage study.

From this information we have determined that the design flow in Equestrian Drive as it reaches Magic Way from the east is 310 CFS. At this point additional flows from west in Equestrian Drive (87 CFS) and flows from the south in Magic Way (33 CFS) combine for a total flow of 430 CFS. Of the total, 65 CFS is collected in the intersection by a 4' foot drop inlet at the southwest corner and a 20 foot drop inlet at the southeast corner. The remainder (365 CFS) flows north in Magic Way.

Both roads are 100 foot ROW with center medians. The medians keep flows on one side of the road from easily crossing the road way to the other side. This condition and the fact that only the west side of Magic has been constructed prevents the long weir opening on the east side of Magic from collecting much flow into the Equestrian Basin.

Poggemeyer Design Group, Inc.
2601 North Tenaya Way
Las Vegas, Nevada 89128
(702) 255-8100
FAX (702) 255-8375

Our proposed collection plan is to construct 2 transverse drainage structures across Equestrian Drive on the east side of the intersection and across Magic Way on the north side of the intersection. This solution was chosen because of the volume of the flow and the current and planned design of the intersection. Very long drop inlets,120 feet on each side of Equestrian Drive, were considered but discarded because of the lengths and pipe sizes.

As the flow approaches the intersection from the east it passes west of the median and reaches equilibrium. The depth of flow at this point is 1.23 feet above the gutter. With this type of flow spreading across the full roadway width the transverse drainage structures can collect up to 3 CFS per foot of width depending on the depth of flow and velocity. Our estimate is that the first 26 feet will collect approximately 3 CFS per foot, with the remainder of width collecting a lesser amount. The Equestrian Drive transverse drainage structure is planed to collect 100 CFS per side of street for a total of 200 CFS. This flow will be collected into a 28 inch wide trough running south to north deepening to the north. At the north end the trough transitions into a 5 X 5 box culvert.

The flow not captured by the transverse drainage structures joins with flows from the west side of the intersection via Equestrian Drive and the south side via Magic Way. The flows not captured by the existing drop inlets on the west side of the intersection turn and flow north in magic. The depth of flow is approximately 0.77 feet in the gutter. The flow does not completely cover the road and less length of transverse drainage structure is planned to collect approximately 100 CFS. This flow will be collected into a 28 inch wide trough running west to east deepening to the east. At the east end the trough transitions into a 5 X 5 box culvert. This box and the one from the Equestrian Drive transverse drainage structure join into the outfall 5 X 7 box discharging into the upper Equestrian basin collection area. The remainder for the flow (65CFS) will continue north until 32 CFS will be collected on the east side by the new drop inlet.

We evaluated the existing utilities located at the intersection and found that the system can be constructed without conflict with the sewer and water. Telephone and gas will be impacted but relocating these is much easier then water or sewer.

The following information is provided as backup for the above discussion.

- Draft plan of facility location with field survey and utilities
- Draft profiles of drainage trough showing underground utilities
- Calculations for Equestrian Drive and Magic Way showing depth of flow

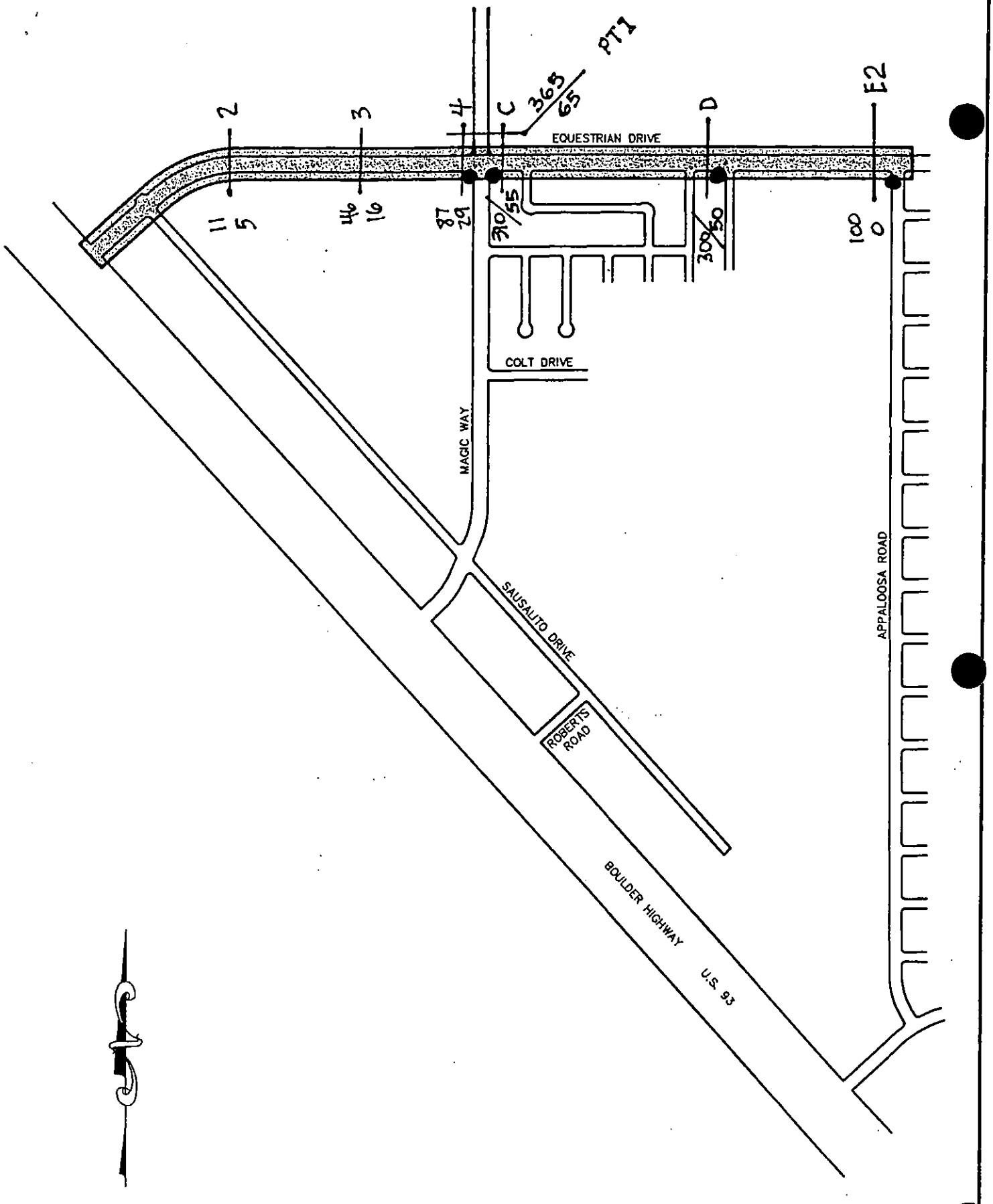
- Figure 2 showing flow in Equestrian drive from Equestrian / Appaloosa Road Improvement plans Drainage Study.
- Spread sheet showing flow collection by transverse drainage structure
- Neenah catalog cut for proposed transverse drainage structure
- Headwater depth for concrete box culverts with inlet control.
- Rating curve for 28" trough
- Critical depth calculations for 5 X 7 box culvert

Please review the concept presented and provide comments or re-direction as necessary. If you have any question or require additional information please call me at your convenience.

Very Truly Yours,

POGGEMEYER DESIGN GROUP, INC.

Stephen L. Weatherman, P.E.
Chief Flood Control Engineer



Equestrian Drive
Appaloosa Road to Boulder Highway

FIG. 2

water sur	100.6		Equesterian									
OFFSET	0	1	2.6875	4.375	6.0625	7.75	9.4375	11.125	12.8125	14.5	16.1875	17.875
	LIP GUT											
ELEV	99.55	99.57	99.60375	99.6375	99.67125	99.705	99.73875	99.7725	99.80625	99.84	99.87375	99.9075
DEPTH	1.05	1.03	0.99625	0.9625	0.92875	0.895	0.86125	0.8275	0.79375	0.76	0.72625	0.6925
Q		5.354664	5.354664	5.354664	5.354664	5.354664	5.354664	5.354664	5.354664	5.354664	5.354664	5.354664

water sur	100.15		Magic									
OFFSET	0	1	2.6875	4.375	6.0625	7.75	9.4375	11.125	12.8125	14.5	16.1875	17.875
	LIP GUT											
ELEV	99.55	99.57	99.60375	99.6375	99.67125	99.705	99.73875	99.7725	99.80625	99.84	99.87375	99.9075
DEPTH	0.6	0.58	0.54625	0.5125	0.47875	0.445	0.41125	0.3775	0.34375	0.31	0.27625	0.2425
Q		6.299605	6.299605	6.299605	5.859735	5.187563	4.548552	3.943588	3.373659	2.839877	2.343512	1.886034

19.5625	21.25	22.9375	24.625	26.3125	28	29.6875	31.375	33.0625	34.75	36.4375	38.125	39.8125
99.94125	99.975	100.0088	100.0425	100.0763	100.11	100.1438	100.1775	100.2113	100.245	100.2788	100.3125	100.3463
0.65875	0.625	0.59125	0.5575	0.52375	0.49	0.45625	0.4225	0.38875	0.355	0.32125	0.2875	0.25375
5.354664	5.354664	5.354664	5.354664	5.354664	5.177368	4.59678	4.044146	3.520191	3.025725	2.561656	2.129015	1.728989

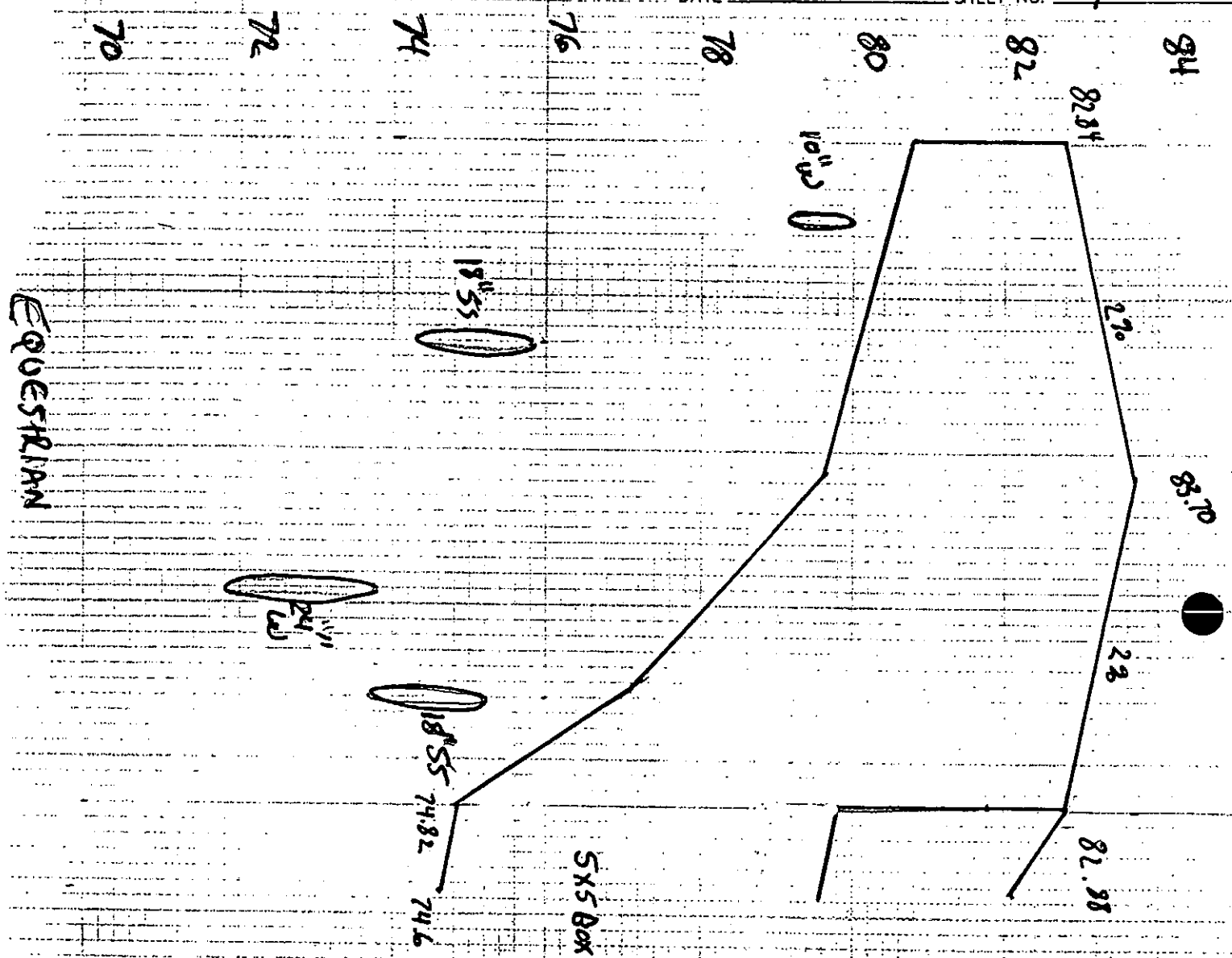
19.5625	21.25	22.9375	24.625	26.3125	28	29.6875	31.375	33.0625	34.75	36.4375	38.125	39.8125
99.94125	99.975	100.0088	100.0425	100.0763	100.11	100.1438	100.1775	100.2113	100.245	100.2788	100.3125	100.3463
0.20875	0.175	0.14125	0.1075	0.07375	0.04	0.00625	-0.0275	-0.06125	-0.095	-0.12875	-0.1625	-0.19625
1.469177	1.095032	0.766203	0.486083	0.259398	0.093569	0.004241	0	0	0	0	0	0

41.5	
100.38	
0.22	
1.362971	113.8214733

41.5	
100.38	
-0.23	
0	53.05503913

ENGINEERS PLANNERS SURVEYORS
POGGEMEYER DESIGN GROUP

CLIENT CSA
PROJECT MAGIC WAY Inlet
ENGINEER SLW JOB NO. 1002005
DATE 12/22/97 SHEET NO. 1/2



ENGINEERS PLANNERS SURVEYORS

POGGEMEYER DESIGN GROUP

CLIENT COH

PROJECT MAGIC WAY INLET

ENGINEER SLW JOB NO. 1001005

DATE 12/22/97 SHEET NO. 2/2

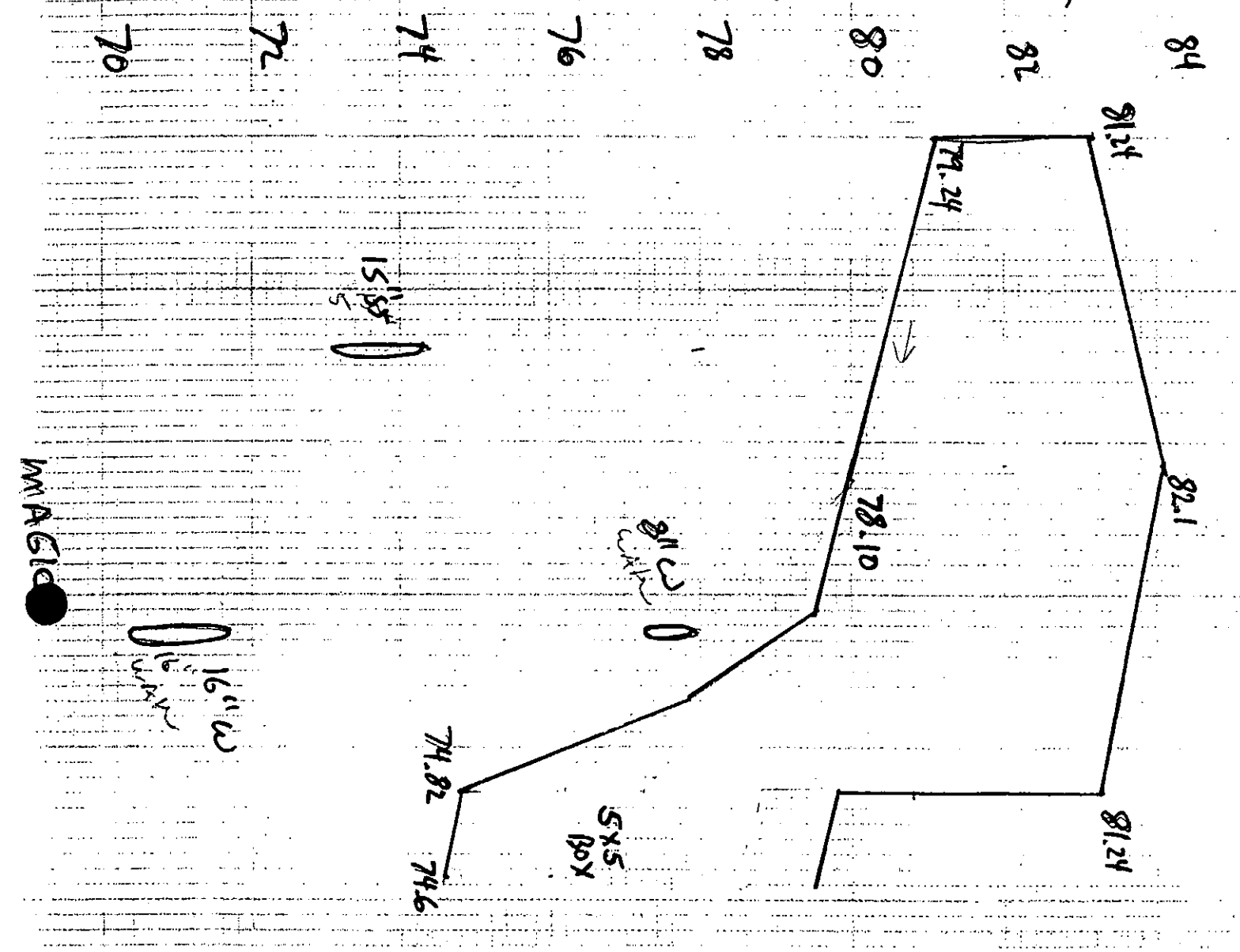
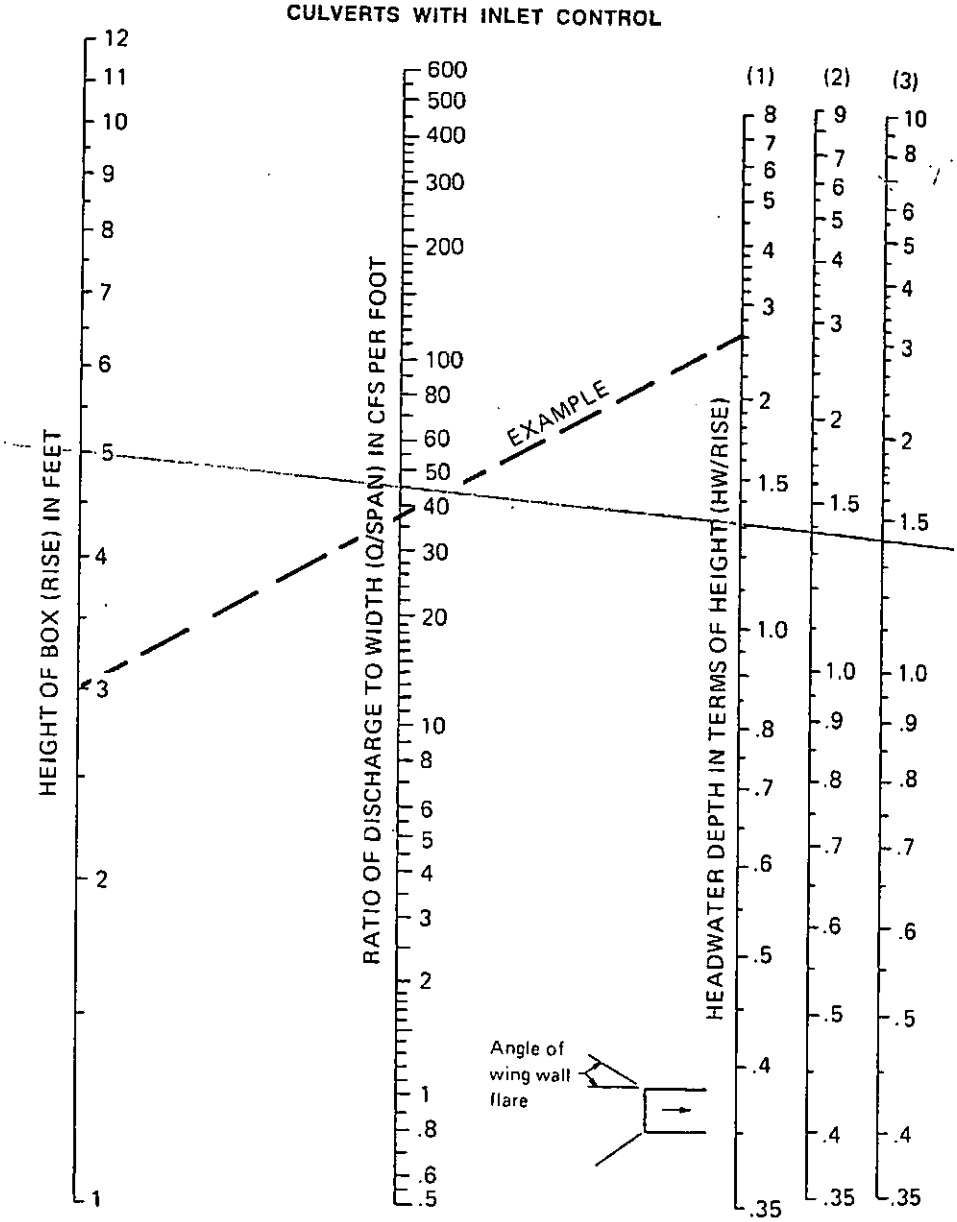


FIGURE 37

HEADWATER DEPTH FOR CONCRETE BOX CULVERTS WITH INLET CONTROL



EXAMPLE

6' x 3' Box Q = 225 cfs
Q/Span = 37.5 cfs/ft

Inlet	HW/Rise	HW ft
(1)	2.6	7.8

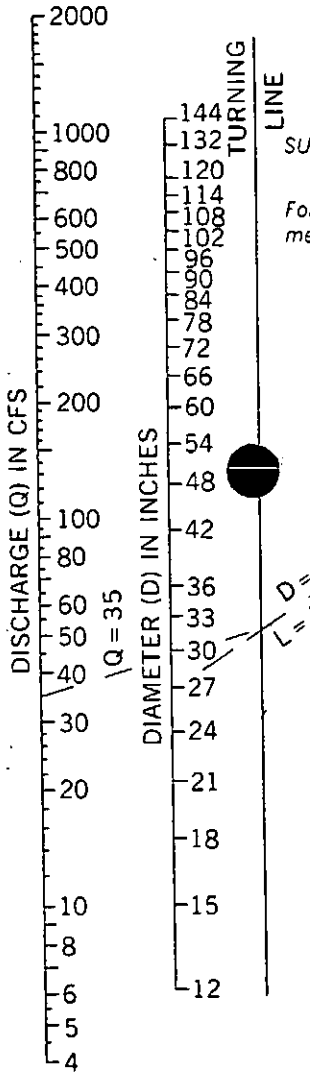
HW/Rise	SCALE	WING WALL FLARE
	(1)	30° to 75°
	(2)	90° and 15°
	(3)	0° (extensions of sides)

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through rise and Q scales, or reverse as illustrated.

BUREAU OF PUBLIC ROADS · JAN 1963

FIGURE 38

HEAD FOR CIR
CULVER



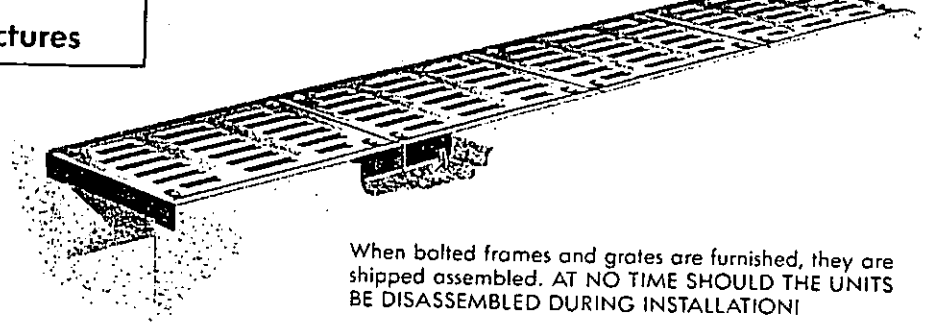
BUREAU OF PUBLIC ROADS

Transverse Drainage Structures

Heavy Duty

Illustrating flat type surface showing Type X frame and Type C grate.

Standard frame and cover sections of this type are bolted and manufactured in 24" standard lengths.

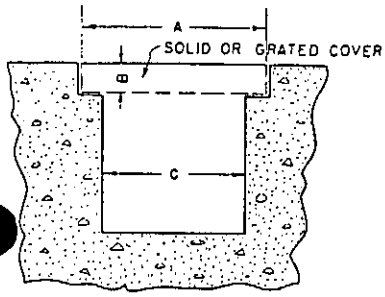


When bolted frames and grates are furnished, they are shipped assembled. AT NO TIME SHOULD THE UNITS BE DISASSEMBLED DURING INSTALLATION!

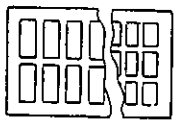
Read Carefully Before Ordering
Specify:
1. Complete catalog number.
2. Length of structure.
3. Type of cover.
4. Perma-Grip surface if required. (See page 229.)
5. End frame sections and number required per unit.
6. If trench drain grates are to be installed in bicycle traffic areas, please advise so that safety standards described on catalog page 89 can be applied.

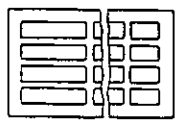
Catalog No.	Dimensions in inches A	B	C	Weight per lineal foot (without frame) Type A	Type C	Type D	Type E	Type P	Frame**
R-4999-AX	8	1½	6	19	22	19	22	25	12
R-4999-BX	10	1½	8	24	27	29	27	31	12
R-4999-CX	12	1½	10	28	31	40	36	37	12
R-4999-DX	14	1½	12	33	35	52	47	45	12
R-4999-EX	17	1½	15	39	52	55	49	—	12
R-4999-FX	20	1½	18	54	67	70	70	—	12
R-4999-GX	23	1½	21	60	77	85	—	—	12
R-4999-HX	26	1½	24	71	100	85	—	—	12
R-4999-JX	30	2	27	100	120	100	—	—	17
R-4999-KX	33	2	30	110	140	150	—	—	17
R-4999-LX	36	2	33	120	130	185	—	—	17
R-4999-MX	39	2	36	130	200	180	—	—	17
R-4999-NX	45	2	42	150	245	210	—	—	17
R-4999-OX	51	2	48	190	—	215	—	—	17

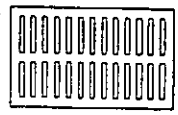
**Weight per foot — includes both sides.

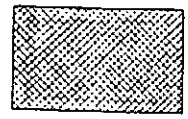


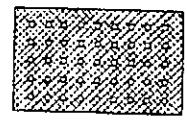
COVER TYPES


Grate Type A


Grate Type C

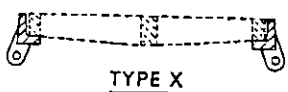

Grate Type P


Solid Checkered Type D


Solid Perforated Type E

Type P grates have ¼" slot widths and are especially applicable for areas of heavy pedestrian traffic.

FRAME TYPE

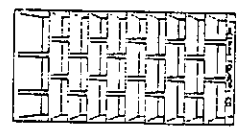


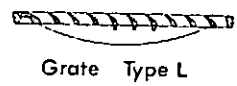
TYPE X

Catalog No.	Dimensions in inches A	B	C	Grate Wt. per lineal ft.
R-4999-L3	14	1½	12	45*
R-4999-L6	24	2	22	88**
R-4999-L9	29¾	2½	26¾	115***

This series furnished standard with Type L grate shown at right.

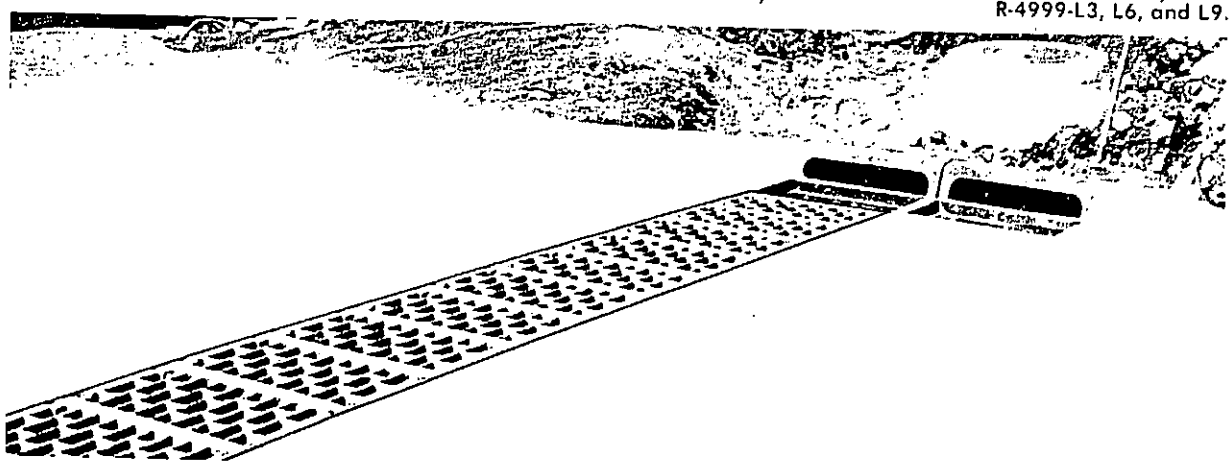
*Furnished in 2 foot increments only.
**Furnished in 1 or 2 foot increments only.
***Furnished in 1½ or 3 foot increments only.





Grate Type L

Available only on R-4999-L3, L6, and L9.



Illustrating R-4999 bolted trench series with Type L grate.

NEENAH FOUNDRY COMPANY

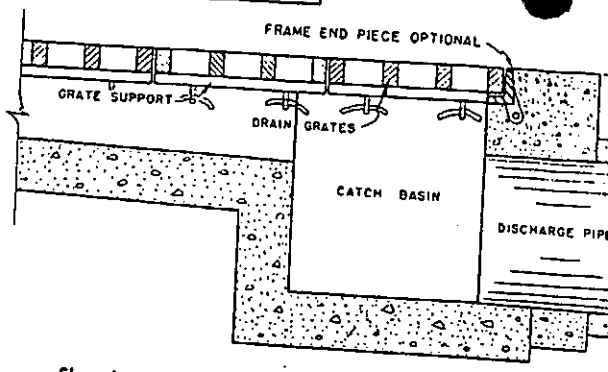
Construction Details for R-4999 Bolted Series Flat or Crowned

NEENA FOUNDRY COM

VARIABLES:

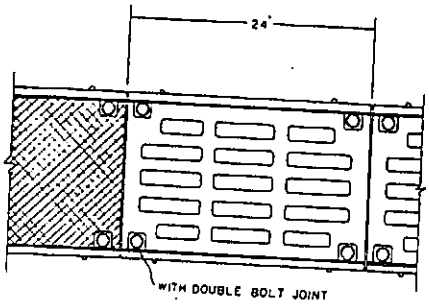
1. Overall length.
2. Cover type.
3. Curb box, catch basin inlet, or frame end piece.
4. Machined horizontal bearing surfaces. (Vertical machined bearing surfaces also available on special order.)

For perfect seating of cover in frame, specify machined horizontal bearing surfaces.



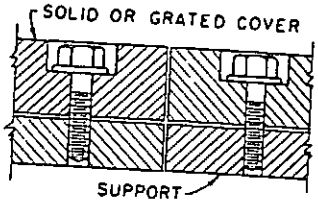
Showing method of construction when no box or inlet is used at end of assembly.

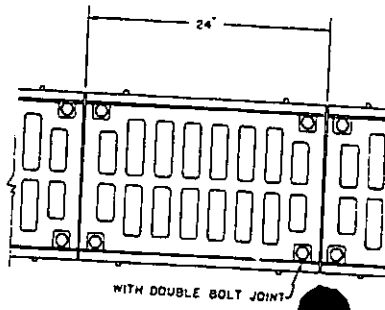
Special assistance is offered providing details shown do not cover your requirements. Shop drawings furnished on request.



Illustrating Type "D" Solid Lid with Type "C" Grate and Frame

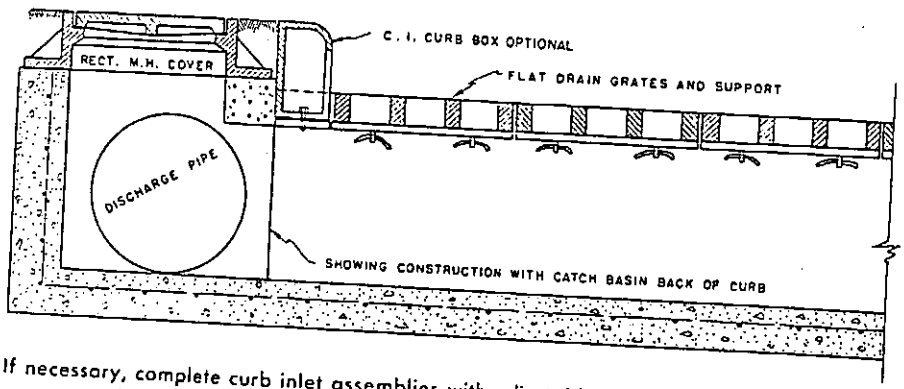
Cover Type Variable
(See page 234)

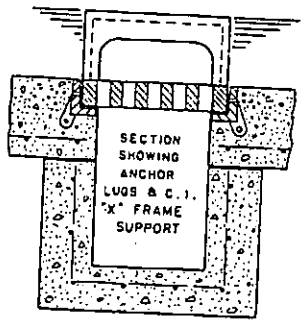




Illustrating Type "A" Grate with Frame

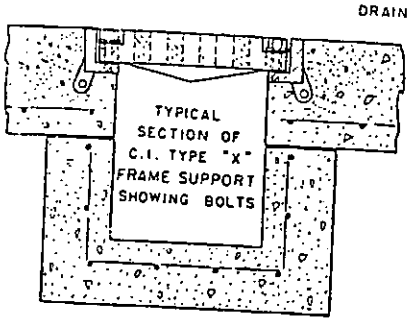
Flat

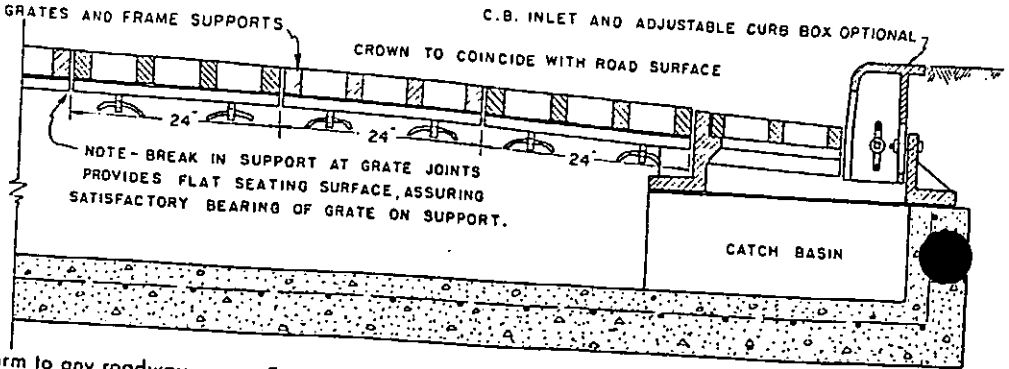




If necessary, complete curb inlet assemblies with adjustable curb boxes or fixed stationary boxes are available. Inlets or curb boxes need not be installed at both ends of the trench drain; they can be used in combination or not at all, depending on drainage conditions.

Crowned





Crowned type drainage structures will conform to any roadway crown. Frames and grates are separated at 2-foot intervals, allowing drain to conform to roadway crown.

Table
Rating Table for Rectangular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	TROUGHT
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Constant Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	2.23	ft

Input Data			
	Minimum	Maximum	Increment
Discharge	10.00	200.00	10.00 ft^3/s

Rating Table

Discharge (ft^3/s)	Depth (ft)
10.00	0.54
20.00	0.89
30.00	1.20
40.00	1.50
50.00	1.78
60.00	2.06
70.00	2.34
80.00	2.62
90.00	2.89
100.00	3.16

Table
Rating Table for Rectangular Channel

Rating Table	
Discharge (ft^3/s)	Depth (ft)
110.00	3.42
120.00	3.69
130.00	3.96
140.00	4.22
150.00	4.49
160.00	4.75
170.00	5.01
180.00	5.28
190.00	5.54
200.00	5.80

4 x 4 box culvert
Worksheet for Rectangular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	box culvert
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	4.00	ft
Discharge	300.00	ft^3/s

Results		
Depth	3.86	ft
Flow Area	15.44	ft^2
Wetted Perimeter	11.72	ft
Top Width	4.00	ft
Critical Depth	5.59	ft
Critical Slope	0.008215	ft/ft
Velocity	19.43	ft/s
Velocity Head	5.86	ft
Specific Energy	9.73	ft
Froude Number	1.74	
Flow is supercritical.		

Equestrian w/o median
Worksheet for Irregular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	Equestrian w/o median
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.005300 ft/ft	
Elevation range: 99.39 ft to 100.38 ft.		
Discharge	310.00	ft^3/s

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	100.00	0.00	100.00	0.017
5.50	99.89			
5.50	99.39			
7.00	99.51			
7.00	99.55			
50.00	100.38			
92.00	99.55			
92.00	99.51			
94.50	99.39			
94.50	99.89			
100.00	100.00			

Results		
Wtd. Mannings Coefficient	0.017	
Water Surface Elevation	100.60	ft
Flow Area	65.55	ft^2
Wetted Perimeter	102.30	ft
Top Width	100.00	ft
Depth	1.21	ft
Critical Water Elev.	100.61	ft

Equestrian w/o median
Worksheet for Irregular Channel

Critical Slope	0.004966	ft/ft
Velocity	4.73	ft/s
Velocity Head	0.35	ft
Specific Energy	100.95	ft
Froude Number	1.03	
Full Flow Capacity	29.79	ft^3/s

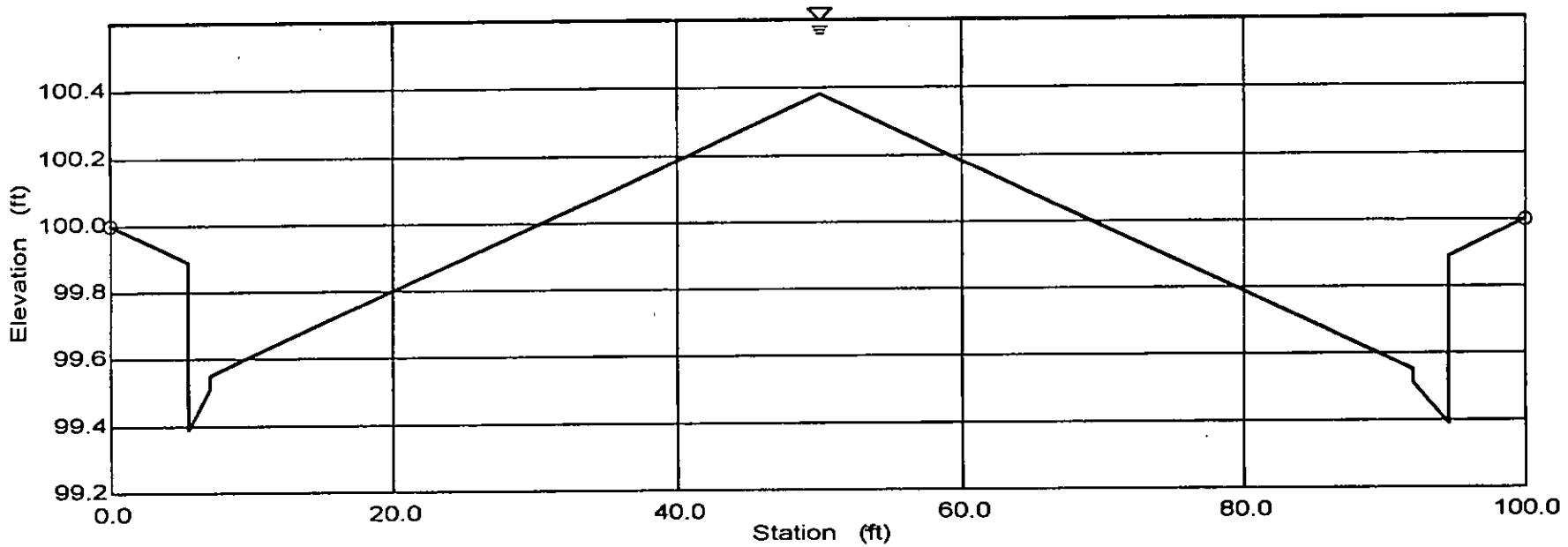
Flow is supercritical.

Water elevation exceeds lowest end station by 0.60 ft.

Equestrian w/o median
Cross Section for Irregular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	Equestrian w/o median
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.005300	ft/ft
Water Surface Elevation	100.60	ft
Discharge	310.00	ft^3/s



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	EQUESTRIAN DR.
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.005300 ft/ft	
Elevation range: 99.39 ft to 100.93 ft.		
Station (ft)	Elevation (ft)	
0.00	100.00	
5.50	99.89	
5.50	99.39	
7.00	99.51	
7.00	99.55	
42.00	100.25	
42.92	100.29	
43.00	100.79	
50.00	100.93	
57.00	100.79	
57.08	100.29	
58.00	100.25	
92.00	99.55	
92.00	99.51	
94.50	99.39	
94.50	99.89	
100.00	100.00	
Discharge	310.00	ft^3/s

Start Station	End Station	Roughness
0.00	100.00	0.017

Results	
Wtd. Mannings Coefficient	0.017

Worksheet
Worksheet for Irregular Channel

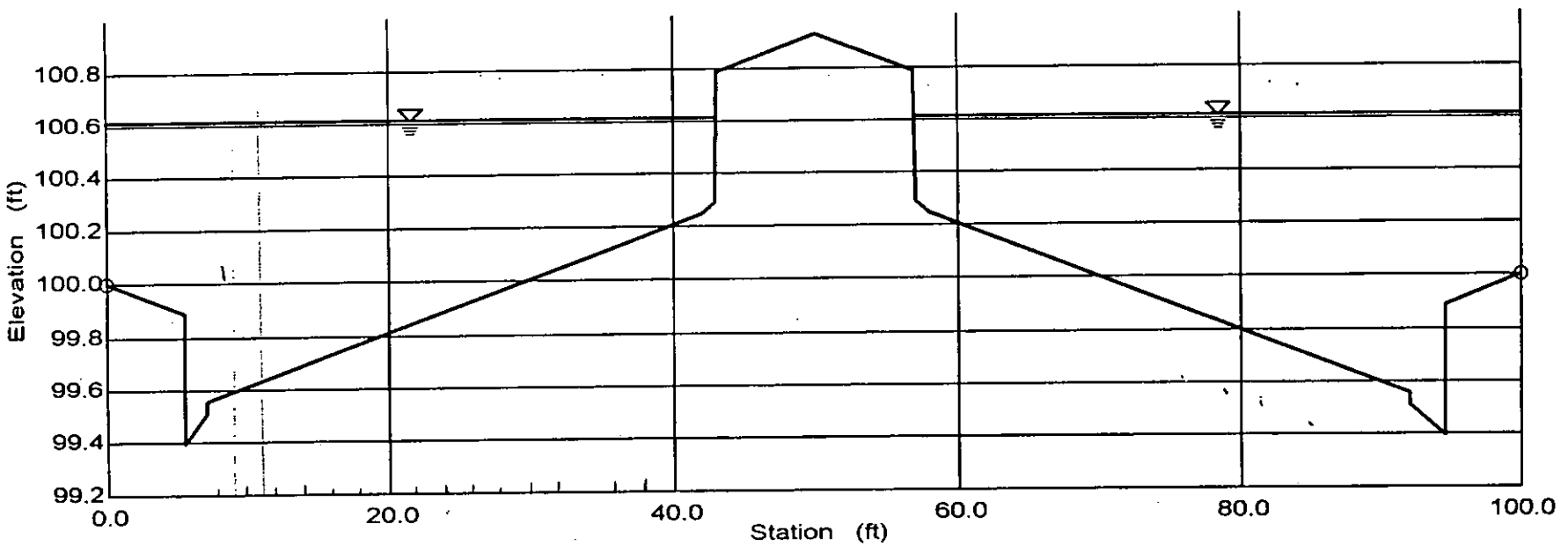
Water Surface Elevation	100.61	ft
Flow Area	61.95	ft^2
Wetted Perimeter	88.83	ft
Top Width	85.94	ft
Depth	1.22	ft
Critical Water Elev.	100.63	ft
Critical Slope	0.004872	ft/ft
Velocity	5.00	ft/s
Velocity Head	0.39	ft
Specific Energy	101.00	ft
Froude Number	1.04	
Full Flow Capacity	28.88	ft^3/s

Flow is supercritical.
Flow is divided.
Water elevation exceeds lowest end station by 0.61 ft.

Cross Section EQUESTRIAN DR
Cross Section for Irregular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	EQUESTRIAN DR.
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.005300	ft/ft
Water Surface Elevation	100.61	ft
Discharge	310.00	ft³/s



Magic w/o median
Worksheet for Irregular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	Magic Way w/o median
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.012000	ft/ft

Elevation range: 99.39 ft to 100.38 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	100.00	0.00	100.00	0.017
5.50	99.89			
5.50	99.39			
7.00	99.51			
7.00	99.55			
50.00	100.38			
92.00	99.55			
92.00	99.51			
94.50	99.39			
94.50	99.89			
100.00	100.00			
Discharge	100.00	ft^3/s		

Results		
Wtd. Mannings Coefficient	0.017	
Water Surface Elevation	100.15	ft
Flow Area	23.29	ft^2
Wetted Perimeter	77.58	ft
Top Width	76.18	ft
Depth	0.76	ft
Critical Water Elev.	100.23	ft

Magic w/o median
Worksheet for Irregular Channel

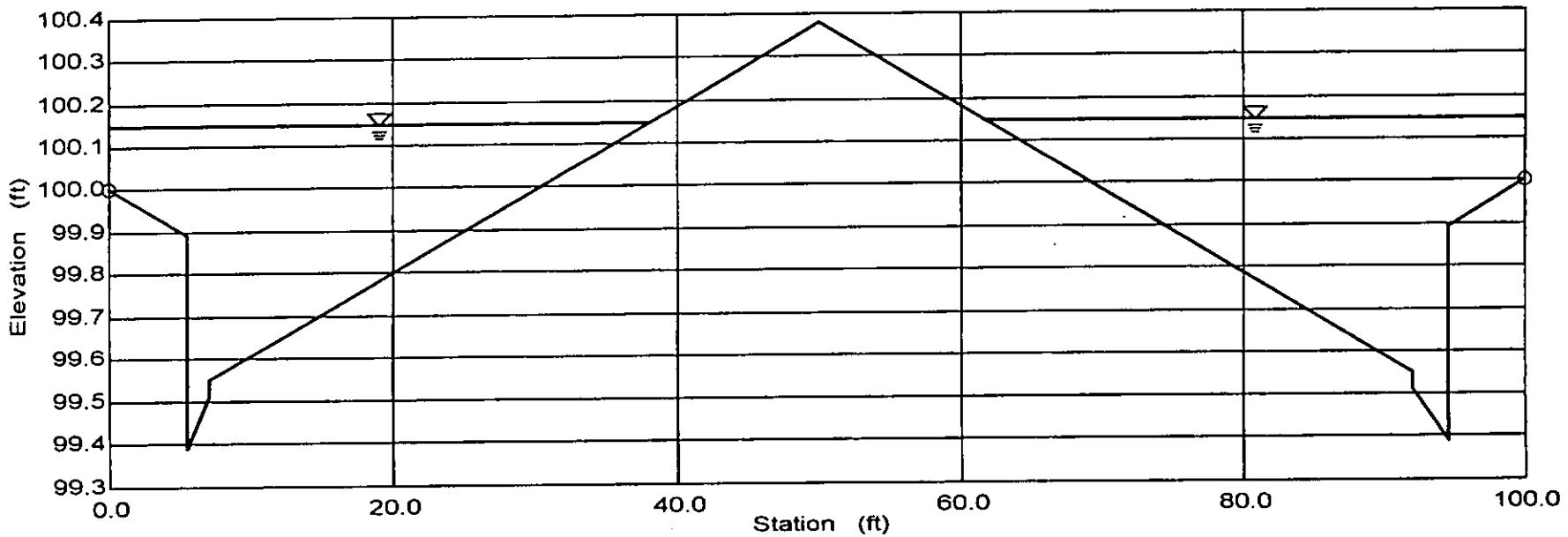
Critical Slope	0.006111	ft/ft
Velocity	4.29	ft/s
Velocity Head	0.29	ft
Specific Energy	100.43	ft
Froude Number	1.37	
Full Flow Capacity	44.83	ft^3/s

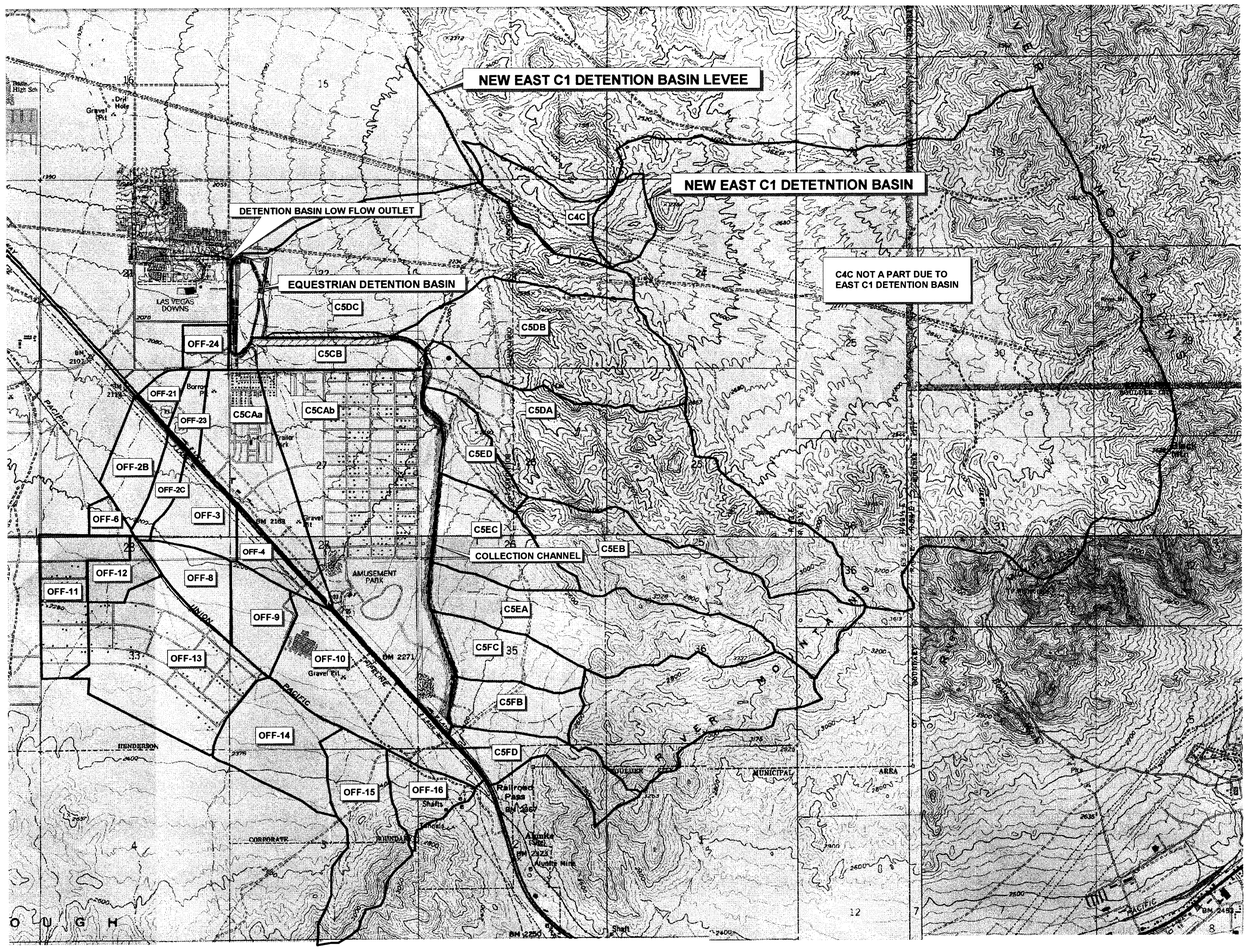
Flow is supercritical.
Flow is divided.
Water elevation exceeds lowest end station by 0.15 ft.

Magic w/o median
Cross Section for Irregular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	Magic Way w/o median
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.012000	ft/ft
Water Surface Elevation	100.15	ft
Discharge	100.00	ft^3/s





N

W E

S

Basin	Area_sf	Acres	Sm
C5FD	5161199	118.48	0.18513
C5FA	14997729	344.30	0.53797
C5FC	5313741	121.99	0.19061
C5FB	4759463	109.26	0.17072
C5EA	14471902	332.23	0.51911
C5EC	7382686	169.48	0.26481
C5ED	4110343	94.36	0.14744
C5EB	16405859	376.63	0.58848
C5DA	28551039	655.44	1.02413
C5DB	18135677	416.34	0.65053
C5CB	4611546	105.87	0.16542
C5DC	28379998	651.52	1.01800
C4C	157900956	3624.91	5.66392
OFF-9	3976806	91.29	0.14264
OFF-8	3666375	84.17	0.13152
OFF-10	11783184	270.50	0.42266
OFF-14	7636455	175.31	0.27392
OFF-16	3203148	73.53	0.11489
OFF-15	9126371	209.51	0.32736
OFF-3	4138731	95.01	0.14845
OFF-2C	1820866	41.80	0.06531
OFF-2B	3788430	86.97	0.13589
OFF-13	14651343	336.35	0.52555
OFF-11	6042651	138.72	0.21675
OFF-12	2180153	50.05	0.07820
C5CAb	31589056	725.18	1.13309

2000 0 2000 4000 6000 8000 10000 12000 14000 16000 18000 Feet

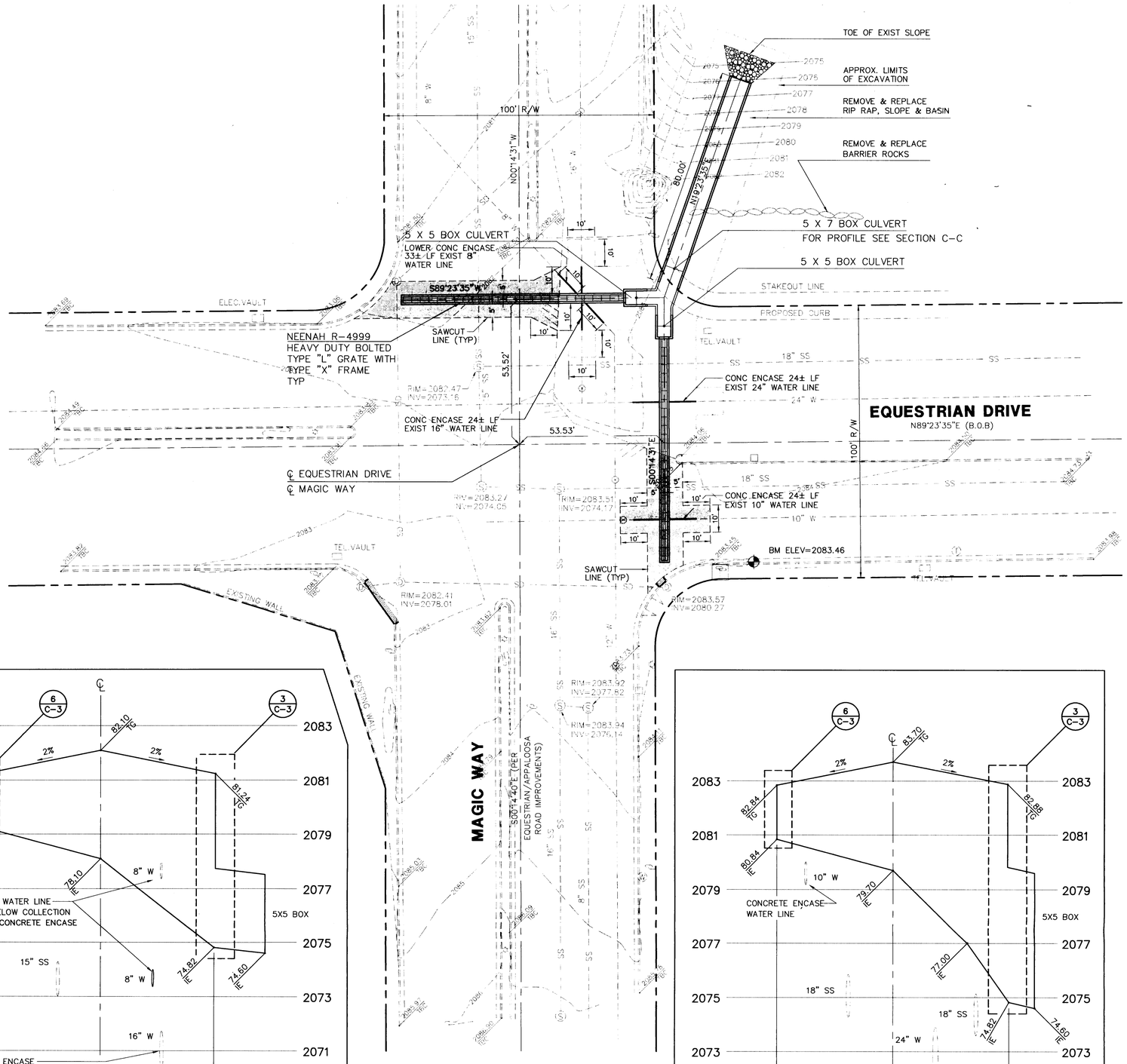
EQUESTRIAN DETENTION BASIN
OVERALL BASIN MAP

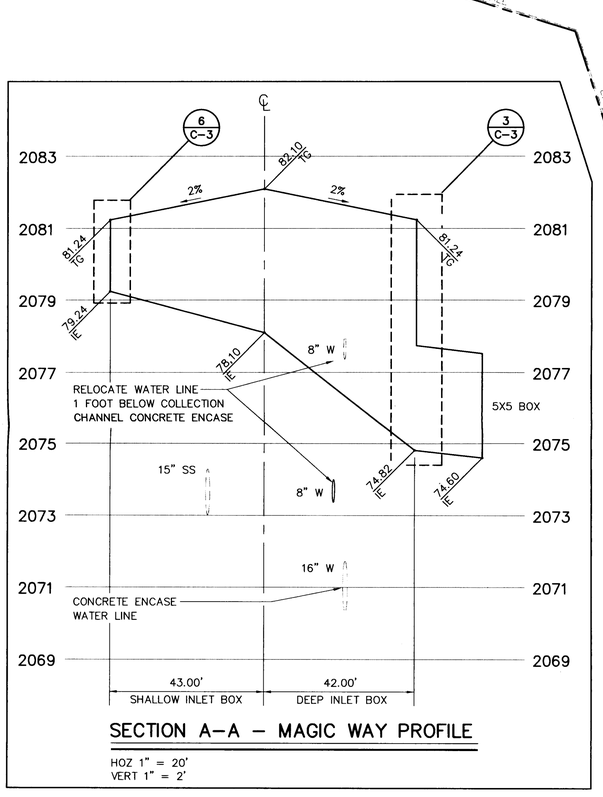
PREPARED FOR THE CITY OF HENDERSON

POGGEMEYER DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS
2601 North Tenaya Way
Las Vegas, NV 89128
(702) 255-8100 FAX (702) 255-8375
pdg-lv@pdg-lv.com

PDG# 1002005

FIGURE 3
BASIN MAP

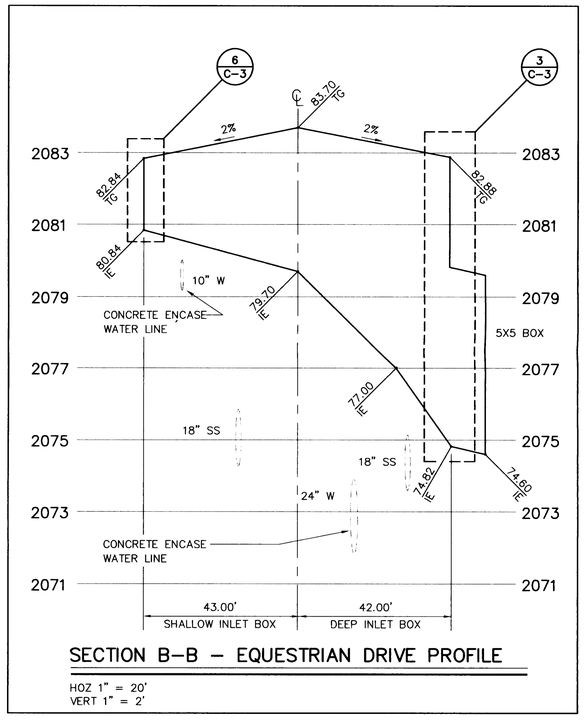




SECTION A–A – MAGIC WAY PROFILE

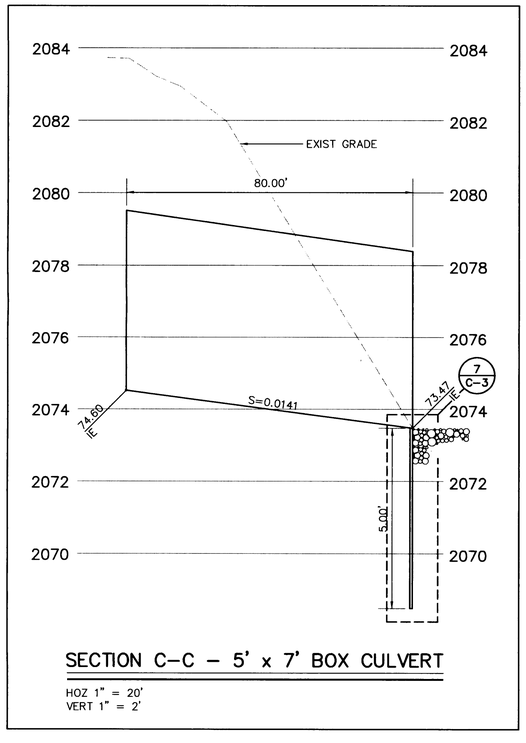
HOZ 1" = 20'
VERT 1" = 2'

NOTE:
PROPERTY LINE INFORMATION, SHOWN HEREON, PER EQUESTRIAN/APPALOOSA ROAD IMPROVEMENTS CONTRACT NO. 96-97.04



SECTION B–B – EQUESTRIAN DRIVE PROFILE

HOZ 1" = 20'
VERT 1" = 2'



SECTION C–C – 5' x 7' BOX CULVERT

HOZ 1" = 20'
VERT 1" = 2'



GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

BASIS OF BEARINGS

BEING THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST M.D.M. TAKEN AS NORTH 89°23'35" EAST, PER PLAT BOOK 55, PAGE 28 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

BENCH MARK: CITY OF HENDERSON DATUM

CITY OF HENDERSON BENCH MARK NO. 100 BEING DESCRIBED AS A BRASS CAP IN THE TOP THE CURB ON THE SOUTHWEST CORNER OF EQUESTRIAN DRIVE AND LONGMEADOW STREET.

ELEVATION = 2,091.675' (637.544 METERS)

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DO OVERHEAD
1-702-563-6111
NEVADA POWER ENVIRONMENT & SAFETY SERVICES DEPARTMENT

Avoid cutting underground utility lines. It's costly.
Call before you Dig.
1-800-227-2600

REVISION	DATE

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POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STATE OF NEVADA — PROFESSIONAL ENGINEER — No. 12257 — 7-1-98

MAGIC WAY INLET

MAGIC WAY INLET
CITY OF HENDERSON
PUBLIC WORKS

JOB NUMBER	1002005
DESIGNED BY	RP
DRAWN BY	DRF
CHECKED BY	TEP
DATE	01.27.98

SHEET NUMBER
C-1
OF 3

FILENAME
PATH:
XREFS:
PSLT:
SHT_NAME:
PLOT_SCALE:
LAST_REV_DATE:

DATE	REVISION

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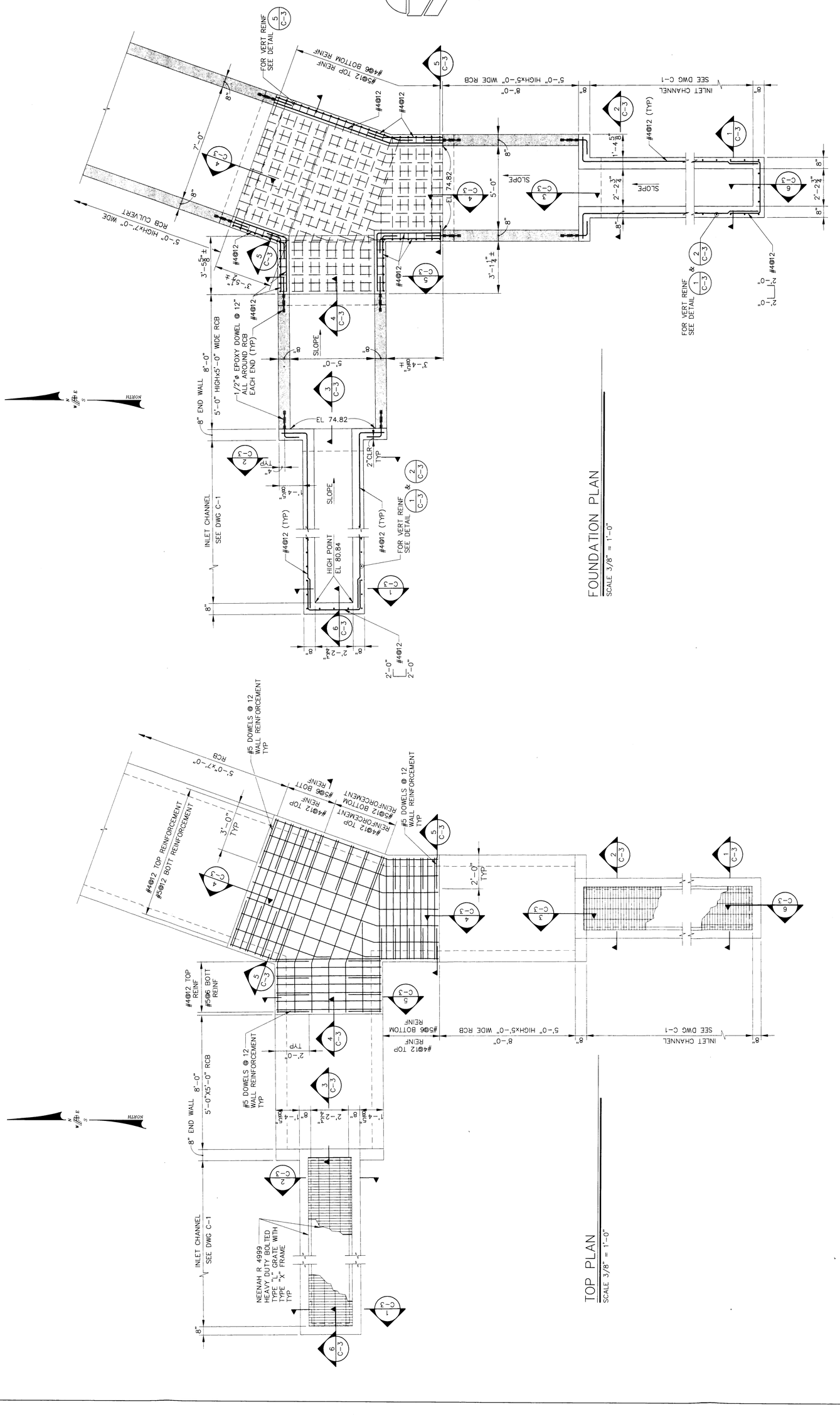
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LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STATE OF NEVADA — REGISTERED — No. 8201 — PROFESSIONAL ENGINEER — STRUCTURAL — STAMP

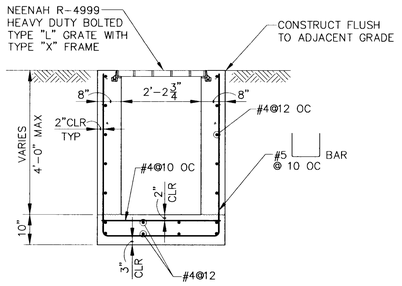
MAGIC WAY INLET

MAGIC WAY INLET
CITY OF HENDERSON
PUBLIC WORKS

JOB NUMBER	1002005
DESIGNED BY	RP
DRAWN BY	DRF
CHECKED BY	TEP
DATE	01.27.98
SHEET NUMBER	C-2 of 3

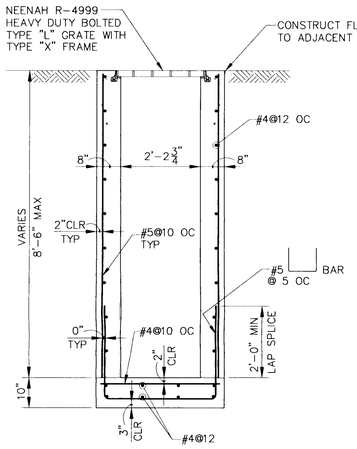


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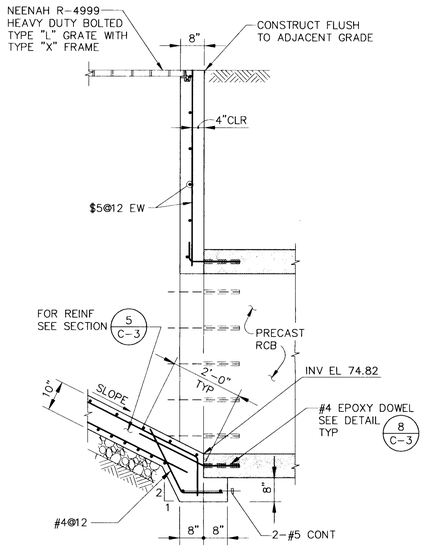
SHALLOW INLET BOX SECTION (1)

SCALE 1/2" = 1'-0"



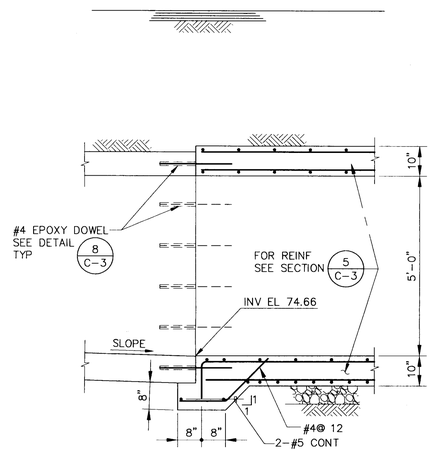
DEEP INLET BOX SECTION (2)

SCALE 1/2" = 1'-0"



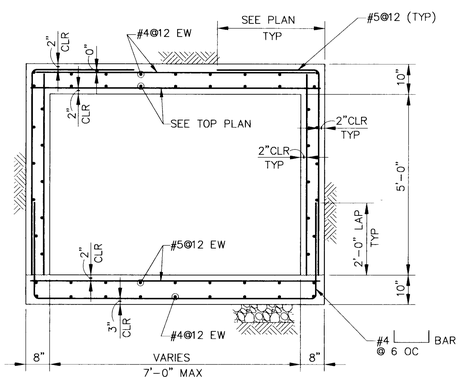
SECTION (3)

SCALE 1/2" = 1'-0"



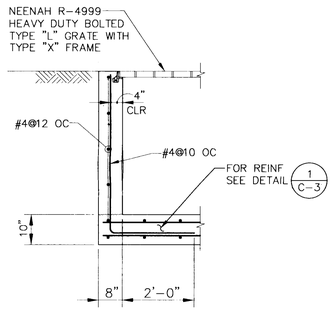
SECTION (4)

SCALE 1/2" = 1'-0"



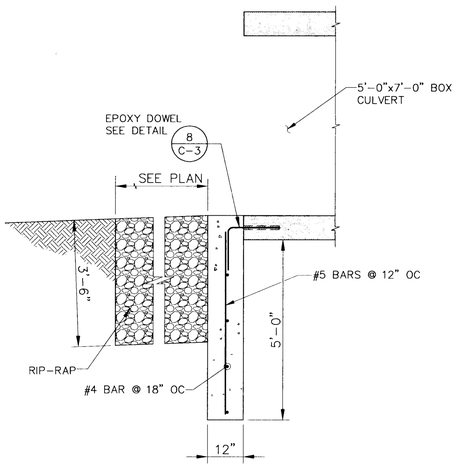
SECTION (5)

SCALE 1/2" = 1'-0"



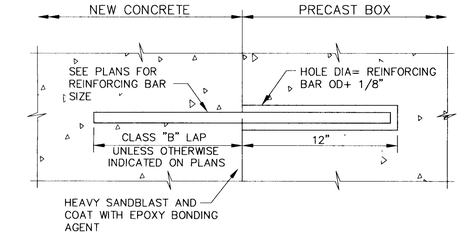
SECTION (6)

SCALE 1/2" = 1'-0"



CUTOFF WALL DETAIL (7)

SCALE 1/2" = 1'-0"

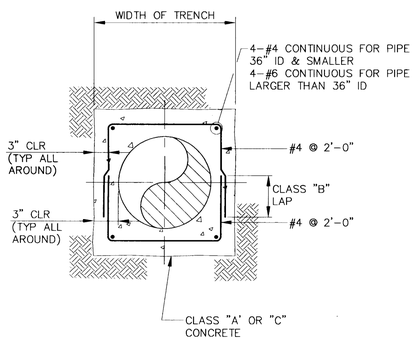


NOTES:

1. DRILL THE HOLE WITH AN IMPACT DRILL TO OBTAIN A ROUGH HOLE SURFACE. THE HOLE SHALL BE FREE OF DUST AND SHALL BE CLEAN AND DRY.
2. THE REINFORCING BAR SHALL BE FREE OF OIL, PAINT, DIRT, OR OTHER COATINGS THAT WILL REDUCE BOND.
3. DO NOT DAMAGE OR CUT EXISTING REINFORCING BARS, ELECTRICAL CONDUITS, OR OTHER ITEMS EMBEDDED IN THE EXISTING CONCRETE. THE LOCATION OF REINFORCING BARS, OR OTHER OBSTRUCTIONS SHALL BE DETERMINED WITH A NONDESTRUCTIVE INDICATOR DEVICE.
4. IF THE DRILL HITS AN EXISTING REINFORCING BAR OR OTHER OBSTRUCTION, STOP DRILLING AND FILL THE HOLE WITH DRY PACK MORTAR. RELOCATE THE HOLE TO MISS THE OBSTRUCTION AND DRILL ANOTHER HOLE. REPEAT THE ABOVE UNTIL THE HOLE HAS BEEN DRILLED TO THE REQUIRED DEPTH.
5. FILL THE HOLE TO 1/2" DEPTH WITH EPOXY GEL BEFORE INSERTING THE REINFORCING BAR.

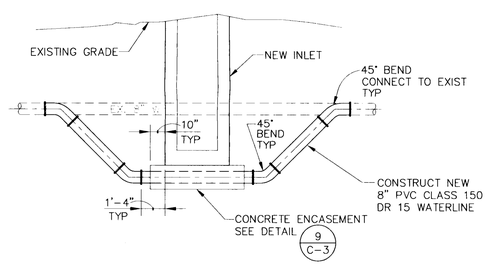
EPOXY BONDED REINFORCING BARS (8)

NO SCALE



CONCRETE ENCASEMENT OF PIPE (9)

NO SCALE

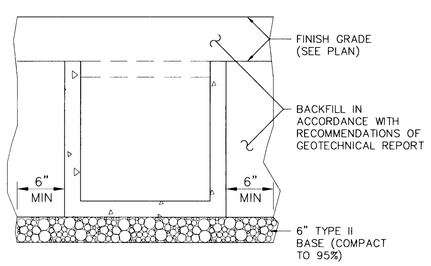


NOTES:

1. INSTALL THRUST BLOCKS IN ACCORDANCE WITH UDS PLATE NO. 5 OR APPROVED MECHANICAL JOINT RESTRAINT AND DRY.
2. PIPE BEDDING AND BACKFILL PER UNIFORM STANDARD DRAWINGS

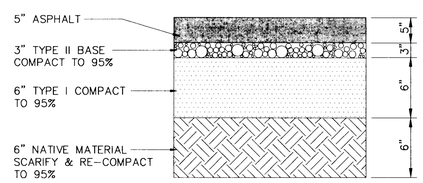
WATER LINE ADJUSTMENT (10)

SCALE 1/4" = 1'-0"



BASE AND BACKFILL DETAIL (11)

NO SCALE



PAVEMENT SECTION (12)

NO SCALE

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NO.	REVISION	DATE

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STATE OF NEVADA — PROFESSIONAL ENGINEER — TIMOTHY E. POGGEMEYER — No. 9307 — 3-12-98

MAGIC WAY INLET

MAGIC WAY INLET
CITY OF HENDERSON
PUBLIC WORKS

JOB NUMBER	1002005
DESIGNED BY	RP
DRAWN BY	DRF
CHECKED BY	TEP
DATE	01.27.98
SHEET NUMBER	C-3 of 3

AVOID HITTING OVERHEAD POWER LINES IT'S COOLY
CALL BEFORE YOU DO OVERHEAD
1-702-593-8111
NEVADA POWER ENVIRONMENT & SAFETY SERVICES DEPARTMENT
Avoid cutting underground utility lines. It's costly.
Call before you Dig.
1-800-227-2600

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PSLTSCALE NO
PLOT STYLE NAMES MEDIEL-LANDUS DETAILS
LAST_REV_BY RP
LAST_REV_DATE 08/05/97

4 x 4 box culvert
Worksheet for Rectangular Channel

Project Description	
Project File	j:\1002001\project1.fm2
Worksheet	box culvert
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Bottom Width	4.00	ft
Discharge	300.00	ft^3/s

Results		
Depth	3.86	ft
Flow Area	15.44	ft^2
Wetted Perimeter	11.72	ft
Top Width	4.00	ft
Critical Depth	5.59	ft
Critical Slope	0.008215	ft/ft
Velocity	19.43	ft/s
Velocity Head	5.86	ft
Specific Energy	9.73	ft
Froude Number	1.74	
Flow is supercritical.		

The Magic Way inlet was designed to collect flows at the Magic Way & Equestrian intersections with ultimate flow conditions. The following calculations are used to define the flow collection in the interim conditions when major flows cross the Boulder Highway. The limiting factor is the entrance head loss in the 5' X 7' box culvert. The collection flow rates for the other existing catch basins are taken from the Equestrian Drive drainage study. Maximum collection due to Magic Way inlet is 385 CFS.

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	MAGIC WAY W/O MEIDAN
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.012000	ft/ft

Elevation range: 99.39 ft to 100.38 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	100.00	0.00	100.00	0.017
5.50	99.98			
5.50	99.39			
7.00	99.51			
7.00	99.55			
50.00	100.38			
92.00	99.55			
92.00	99.51			
94.50	99.39			
94.50	99.89			
100.00	100.00			

Discharge	957.00	ft^3/s

Results		
Wtd. Mannings Coefficient	0.017	
Water Surface Elevation	100.96	ft
Flow Area	101.20	ft^2
Wetted Perimeter	103.11	ft
Top Width	100.00	ft
Depth	1.57	ft
Critical Water Elev.	101.36	ft
Critical Slope	0.003946	ft/ft
Velocity	9.46	ft/s
Velocity Head	1.39	ft
Specific Energy	102.35	ft
Froude Number	1.66	
Full Flow Capacity	43.39	ft^3/s

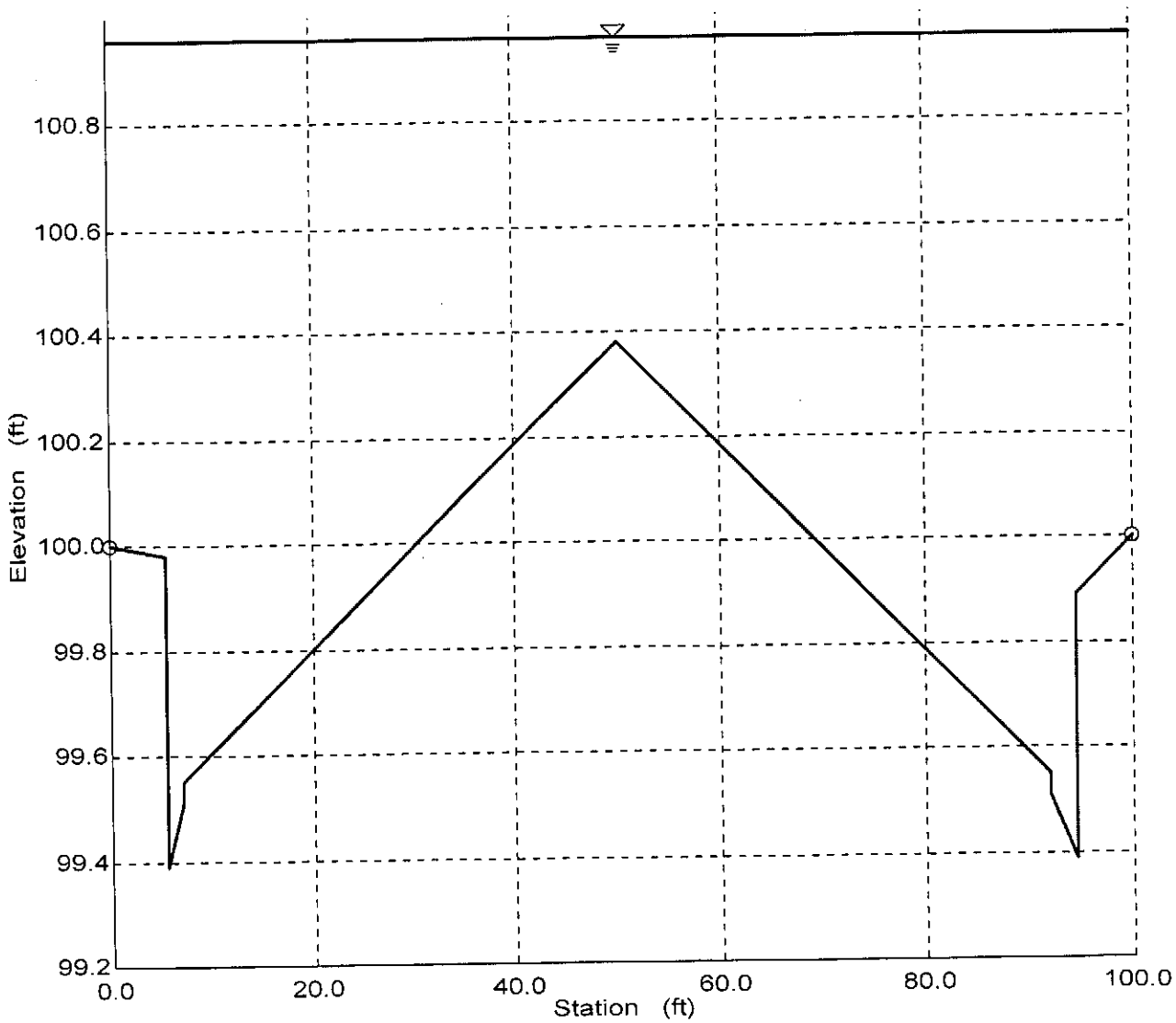
Flow is supercritical.

Water elevation exceeds lowest end station by 0.96 ft.

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	MAGIC WAY W/O MEIDAN
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.012000	ft/ft
Water Surface Elevation	100.96	ft
Discharge	957.00	ft^3/s



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	EQUESTRIAN W/O MEIDAN
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

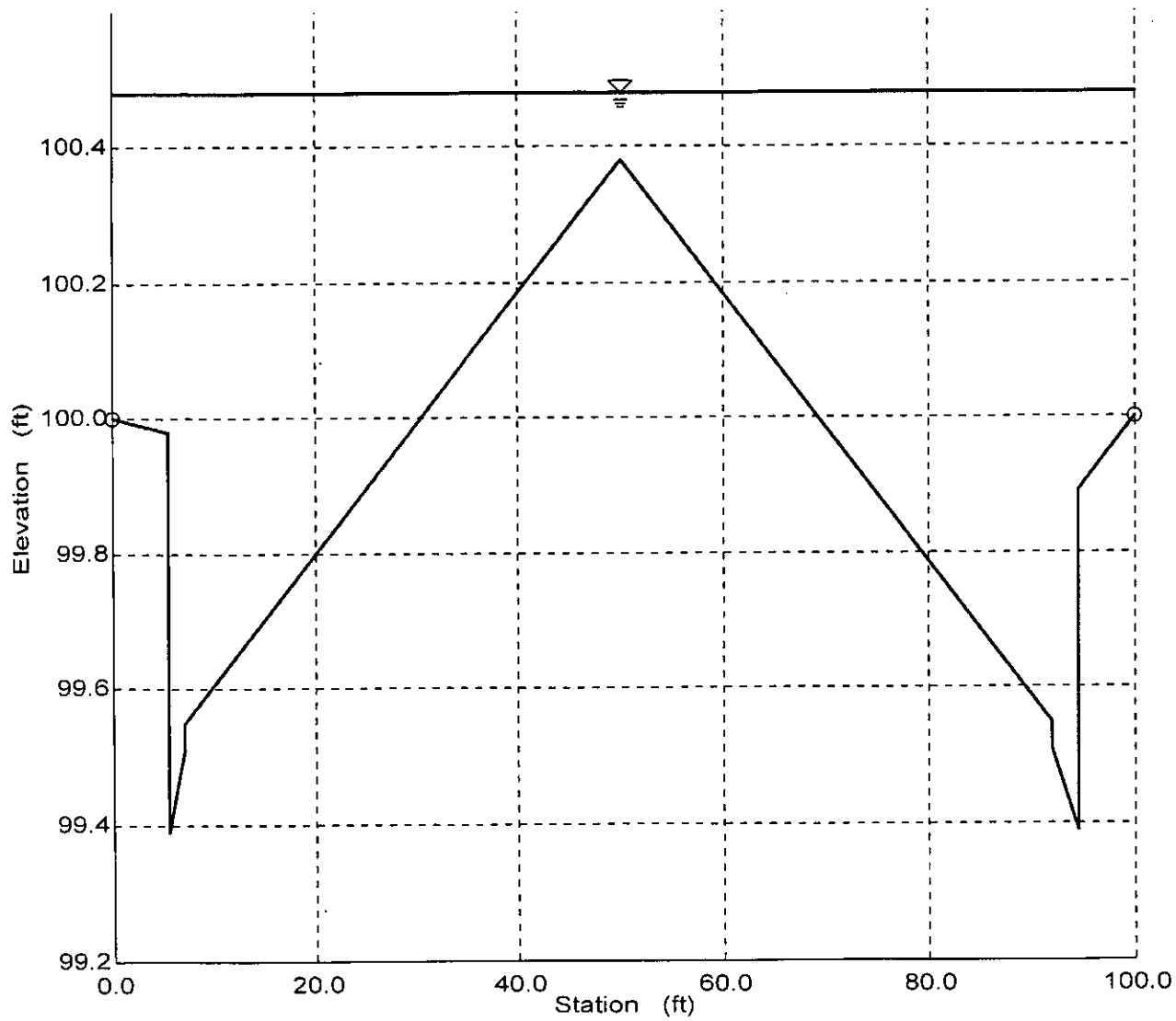
Input Data				
Channel Slope	0.005300 ft/ft			
Elevation range: 99.39 ft to 100.38 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	100.00	0.00	100.00	0.017
5.50	99.98			
5.50	99.39			
7.00	99.51			
7.00	99.55			
50.00	100.38			
92.00	99.55			
92.00	99.51			
94.50	99.39			
94.50	99.89			
100.00	100.00			
Discharge	220.00	ft^3/s		

Results		
Wtd. Mannings Coefficient	0.017	
Water Surface Elevation	100.48	ft
Flow Area	53.33	ft^2
Wetted Perimeter	102.15	ft
Top Width	100.00	ft
Depth	1.09	ft
Critical Water Elev.	100.48	ft
Critical Slope	0.005347	ft/ft
Velocity	4.13	ft/s
Velocity Head	0.26	ft
Specific Energy	100.74	ft
Froude Number	1.00	
Full Flow Capacity	28.84	ft^3/s
Flow is subcritical.		
Water elevation exceeds lowest end station by 0.48 ft.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	EQUESTRIAN W/O MEIDAN
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.005300	ft/ft
Water Surface Elevation	100.48	ft
Discharge	220.00	ft^3/s

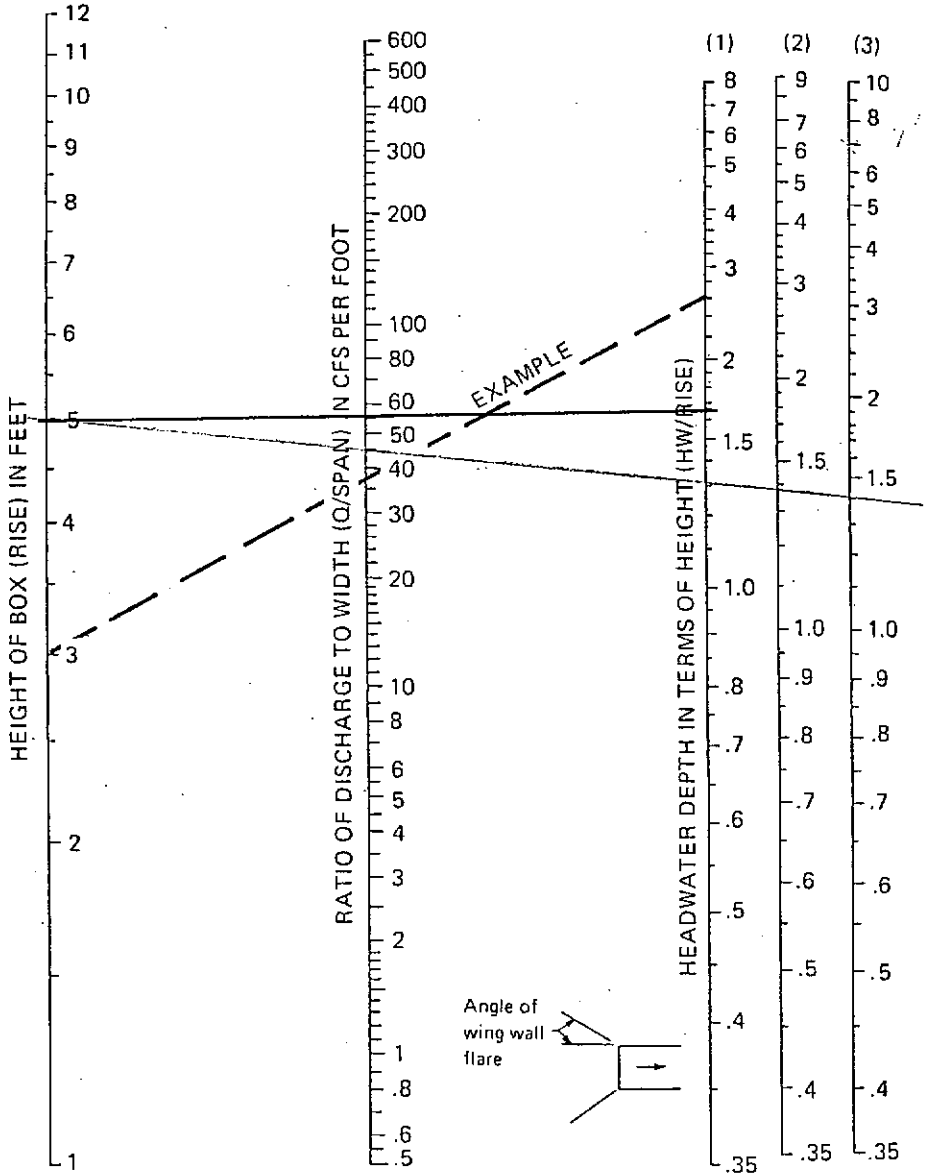


water sur	100.48		**EQUESTRIAN**										
OFFSET	0.000	1.000	2.688	4.375	6.063	7.750	9.438	11.125	12.813	14.500	16.188	17.875	19.563	21.250
	LIP GUT													
ELEV	99.550	99.570	99.604	99.638	99.671	99.705	99.739	99.773	99.806	99.840	99.874	99.908	99.941	99.975
DEPTH	0.930	0.910	0.876	0.843	0.809	0.775	0.741	0.708	0.674	0.640	0.606	0.573	0.539	0.505
Q		5.355	5.355	5.355	5.355	5.355	5.355	5.355	5.355	5.355	5.355	5.355	5.355	5.355
water sur	100.96		**MAGIC**											
OFFSET	0.000	1.000	2.688	4.375	6.063	7.750	9.438	11.125	12.813	14.500	16.188	17.875	19.563	21.250
	LIP GUT													
ELEV	99.550	99.570	99.604	99.638	99.671	99.705	99.739	99.773	99.806	99.840	99.874	99.908	99.941	99.975
DEPTH	1.410	1.390	1.356	1.322	1.289	1.255	1.221	1.188	1.154	1.120	1.086	1.052	1.019	0.985
Q		6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300

22.938	24.625	26.313	28.000	29.688	31.375	33.063	34.750	36.438	38.125	39.813	41.500		
100.009	100.043	100.076	100.110	100.144	100.178	100.211	100.245	100.279	100.313	100.346	100.380		
0.471	0.438	0.404	0.370	0.336	0.303	0.269	0.235	0.201	0.168	0.134	0.100		
4.851	4.286	3.749	3.242	2.764	2.317	1.903	1.521	1.175	0.865	0.595	0.366		97.246
22.938	24.625	26.313	28.000	29.688	31.375	33.063	34.750	36.438	38.125	39.813	41.500		
100.009	100.043	100.076	100.110	100.144	100.178	100.211	100.245	100.279	100.313	100.346	100.380		
0.951	0.917	0.884	0.850	0.816	0.782	0.749	0.715	0.681	0.647	0.614	0.580		
6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300	6.300		157.490

FIGURE 37

HEADWATER DEPTH FOR CONCRETE BOX CULVERTS WITH INLET CONTROL



EXAMPLE

6' x 3' Box Q = 225 cfs

Q/Span = 37.5 cfs/ft

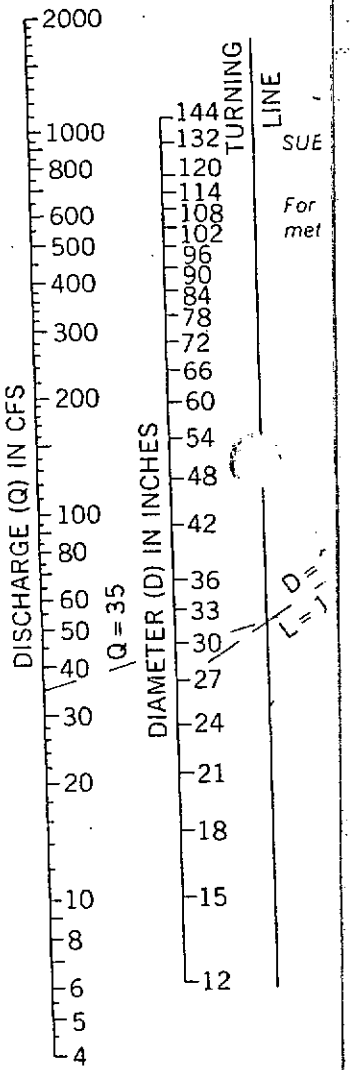
HW *HW*

HW / Rise	SCALE	WING WALL FLARE
	(1)	30° to 75°
	(2)	90° and 15°

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through rise and Q scales, or reverse as illustrated.

FIGURE 38

HEAD FOR CIR
CULVER



The flow not collected at the magic Way and Equestrian intersection flows north in Magic Way. Magic Way is a ½ improved 100 foot ROW road with full improvements on the west side. The flow (202-CFS) will be contained within the west side improvements. The existing improvements are as shown in the approved LOMR application for Heritage II 96-09-163R / 97-09-105P except the proposed channel noted to be on the east side of the roadway is not present. The sections provided shown the ½ ROW road and that the flows do not exceed the center line elevation nor the existing median.

MAGIC WAY NORTH OF EQUESTRIAN WEST SIDE
Worksheet for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	MAGIC WAY 1/2 ROW
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.020100	ft/ft

Elevation range: 99.39 ft to 100.91 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	100.00	0.00	50.00	0.017
5.50	99.98			
5.50	99.39			
7.00	99.51			
7.00	99.55			
48.00	100.37			
48.00	100.87			
50.00	100.91			

Discharge	202.00	ft^3/s

Results		
Wtd. Mannings Coefficient	0.017	
Water Surface Elevation	100.48	ft
Flow Area	25.36	ft^2
Wetted Perimeter	49.22	ft
Top Width	48.00	ft
Depth	1.09	ft
Critical Water Elev.	100.77	ft
Critical Slope	0.004727	ft/ft
Velocity	7.96	ft/s
Velocity Head	0.99	ft
Specific Energy	101.46	ft
Froude Number	1.93	
Full Flow Capacity	529.51	ft^3/s

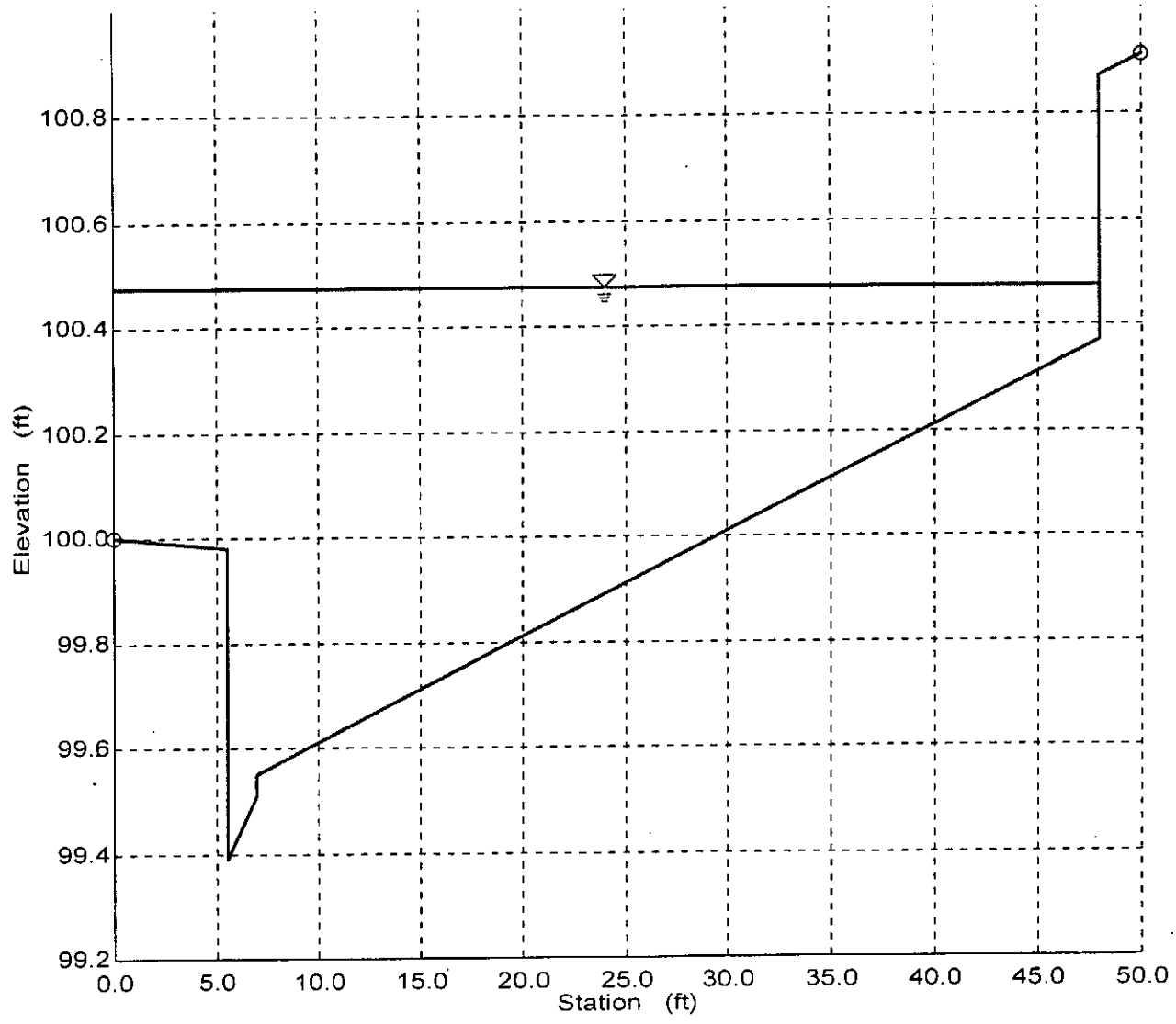
Flow is supercritical.

Water elevation exceeds lowest end station by 0.48 ft.

MAGIC WAY NORTH OF EQUESTRIAN
Cross Section for Irregular Channel

Project Description	
Project File	j:\1002005\equestin.fm2
Worksheet	MAGIC WAY 1/2 ROW
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.017	
Channel Slope	0.020100	ft/ft
Water Surface Elevation	100.48	ft
Discharge	202.00	ft^3/s



APPENDIX F

HEC-RAS CALCULATIONS

Sub-Critical Evaluation

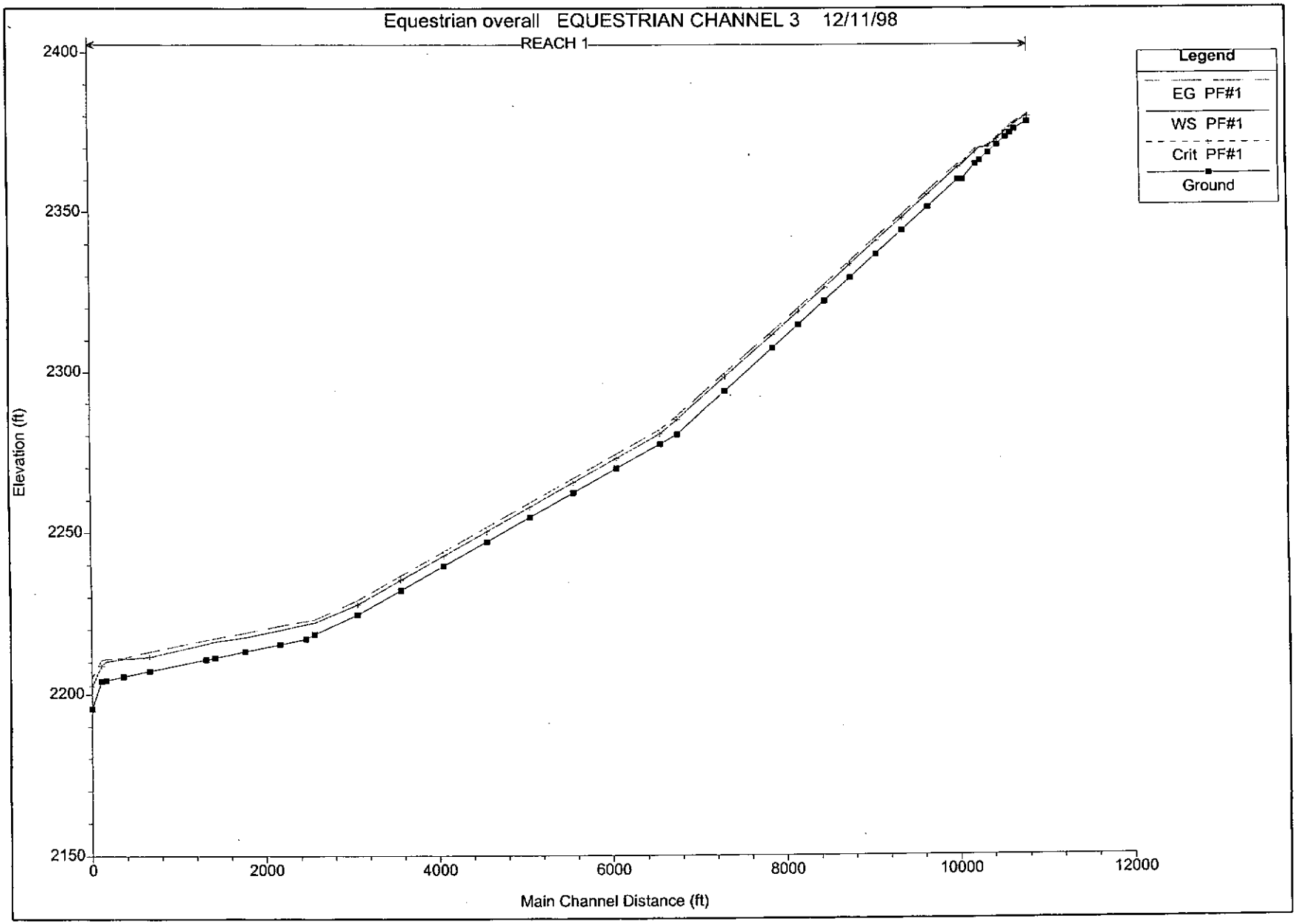
Of Non-Lined Channel

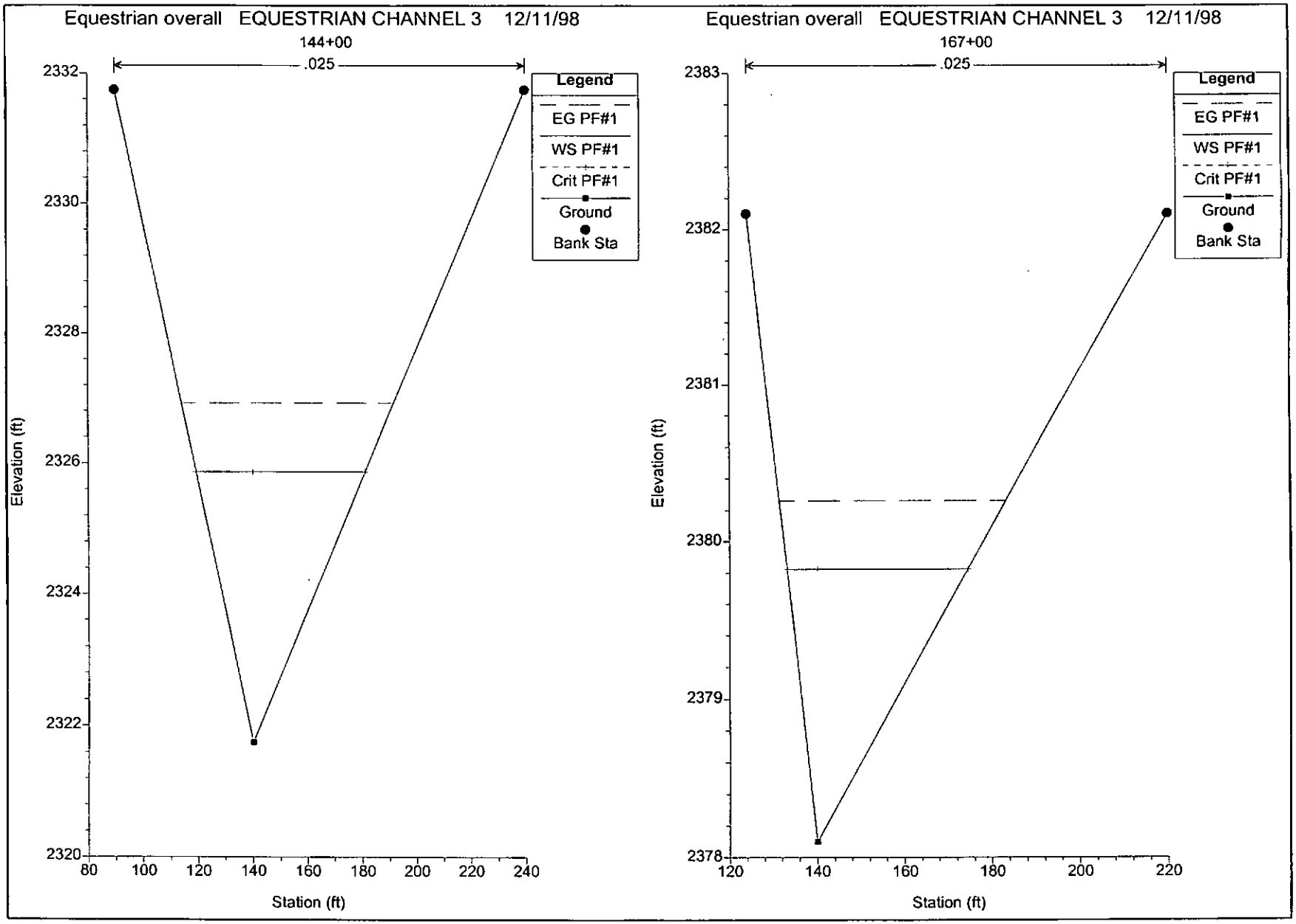
HEC-RAS Plan: EQOVERALL3 River: REACH 1 Reach: REACH 1

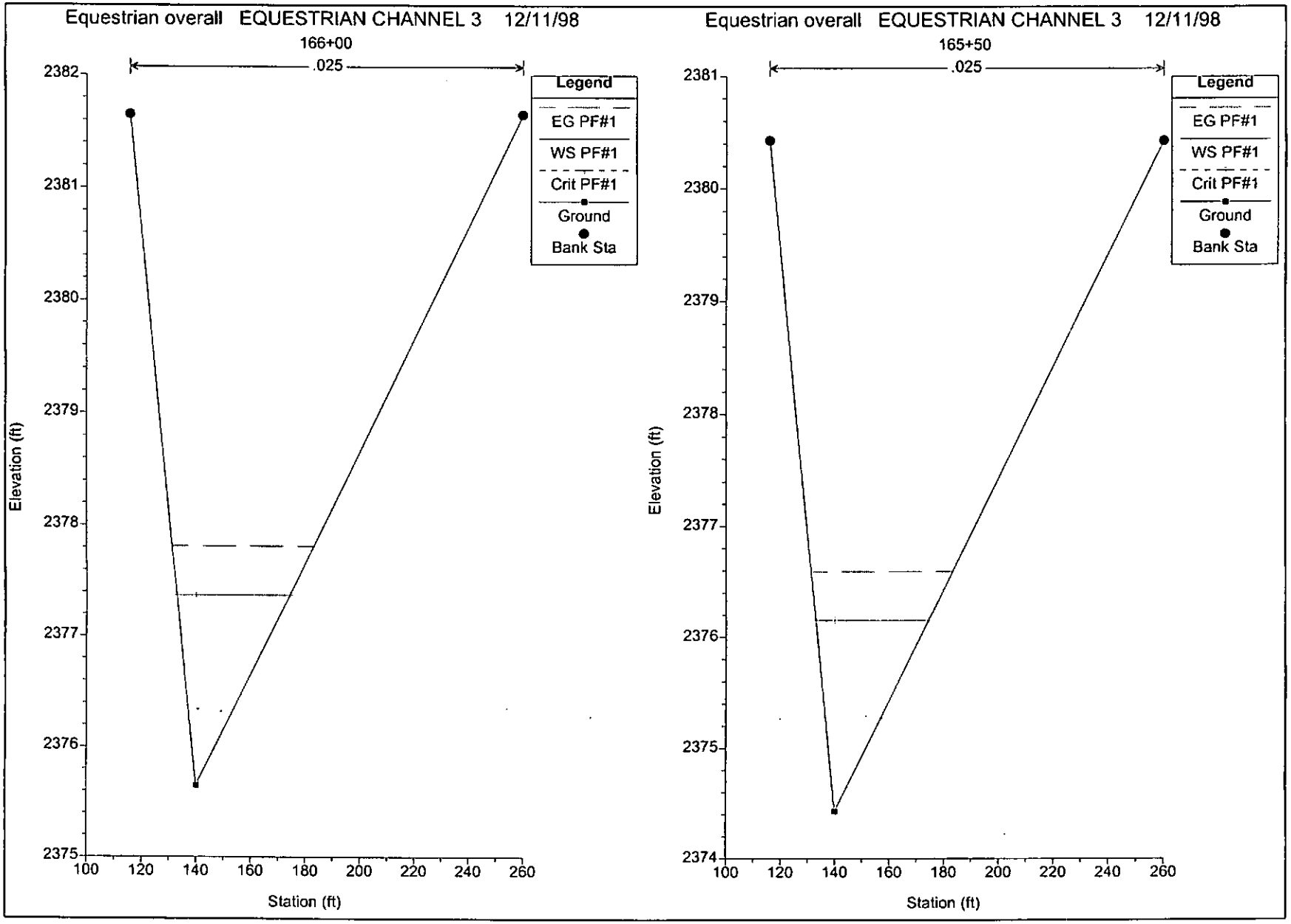
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH 1	16700	189.00	2378.10	2379.82	2379.82	2380.26	0.009832	5.31	35.58	41.33	1.01
REACH 1	16600	189.00	2375.65	2377.37	2377.37	2377.81	0.009832	5.31	35.58	41.33	1.01
REACH 1	16550	189.00	2374.43	2376.15	2376.15	2376.59	0.009832	5.31	35.58	41.33	1.01
REACH 1	16500	189.00	2373.20	2374.92	2374.92	2375.36	0.009952	5.34	35.42	41.23	1.01
REACH 1	16400	189.00	2370.75	2372.44	2372.44	2372.88	0.009861	5.27	35.88	42.36	1.01
REACH 1	16300	189.00	2368.30	2369.99	2369.99	2370.43	0.009998	5.29	35.70	42.25	1.01
REACH 1	16200	189.00	2365.85	2369.69		2369.71	0.000125	1.02	184.45	96.03	0.13
REACH 1	16150	915.00	2364.63	2368.53	2368.53	2369.53	0.007533	8.00	114.31	58.56	1.01
REACH 1	16000	915.00	2359.73	2364.42		2364.90	0.002839	5.55	164.83	70.32	0.64
REACH 1	15950	915.00	2359.73	2363.64	2363.64	2364.63	0.007520	8.00	114.38	58.58	1.01
REACH 1	15600	915.00	2351.15	2355.05	2355.05	2356.05	0.007598	8.03	113.94	58.47	1.01
REACH 1	15300	915.00	2343.80	2347.72	2347.72	2348.70	0.007398	7.95	115.09	58.76	1.00
REACH 1	15000	1046.00	2336.45	2340.57	2340.57	2341.62	0.007402	8.22	127.21	61.78	1.01
REACH 1	14700	1046.00	2329.10	2333.22	2333.22	2334.27	0.007402	8.22	127.21	61.78	1.01
REACH 1	14400	1046.00	2321.75	2325.87	2325.87	2326.92	0.007414	8.23	127.13	61.76	1.01
REACH 1	14100	1046.00	2314.40	2318.52	2318.52	2319.57	0.007384	8.21	127.33	61.81	1.01
REACH 1	13800	1046.00	2307.05	2311.16	2311.16	2312.22	0.007438	8.24	126.98	61.72	1.01
REACH 1	13250	1315.00	2293.58	2298.10	2298.10	2299.24	0.007102	8.57	153.39	67.84	1.00
REACH 1	12700	1315.00	2280.10	2284.63	2284.63	2285.76	0.007051	8.55	153.81	67.93	1.00
REACH 1	12500	1315.00	2277.10	2280.25	2280.25	2281.53	0.006894	9.09	144.71	57.02	1.01
REACH 1	12000	1315.00	2269.60	2272.75	2272.75	2274.03	0.006894	9.09	144.71	57.02	1.01
REACH 1	11500	1315.00	2262.10	2265.25	2265.25	2266.53	0.006894	9.09	144.71	57.02	1.01
REACH 1	11000	1315.00	2254.60	2257.75	2257.75	2259.03	0.006894	9.09	144.71	57.02	1.01
REACH 1	10500	1315.00	2247.10	2250.25	2250.25	2251.53	0.006894	9.09	144.71	57.02	1.01
REACH 1	10000	1315.00	2239.60	2242.74	2242.74	2244.03	0.006923	9.10	144.50	56.99	1.01
REACH 1	9500	1315.00	2232.10	2235.26	2235.26	2236.54	0.006868	9.08	144.76	56.90	1.00
REACH 1	9000	1315.00	2224.60	2227.75	2227.75	2229.03	0.006896	9.09	144.69	57.02	1.01
REACH 1	8600	1315.00	2218.60	2222.12		2223.09	0.004575	7.89	166.71	59.66	0.83
REACH 1	8500	1315.00	2217.10	2221.61		2222.64	0.004225	8.14	161.63	51.60	0.81
REACH 1	8200	1438.00	2215.45	2219.89		2221.18	0.005414	9.12	157.63	51.06	0.91
REACH 1	7800	1438.00	2213.25	2217.65		2218.97	0.005596	9.23	155.76	50.80	0.93
REACH 1	7450	1494.00	2211.33	2216.29		2217.30	0.003741	8.06	185.34	54.72	0.77
REACH 1	7350	1494.00	2210.78	2215.58		2216.85	0.004748	9.04	165.23	48.81	0.87
REACH 1	6700	1494.00	2207.20	2211.63	2211.63	2213.22	0.006527	10.14	147.31	46.56	1.00
REACH 1	6400	1494.00	2205.55	2210.98		2211.33	0.001319	4.74	315.13	96.04	0.46
REACH 1	6200	1494.00	2204.43	2210.20		2210.95	0.002286	6.93	215.44	54.64	0.62

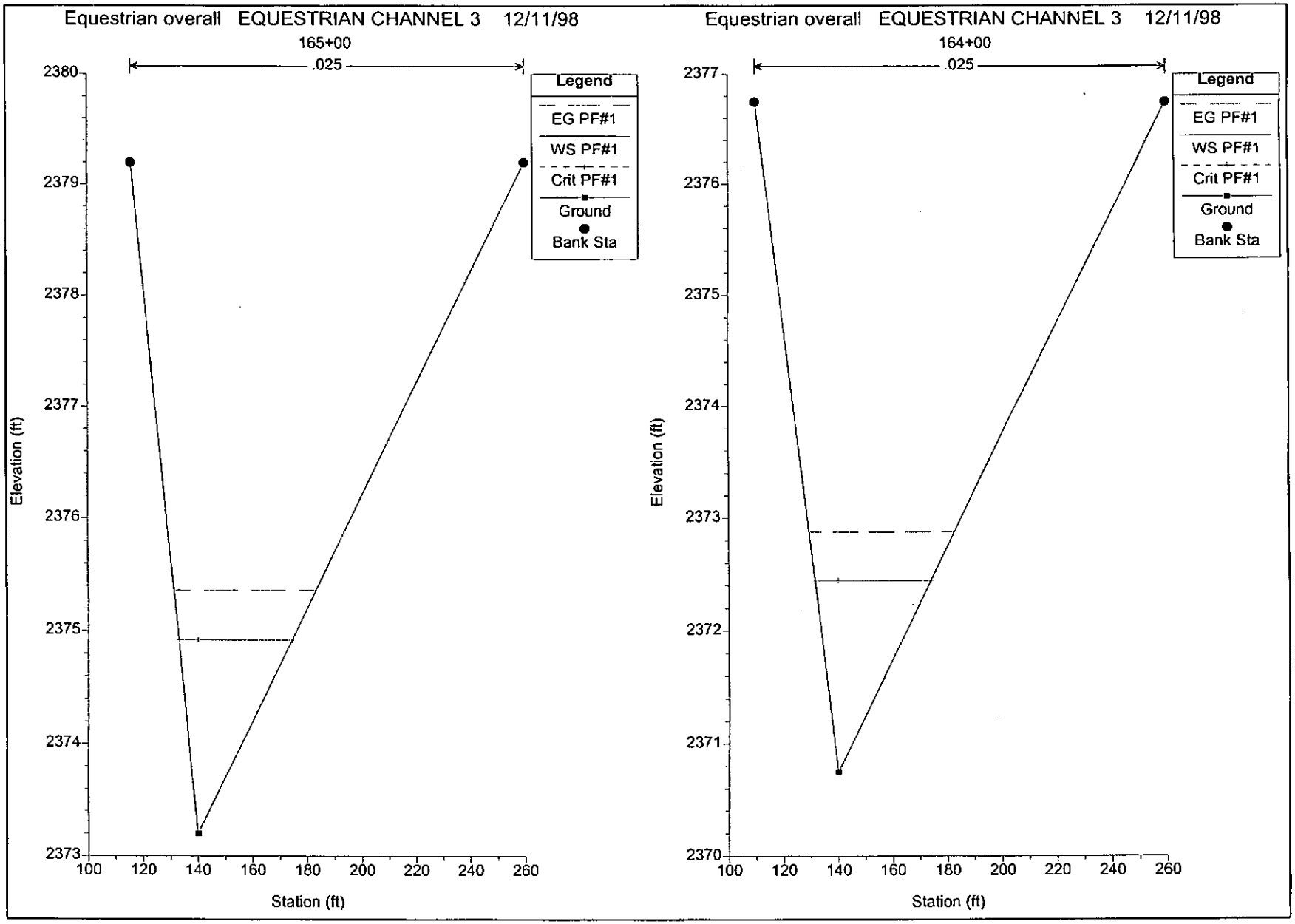
HEC-RAS Plan: EQOVERALL3 River: REACH 1 Reach: REACH 1 (Continued)

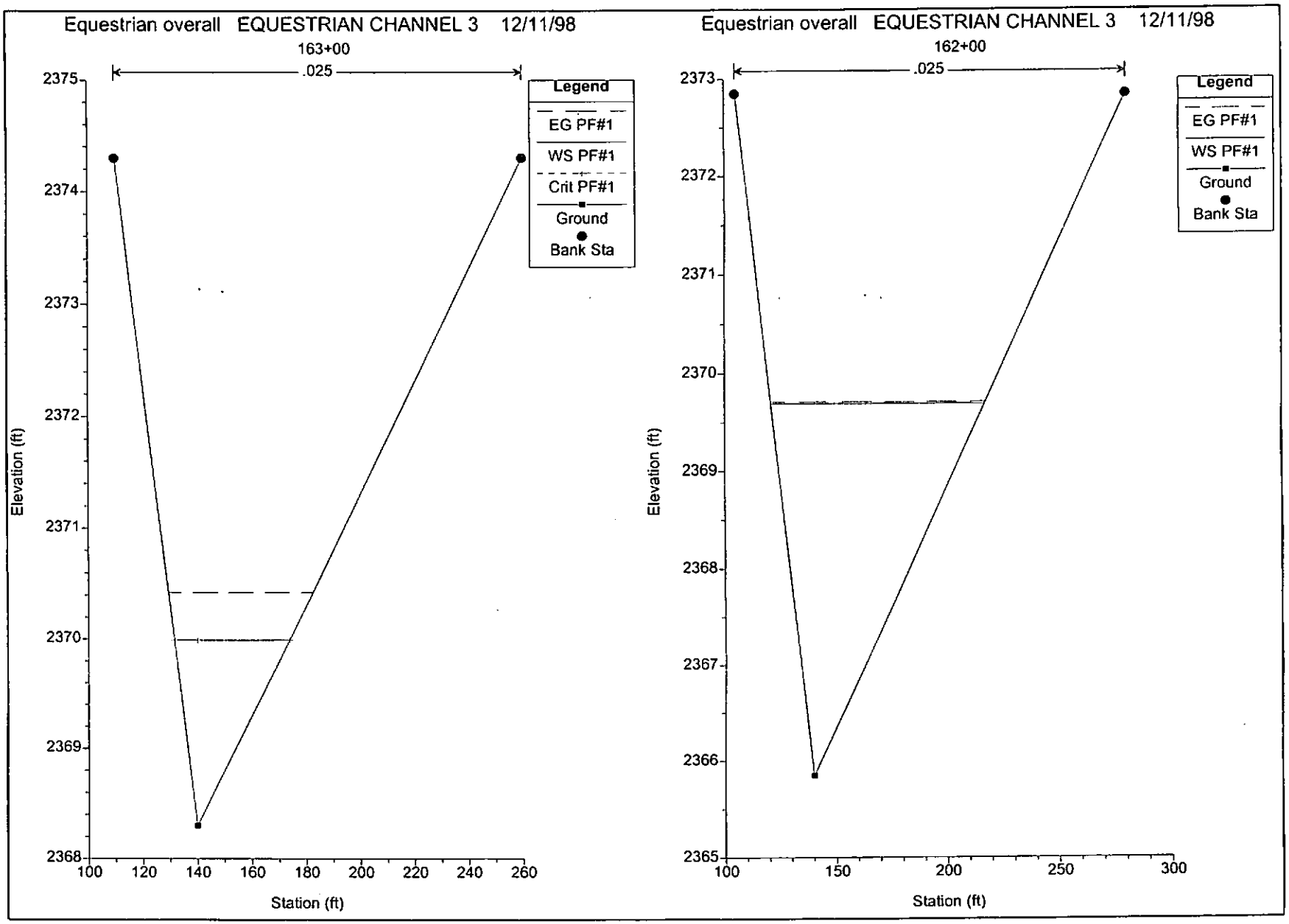
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH 1	6150	1494.00	2204.15	2208.86	2208.86	2210.67	0.006494	10.78	138.62	38.85	1.01
REACH 1	6037	3058.00	2195.53	2202.59	2202.59	2205.09	0.002099	12.68	241.09	48.26	1.00

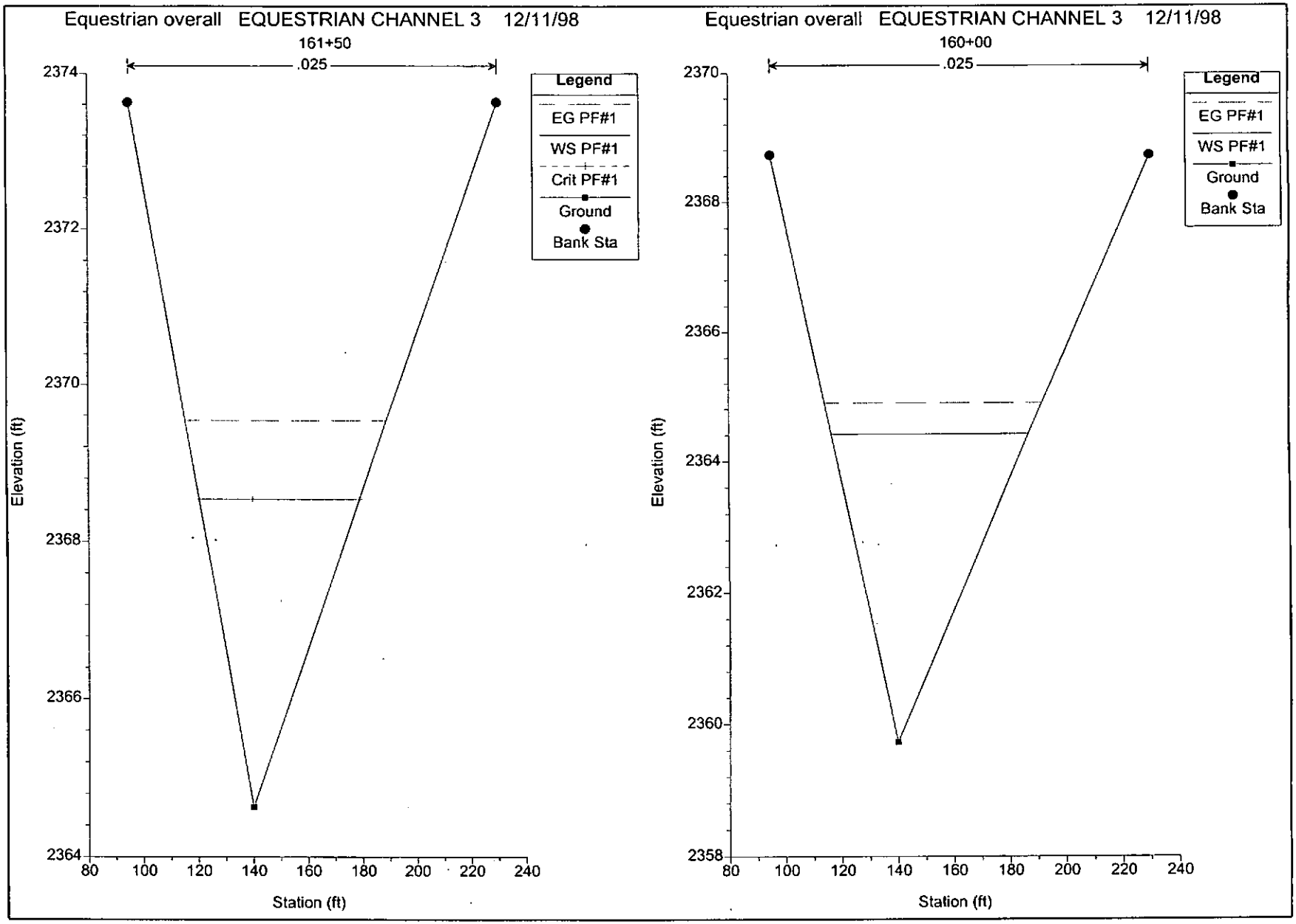

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
REACH 1
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Elevation (ft)
2400
2350
2300
2250
2200
2150
0
2000
4000
6000
8000
10000
12000
Main Channel Distance (ft)

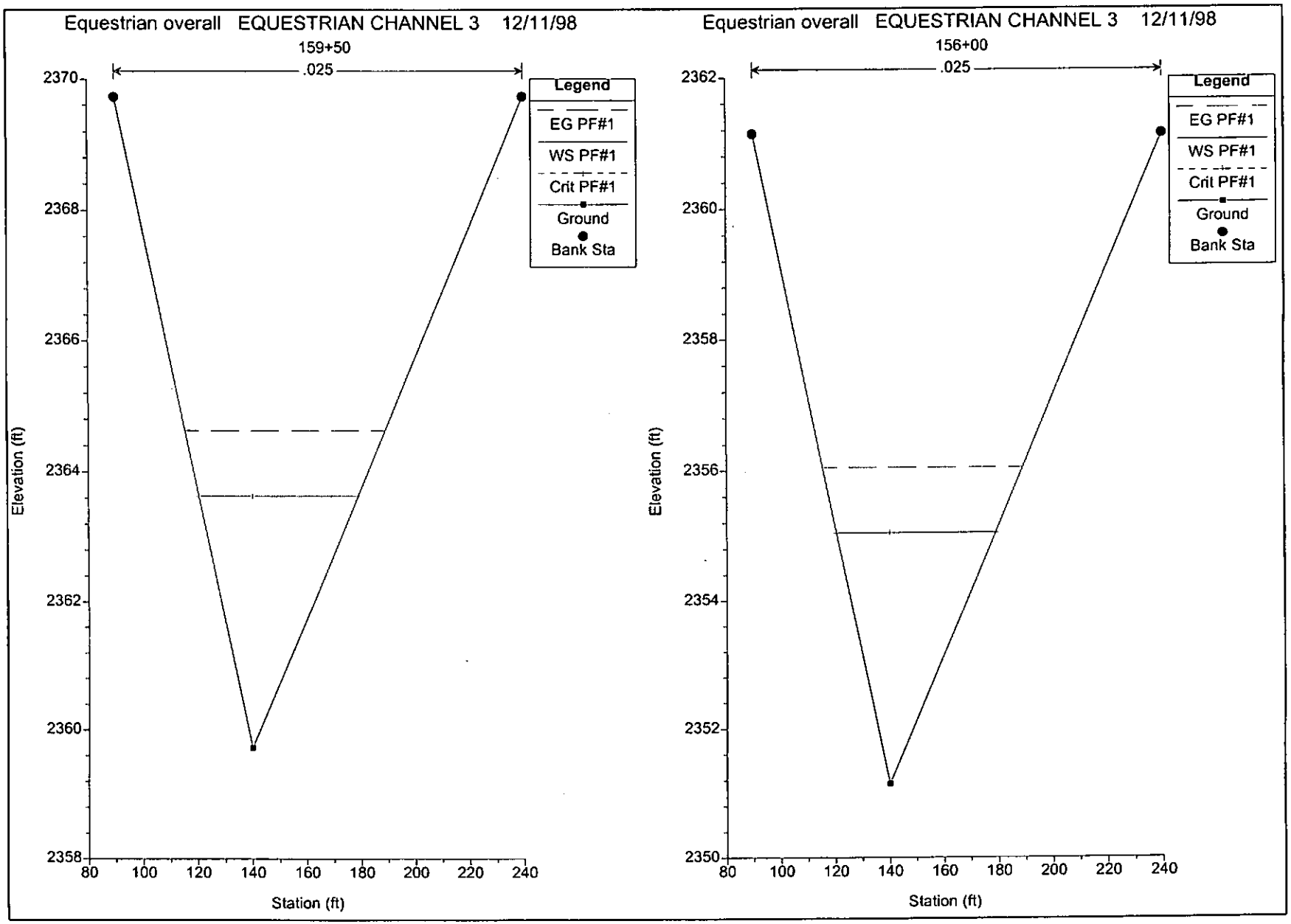

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
144+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2332
2330
2328
2326
2324
2322
2320
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
167+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2383
2382
2381
2380
2379
2378
120
140
160
180
200
220

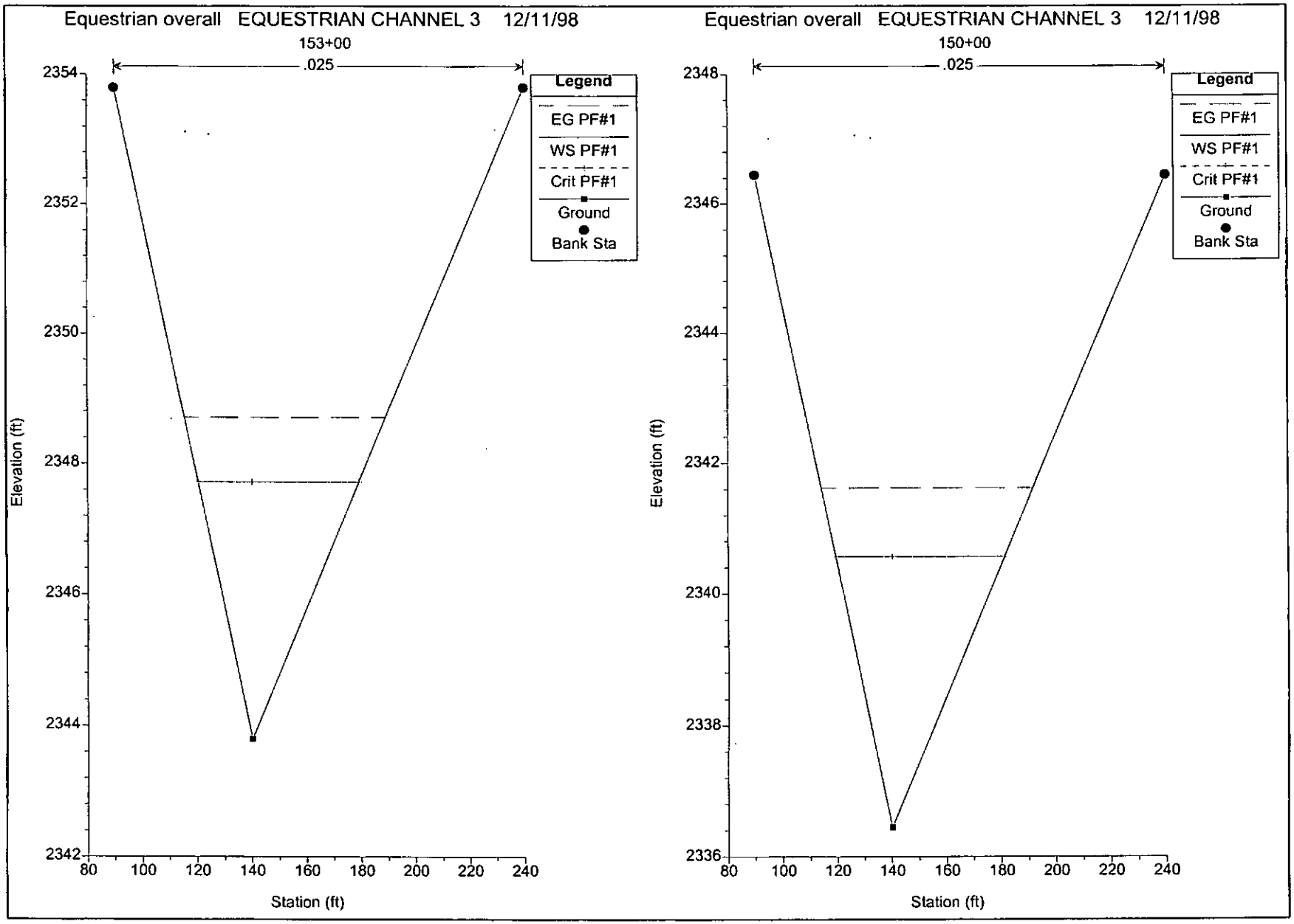

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
166+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2382
2381
2380
2379
2378
2377
2376
2375
100
120
140
160
180
200
220
240
260
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
165+50
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2381
2380
2379
2378
2377
2376
2375
2374
100
120
140
160
180
200
220
240
260

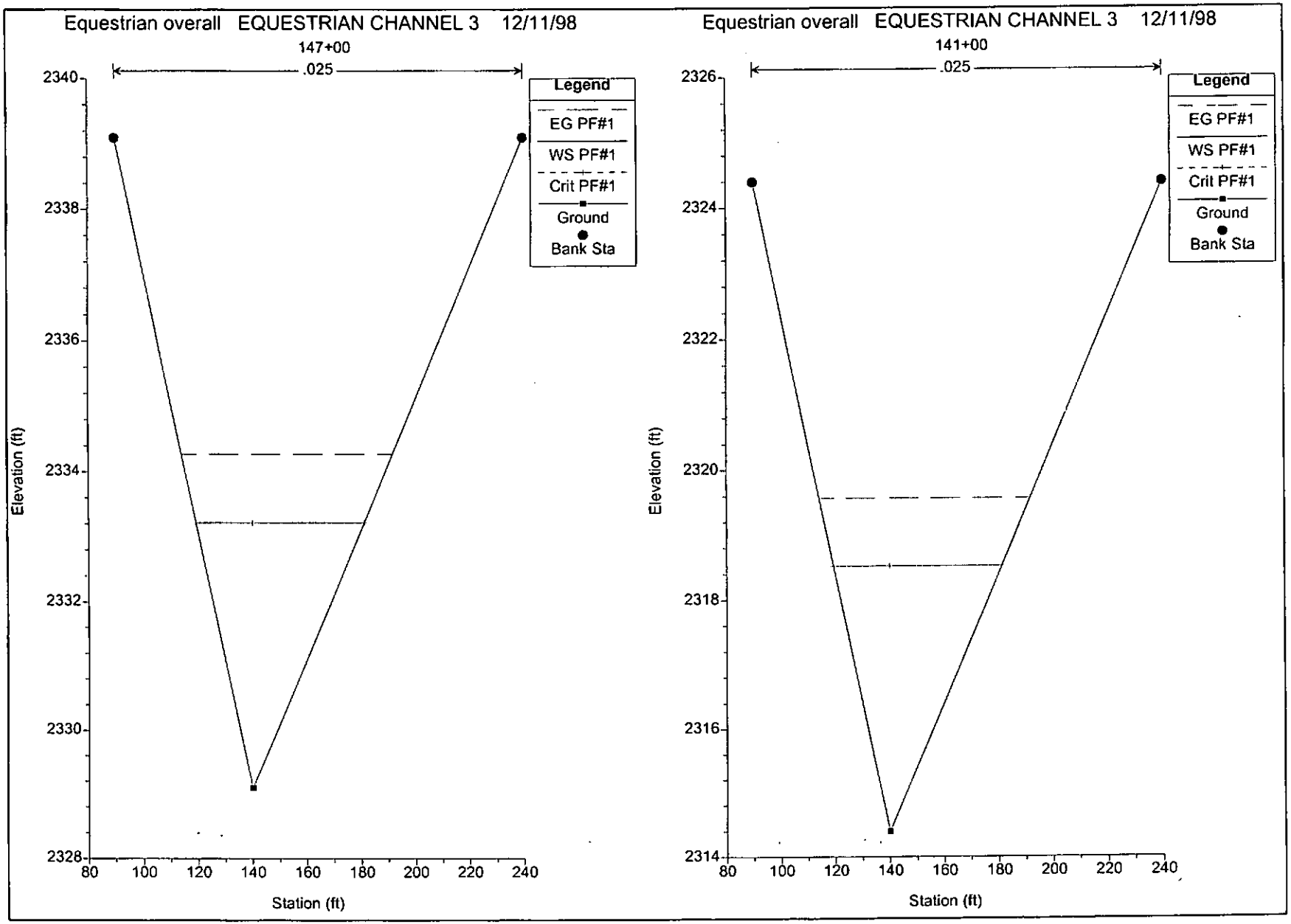

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
165+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2380
2379
2378
2377
2376
2375
2374
2373
100
120
140
160
180
200
220
240
260
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
164+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2377
2376
2375
2374
2373
2372
2371
2370
100
120
140
160
180
200
220
240
260

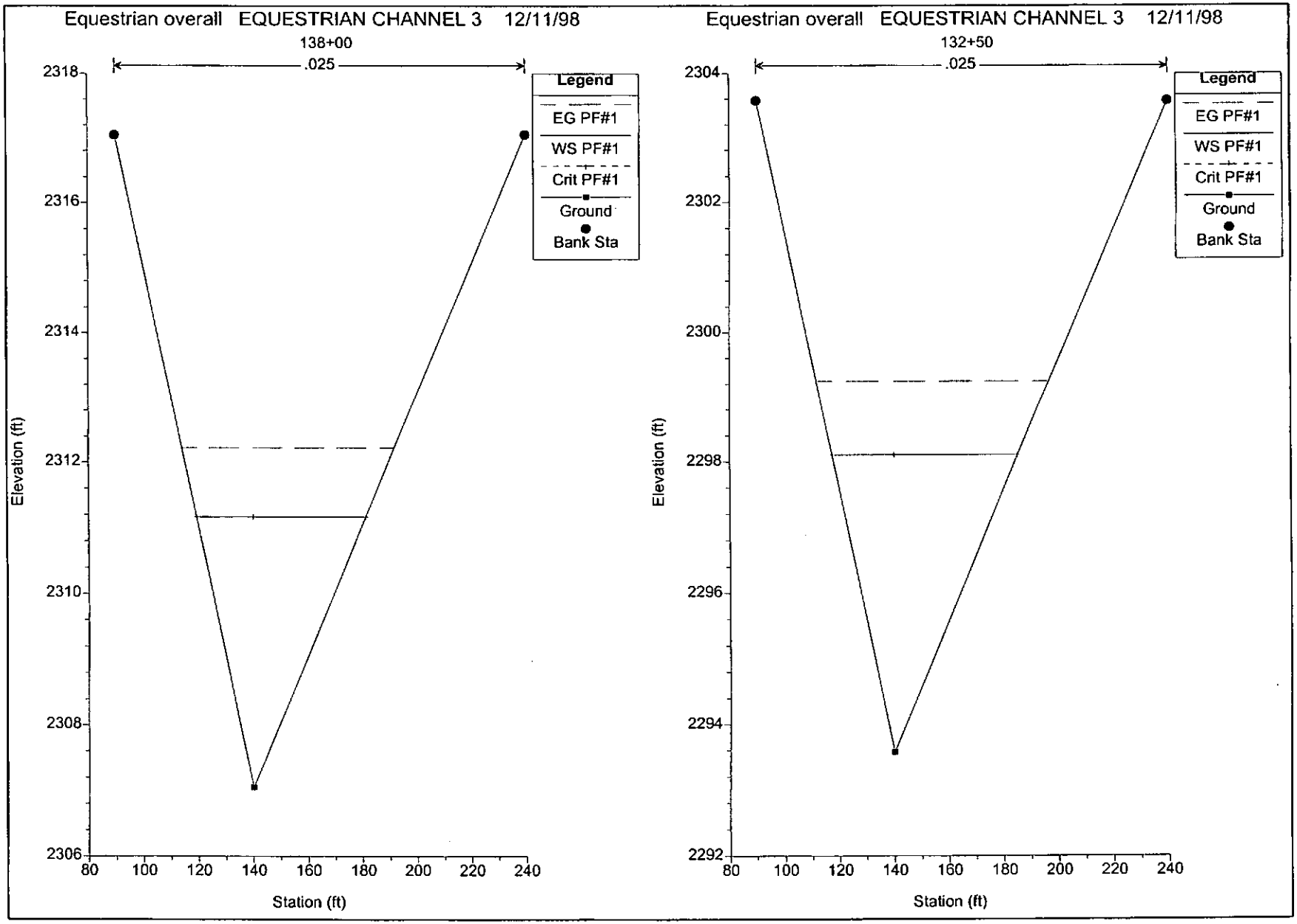

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
163+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2375
2374
2373
2372
2371
2370
2369
2368
100
120
140
160
180
200
220
240
260
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
162+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2373
2372
2371
2370
2369
2368
2367
2366
2365
100
150
200
250
300

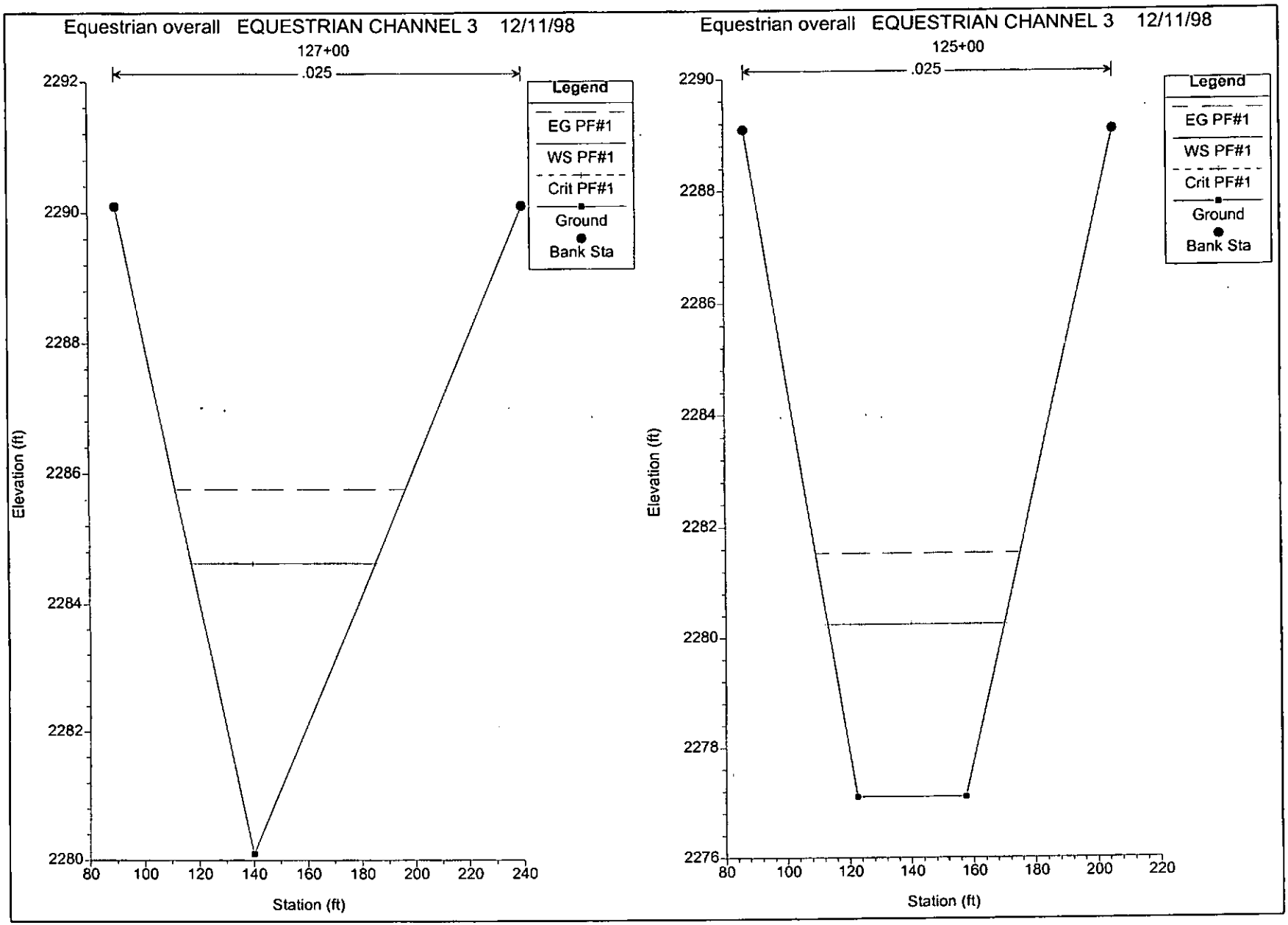

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
161+50
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
160+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)

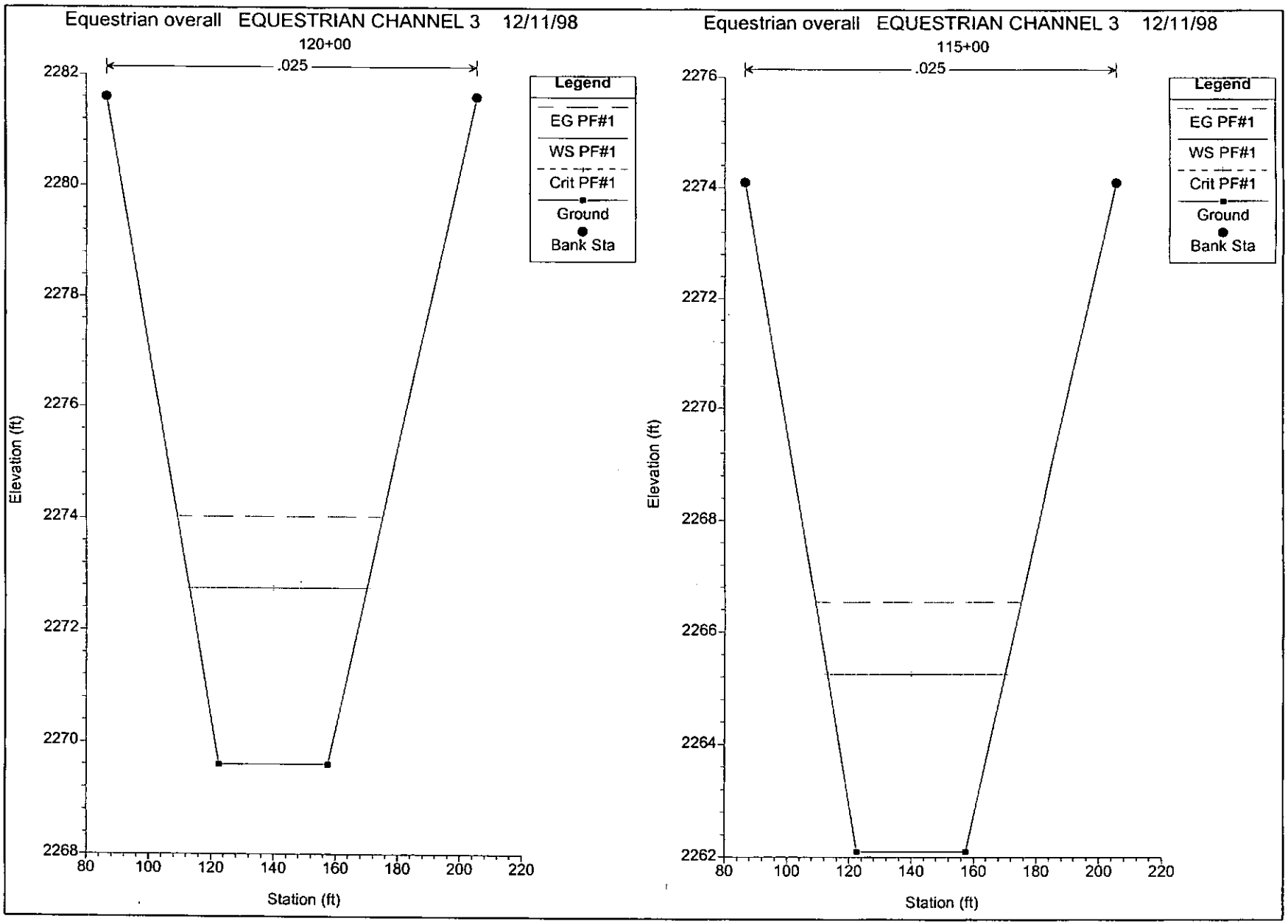

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
159+50
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
156+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)

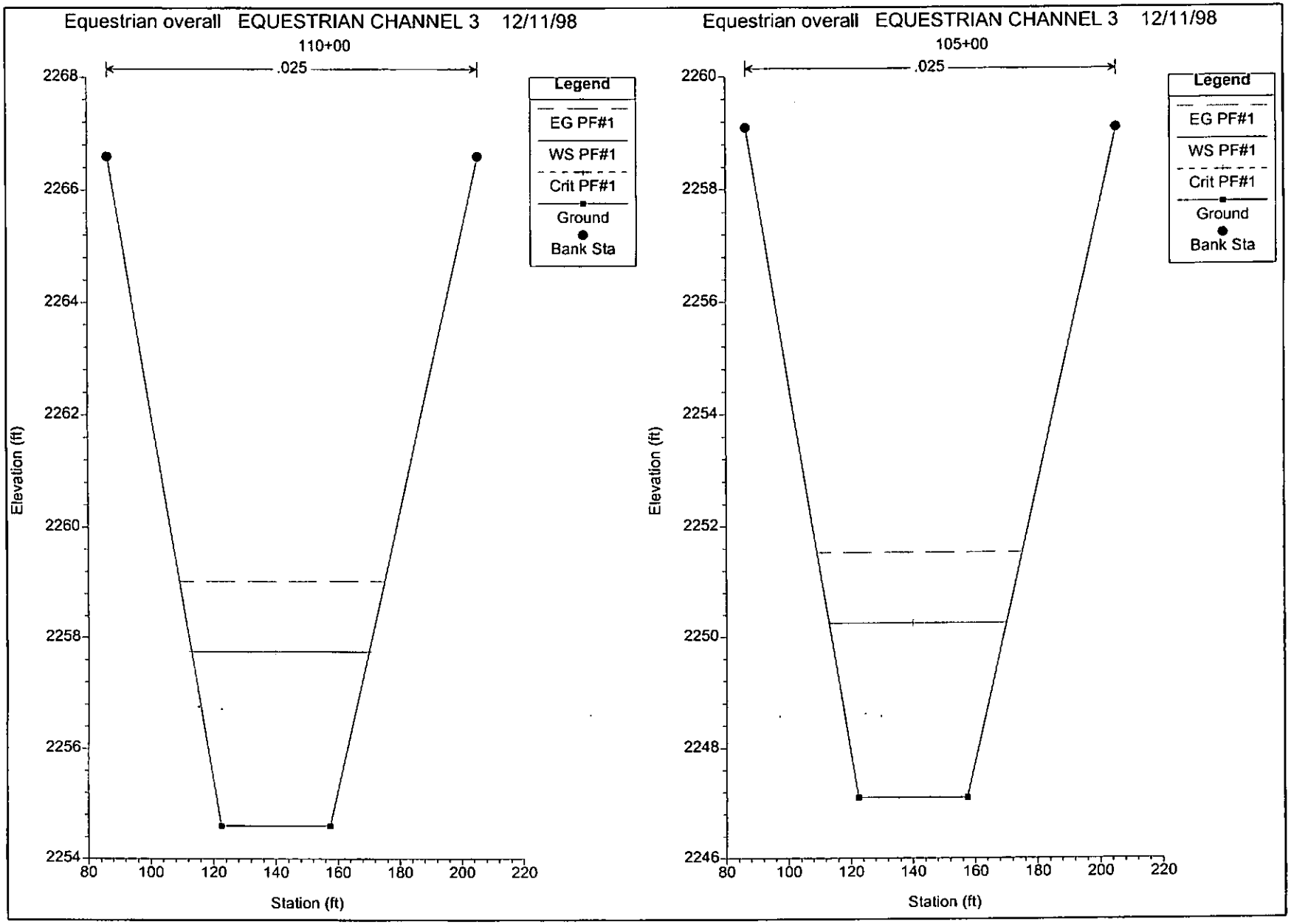

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
153+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2354
2352
2350
2348
2346
2344
2342
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
150+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2348
2346
2344
2342
2340
2338
2336
80
100
120
140
160
180
200
220
240

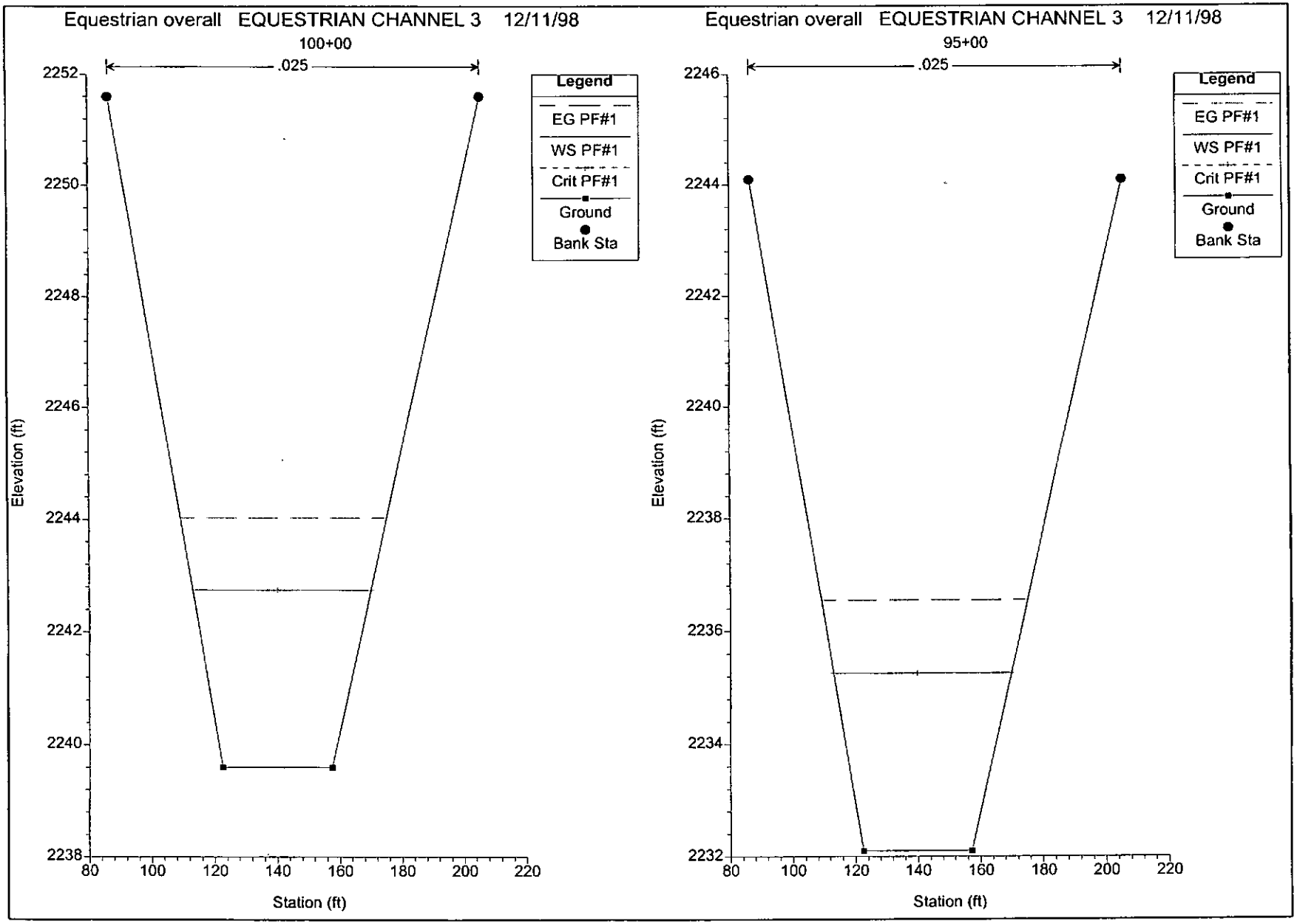

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
147+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2340
2338
2336
2334
2332
2330
2328
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
141+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2326
2324
2322
2320
2318
2316
2314
80
100
120
140
160
180
200
220
240

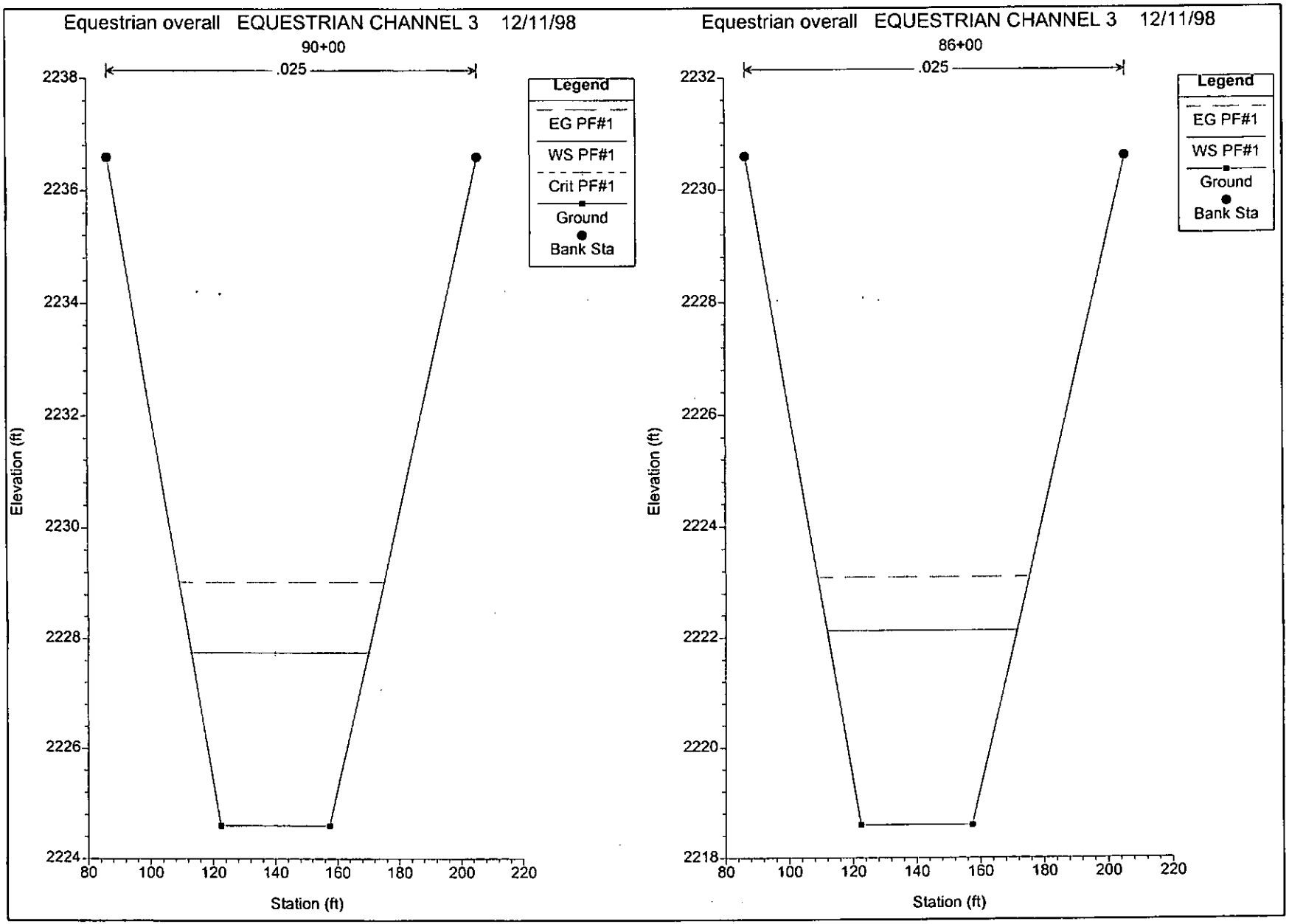

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
138+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2318
2316
2314
2312
2310
2308
2306
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
132+50
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2304
2302
2300
2298
2296
2294
2292
80
100
120
140
160
180
200
220
240

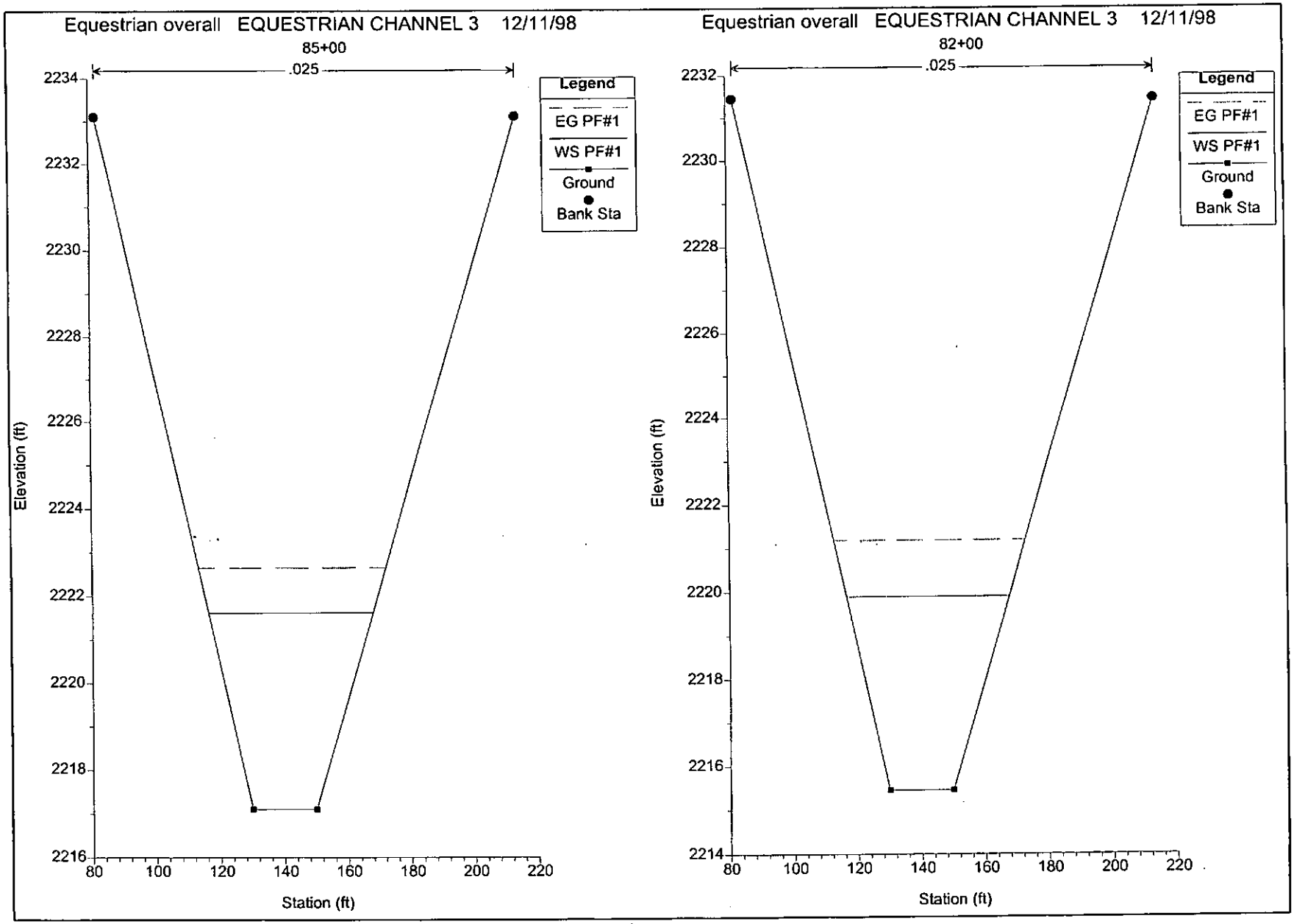

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
127+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2292
2290
2288
2286
2284
2282
2280
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
125+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2290
2288
2286
2284
2282
2280
2278
2276
80
100
120
140
160
180
200
220

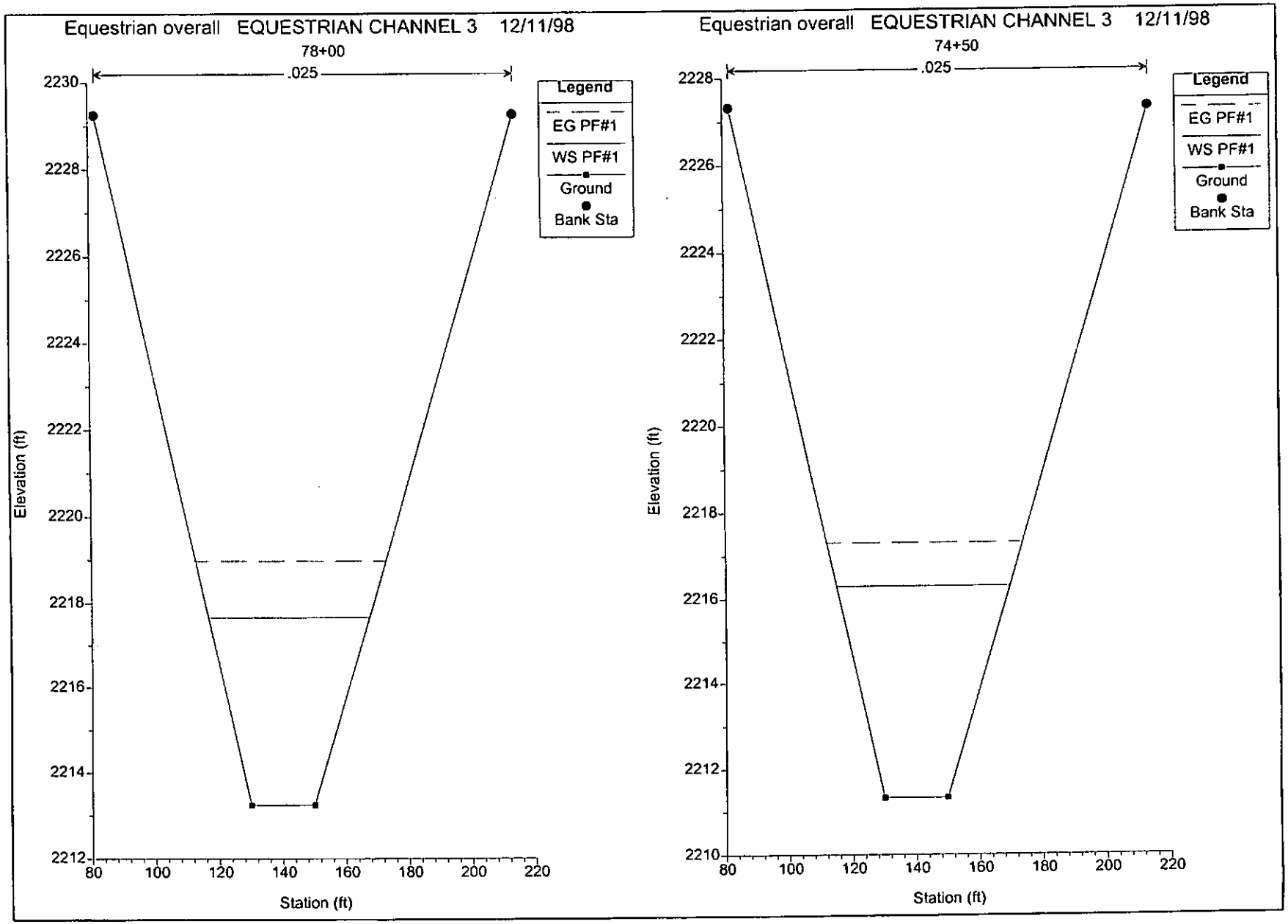

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
120+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2282
2280
2278
2276
2274
2272
2270
2268
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
115+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2276
2274
2272
2270
2268
2266
2264
2262
80
100
120
140
160
180
200
220

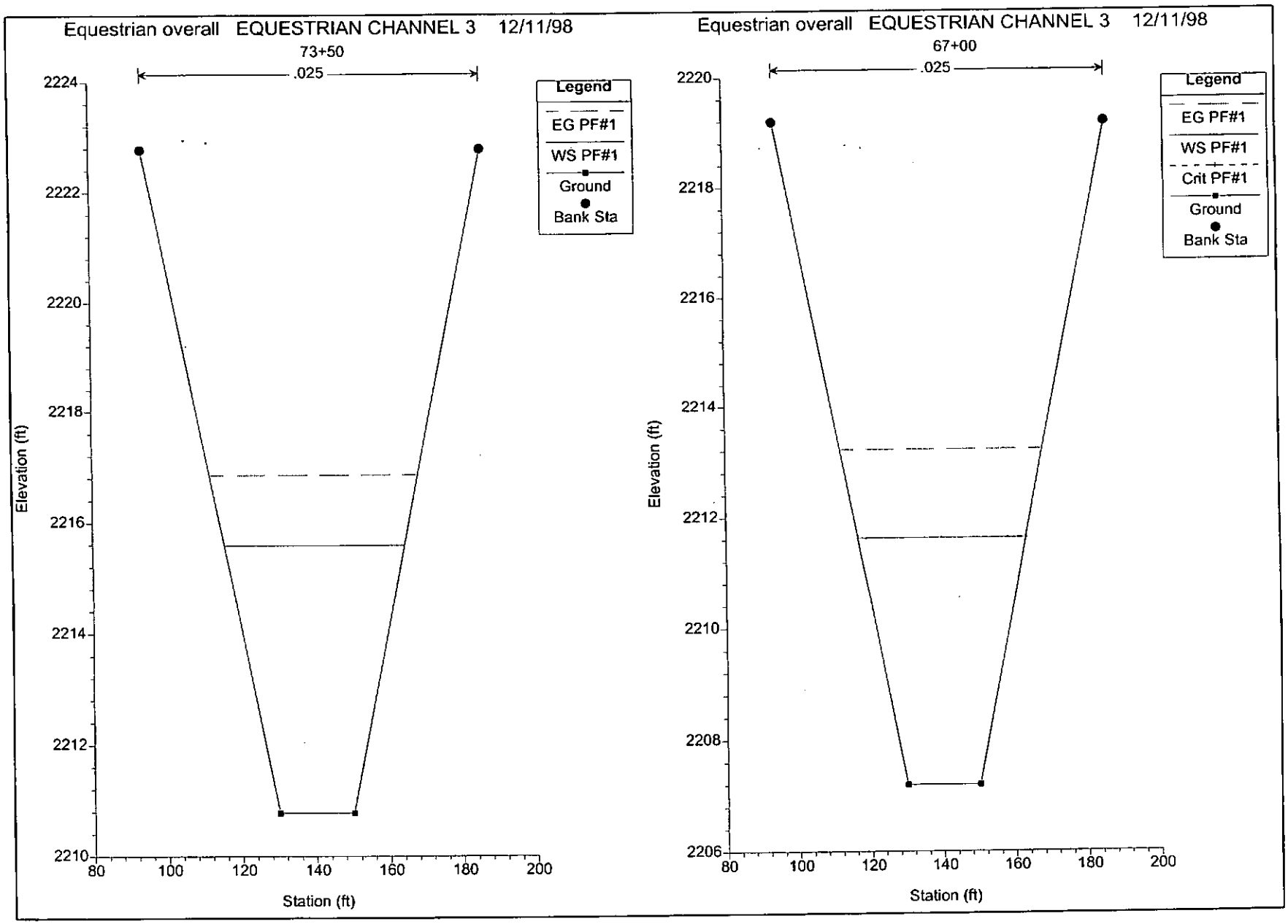

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
110+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
105+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)

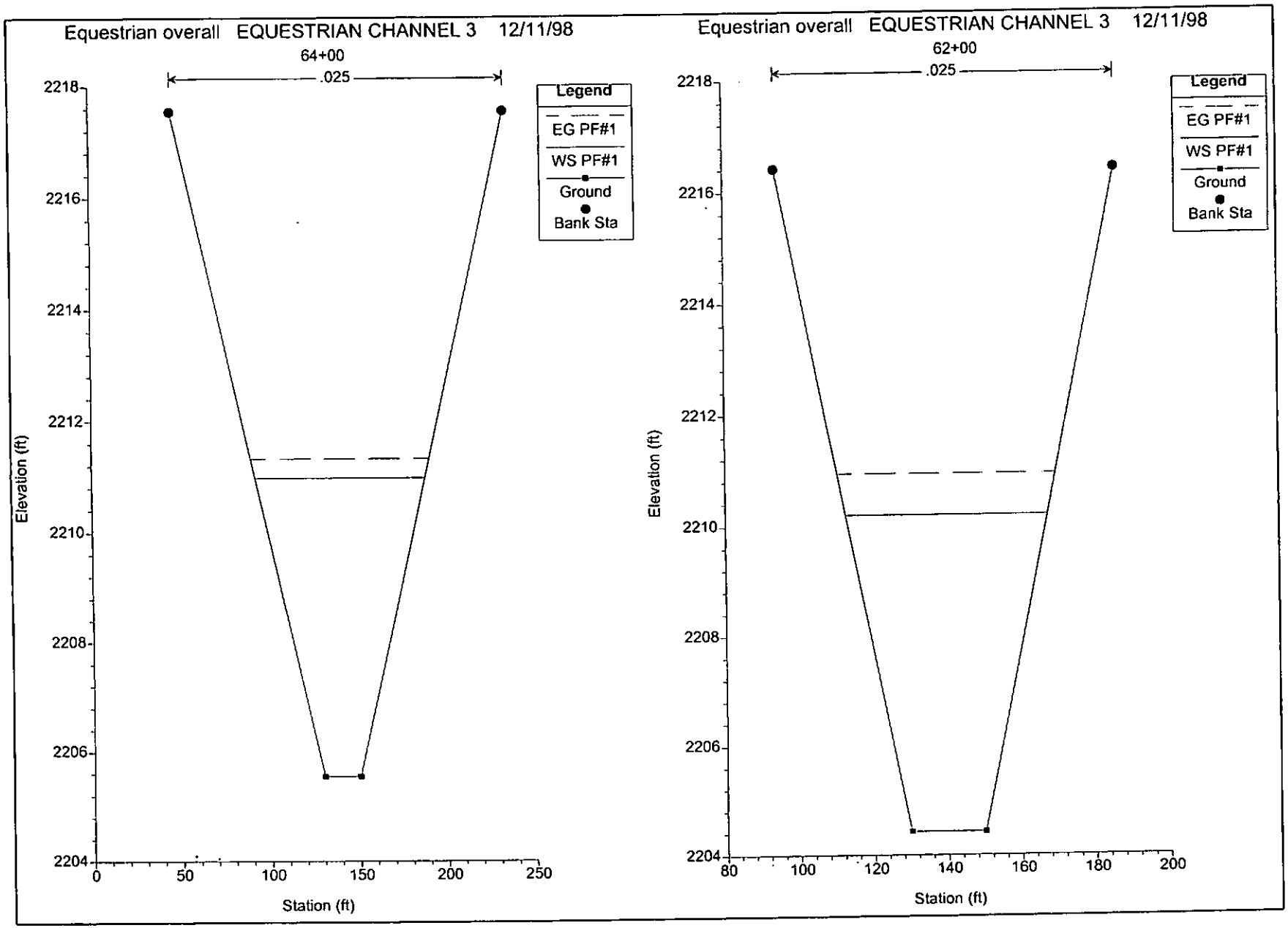

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
100+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2252
2250
2248
2246
2244
2242
2240
2238
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
95+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2246
2244
2242
2240
2238
2236
2234
2232
80
100
120
140
160
180
200
220

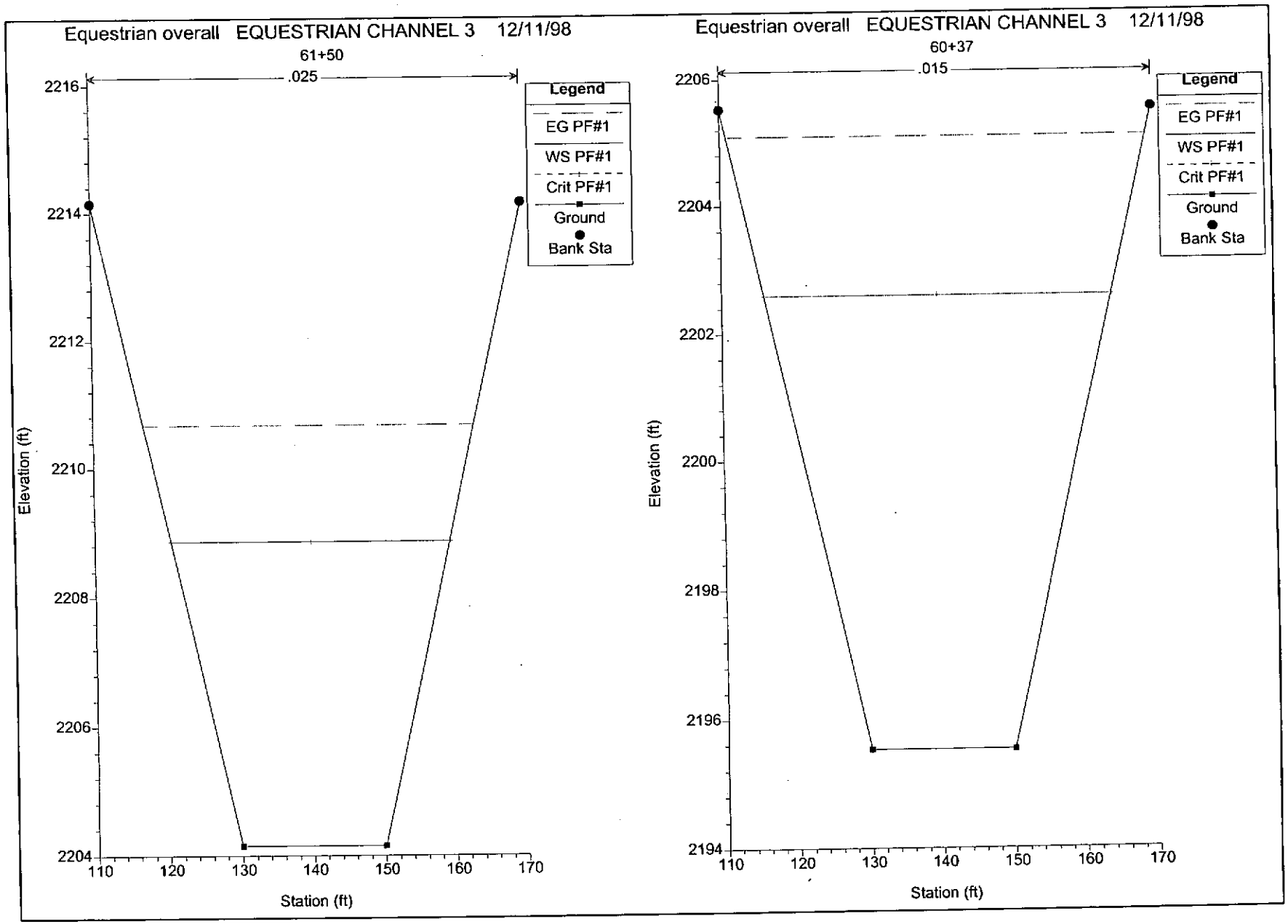

Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
90+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2238
2236
2234
2232
2230
2228
2226
2224
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
86+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2232
2230
2228
2226
2224
2222
2220
2218
80
100
120
140
160
180
200
220


Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
85+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2234
2232
2230
2228
2226
2224
2222
2220
2218
2216
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
82+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2232
2230
2228
2226
2224
2222
2220
2218
2216
2214
80
100
120
140
160
180
200
220


Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
78+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2230
2228
2226
2224
2222
2220
2218
2216
2214
2212
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
74+50
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2228
2226
2224
2222
2220
2218
2216
2214
2212
2210
80
100
120
140
160
180
200
220


Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
73+50
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2224
2222
2220
2218
2216
2214
2212
2210
80
100
120
140
160
180
200
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
67+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2220
2218
2216
2214
2212
2210
2208
2206
80
100
120
140
160
180
200


Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
64+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2218
2216
2214
2212
2210
2208
2206
2204
0
50
100
150
200
250
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
62+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2218
2216
2214
2212
2210
2208
2206
2204
80
100
120
140
160
180
200


Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
61+50
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2216
2214
2212
2210
2208
2206
2204
110
120
130
140
150
160
170
Equestrian overall EQUESTRIAN CHANNEL 3 12/11/98
60+37
.015
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2206
2204
2202
2200
2198
2196
2194
110
120
130
140
150
160
170

HEC-RAS Version 2.1 October 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX         XXXX        XX      XXXX
X     X  X        X    X       X   X      X  X     X
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PROJECT DATA
Project Title: Equestrian overall
Project File : eqcoall.prj
Run Date and Time: 12/11/98 2:09:30 PM

Project in English units

Project Description:
Overall HecRas evaluations

PLAN DATA

Plan Title: EQUESTRIAN CHANNEL 3
Plan File : j:\1002005\LOMR\eqcoall.p07

Geometry Title: EQUESTRAIN NON LINED
Geometry File : j:\1002005\LOMR\eqcoall.g03

Flow Title : ESQUESTRAIN CHANNEL 2 NEW
Flow File : j:\1002005\LOMR\eqcoall.f04

Plan Summary Information:
Number of: Cross Sections = 38 Mulitple Openings = 0

Culverts = 0 Inline Weirs = 0
Bridges = 0

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

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: ESQUESTRAIN CHANNEL 2 NEW
Flow File : j:\1002005\LOMR\eqcoall.f04

Flow Data (cfs)

River	Reach	RS	PF#1
REACH 1	REACH 1	16700	189
REACH 1	REACH 1	16150	915
REACH 1	REACH 1	15000	1046
REACH 1	REACH 1	13250	1315
REACH 1	REACH 1	8200	1438
REACH 1	REACH 1	7450	1494
REACH 1	REACH 1	6037	3058

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
REACH 1	REACH 1	PF#1	Known WS = 2379.99	Known WS = 2200.05

GEOMETRY DATA

Geometry Title: EQUESTRAIN NON LINED
Geometry File : j:\1002005\LOMR\eqcoall.g03

CROSS SECTION RIVER: REACH 1

REACH: REACH 1 RS: 16700

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
124	2382.1	140	2378.1	220	2382.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
124	.025	124	.025	220	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
124	220	150	150	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2379.82	Element			
Vel Head (ft)	0.44	Wt. n-Val.		0.025	
E.G. Elev (ft)	2380.26	Reach Len. (ft)	150.00	150.00	150.00
Crit W.S. (ft)	2379.82	Flow Area (sq ft)		35.58	
E.G. Slope (ft/ft)	0.009832	Area (sq ft)		35.58	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	41.33	Top Width (ft)		41.33	
Vel Total (ft/s)	5.31	Avg. Vel. (ft/s)		5.31	
Max Chl Dpth (ft)	1.72	Hydr. Depth (ft)		0.86	
Conv. Total (cfs)	1906.1	Conv. (cfs)		1906.1	
Length Wtd. (ft)	150.00	Wetted Per. (ft)		41.58	
Min Ch El (ft)	2378.10	Shear (lb/sq ft)		0.53	
Alpha	1.00	Stream Power (lb/ft s)		2.79	
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)		35.81	
C & E Loss (ft)	0.00	Cum SA (acres)		14.38	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1

REACH: REACH 1 RS: 16600

INPUT
Description:
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
116	2381.65	140	2375.65	260	2381.65

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
116	.025	116	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
116	260	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2377.37	Element			
Vel Head (ft)	0.44	Wt. n-Val.		0.025	
E.G. Elev (ft)	2377.81	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2377.37	Flow Area (sq ft)		35.58	
E.G. Slope (ft/ft)	0.009832	Area (sq ft)		35.58	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	41.33	Top Width (ft)		41.33	
Vel Total (ft/s)	5.31	Avg. Vel. (ft/s)		5.31	
Max Chl Dpth (ft)	1.72	Hydr. Depth (ft)		0.86	
Conv. Total (cfs)	1906.1	Conv. (cfs)		1906.1	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		41.58	
Min Ch El (ft)	2375.65	Shear (lb/sq ft)		0.53	
Alpha	1.00	Stream Power (lb/ft s)		2.79	
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)		35.69	
C & E Loss (ft)	0.00	Cum SA (acres)		14.24	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m) between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1

REACH: REACH 1 RS: 16550

INPUT
Description:
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
116	2380.43	140	2374.43	260	2380.43

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
116	.025	116	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
116	260	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2376.15	Element			
Vel Head (ft)	0.44	Wt. n-Val.		0.025	
E.G. Elev (ft)	2376.59	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2376.15	Flow Area (sq ft)		35.58	
E.G. Slope (ft/ft)	0.009832	Area (sq ft)		35.58	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	41.33	Top Width (ft)		41.33	
Vel Total (ft/s)	5.31	Avg. Vel. (ft/s)		5.31	
Max Chl Dpth (ft)	1.72	Hydr. Depth (ft)		0.86	
Conv. Total (cfs)	1906.1	Conv. (cfs)		1906.1	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		41.58	
Min Ch El (ft)	2374.43	Shear (lb/sq ft)		0.53	
Alpha	1.00	Stream Power (lb/ft s)		2.79	
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)		35.65	
C & E Loss (ft)	0.00	Cum SA (acres)		14.19	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1

REACH: REACH 1 RS: 16500

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
116	2379.2	140	2373.2	260	2379.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
116	.025	116	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
116	260	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2374.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.025	
E.G. Elev (ft)	2375.36	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2374.92	Flow Area (sq ft)		35.42	
E.G. Slope (ft/ft)	0.009952	Area (sq ft)		35.42	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	41.23	Top Width (ft)		41.23	
Vel Total (ft/s)	5.34	Avg. Vel. (ft/s)		5.34	
Max Chl Dpth (ft)	1.72	Hydr. Depth (ft)		0.86	
Conv. Total (cfs)	1894.6	Conv. (cfs)		1894.6	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		41.49	
Min Ch El (ft)	2373.20	Shear (lb/sq ft)		0.53	
Alpha	1.00	Stream Power (lb/ft s)		2.83	
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)		35.61	
C & E Loss (ft)	0.00	Cum SA (acres)		14.14	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1

REACH: REACH 1 RS: 16400

INPUT
Description:
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
110	2376.75	140	2370.75	260	2376.75

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.025	110	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	260	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2372.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.025	
E.G. Elev (ft)	2372.88	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2372.44	Flow Area (sq ft)		35.88	
E.G. Slope (ft/ft)	0.009861	Area (sq ft)		35.88	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	42.36	Top Width (ft)		42.36	
Vel Total (ft/s)	5.27	Avg. Vel. (ft/s)		5.27	
Max Chl Dpth (ft)	1.69	Hydr. Depth (ft)		0.85	
Conv. Total (cfs)	1903.3	Conv. (cfs)		1903.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		42.57	
Min Ch El (ft)	2370.75	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.73	
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)		35.52	
C & E Loss (ft)	0.00	Cum SA (acres)		14.05	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1

REACH: REACH 1 RS: 16300

INPUT
Description:
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
110	2374.3	140	2368.3	260	2374.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.025	110	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	260	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2369.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.025	
E.G. Elev (ft)	2370.43	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2369.99	Flow Area (sq ft)		35.70	
E.G. Slope (ft/ft)	0.009998	Area (sq ft)		35.70	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	42.25	Top Width (ft)		42.25	
Vel Total (ft/s)	5.29	Avg. Vel. (ft/s)		5.29	
Max Chl Dpth (ft)	1.69	Hydr. Depth (ft)		0.84	
Conv. Total (cfs)	1890.2	Conv. (cfs)		1890.2	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		42.46	
Min Ch El (ft)	2368.30	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.78	
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)		35.44	
C & E Loss (ft)	0.13	Cum SA (acres)		13.95	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16200

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
105	2372.85	140	2365.85	280	2372.85

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
105	.025	105	.025	280	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105	280	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2369.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.025	
E.G. Elev (ft)	2369.71	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)		184.45	
E.G. Slope (ft/ft)	0.000125	Area (sq ft)		184.45	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	96.03	Top Width (ft)		96.03	
Vel Total (ft/s)	1.02	Avg. Vel. (ft/s)		1.02	
Max Chl Dpth (ft)	3.84	Hydr. Depth (ft)		1.92	
Conv. Total (cfs)	16883.3	Conv. (cfs)		16883.3	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		96.51	
Min Ch El (ft)	2365.85	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)		0.02	
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)		35.19	
C & E Loss (ft)	0.10	Cum SA (acres)		13.79	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16150

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
95	2373.63	140	2364.63	230	2373.63

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.025	95	.025	230	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	230	150	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2368.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.		0.025	
E.G. Elev (ft)	2369.53	Reach Len. (ft)	150.00	150.00	150.00
Crit W.S. (ft)	2368.53	Flow Area (sq ft)		114.31	
E.G. Slope (ft/ft)	0.007533	Area (sq ft)		114.31	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	58.56	Top Width (ft)		58.56	
Vel Total (ft/s)	8.00	Avg. Vel. (ft/s)		8.00	
Max Chl Dpth (ft)	3.90	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	10542.5	Conv. (cfs)		10542.5	
Length Wtd. (ft)	150.00	Wetted Per. (ft)		59.14	
Min Ch El (ft)	2364.63	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		7.28	
Frctn Loss (ft)	0.65	Cum Volume (acre-ft)		35.02	
C & E Loss (ft)	0.15	Cum SA (acres)		13.70	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16000

INPUT
Description:
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
95	2368.73	140	2359.73	230	2368.73

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.025	95	.025	230	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	230	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2364.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.		0.025	
E.G. Elev (ft)	2364.90	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)		164.83	
E.G. Slope (ft/ft)	0.002839	Area (sq ft)		164.83	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	70.32	Top Width (ft)		70.32	
Vel Total (ft/s)	5.55	Avg. Vel. (ft/s)		5.55	
Max Chl Dpth (ft)	4.69	Hydr. Depth (ft)		2.34	
Conv. Total (cfs)	17173.8	Conv. (cfs)		17173.8	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		71.02	
Min Ch El (ft)	2359.73	Shear (lb/sq ft)		0.41	
Alpha	1.00	Stream Power (lb/ft s)		2.28	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)		34.54	
C & E Loss (ft)	0.05	Cum SA (acres)		13.48	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15950

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2369.73	140	2359.73	240	2369.73

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	350	350	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2363.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.		0.025	
E.G. Elev (ft)	2364.63	Reach Len. (ft)	350.00	350.00	350.00
Crit W.S. (ft)	2363.64	Flow Area (sq ft)		114.38	
E.G. Slope (ft/ft)	0.007520	Area (sq ft)		114.38	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	58.58	Top Width (ft)		58.58	
Vel Total (ft/s)	8.00	Avg. Vel. (ft/s)		8.00	
Max Chl Dpth. (ft)	3.91	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	10551.3	Conv. (cfs)		10551.3	
Length Wtd. (ft)	350.00	Wetted Per. (ft)		59.16	
Min Ch El (ft)	2359.73	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		7.26	
Frctn Loss (ft)	2.65	Cum Volume (acre-ft)		34.38	
C & E Loss (ft)	0.00	Cum SA (acres)		13.41	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15600

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2361.15	140	2351.15	240	2361.15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2355.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.00	Wt. n-Val.		0.025	
E.G. Elev (ft)	2356.05	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2355.05	Flow Area (sq ft)		113.94	
E.G. Slope (ft/ft)	0.007598	Area (sq ft)		113.94	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	58.47	Top Width (ft)		58.47	
Vel Total (ft/s)	8.03	Avg. Vel. (ft/s)		8.03	
Max Chl Dpth (ft)	3.90	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	10496.9	Conv. (cfs)		10496.9	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		59.05	
Min Ch El (ft)	2351.15	Shear (lb/sq ft)		0.92	
Alpha	1.00	Stream Power (lb/ft s)		7.35	
Frctn Loss (ft)	2.25	Cum Volume (acre-ft)		33.46	
C & E Loss (ft)	0.01	Cum SA (acres)		12.94	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15300

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2353.8	140	2343.8	240	2353.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2347.72	Element			
Vel Head (ft)	0.98	Wt. n-Val.		0.025	
E.G. Elev (ft)	2348.70	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2347.72	Flow Area (sq ft)		115.09	
E.G. Slope (ft/ft)	0.007398	Area (sq ft)		115.09	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	58.76	Top Width (ft)		58.76	
Vel Total (ft/s)	7.95	Avg. Vel. (ft/s)		7.95	
Max Chl Dpth (ft)	3.92	Hydr. Depth (ft)		1.96	
Conv. Total (cfs)	10637.7	Conv. (cfs)		10637.7	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		59.34	
Min Ch El (ft)	2343.80	Shear (lb/sq ft)		0.90	
Alpha	1.00	Stream Power (lb/ft s)		7.12	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)		32.67	
C & E Loss (ft)	0.01	Cum SA (acres)		12.53	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15000

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2346.45	140	2336.45	240	2346.45

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2340.57				
Vel Head (ft)	1.05	Wt. n-Val.		0.025	
E.G. Elev (ft)	2341.62	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2340.57	Flow Area (sq ft)		127.21	
E.G. Slope (ft/ft)	0.007402	Area (sq ft)		127.21	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	61.78	Top Width (ft)		61.78	
Vel Total (ft/s)	8.22	Avg. Vel. (ft/s)		8.22	
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	12157.6	Conv. (cfs)		12157.6	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		62.39	
Min Ch El (ft)	2336.45	Shear (lb/sq ft)		0.94	
Alpha	1.00	Stream Power (lb/ft s)		7.75	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)		31.84	
C & E Loss (ft)	0.00	Cum SA (acres)		12.12	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 14700

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2339.1	140	2329.1	240	2339.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2333.22	Element			
Vel Head (ft)	1.05	Wt. n-Val.		0.025	
E.G. Elev (ft)	2334.27	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2333.22	Flow Area (sq ft)		127.21	
E.G. Slope (ft/ft)	0.007402	Area (sq ft)		127.21	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	61.78	Top Width (ft)		61.78	
Vel Total (ft/s)	8.22	Avg. Vel. (ft/s)		8.22	
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	12157.6	Conv. (cfs)		12157.6	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		62.39	
Min Ch El (ft)	2329.10	Shear (lb/sq ft)		0.94	
Alpha	1.00	Stream Power (lb/ft s)		7.75	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)		30.96	
C & E Loss (ft)	0.00	Cum SA (acres)		11.69	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 14400

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2331.75	140	2321.75	240	2331.75

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2325.87	Element			
Vel Head (ft)	1.05	Wt. n-Val.		0.025	
E.G. Elev (ft)	2326.92	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2325.87	Flow Area (sq ft)		127.13	
E.G. Slope (ft/ft)	0.007414	Area (sq ft)		127.13	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	61.76	Top Width (ft)		61.76	
Vel Total (ft/s)	8.23	Avg. Vel. (ft/s)		8.23	
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	12148.0	Conv. (cfs)		12148.0	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		62.37	
Min Ch El (ft)	2321.75	Shear (lb/sq ft)		0.94	
Alpha	1.00	Stream Power (lb/ft s)		7.76	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)		30.09	
C & E Loss (ft)	0.00	Cum SA (acres)		11.27	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 14100

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2324.4	140	2314.4	240	2324.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2318.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.		0.025	
E.G. Elev (ft)	2319.57	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2318.52	Flow Area (sq ft)		127.33	
E.G. Slope (ft/ft)	0.007384	Area (sq ft)		127.33	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	61.81	Top Width (ft)		61.81	
Vel Total (ft/s)	8.21	Avg. Vel. (ft/s)		8.21	
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	12173.0	Conv. (cfs)		12173.0	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		62.42	
Min Ch El (ft)	2314.40	Shear (lb/sq ft)		0.94	
Alpha	1.00	Stream Power (lb/ft s)		7.72	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)		29.21	
C & E Loss (ft)	0.00	Cum SA (acres)		10.84	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 13800

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2317.05	140	2307.05	240	2317.05

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	550	550	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2311.16	Element			
Vel Head (ft)	1.05	Wt. n-Val.		0.025	
E.G. Elev (ft)	2312.22	Reach Len. (ft)	550.00	550.00	550.00
Crit W.S. (ft)	2311.16	Flow Area (sq ft)		126.98	
E.G. Slope (ft/ft)	0.007438	Area (sq ft)		126.98	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	61.72	Top Width (ft)		61.72	
Vel Total (ft/s)	8.24	Avg. Vel. (ft/s)		8.24	
Max Chl Dpth (ft)	4.11	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	12128.8	Conv. (cfs)		12128.8	
Length Wtd. (ft)	550.00	Wetted Per. (ft)		62.33	
Min Ch El (ft)	2307.05	Shear (lb/sq ft)		0.95	
Alpha	1.00	Stream Power (lb/ft s)		7.79	
Frctn Loss (ft)	3.99	Cum Volume (acre-ft)		28.33	
C & E Loss (ft)	0.01	Cum SA (acres)		10.42	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 13250

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2303.58	140	2293.58	240	2303.58

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	550	550	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2298.10	Element			
Vel Head (ft)	1.14	Wt. n-Val.		0.025	
E.G. Elev (ft)	2299.24	Reach Len. (ft)	550.00	550.00	550.00
Crit W.S. (ft)	2298.10	Flow Area (sq ft)		153.39	
E.G. Slope (ft/ft)	0.007102	Area (sq ft)		153.39	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	67.84	Top Width (ft)		67.84	
Vel Total (ft/s)	8.57	Avg. Vel. (ft/s)		8.57	
Max Chl Dpth (ft)	4.52	Hydr. Depth (ft)		2.26	
Conv. Total (cfs)	15604.0	Conv. (cfs)		15604.0	
Length Wtd. (ft)	550.00	Wetted Per. (ft)		68.51	
Min Ch El (ft)	2293.58	Shear (lb/sq ft)		0.99	
Alpha	1.00	Stream Power (lb/ft s)		8.51	
Frctn Loss (ft)	3.89	Cum Volume (acre-ft)		26.56	
C & E Loss (ft)	0.00	Cum SA (acres)		9.60	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 12700

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2290.1	140	2280.1	240	2290.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	200	200	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2284.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.14	Wt. n-Val.		0.025	
E.G. Elev (ft)	2285.76	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	2284.63	Flow Area (sq ft)		153.81	
E.G. Slope (ft/ft)	0.007051	Area (sq ft)		153.81	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	67.93	Top Width (ft)		67.93	
Vel Total (ft/s)	8.55	Avg. Vel. (ft/s)		8.55	
Max Chl Dpth (ft)	4.53	Hydr. Depth (ft)		2.26	
Conv. Total (cfs)	15660.2	Conv. (cfs)		15660.2	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		68.60	
Min Ch El (ft)	2280.10	Shear (lb/sq ft)		0.99	
Alpha	1.00	Stream Power (lb/ft s)		8.44	
Frctn Loss (ft)	1.39	Cum Volume (acre-ft)		24.62	
C & E Loss (ft)	0.01	Cum SA (acres)		8.74	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 12500

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2289.1	122.5	2277.1	157.5	2277.1	205.5	2289.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2280.25	Wt. n-Val.		0.025	
Vel Head (ft)	1.28	Reach Len. (ft)	500.00	500.00	500.00
E.G. Elev (ft)	2281.53	Flow Area (sq ft)		144.71	
Crit W.S. (ft)	2280.25	Area (sq ft)		144.71	
E.G. Slope (ft/ft)	0.006894	Flow (cfs)		1315.00	
Q Total (cfs)	1315.00	Top Width (ft)		57.02	
Top Width (ft)	57.02	Avg. Vel. (ft/s)		9.09	
Vel Total (ft/s)	9.09	Hydr. Depth (ft)		2.54	
Max Chl Dpth (ft)	3.15	Conv. (cfs)		15837.5	
Conv. Total (cfs)	15837.5	Wetted Per. (ft)		57.91	
Length Wtd. (ft)	500.00	Shear (lb/sq ft)		1.08	
Min Ch El (ft)	2277.10	Stream Power (lb/ft s)		9.77	
Alpha	1.00	Cum Volume (acre-ft)		23.94	
Frctn Loss (ft)	3.45	Cum SA (acres)		8.46	
C & E Loss (ft)	0.00				

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 12000

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2281.6	122.5	2269.6	157.5	2269.6	205.5	2281.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2272.75	Element		0.025	
Vel Head (ft)	1.28	Wt. n-Val.			
E.G. Elev (ft)	2274.03	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2272.75	Flow Area (sq ft)		144.71	
E.G. Slope (ft/ft)	0.006894	Area (sq ft)		144.71	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	57.02	Top Width (ft)		57.02	
Vel Total (ft/s)	9.09	Avg. Vel. (ft/s)		9.09	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	15837.5	Conv. (cfs)		15837.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		57.91	
Min Ch El (ft)	2269.60	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		9.77	
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)		22.28	
C & E Loss (ft)	0.00	Cum SA (acres)		7.80	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 11500

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2274.1	122.5	2262.1	157.5	2262.1	205.5	2274.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2265.25	Element			
Vel Head (ft)	1.28	Wt. n-Val.		0.025	
E.G. Elev (ft)	2266.53	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2265.25	Flow Area (sq ft)		144.71	
E.G. Slope (ft/ft)	0.006894	Area (sq ft)		144.71	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	57.02	Top Width (ft)		57.02	
Vel Total (ft/s)	9.09	Avg. Vel. (ft/s)		9.09	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	15837.5	Conv. (cfs)		15837.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		57.91	
Min Ch El (ft)	2262.10	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		9.77	
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)		20.62	
C & E Loss (ft)	0.00	Cum SA (acres)		7.15	

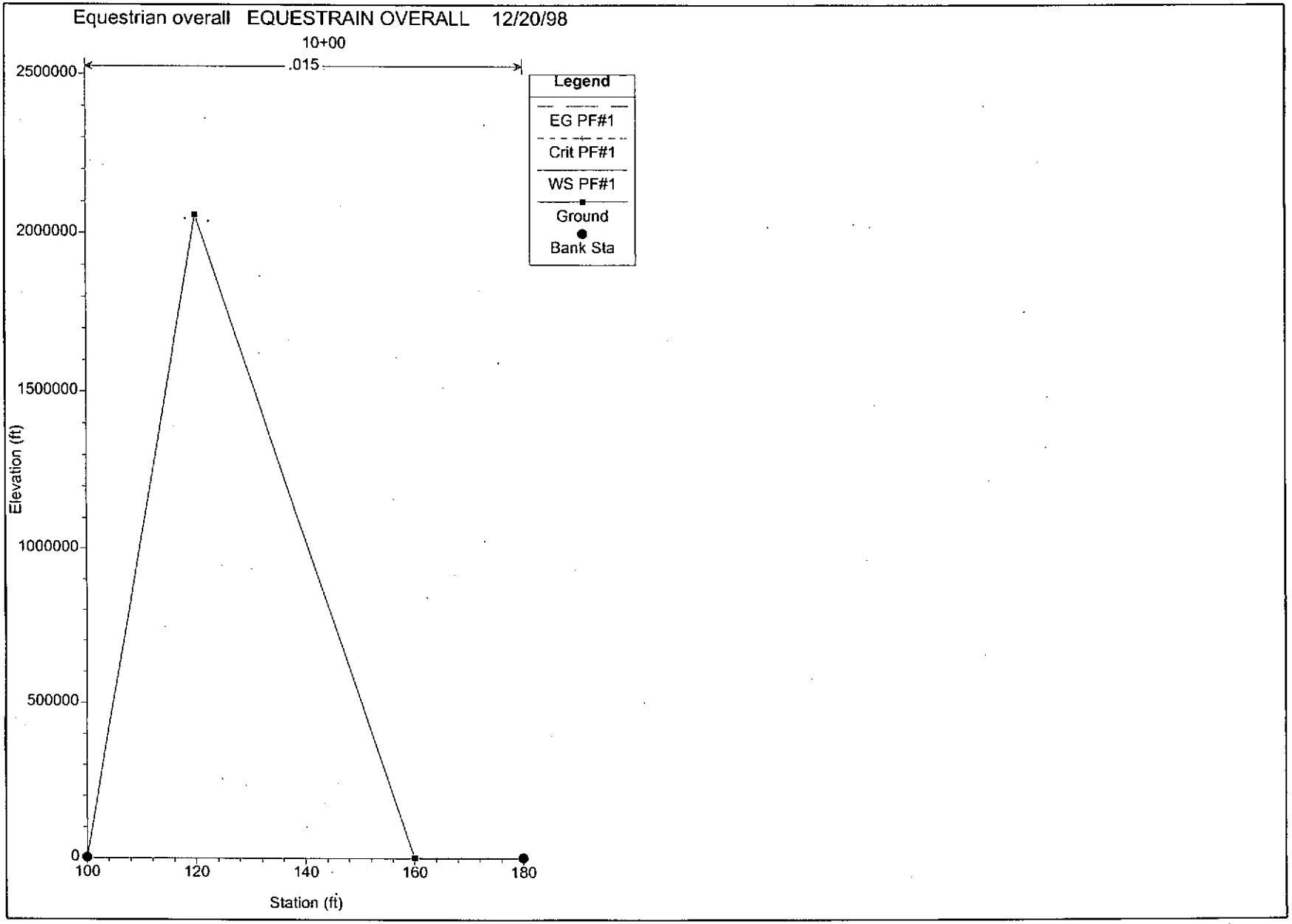
Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

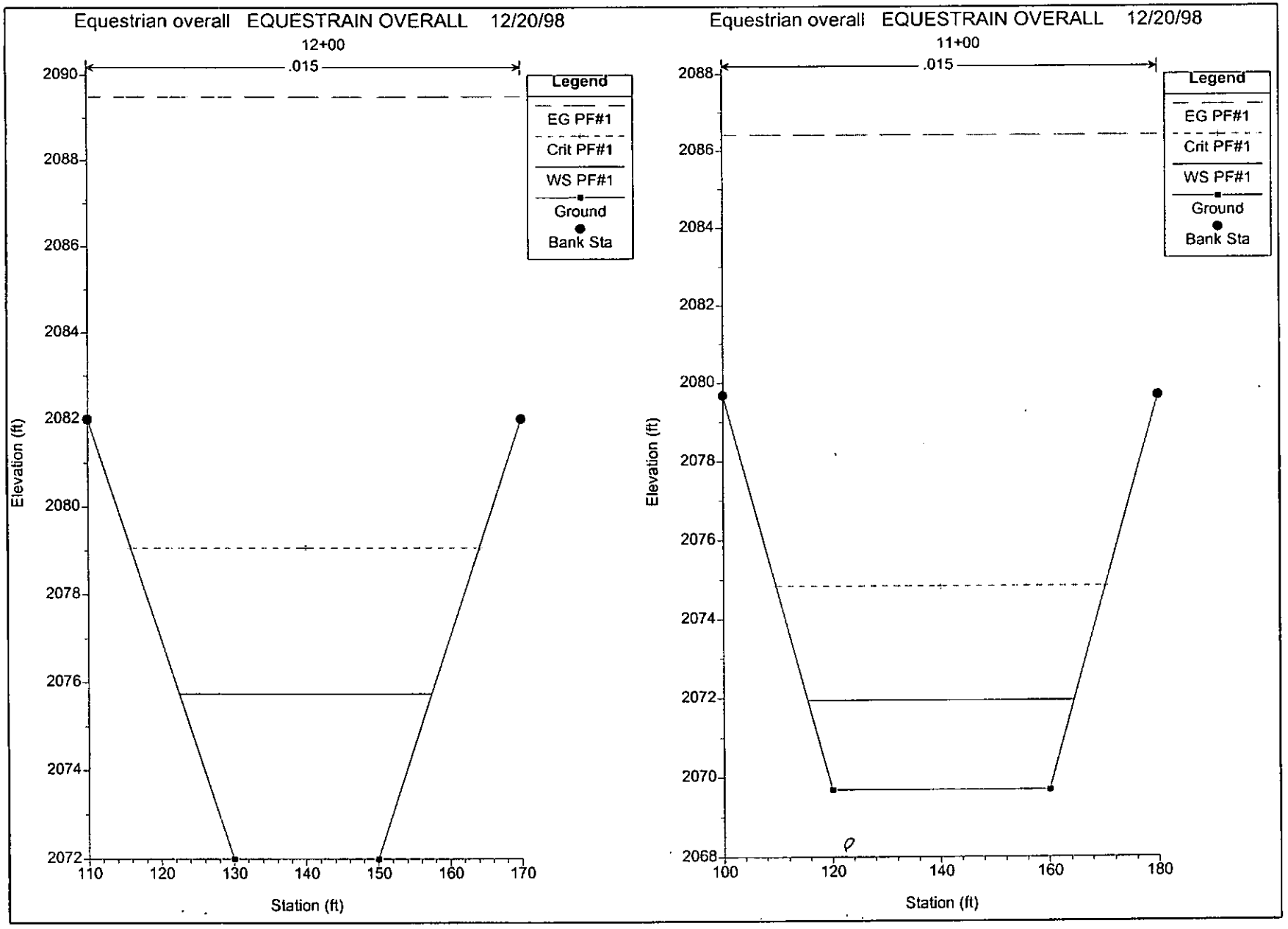
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

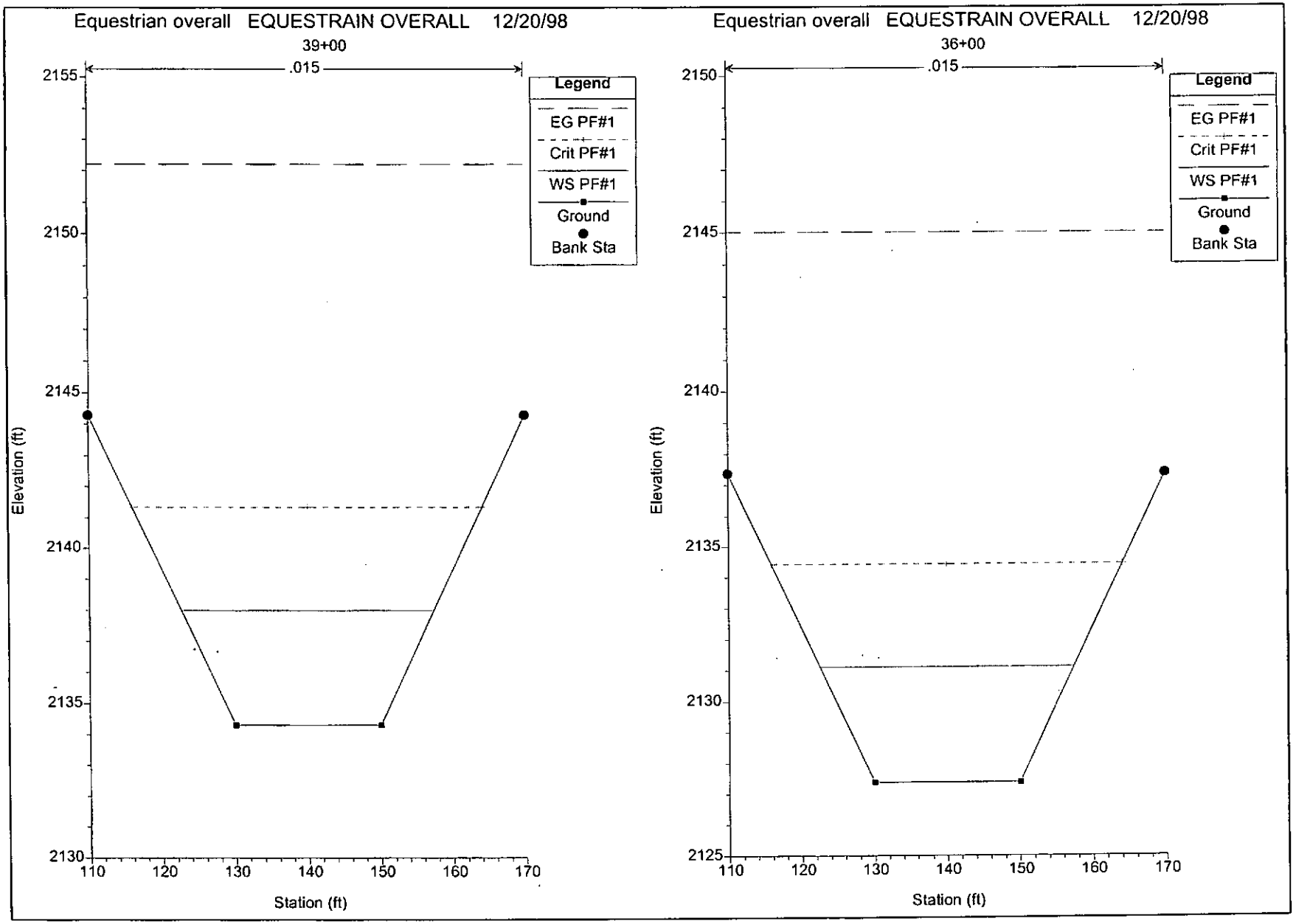
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

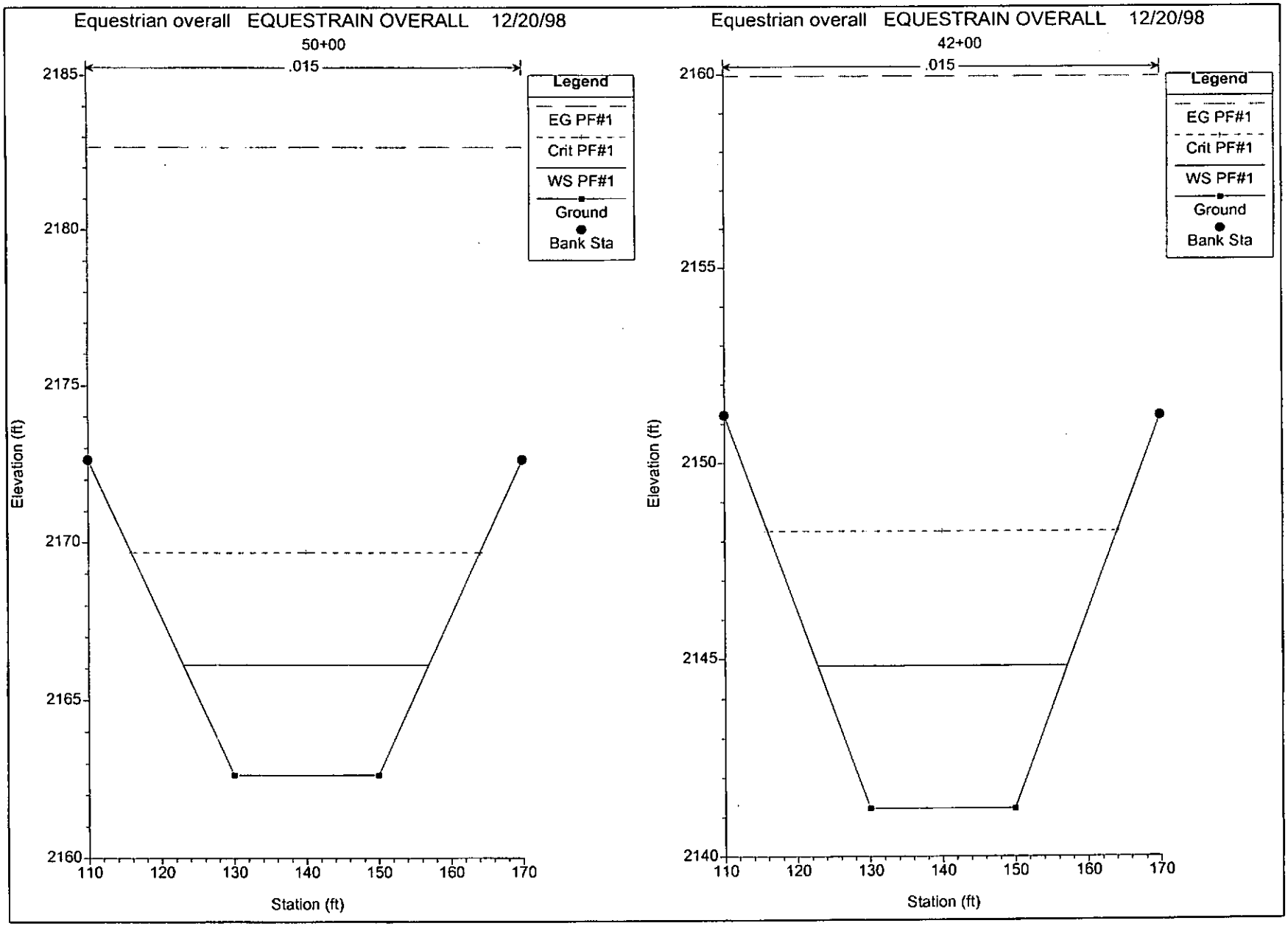
CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 11000

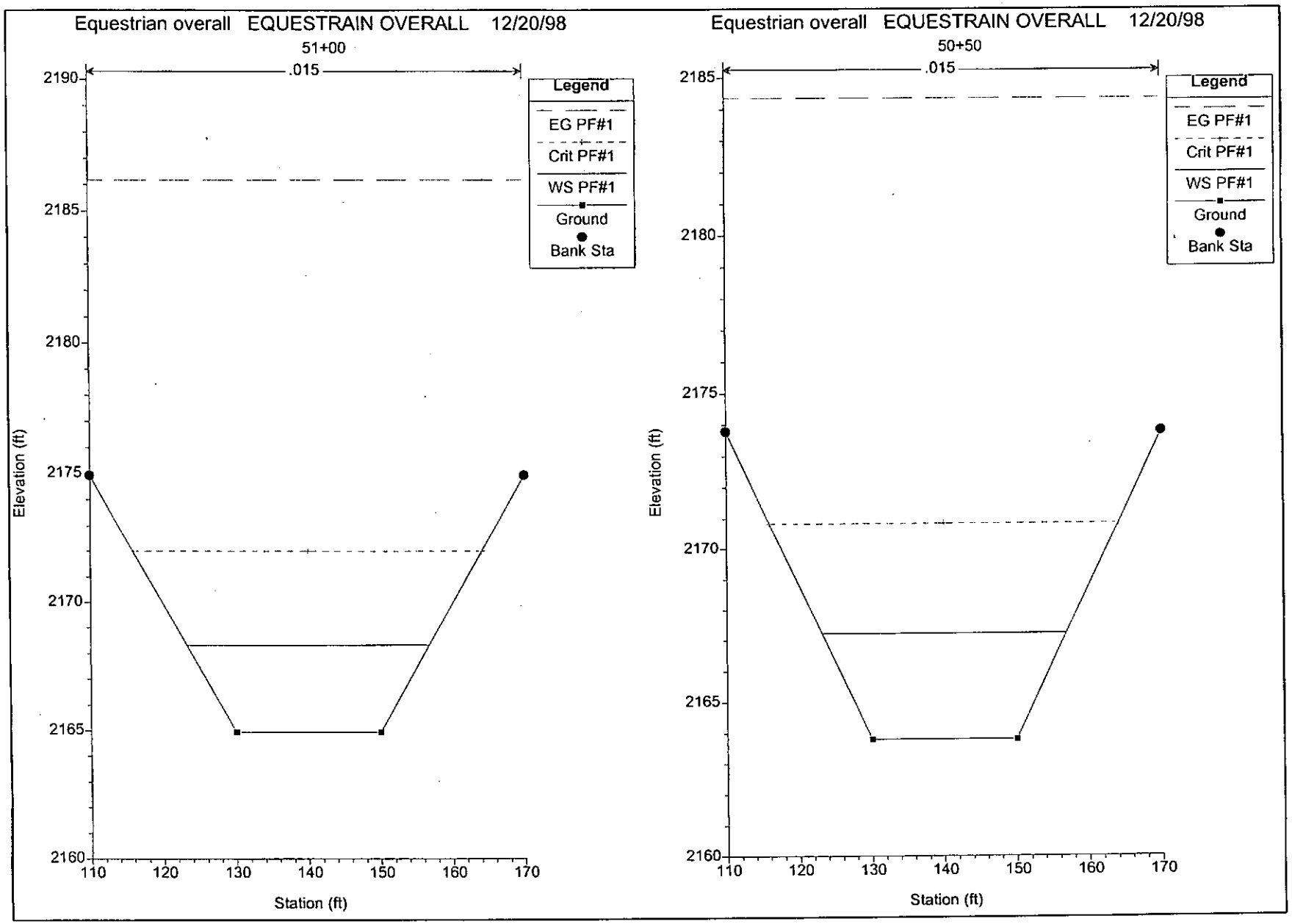
INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

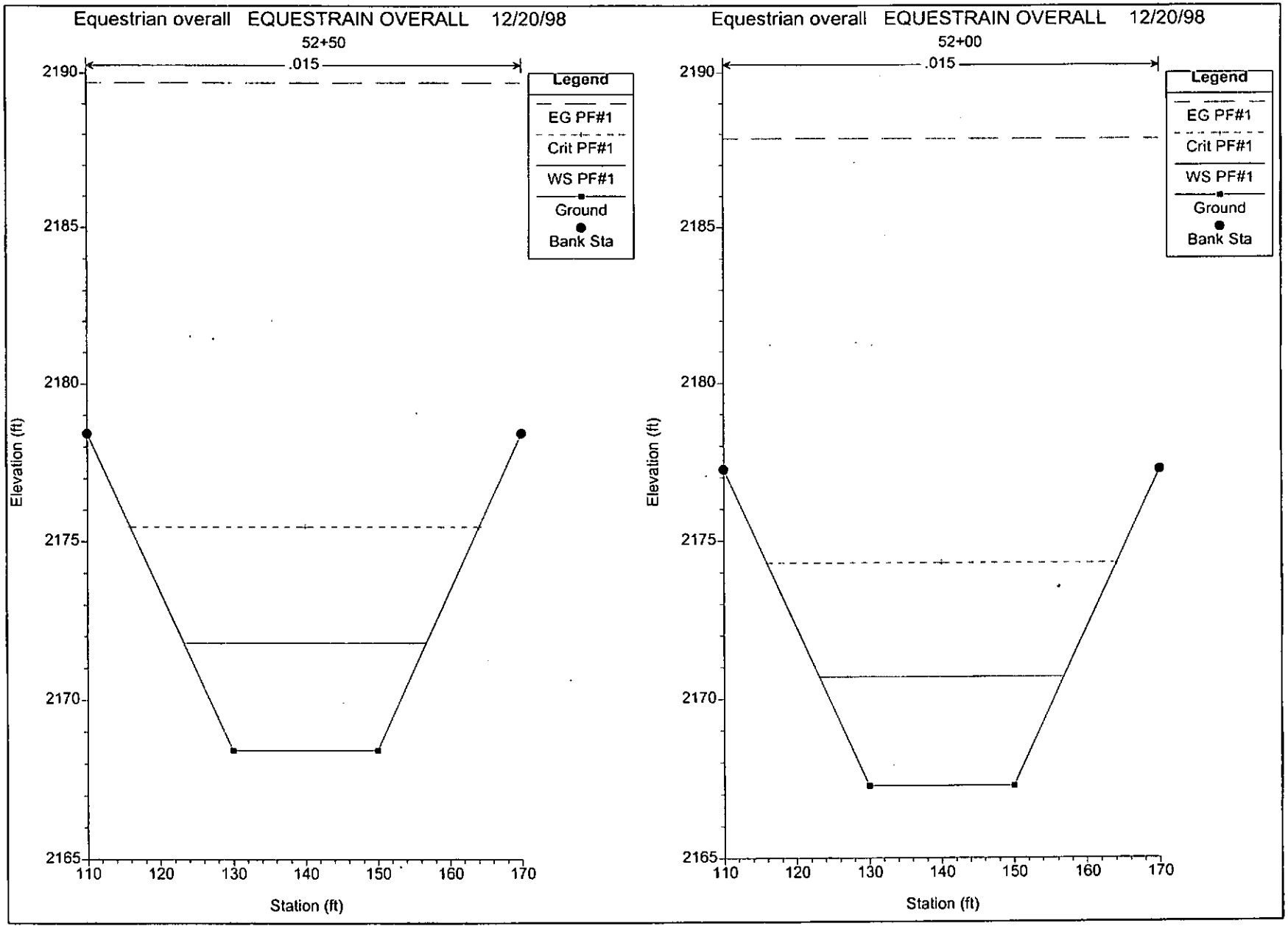

Equestrian overall EQUESTRAIN OVERALL 12/20/98
10+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
2500000
2000000
1500000
1000000
500000
0
Elevation (ft)
100
120
140
160
180
Station (ft)

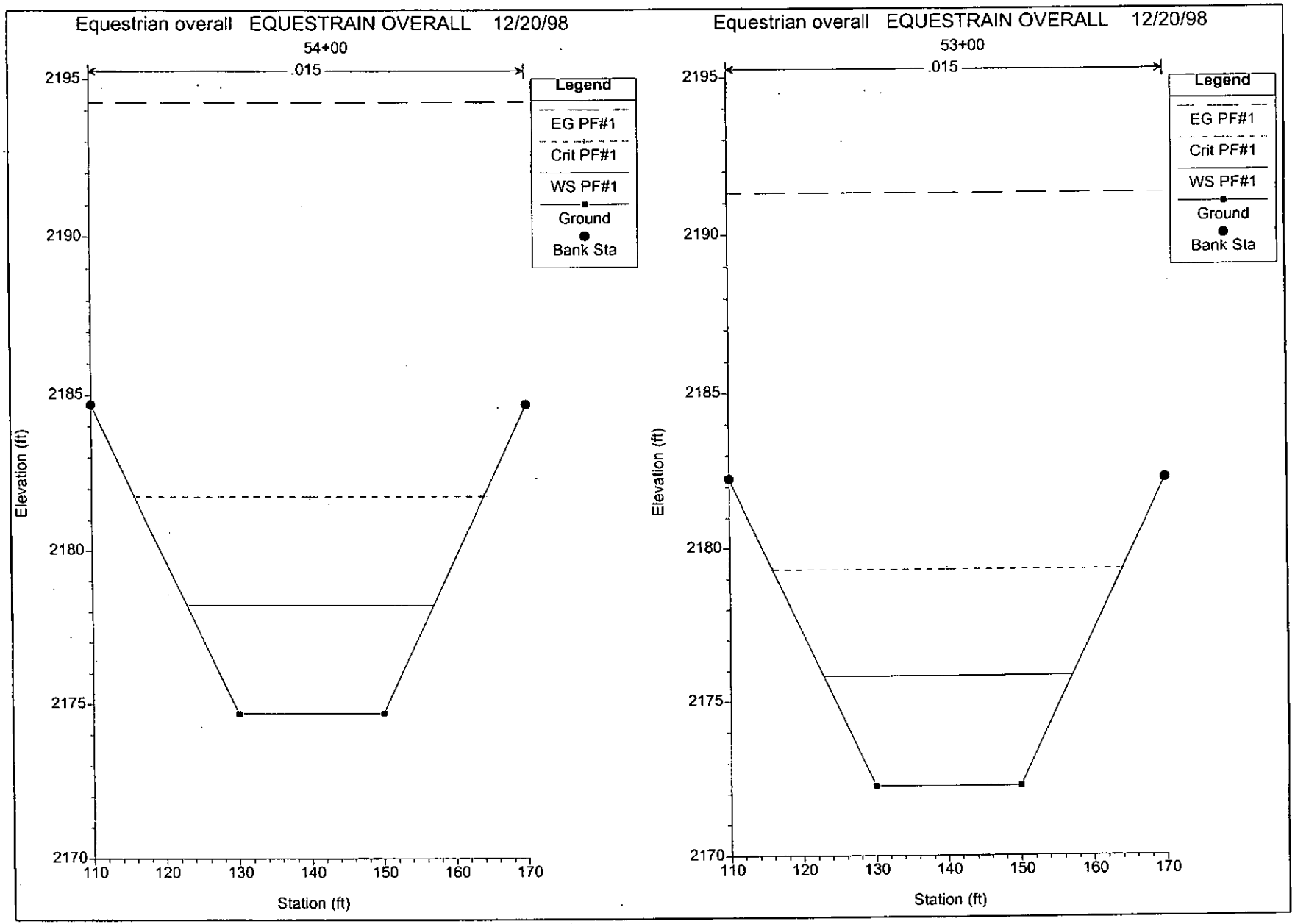

Equestrian overall EQUESTRAIN OVERALL 12/20/98
12+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2090
2088
2086
2084
2082
2080
2078
2076
2074
2072
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
11+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2088
2086
2084
2082
2080
2078
2076
2074
2072
2070
2068
100
120
140
160
180

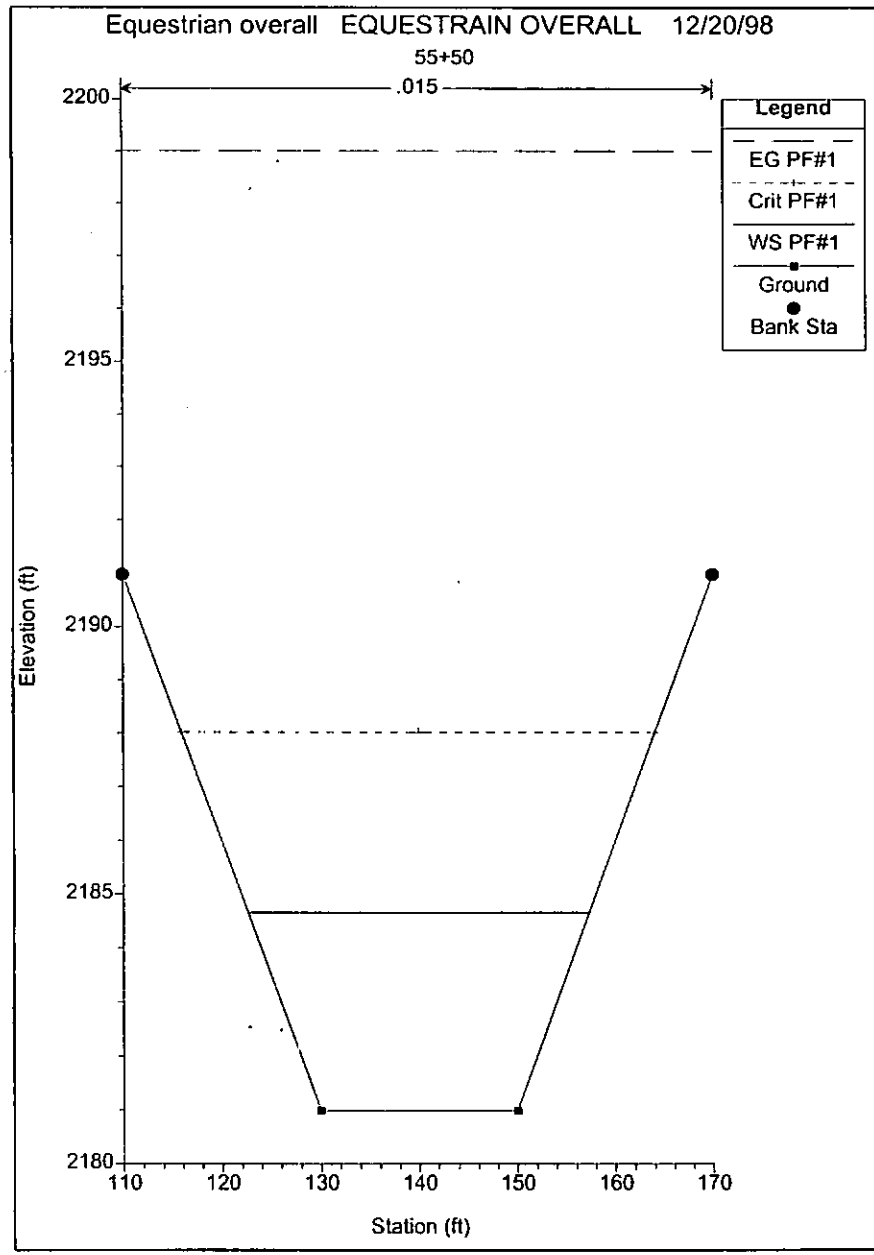

Equestrian overall EQUESTRAIN OVERALL 12/20/98
39+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2155
2150
2145
2140
2135
2130
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
36+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
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2145
2140
2135
2130
2125
110
120
130
140
150
160
170

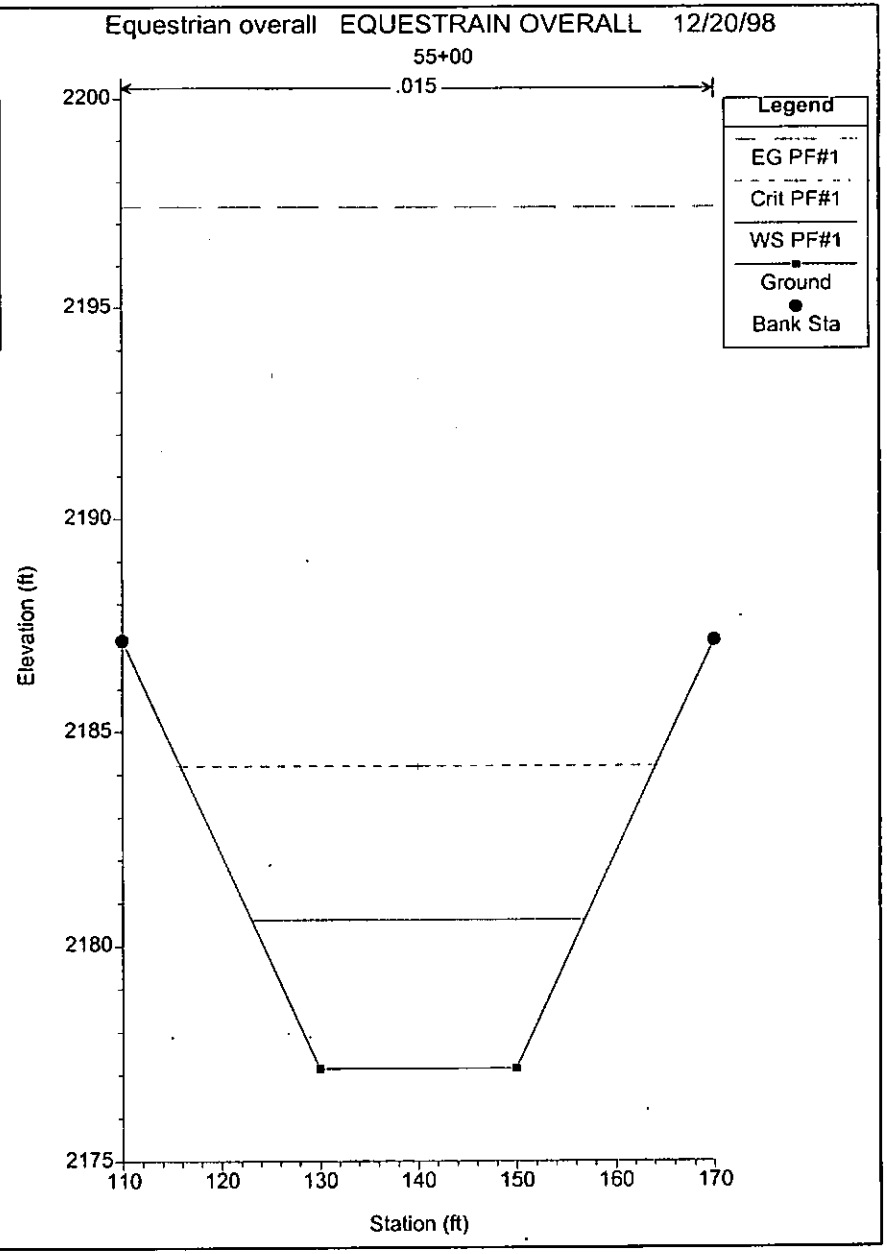

Equestrian overall EQUESTRAIN OVERALL 12/20/98
50+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2185
2180
2175
2170
2165
2160
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
42+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2160
2155
2150
2145
2140
110
120
130
140
150
160
170

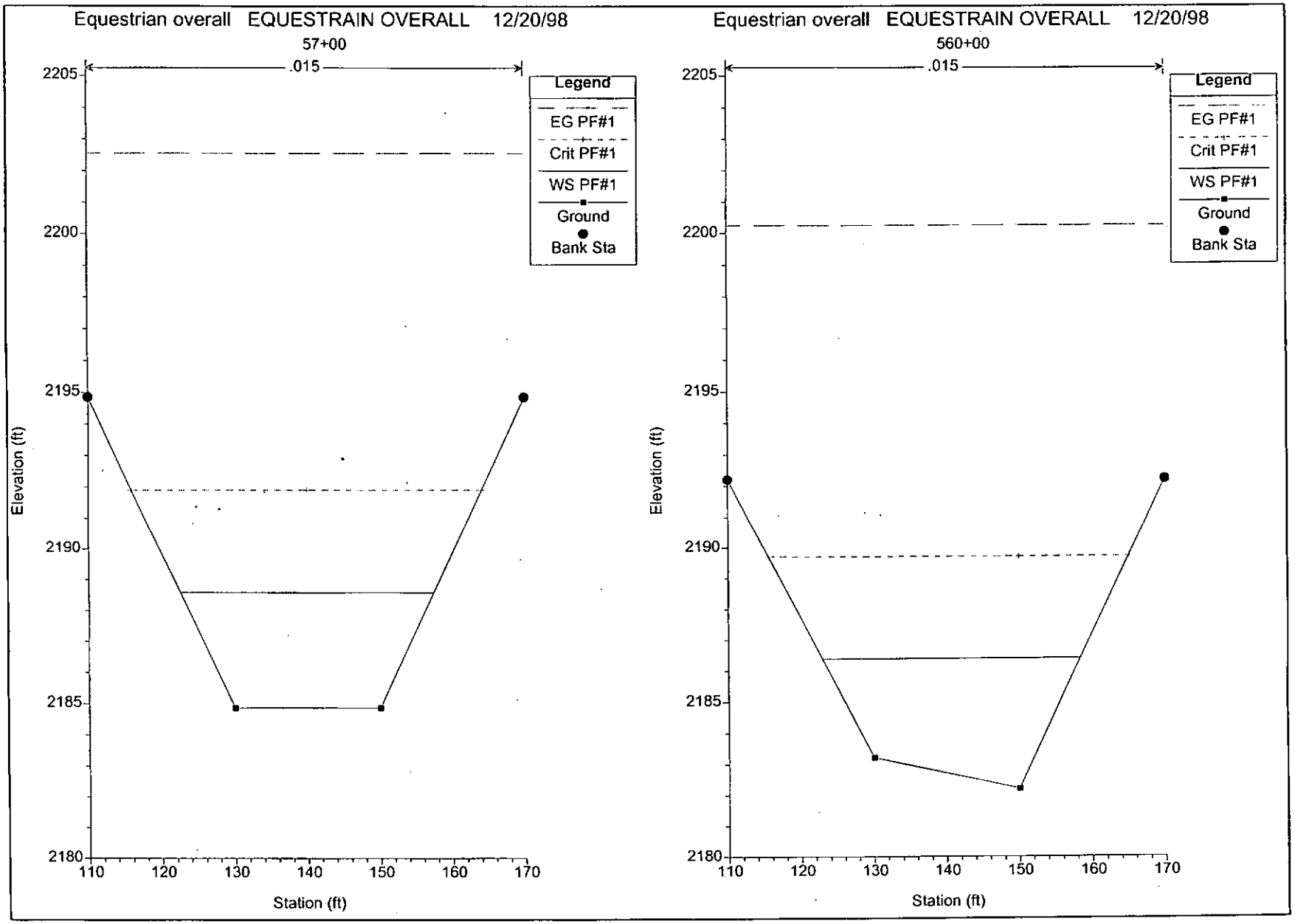

Equestrian overall EQUESTRAIN OVERALL 12/20/98
51+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2190
2185
2180
2175
2170
2165
2160
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
50+50
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2185
2180
2175
2170
2165
2160
110
120
130
140
150
160
170

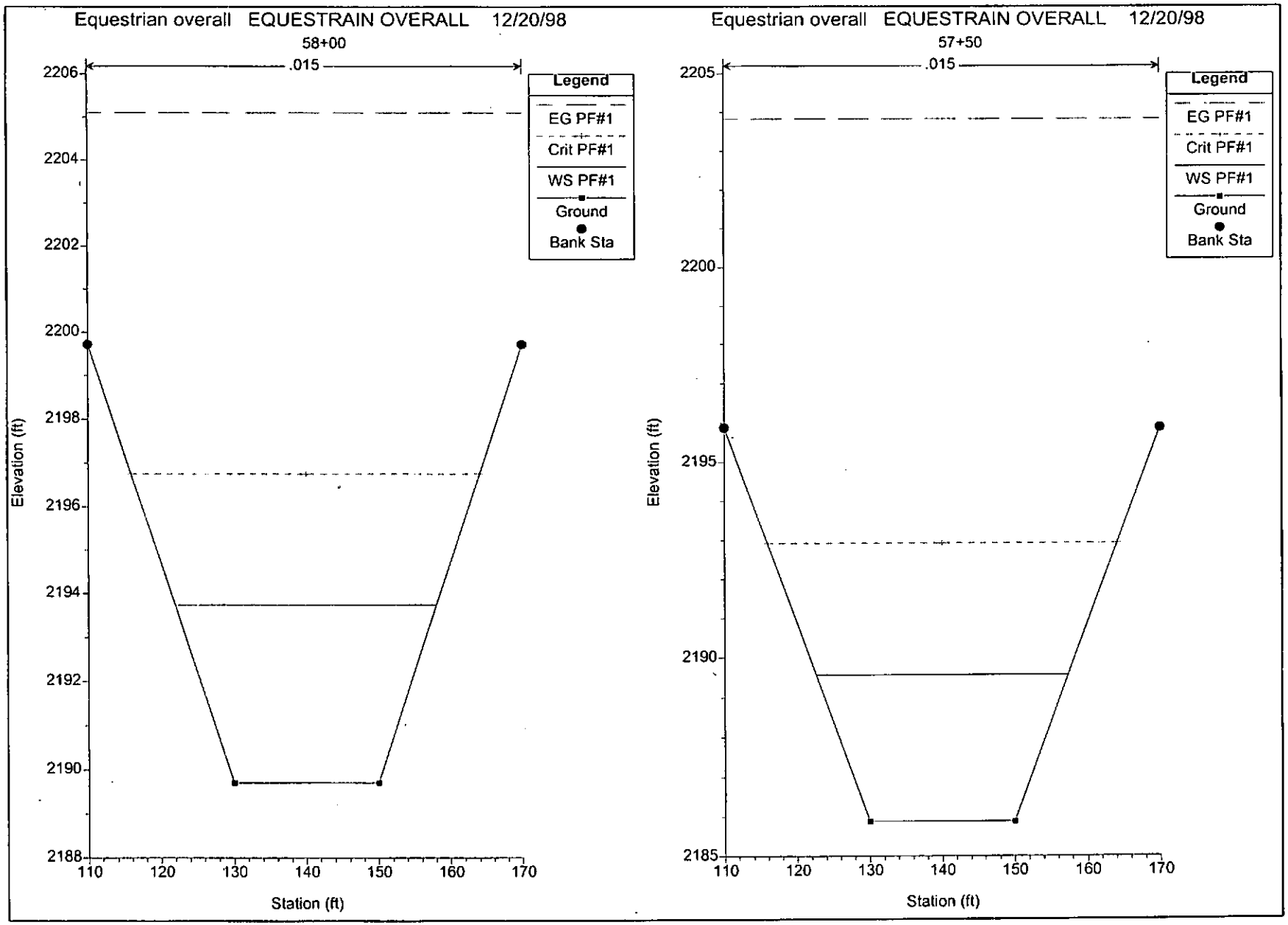

Equestrian overall EQUESTRAIN OVERALL 12/20/98
52+50
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2190
2185
2180
2175
2170
2165
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
52+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)

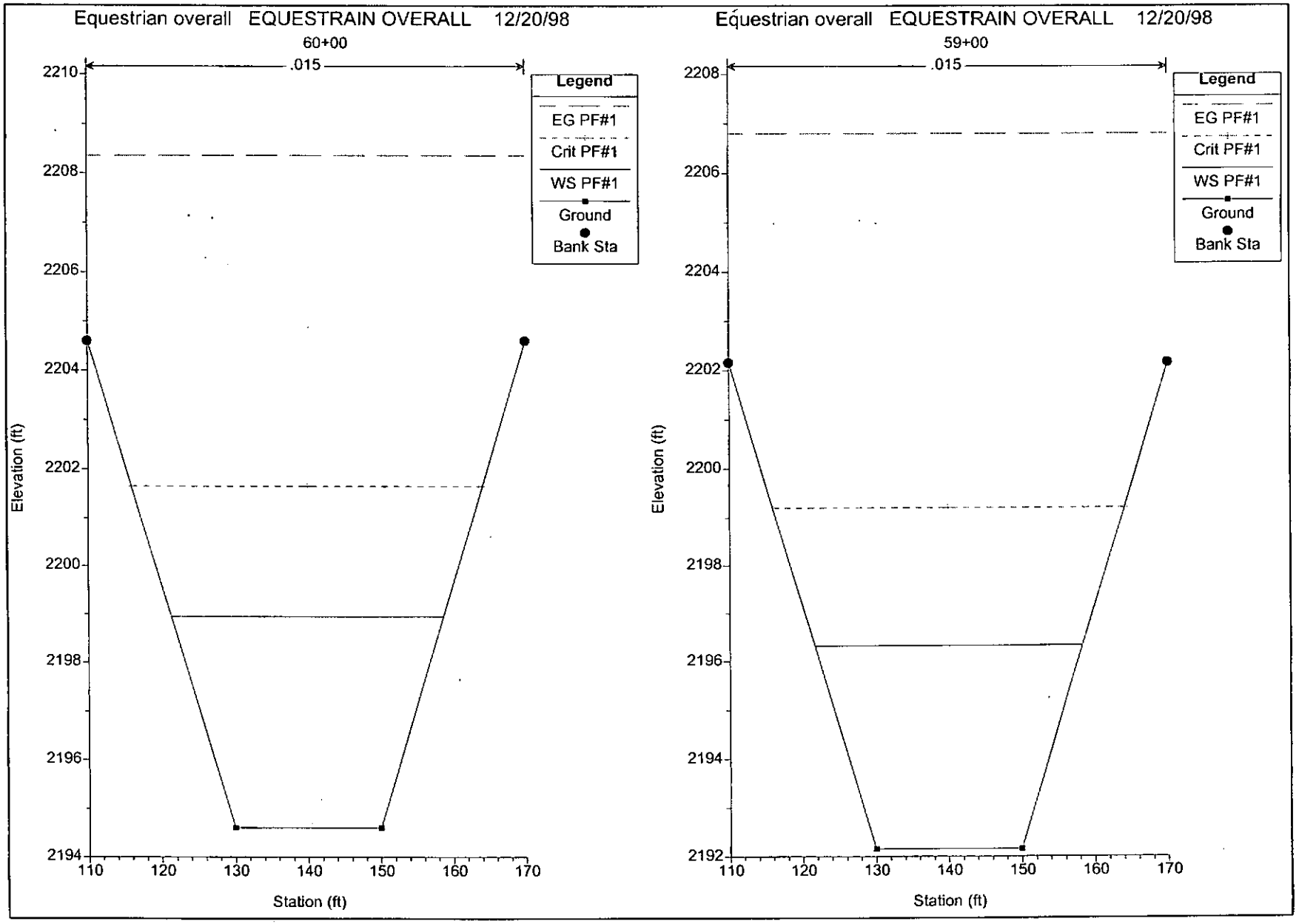

Equestrian overall EQUESTRAIN OVERALL 12/20/98
54+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
2195
2190
2185
2180
2175
2170
Elevation (ft)
110
120
130
140
150
160
170
Station (ft)
Equestrian overall EQUESTRAIN OVERALL 12/20/98
53+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
2195
2190
2185
2180
2175
2170
Elevation (ft)
110
120
130
140
150
160
170
Station (ft)

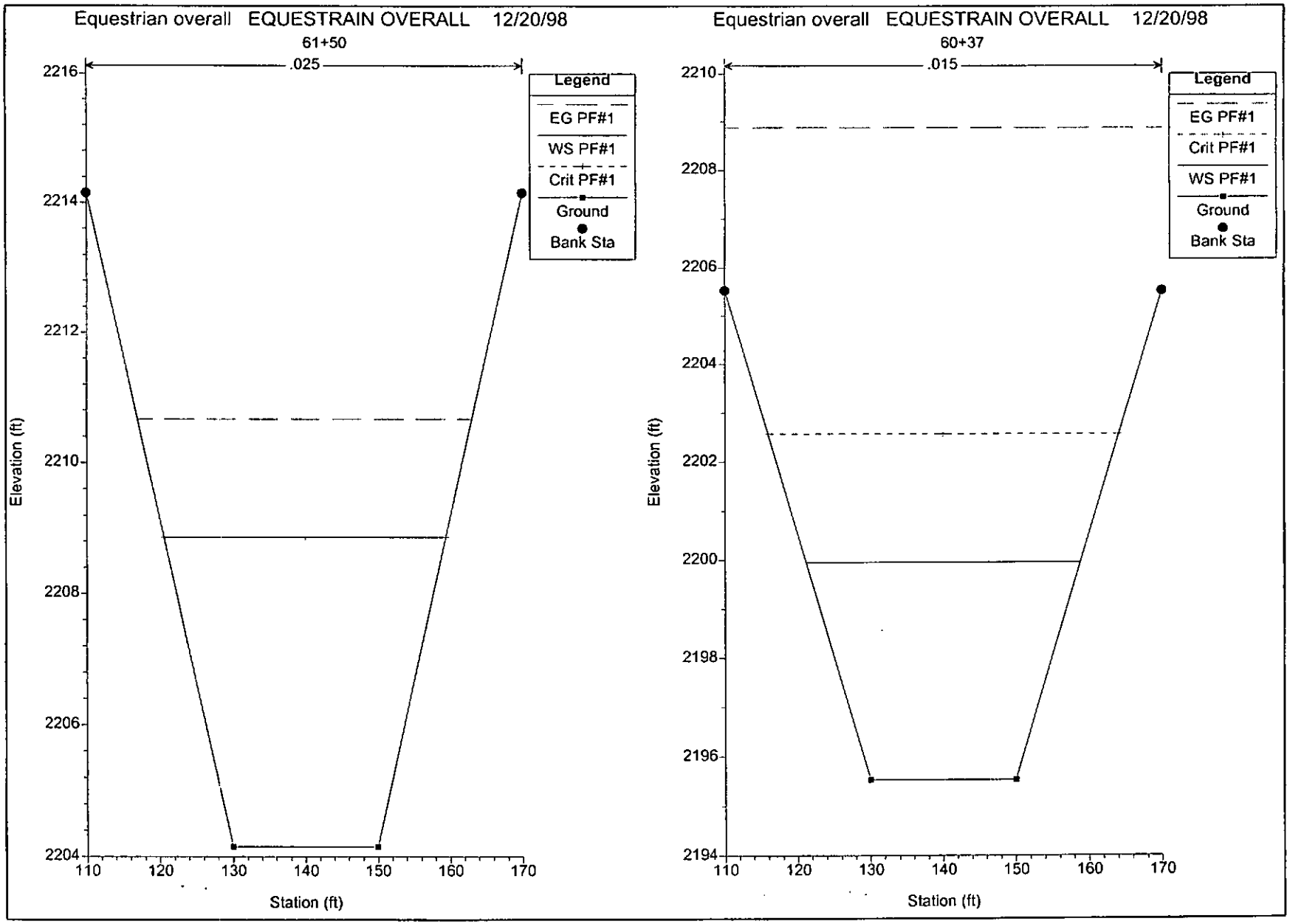

Equestrian overall EQUESTRAIN OVERALL 12/20/98
55+50
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2200
2195
2190
2185
2180
110
120
130
140
150
160
170

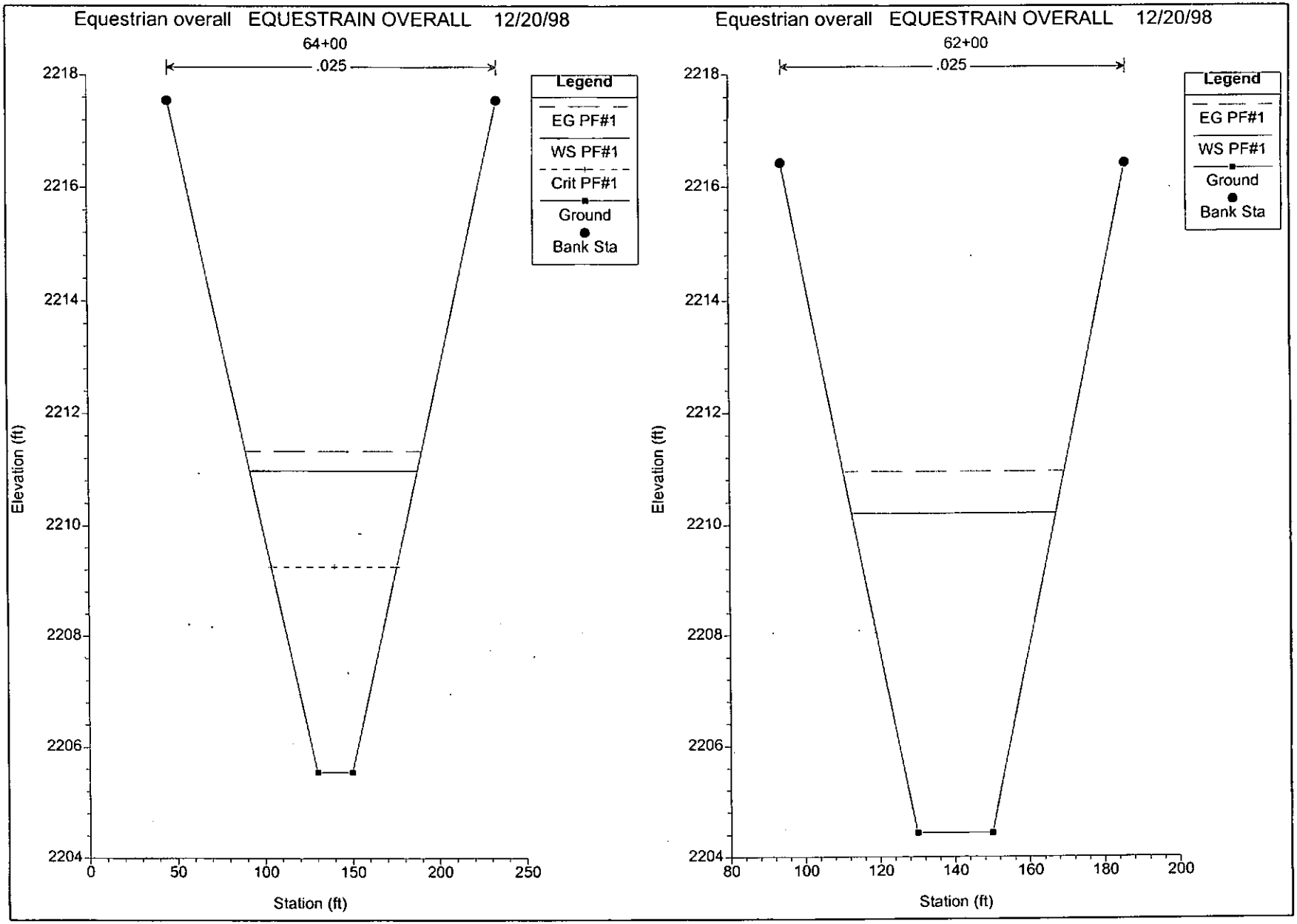

Equestrian overall EQUESTRAIN OVERALL 12/20/98
55+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2200
2195
2190
2185
2180
2175
110
120
130
140
150
160
170

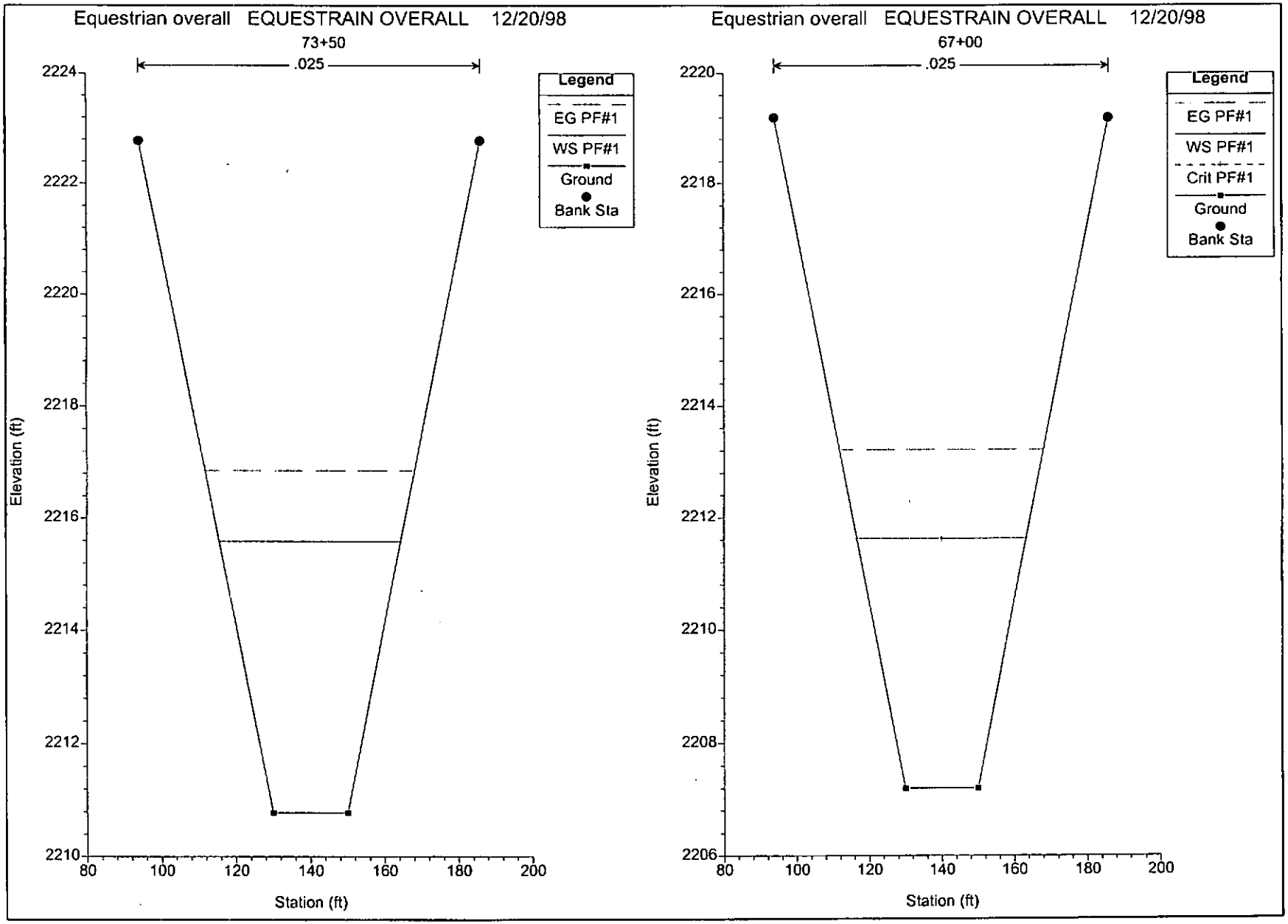

Equestrian overall EQUESTRAIN OVERALL 12/20/98
57+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2205
2200
2195
2190
2185
2180
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
560+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)

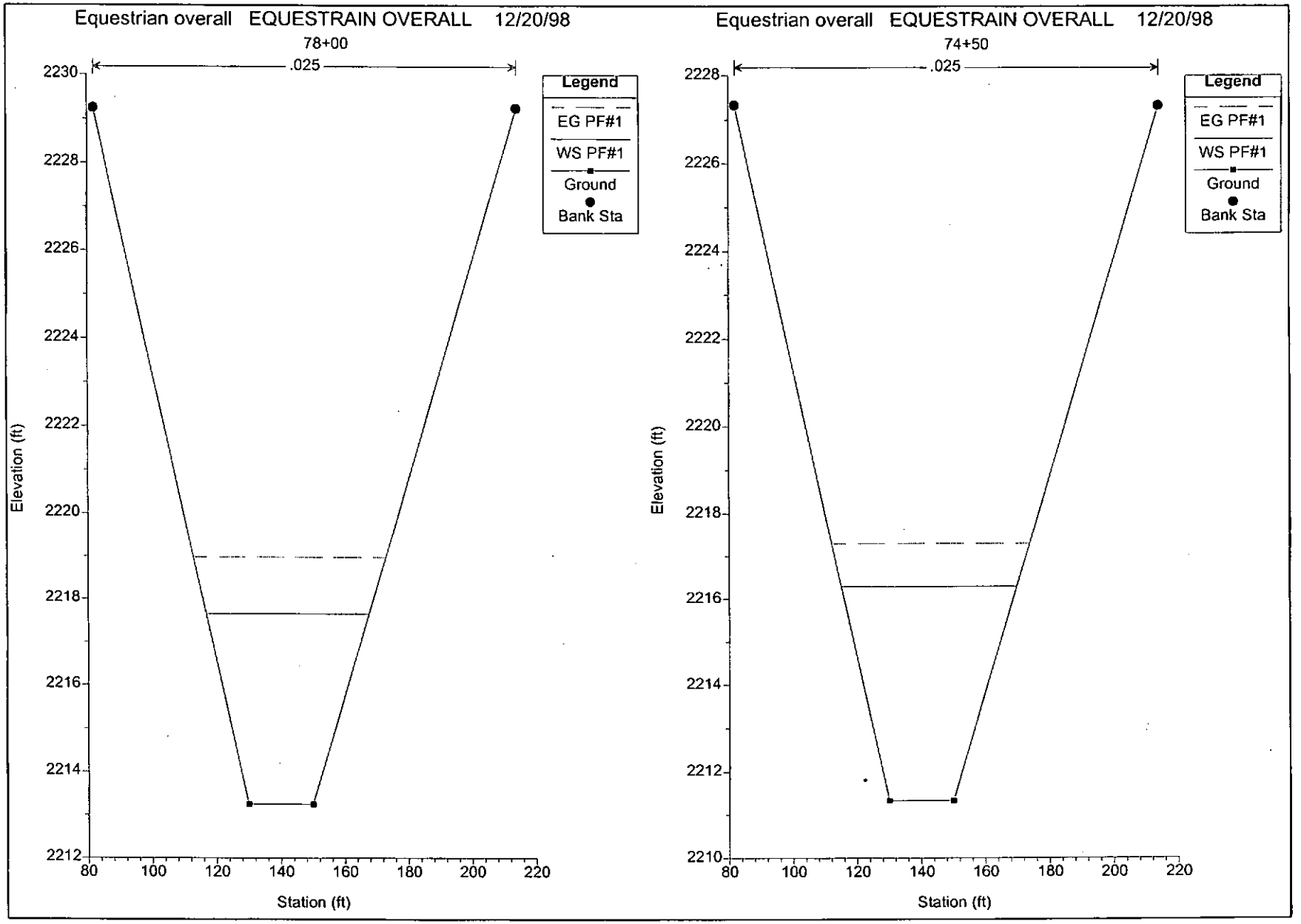

Equestrian overall EQUESTRAIN OVERALL 12/20/98
58+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2206
2204
2202
2200
2198
2196
2194
2192
2190
2188
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
57+50
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2205
2200
2195
2190
2185
110
120
130
140
150
160
170

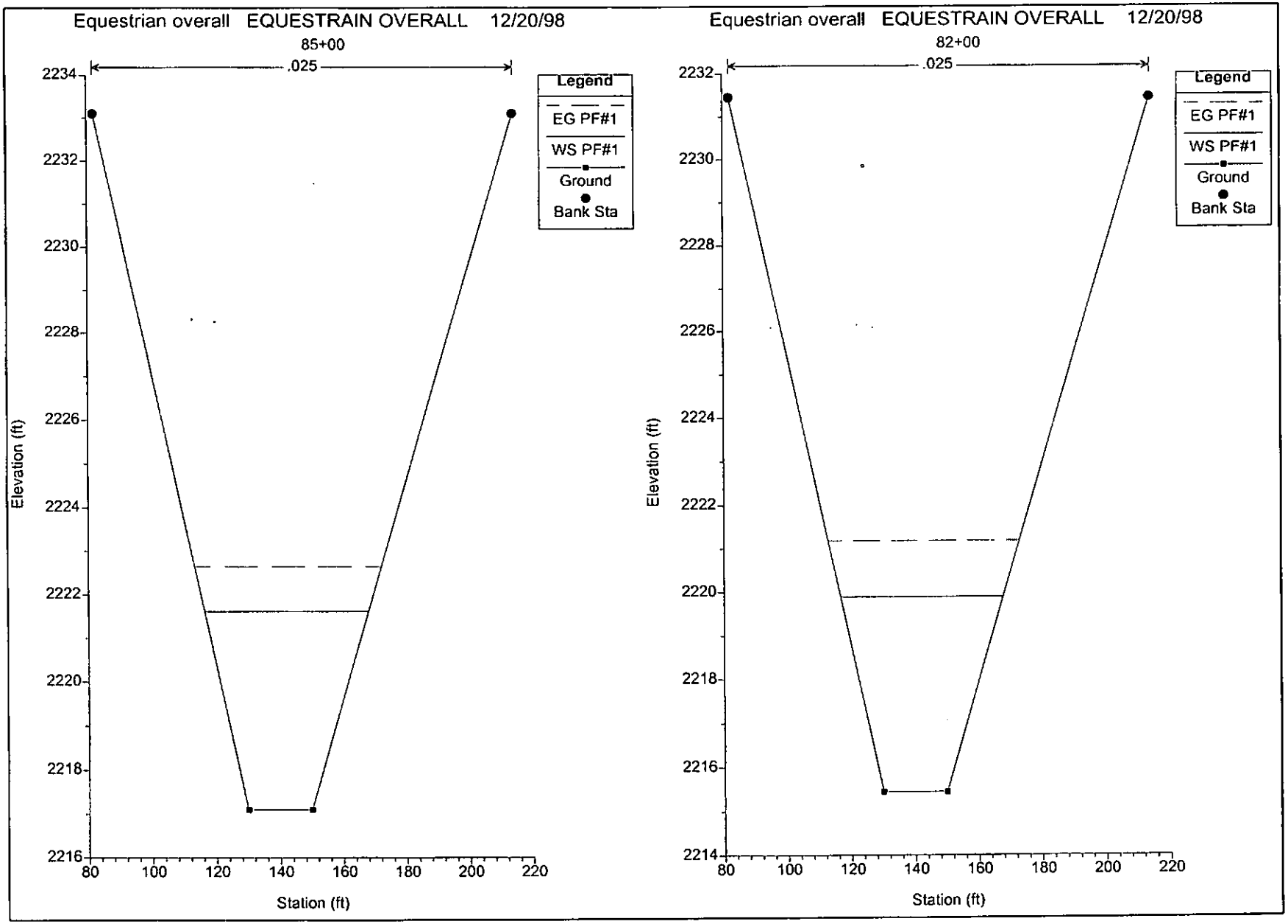

Equestrian overall EQUESTRAIN OVERALL 12/20/98
60+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2210
2208
2206
2204
2202
2200
2198
2196
2194
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
59+00
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2208
2206
2204
2202
2200
2198
2196
2194
2192
110
120
130
140
150
160
170

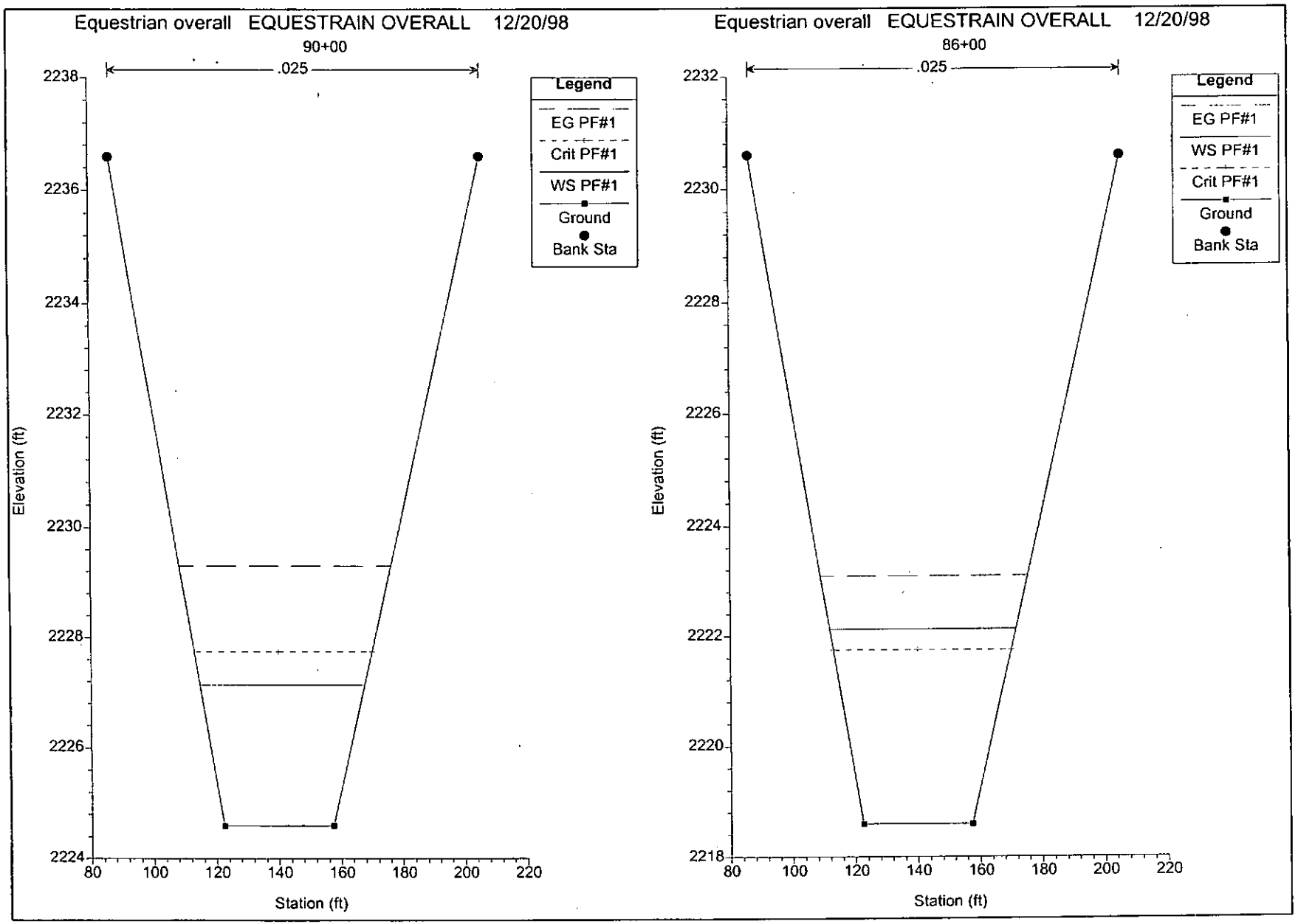

Equestrian overall EQUESTRAIN OVERALL 12/20/98
61+50
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2216
2214
2212
2210
2208
2206
2204
110
120
130
140
150
160
170
Equestrian overall EQUESTRAIN OVERALL 12/20/98
60+37
.015
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2210
2208
2206
2204
2202
2200
2198
2196
2194
110
120
130
140
150
160
170

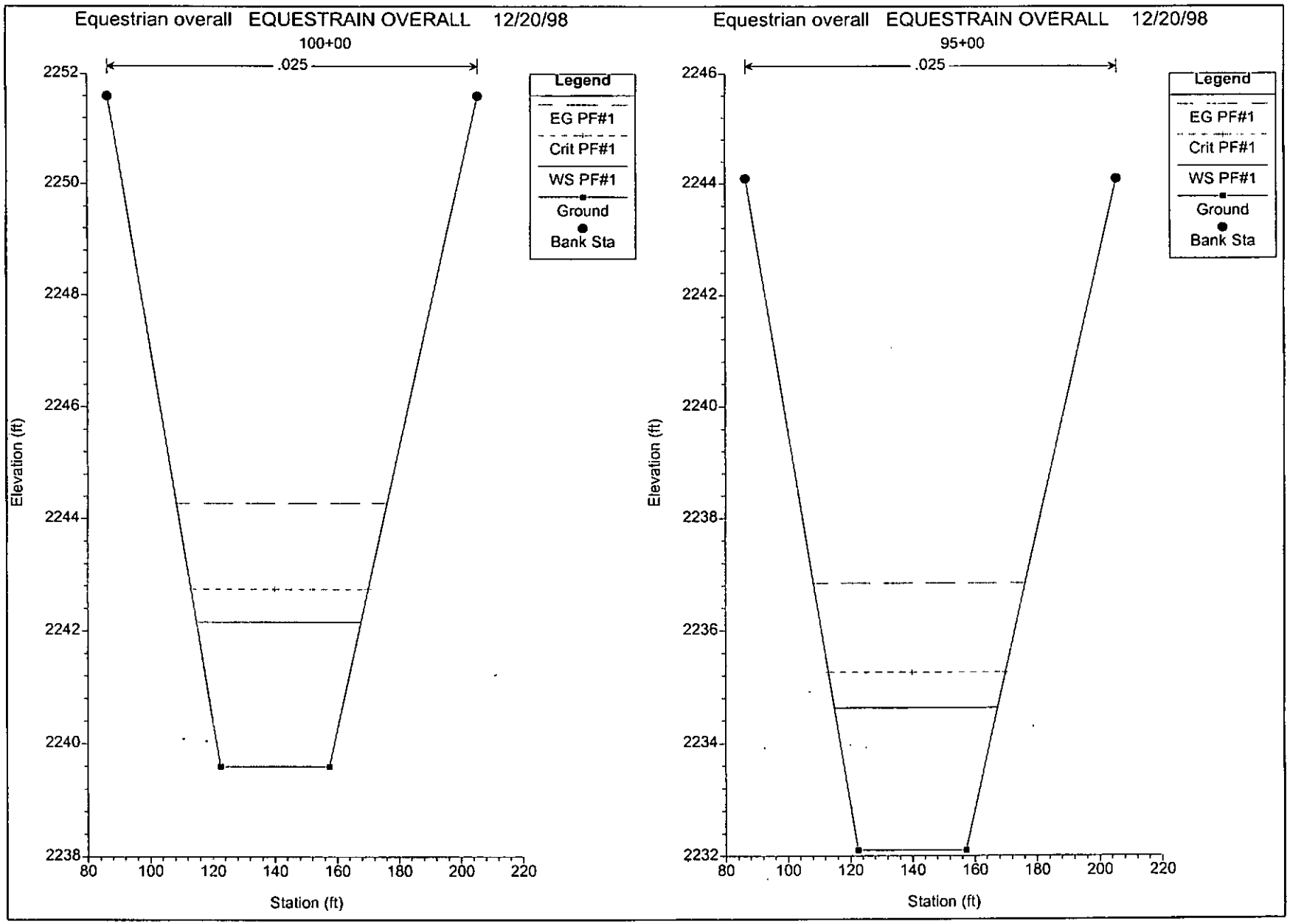

Equestrian overall EQUESTRAIN OVERALL 12/20/98
64+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2218
2216
2214
2212
2210
2208
2206
2204
0
50
100
150
200
250
Equestrian overall EQUESTRAIN OVERALL 12/20/98
62+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2218
2216
2214
2212
2210
2208
2206
2204
80
100
120
140
160
180
200

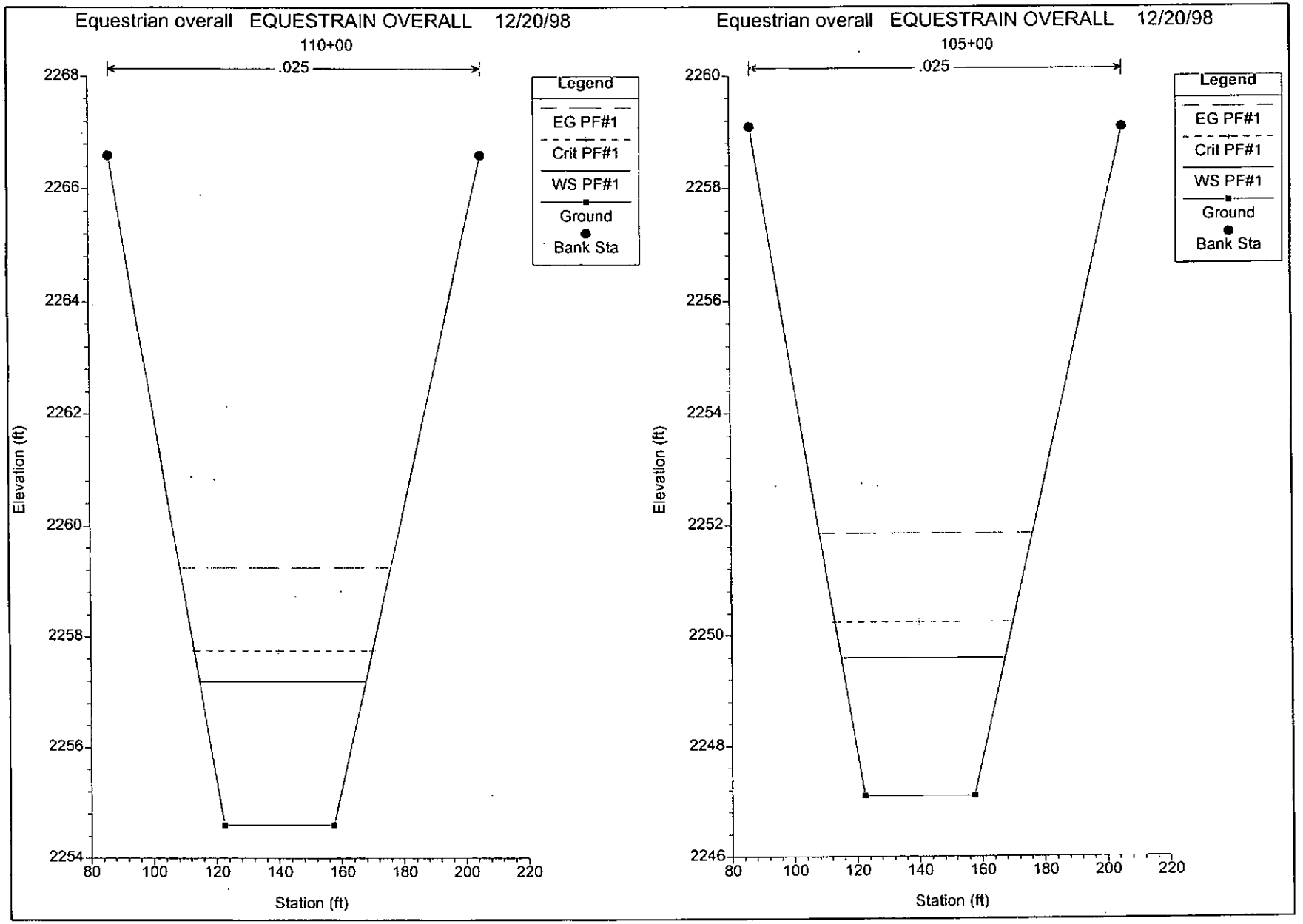

Equestrian overall EQUESTRAIN OVERALL 12/20/98
73+50
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2224
2222
2220
2218
2216
2214
2212
2210
80
100
120
140
160
180
200
Equestrian overall EQUESTRAIN OVERALL 12/20/98
67+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2220
2218
2216
2214
2212
2210
2208
2206
80
100
120
140
160
180
200

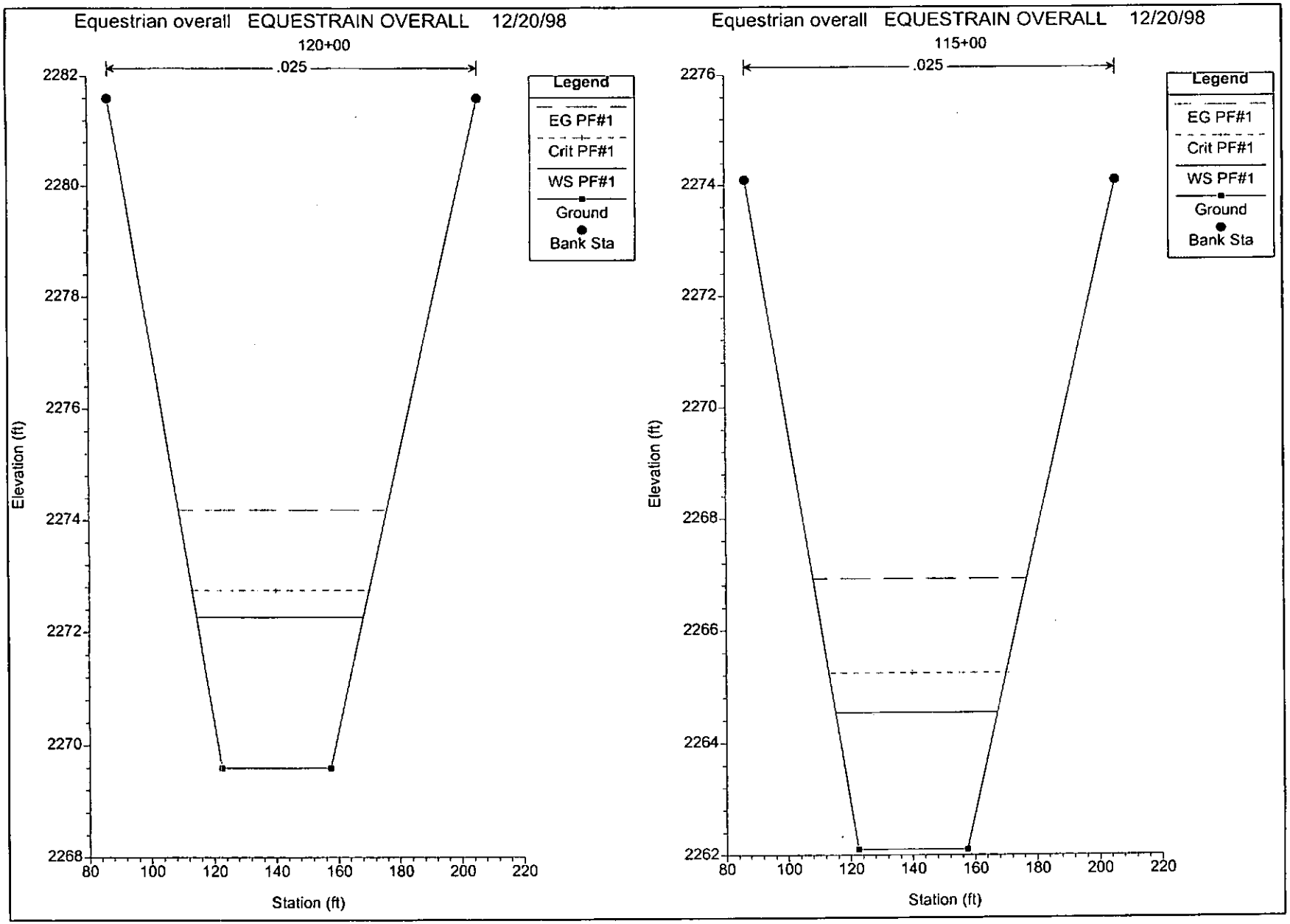

Equestrian overall EQUESTRAIN OVERALL 12/20/98
78+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2230
2228
2226
2224
2222
2220
2218
2216
2214
2212
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRAIN OVERALL 12/20/98
74+50
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2228
2226
2224
2222
2220
2218
2216
2214
2212
2210
80
100
120
140
160
180
200
220

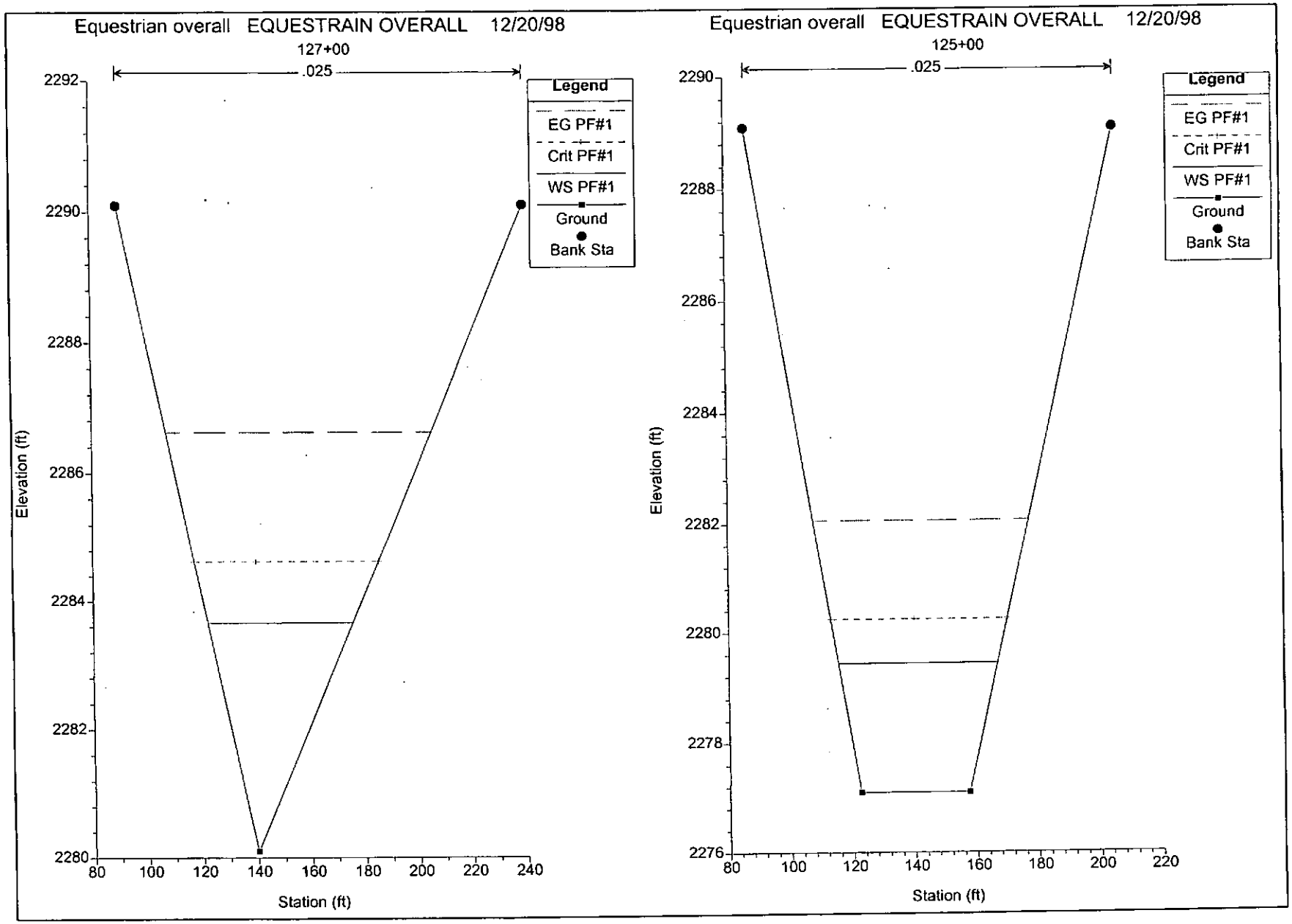

Equestrian overall EQUESTRAIN OVERALL 12/20/98
85+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2234
2232
2230
2228
2226
2224
2222
2220
2218
2216
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRAIN OVERALL 12/20/98
82+00
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2232
2230
2228
2226
2224
2222
2220
2218
2216
2214
80
100
120
140
160
180
200
220

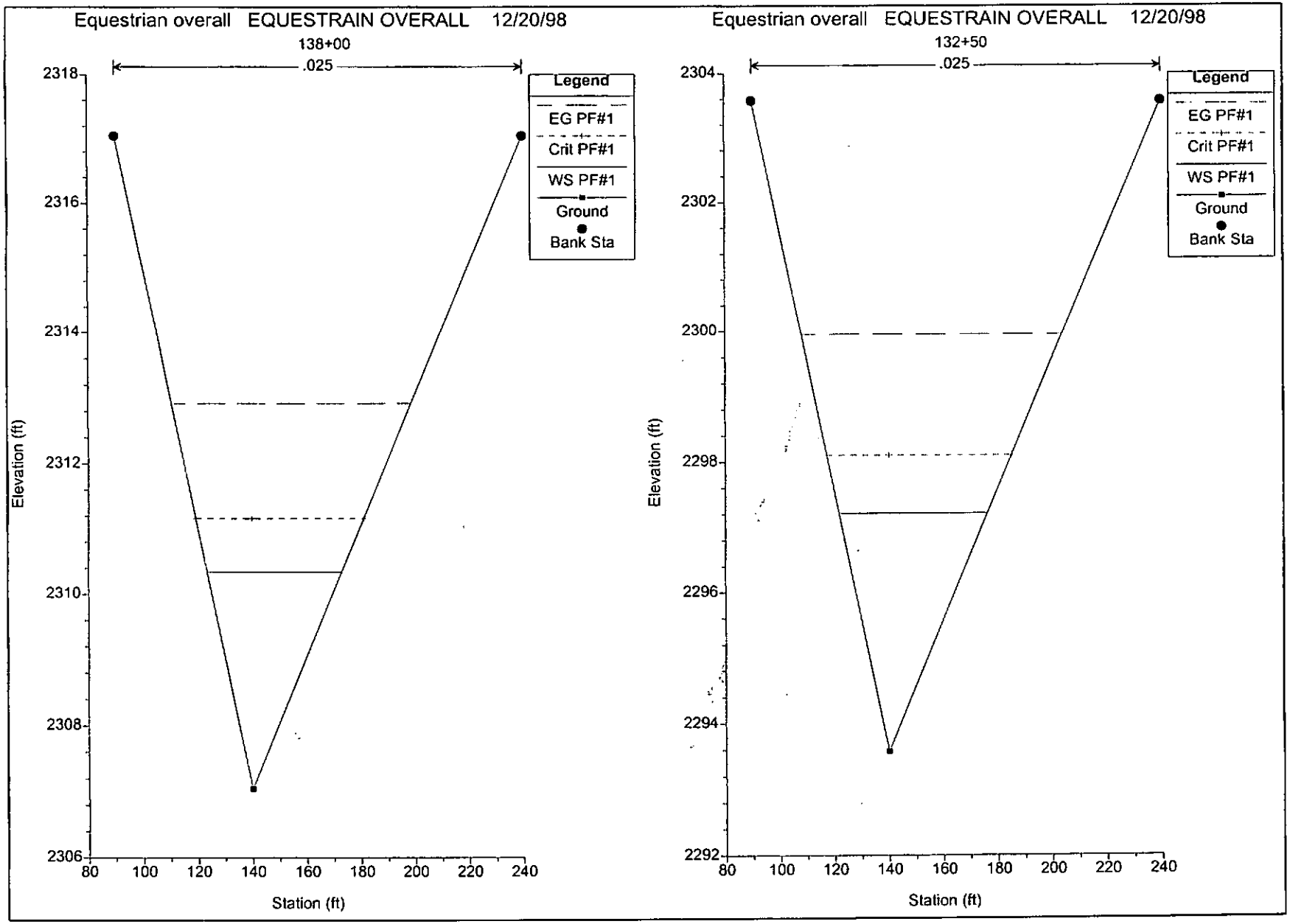

Equestrian overall EQUESTRAIN OVERALL 12/20/98
90+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2238
2236
2234
2232
2230
2228
2226
2224
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRAIN OVERALL 12/20/98
86+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2232
2230
2228
2226
2224
2222
2220
2218
80
100
120
140
160
180
200
220

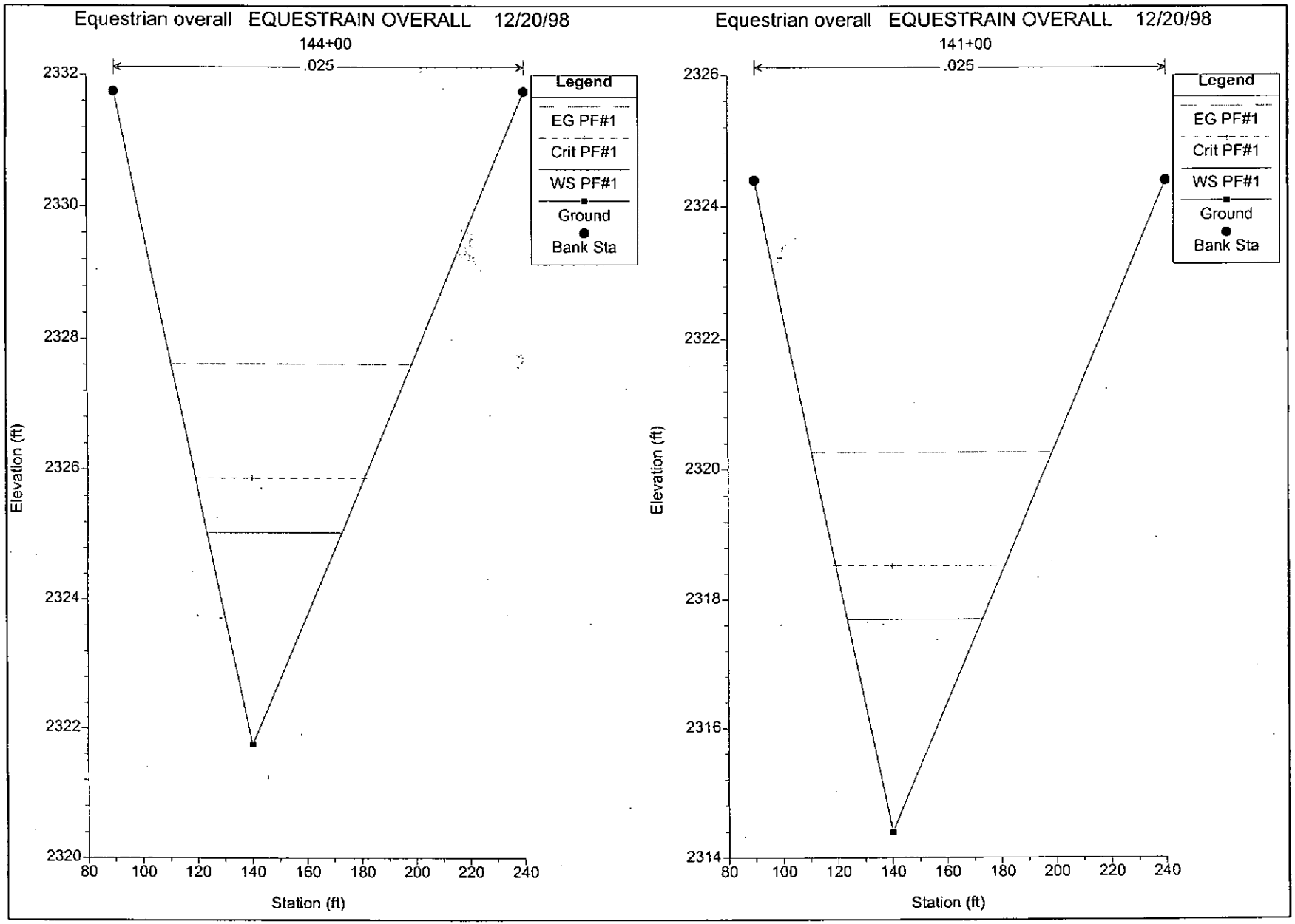

Equestrian overall EQUESTRAIN OVERALL 12/20/98
100+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2252
2250
2248
2246
2244
2242
2240
2238
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRAIN OVERALL 12/20/98
95+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2246
2244
2242
2240
2238
2236
2234
2232
80
100
120
140
160
180
200
220

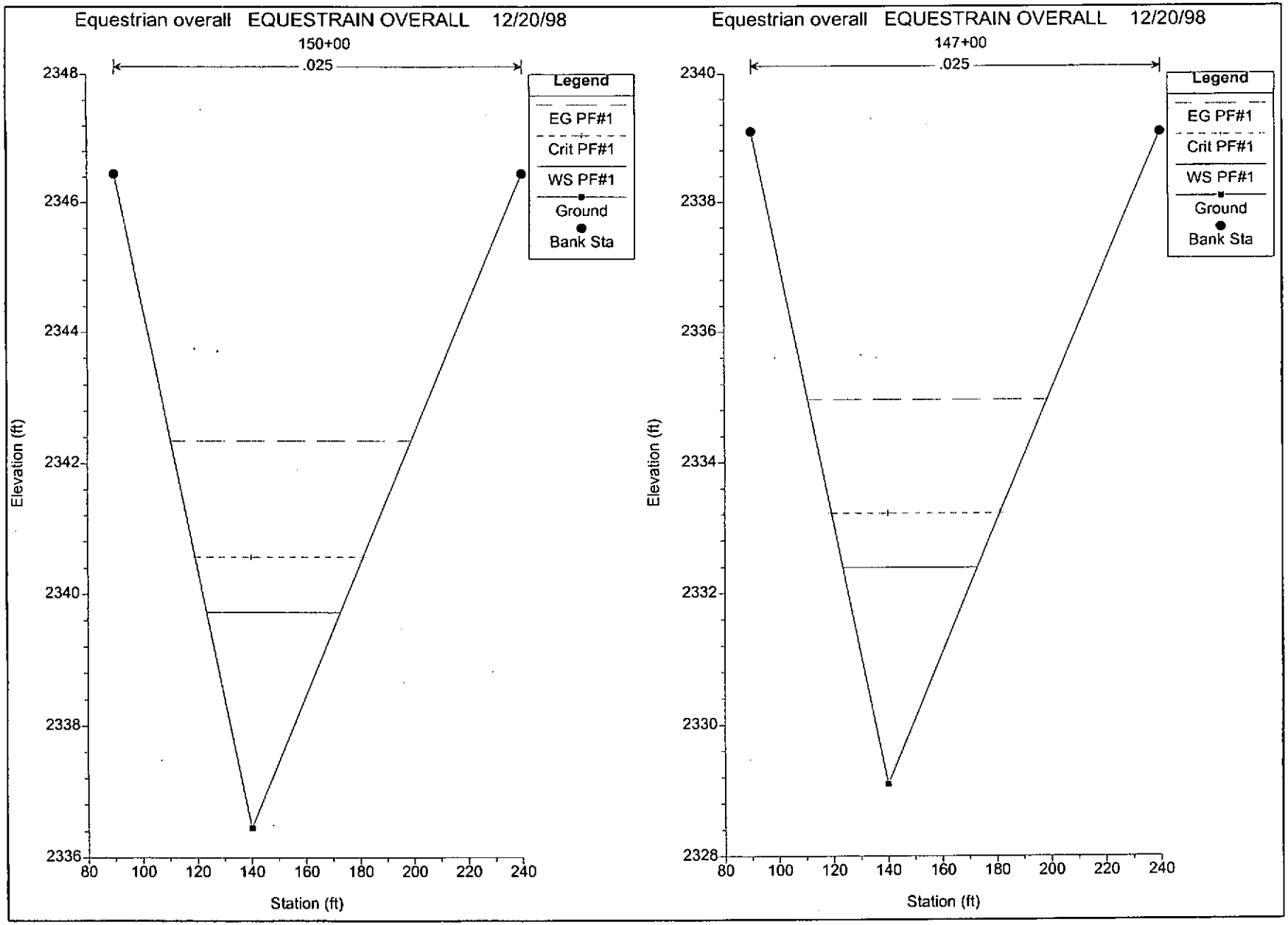

Equestrian overall EQUESTRAIN OVERALL 12/20/98
110+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2268
2266
2264
2262
2260
2258
2256
2254
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRAIN OVERALL 12/20/98
105+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2260
2258
2256
2254
2252
2250
2248
2246
80
100
120
140
160
180
200
220

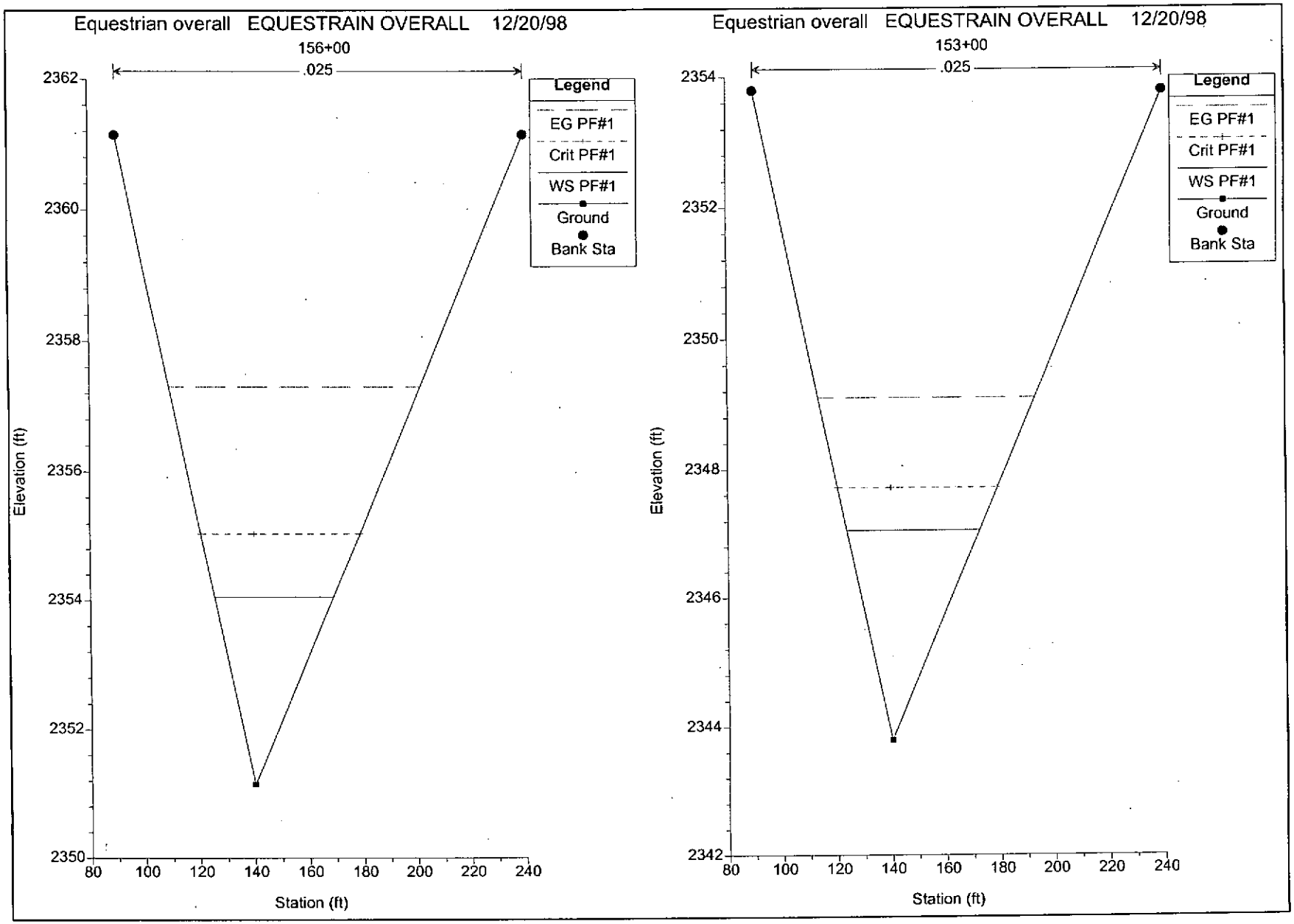

Equestrian overall EQUESTRAIN OVERALL 12/20/98
120+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2282
2280
2278
2276
2274
2272
2270
2268
80
100
120
140
160
180
200
220
Equestrian overall EQUESTRAIN OVERALL 12/20/98
115+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2276
2274
2272
2270
2268
2266
2264
2262
80
100
120
140
160
180
200
220

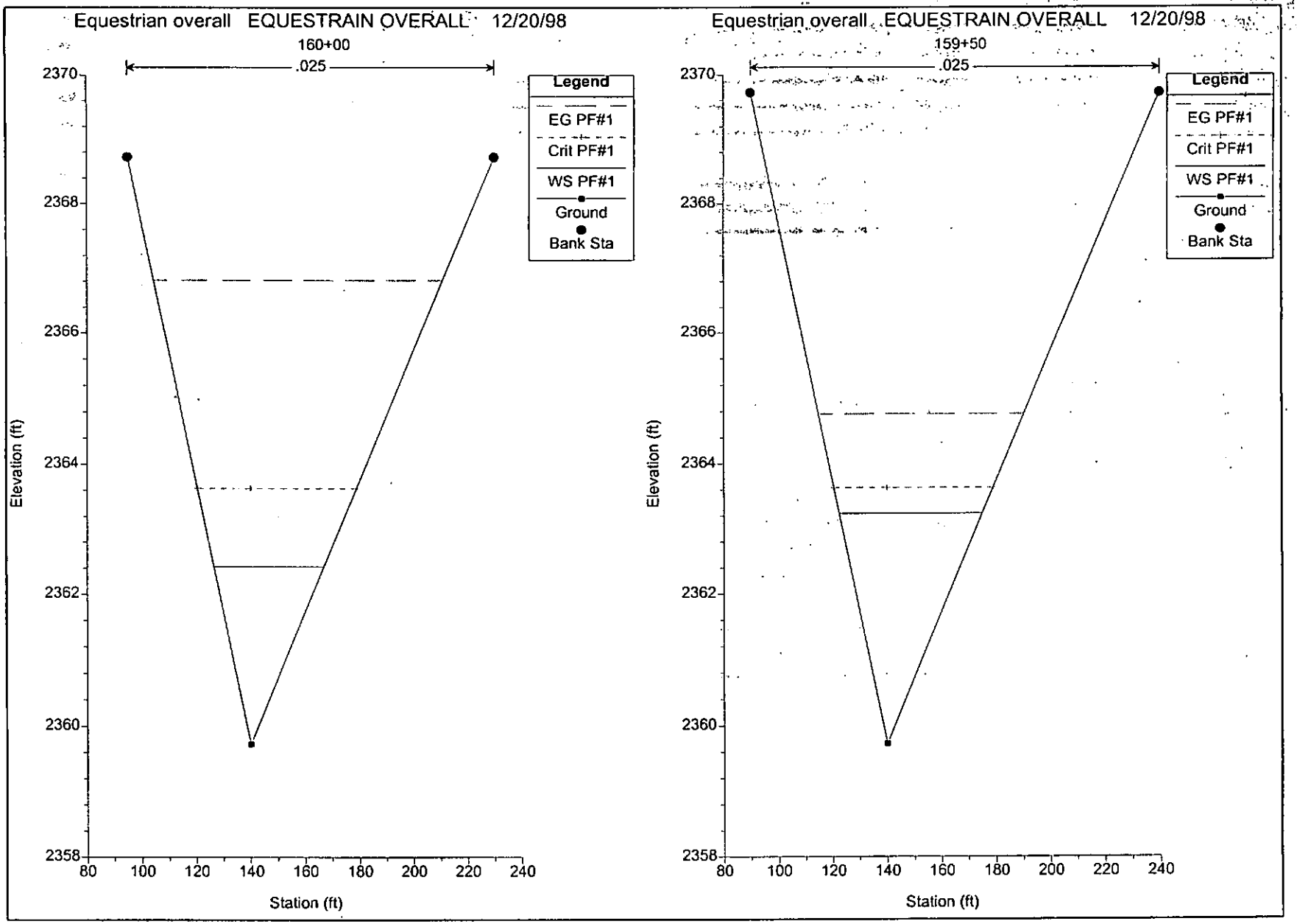

Equestrian overall EQUESTRAIN OVERALL 12/20/98
127+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2292
2290
2288
2286
2284
2282
2280
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRAIN OVERALL 12/20/98
125+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2290
2288
2286
2284
2282
2280
2278
2276
80
100
120
140
160
180
200
220

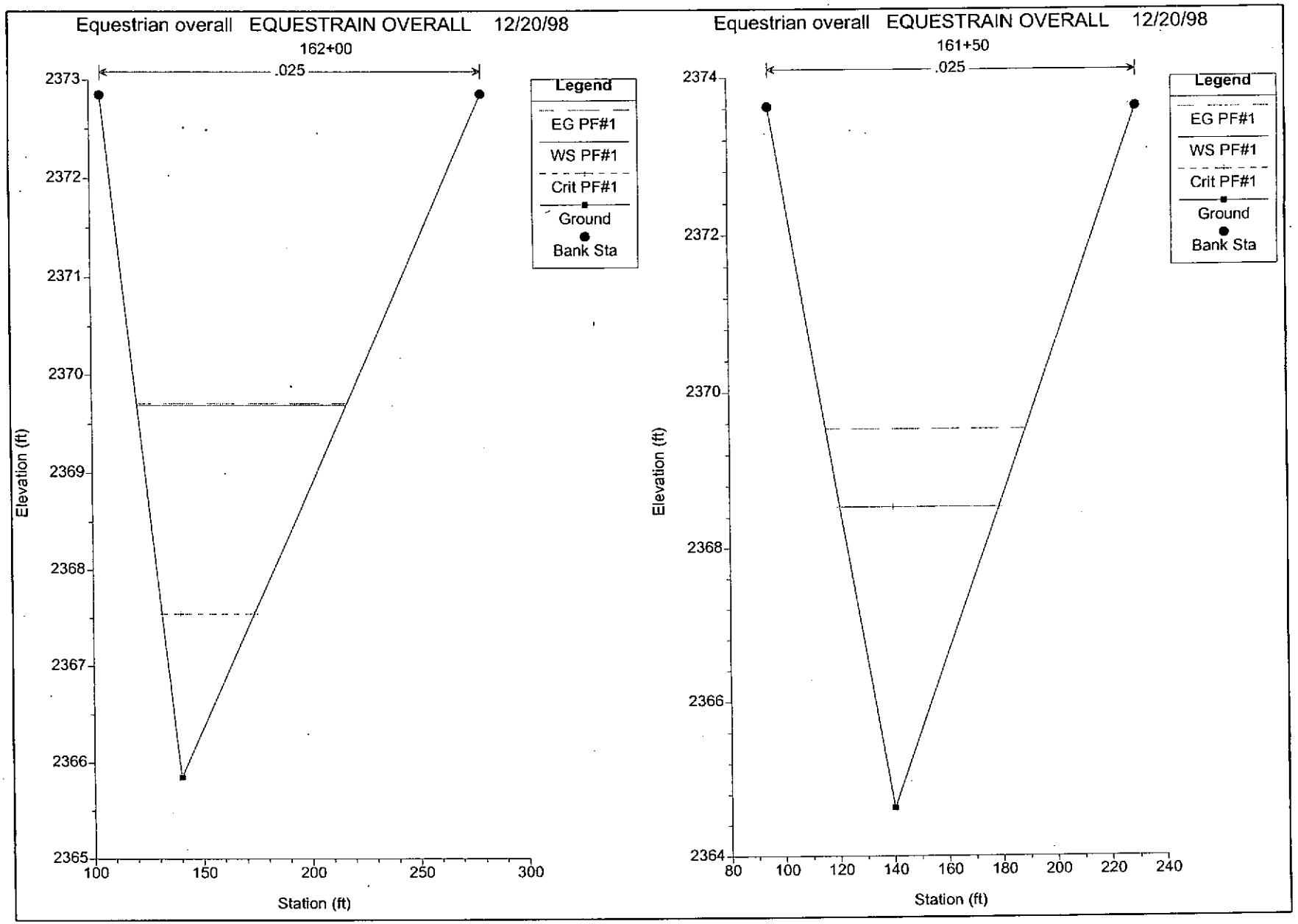

Equestrian overall EQUESTRAIN OVERALL 12/20/98
138+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2318
2316
2314
2312
2310
2308
2306
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRAIN OVERALL 12/20/98
132+50
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2304
2302
2300
2298
2296
2294
2292
80
100
120
140
160
180
200
220
240

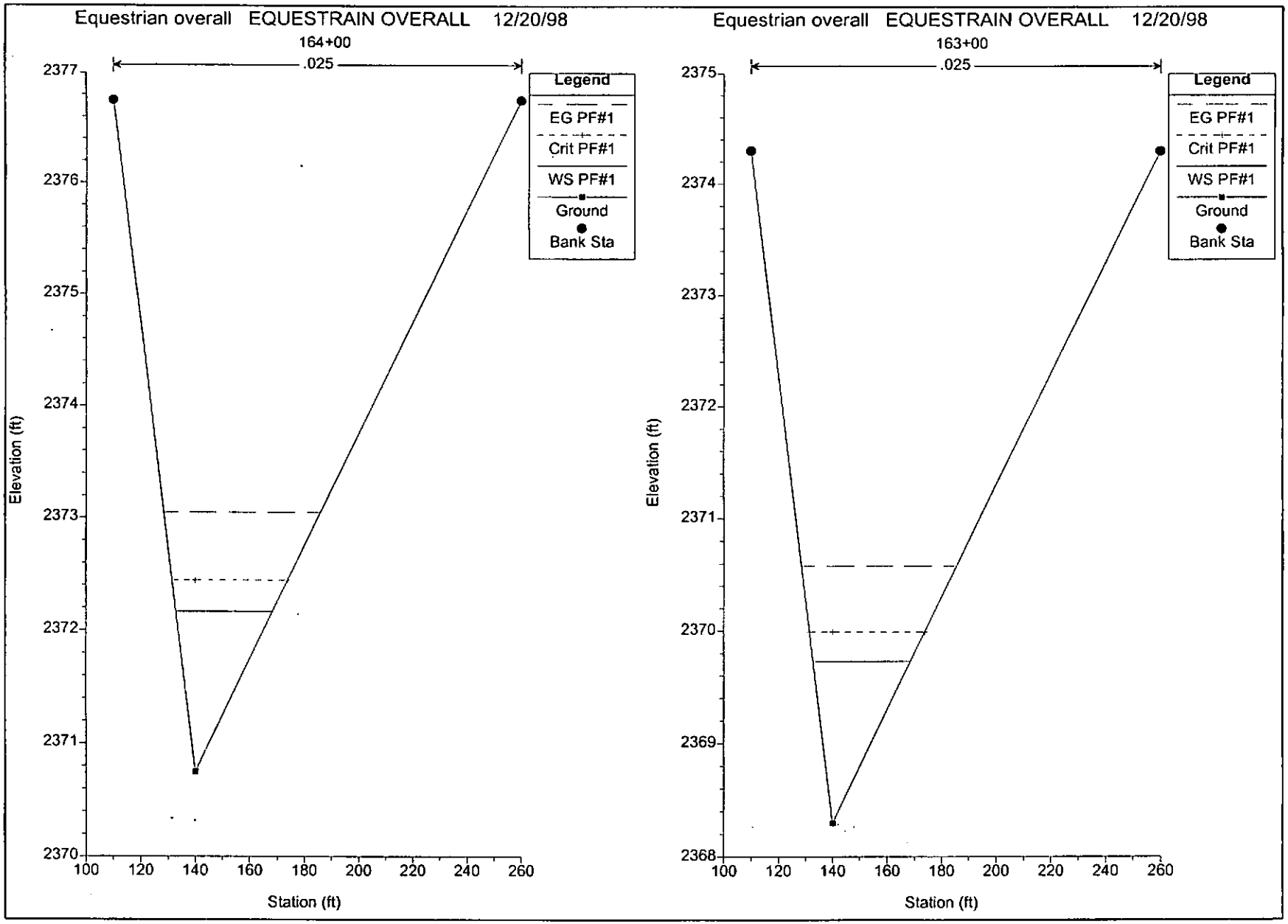

Equestrian overall EQUESTRAIN OVERALL 12/20/98
144+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2332
2330
2328
2326
2324
2322
2320
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRAIN OVERALL 12/20/98
141+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2326
2324
2322
2320
2318
2316
2314
80
100
120
140
160
180
200
220
240

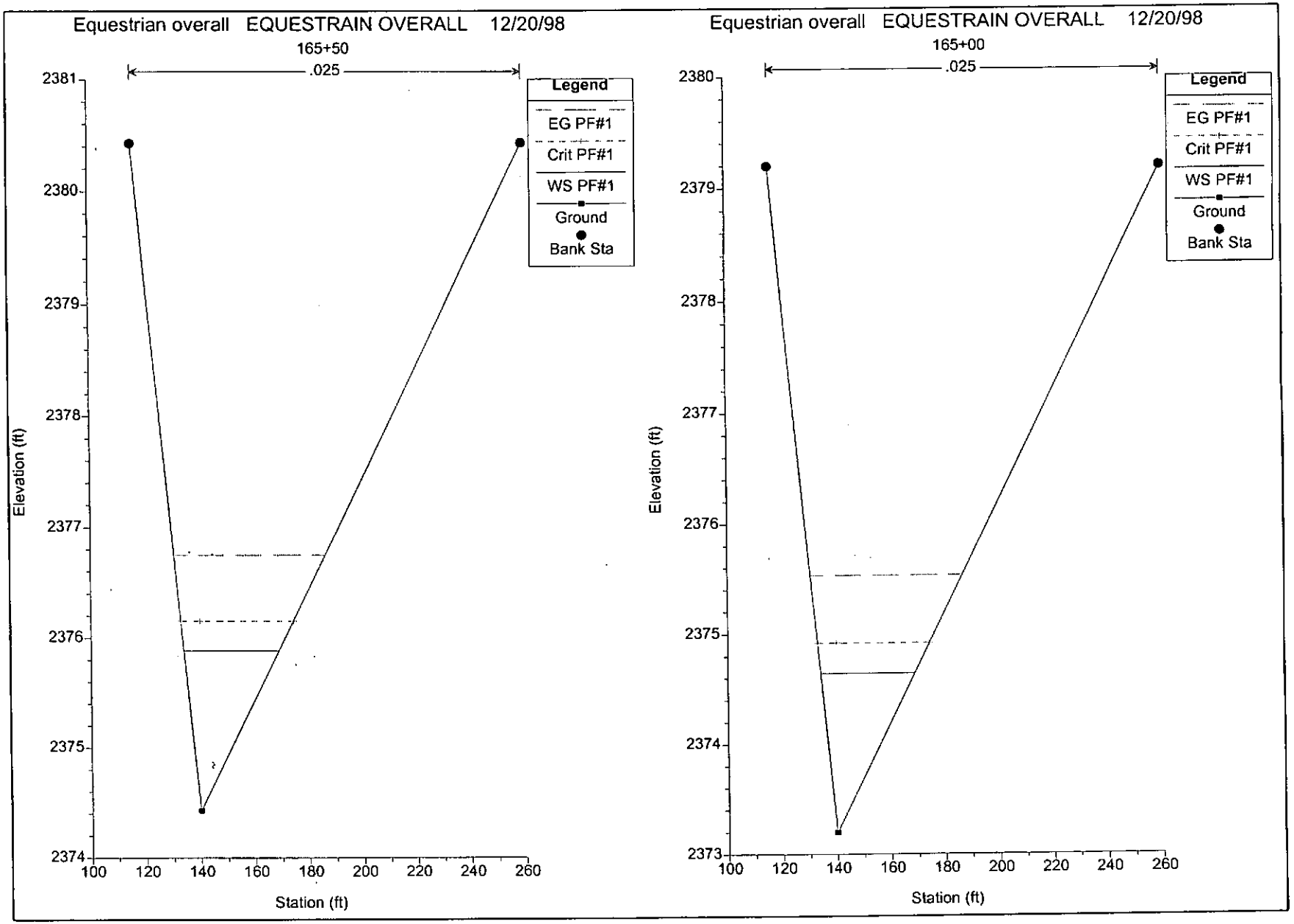

Equestrian overall EQUESTRAIN OVERALL 12/20/98
150+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2348
2346
2344
2342
2340
2338
2336
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRAIN OVERALL 12/20/98
147+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2340
2338
2336
2334
2332
2330
2328
80
100
120
140
160
180
200
220
240

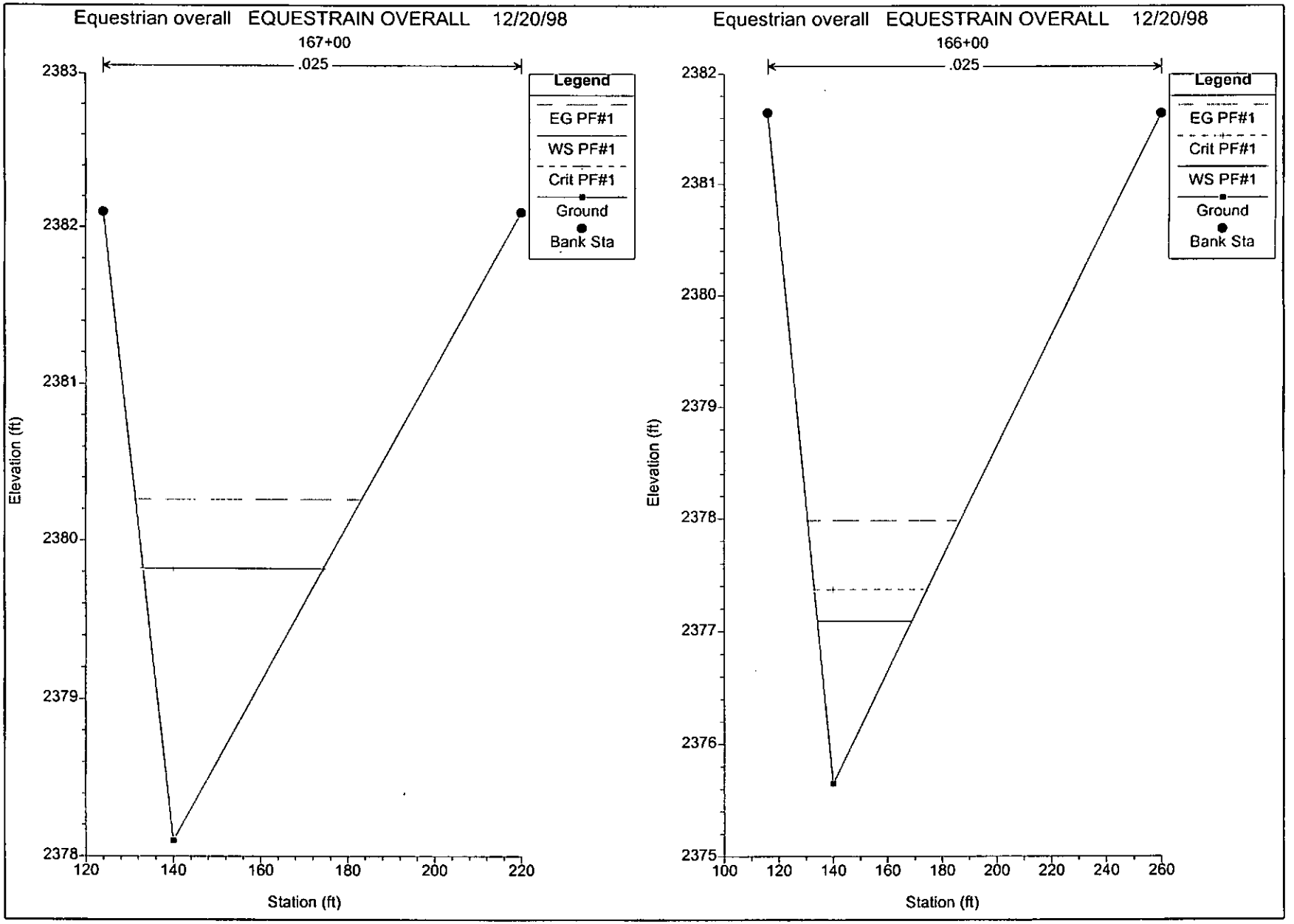

Equestrian overall EQUESTRAIN OVERALL 12/20/98
156+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2362
2360
2358
2356
2354
2352
2350
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRAIN OVERALL 12/20/98
153+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2354
2352
2350
2348
2346
2344
2342
80
100
120
140
160
180
200
220
240

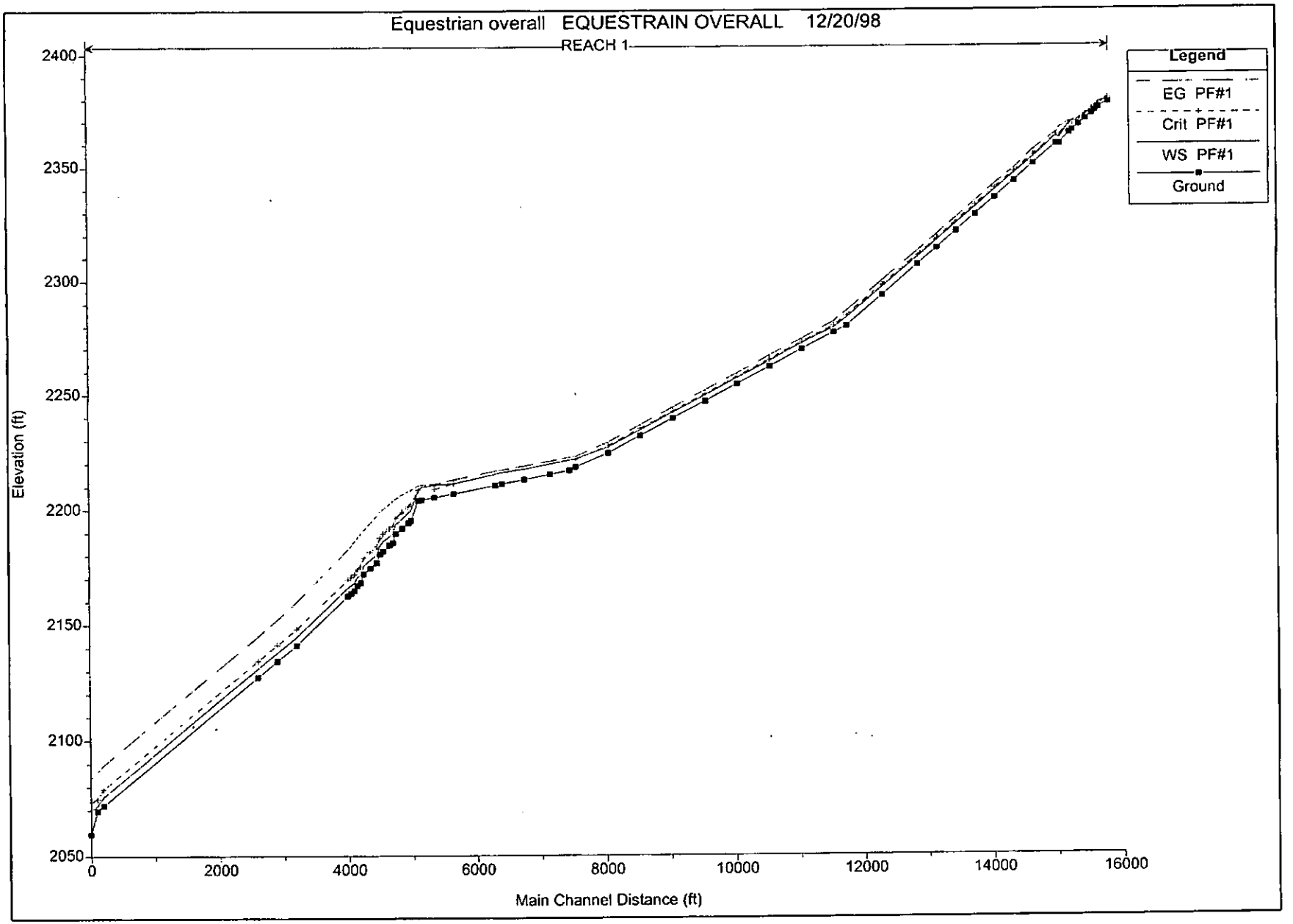

Equestrian overall EQUESTRAIN OVERALL 12/20/98
160+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2370
2368
2366
2364
2362
2360
2358
80
100
120
140
160
180
200
220
240
Equestrian overall EQUESTRAIN OVERALL 12/20/98
159+50
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2370
2368
2366
2364
2362
2360
2358
80
100
120
140
160
180
200
220
240


Equestrian overall EQUESTRAIN OVERALL 12/20/98
162+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2373
2372
2371
2370
2369
2368
2367
2366
2365
100
150
200
250
300
Equestrian overall EQUESTRAIN OVERALL 12/20/98
161+50
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2374
2372
2370
2368
2366
2364
80
100
120
140
160
180
200
220
240


Equestrian overall EQUESTRAIN OVERALL 12/20/98
164+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2377
2376
2375
2374
2373
2372
2371
2370
100
120
140
160
180
200
220
240
260
Equestrian overall EQUESTRAIN OVERALL 12/20/98
163+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2375
2374
2373
2372
2371
2370
2369
2368
100
120
140
160
180
200
220
240
260


Equestrian overall EQUESTRAIN OVERALL 12/20/98
165+50
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2381
2380
2379
2378
2377
2376
2375
2374
100
120
140
160
180
200
220
240
260
Equestrian overall EQUESTRAIN OVERALL 12/20/98
165+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2380
2379
2378
2377
2376
2375
2374
2373
100
120
140
160
180
200
220
240
260


Equestrian overall EQUESTRAIN OVERALL 12/20/98
167+00
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2383
2382
2381
2380
2379
2378
120
140
160
180
200
220
Equestrian overall EQUESTRAIN OVERALL 12/20/98
166+00
.025
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2382
2381
2380
2379
2378
2377
2376
2375
100
120
140
160
180
200
220
240
260


Equestrian overall EQUESTRAIN OVERALL 12/20/98
REACH 1
Legend
EG PF#1
Crit PF#1
WS PF#1
Ground
Elevation (ft)
2400
2350
2300
2250
2200
2150
2100
2050
0
2000
4000
6000
8000
10000
12000
14000
16000
Main Channel Distance (ft)

HEC-RAS Plan: OVERALLM River: REACH 1 Reach: REACH 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl	Max Chl Dpth	Top Width	LOB Elev	ROB Elev
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)
REACH 1	6150	1494.00	2204.15	2208.86	2208.86	2210.67	10.78	4.71	38.85	2214.15	2214.15
REACH 1	6037	3058.00	2195.53	2199.95	2202.57	2208.88	23.98	4.42	37.69	2205.53	2205.53
REACH 1	6000	3058.00	2194.61	2198.94	2201.65	2208.36	24.62	4.33	37.33	2204.61	2204.61
REACH 1	5900	3058.00	2192.16	2196.32	2199.20	2206.80	25.98	4.16	36.63	2202.16	2202.16
REACH 1	5800	3058.00	2189.71	2193.74	2196.75	2205.10	27.05	4.03	36.12	2199.71	2199.71
REACH 1	5750	3058.00	2185.88	2189.57	2192.92	2203.83	30.31	3.69	34.74	2195.88	2195.88
REACH 1	5700	3058.00	2184.86	2188.58	2191.90	2202.56	30.01	3.72	34.86	2194.86	2194.86
REACH 1	5600	3058.00	2182.21	2186.39	2189.70	2200.25	29.87	4.18	35.43	2192.21	2192.21
REACH 1	5550	3058.00	2180.98	2184.66	2188.02	2199.00	30.40	3.68	34.71	2190.98	2190.98
REACH 1	5500	3058.00	2177.15	2180.60	2184.19	2197.41	32.89	3.45	33.82	2187.15	2187.15
REACH 1	5400	3058.00	2174.70	2178.22	2181.74	2194.25	32.13	3.52	34.08	2184.70	2184.70
REACH 1	5300	3058.00	2172.25	2175.82	2179.29	2191.32	31.60	3.57	34.27	2182.25	2182.25
REACH 1	5250	3058.00	2168.42	2171.79	2175.46	2189.69	33.95	3.37	33.48	2178.42	2178.42
REACH 1	5200	3058.00	2167.26	2170.68	2174.30	2187.86	33.26	3.42	33.70	2177.26	2177.26
REACH 1	5100	3058.00	2164.95	2168.32	2171.99	2186.18	33.91	3.37	33.49	2174.95	2174.95
REACH 1	5050	3058.00	2163.80	2167.23	2170.84	2184.36	33.21	3.43	33.71	2173.80	2173.80
REACH 1	5000	3058.00	2162.64	2166.11	2169.68	2182.67	32.65	3.47	33.90	2172.64	2172.64
REACH 1	4200	3058.00	2141.22	2144.82	2148.26	2159.96	31.22	3.60	34.40	2151.22	2151.22
REACH 1	3900	3058.00	2134.30	2137.99	2141.34	2152.22	30.27	3.69	34.76	2144.30	2144.30
REACH 1	3600	3058.00	2127.38	2131.10	2134.44	2145.02	29.94	3.72	34.89	2137.38	2137.38
REACH 1	1200.	3058.00	2072.00	2075.74	2079.06	2089.50	29.76	3.74	34.96	2082.00	2082.00
REACH 1	1100	3058.00	2069.69	2071.94	2074.84	2086.41	30.52	2.25	49.01	2079.69	2079.69
REACH 1	1000	3058.00	2059.69	2069.83	2073.64	2083.55	29.72	10.14	20.00	2069.69	2069.69

REACH 1	14100	.1	.3
REACH 1	13800	.1	.3
REACH 1	13250	.1	.3
REACH 1	12700	.1	.3
REACH 1	12500	.1	.3
REACH 1	12000	.1	.3
REACH 1	11500	.1	.3
REACH 1	11000	.1	.3
REACH 1	10500	.1	.3
REACH 1	10000	.1	.3
REACH 1	9500	.1	.3
REACH 1	9000	.1	.3
REACH 1	8600	.1	.3
REACH 1	8500	.1	.3
REACH 1	8200	.1	.3
REACH 1	7800	.1	.3
REACH 1	7450	.1	.3
REACH 1	7350	.1	.3
REACH 1	6700	.1	.3
REACH 1	6400	.1	.3
REACH 1	6200	.1	.3
REACH 1	6150	.1	.3
REACH 1	6037	.1	.3

REACH 1	12500	.025	.025	.025
REACH 1	12000	.025	.025	.025
REACH 1	11500	.025	.025	.025
REACH 1	11000	.025	.025	.025
REACH 1	10500	.025	.025	.025
REACH 1	10000	.025	.025	.025
REACH 1	9500	.025	.025	.025
REACH 1	9000	.025	.025	.025
REACH 1	8600	.025	.025	.025
REACH 1	8500	.025	.025	.025
REACH 1	8200	.025	.025	.025
REACH 1	7800	.025	.025	.025
REACH 1	7450	.025	.025	.025
REACH 1	7350	.025	.025	.025
REACH 1	6700	.025	.025	.025
REACH 1	6400	.025	.025	.025
REACH 1	6200	.025	.025	.025
REACH 1	6150	.025	.025	.025
REACH 1	6037	.015	.015	.015

SUMMARY OF REACH LENGTHS

River: REACH 1

Reach	River Sta.	Left	Channel	Right
REACH 1	16700	150	150	150
REACH 1	16600	50	50	50
REACH 1	16550	50	50	50
REACH 1	16500	100	100	100
REACH 1	16400	100	100	100
REACH 1	16300	100	100	100
REACH 1	16200	50	50	50
REACH 1	16150	150	150	150
REACH 1	16000	50	50	50
REACH 1	15950	350	350	350
REACH 1	15600	300	300	300
REACH 1	15300	300	300	300
REACH 1	15000	300	300	300
REACH 1	14700	300	300	300
REACH 1	14400	300	300	300
REACH 1	14100	300	300	300
REACH 1	13800	550	550	550

Top Width (ft)	38.85	Top Width (ft)	38.85
Vel Total (ft/s)	10.78	Avg. Vel. (ft/s)	10.78
Max Chl Dpth (ft)	4.71	Hydr. Depth (ft)	3.57
Conv. Total (cfs)	18539.6	Conv. (cfs)	18539.6
Length Wtd. (ft)	113.00	Wetted Per. (ft)	41.07
Min Ch El (ft)	2204.15	Shear (lb/sq ft)	1.37
Alpha	1.00	Stream Power (lb/ft s)	14.75
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	0.49
C & E Loss (ft)	0.07	Cum SA (acres)	0.11

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6037

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2205.53	130	2195.53	150	2195.53	170	2205.53

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	37	37	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2202.59	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.75	Wt. n-Val.		0.025	
E.G. Elev (ft)	2210.95	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)		215.44	
E.G. Slope (ft/ft)	0.002286	Area (sq ft)		215.44	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	54.64	Top Width (ft)		54.64	
Vel Total (ft/s)	6.93	Avg. Vel. (ft/s)		6.93	
Max Chl Dpth (ft)	5.77	Hydr. Depth (ft)		3.94	
Conv. Total (cfs)	31249.4	Conv. (cfs)		31249.4	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		56.51	
Min Ch El (ft)	2204.43	Shear (lb/sq ft)		0.54	
Alpha	1.00	Stream Power (lb/ft s)		3.77	
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)		0.70	
C & E Loss (ft)	0.11	Cum SA (acres)		0.17	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6150

INPUT
Description:
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2214.15	130	2204.15	150	2204.15	170	2214.15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.025	110	.025	170	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	113	113	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2208.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.80	Wt. n-Val.		0.025	
E.G. Elev (ft)	2210:67	Reach Len. (ft)	113.00	113.00	113.00
Crit W.S. (ft)	2208.86	Flow Area (sq ft)		138.62	
E.G. Slope (ft/ft)	0.006494	Area (sq ft)		138.62	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
46	.025	46	.025	234	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	234	200	200	200 .1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2210.98				
Vel Head (ft)	0.35	Wt. n-Val.		0.025	
E.G. Elev (ft)	2211.33	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)		315.13	
E.G. Slope (ft/ft)	0.001319	Area (sq ft)		315.13	
Q Total (cfs).	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	96.04	Top Width (ft)		96.04	
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		4.74	
Max Chl Dpth (ft)	5.43	Hydr. Depth (ft)		3.28	
Conv. Total (cfs)	41138.6	Conv. (cfs)		41138.6	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		96.81	
Min Ch El (ft)	2205.55	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)		1.27	
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)		1.91	
C & E Loss (ft)	0.04	Cum SA (acres)		0.51	

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6200

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
94	2216.43	130	2204.43	150	2204.43	186	2216.43

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
94	.025	94	.025	186	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
94	186	50	50	50 .1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2210.20				

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
94	186	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2211.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.60	Wt. n-Val.		0.025	
E.G. Elev (ft)	2213.22	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2211.63	Flow Area (sq ft)		147.31	
E.G. Slope (ft/ft)	0.006527	Area (sq ft)		147.31	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	46.56	Top Width (ft)		46.56	
Vel Total (ft/s)	10.14	Avg. Vel. (ft/s)		10.14	
Max Chl Dpth (ft)	4.43	Hydr. Depth (ft)		3.16	
Conv. Total (cfs)	18492.1	Conv. (cfs)		18492.1	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		48.00	
Min Ch El (ft)	2207.20	Shear (lb/sq ft)		1.25	
Alpha	1.00	Stream Power (lb/ft s)		12.68	
Frctn Loss (ft)	0.75	Cum Volume (acre-ft)		3.51	
C & E Loss (ft)	0.37	Cum SA (acres)		1.00	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6400

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
46	2217.55	130	2205.55	150	2205.55	234	2217.55

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
94	2222.78	130	2210.78	150	2210.78	186	2222.78

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
94	.025	94	.025	186	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
94	186	650	650	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2215.58	Element		0.025	
Vel Head (ft)	1.27	Wt. n-Val.			
E.G. Elev (ft)	2216.85	Reach Len. (ft)	650.00	650.00	650.00
Crit W.S. (ft)		Flow Area (sq ft)		165.23	
E.G. Slope (ft/ft)	0.004748	Area (sq ft)		165.23	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	48.81	Top Width (ft)		48.81	
Vel Total (ft/s)	9.04	Avg. Vel. (ft/s)		9.04	
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)		3.38	
Conv. Total (cfs)	21680.8	Conv. (cfs)		21680.8	
Length Wtd. (ft)	650.00	Wetted Per. (ft)		50.37	
Min Ch El (ft)	2210.78	Shear (lb/sq ft)		0.97	
Alpha	1.00	Stream Power (lb/ft s)		8.79	
Frctn Loss (ft)	3.60	Cum Volume (acre-ft)		5.84	
C & E Loss (ft)	0.03	Cum SA (acres)		1.72	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6700

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
94	2219.2	130	2207.2	150	2207.2	186	2219.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
94	.025	94	.025	186	.025

C & E Loss (ft)	0.10	Cum SA (acres)	2.26

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 7450

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2227.33	130	2211.33	150	2211.33	214	2227.33

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	100	100	105	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2216.29	Wt. n-Val.		0.025	
Vel Head (ft)	1.01	Reach Len. (ft)	100.00	100.00	105.00
E.G. Elev (ft)	2217.30	Flow Area (sq ft)		185.34	
Crit W.S. (ft)		Area (sq ft)		185.34	
E.G. Slope (ft/ft)	0.003741	Flow (cfs)		1494.00	
Q Total (cfs)	1494.00	Top Width (ft)		54.72	
Top Width (ft)	54.72	Avg. Vel. (ft/s)		8.06	
Vel Total (ft/s)	8.06	Hydr. Depth (ft)		3.39	
Max Chl Dpth (ft)	4.96	Conv. (cfs)		24424.9	
Conv. Total (cfs)	24424.9	Wetted Per. (ft)		56.14	
Length Wtd. (ft)	100.00	Shear (lb/sq ft)		0.77	
Min Ch El (ft)	2211.33	Stream Power (lb/ft s)		6.22	
Alpha	1.00	Cum Volume (acre-ft)		6.24	
Frctn Loss (ft)	0.42	Cum SA (acres)		1.83	
C & E Loss (ft)	0.03				

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 7350

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Top Width (ft)	51.06	Top Width (ft)	51.06
Vel Total (ft/s)	9.12	Avg. Vel. (ft/s)	9.12
Max Chl Dpth (ft)	4.44	Hydr. Depth (ft)	3.09
Conv. Total (cfs)	19543.4	Conv. (cfs)	19543.4
Length Wtd. (ft)	400.00	Wetted Per. (ft)	52.32
Min Ch El (ft)	2215.45	Shear (lb/sq ft)	1.02
Alpha	1.00	Stream Power (lb/ft s)	9.29
Frctn Loss (ft)	2.21	Cum Volume (acre-ft)	9.05
C & E Loss (ft)	0.00	Cum SA (acres)	2.73

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 7800

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2229.25	130	2213.25	150	2213.25	214	2229.25

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	350	350	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2217.65	Wt. n-Val.		0.025	
Vel Head (ft)	1.32	Reach Len. (ft)	350.00	350.00	350.00
E.G. Elev (ft)	2218.97	Flow Area (sq ft)		155.76	
Crit W.S. (ft)		Area (sq ft)		155.76	
E.G. Slope (ft/ft)	0.005596	Flow (cfs)		1438.00	
Q Total (cfs)	1438.00	Top Width (ft)		50.80	
Top Width (ft)	50.80	Avg. Vel. (ft/s)		9.23	
Vel Total (ft/s)	9.23	Hydr. Depth (ft)		3.07	
Max Chl Dpth (ft)	4.40	Conv. (cfs)		19222.8	
Conv. Total (cfs)	19222.8	Wetted Per. (ft)		52.05	
Length Wtd. (ft)	350.00	Shear (lb/sq ft)		1.05	
Min Ch El (ft)	2213.25	Stream Power (lb/ft s)		9.65	
Alpha	1.00	Cum Volume (acre-ft)		7.61	
Frctn Loss (ft)	1.58				

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2221.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.03	Wt. n-Val.		0.025	
E.G. Elev (ft)	2222.64	Reach Len. (ft)	302.00	300.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)		161.63	
E.G. Slope (ft/ft)	0.004225	Area (sq ft)		161.63	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	51.60	Top Width (ft)		51.60	
Vel Total (ft/s)	8.14	Avg. Vel. (ft/s)		8.14	
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)		3.13	
Conv. Total (cfs)	20230.4	Conv. (cfs)		20230.4	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		52.89	
Min Ch El (ft)	2217.10	Shear (lb/sq ft)		0.81	
Alpha	1.00	Stream Power (lb/ft s)		6.56	
Frctn Loss (ft)	1.44	Cum Volume (acre-ft)		10.15	
C & E Loss (ft)	0.03	Cum SA (acres)		3.08	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 8200

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2231.45	130	2215.45	150	2215.45	214	2231.45

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	400	400	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2219.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.29	Wt. n-Val.		0.025	
E.G. Elev (ft)	2221.18	Reach Len. (ft)	400.00	400.00	400.00
Crit W.S. (ft)		Flow Area (sq ft)		157.63	
E.G. Slope (ft/ft)	0.005414	Area (sq ft)		157.63	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2230.6	122.5	2218.6	157.5	2218.6	205.5	2230.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2222.12	Element		0.025	
Vel Head (ft)	0.97	Wt. n-Val.			
E.G. Elev (ft)	2223.09	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		166.71	
E.G. Slope (ft/ft)	0.004575	Area (sq ft)		166.71	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	59.66	Top Width (ft)		59.66	
Vel Total (ft/s)	7.89	Avg. Vel. (ft/s)		7.89	
Max Chl Dpth (ft)	3.52	Hydr. Depth (ft)		2.79	
Conv. Total (cfs)	19441.3	Conv. (cfs)		19441.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		60.66	
Min Ch El (ft)	2218.60	Shear (lb/sq ft)		0.78	
Alpha	1.00	Stream Power (lb/ft s)		6.19	
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)		10.53	
C & E Loss (ft)	0.01	Cum SA (acres)		3.21	

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 8500

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2233.1	130	2217.1	150	2217.1	214	2233.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	302	300	300	.1	.3

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2236.6	122.5	2224.6	157.5	2224.6	205.5	2236.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2227.75	Element			
Vel Head (ft)	1.28	Wt. n-Val.		0.025	
E.G. Elev (ft)	2229.03	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2227.75	Flow Area (sq ft)		144.69	
E.G. Slope (ft/ft)	0.006896	Area (sq ft)		144.69	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	57.02	Top Width (ft)		57.02	
Vel Total (ft/s)	9.09	Avg. Vel. (ft/s)		9.09	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	15835.3	Conv. (cfs)		15835.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		57.91	
Min Ch El (ft)	2224.60	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		9.78	
Frctn Loss (ft)	2.78	Cum Volume (acre-ft)		12.31	
C & E Loss (ft)	0.09	Cum SA (acres)		3.88	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 8600

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2244.1	122.5	2232.1	157.2	2232.1	205.5	2244.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2235.26	Element			
Vel Head (ft)	1.28	Wt. n-Val.		0.025	
E.G. Elev (ft)	2236.54	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2235.26	Flow Area (sq ft)		144.76	
E.G. Slope (ft/ft)	0.006868	Area (sq ft)		144.76	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	56.90	Top Width (ft)		56.90	
Vel Total (ft/s)	9.08	Avg. Vel. (ft/s)		9.08	
Max Chl Dpth (ft)	3.16	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	15867.8	Conv. (cfs)		15867.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		57.80	
Min Ch El (ft)	2232.10	Shear (lb/sq ft)		1.07	
Alpha	1.00	Stream Power (lb/ft s)		9.75	
Frctn Loss (ft)	3.44	Cum Volume (acre-ft)		13.97	
C & E Loss (ft)	0.00	Cum SA (acres)		4.53	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 9000

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2251.6	122.5	2239.6	157.5	2239.6	205.5	2251.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2242.74	Element			
Vel Head (ft)	1.29	Wt. n-Val.		0.025	
E.G. Elev (ft)	2244.03	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2242.74	Flow Area (sq ft)		144.50	
E.G. Slope (ft/ft)	0.006923	Area (sq ft)		144.50	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	56.99	Top Width (ft)		56.99	
Vel Total (ft/s)	9.10	Avg. Vel. (ft/s)		9.10	
Max Chl Dpth (ft)	3.14	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	15804.3	Conv. (cfs)		15804.3	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		57.89	
Min Ch El (ft)	2239.60	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		9.82	
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)		15.63	
C & E Loss (ft)	0.00	Cum SA (acres)		5.18	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 9500

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2259.1	122.5	2247.1	157.5	2247.1	205.5	2259.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2250.25	Element			
Vel Head (ft)	1.28	Wt. n-Val.		0.025	
E.G. Elev (ft)	2251.53	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2250.25	Flow Area (sq ft)		144.71	
E.G. Slope (ft/ft)	0.006894	Area (sq ft)		144.71	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	57.02	Top Width (ft)		57.02	
Vel Total (ft/s)	9.09	Avg. Vel. (ft/s)		9.09	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	15837.5	Conv. (cfs)		15837.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		57.91	
Min Ch El (ft)	2247.10	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		9.77	
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)		17.29	
C & E Loss (ft)	0.00	Cum SA (acres)		5.84	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 10000

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2266.6	122.5	2254.6	157.5	2254.6	205.5	2266.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2257.75	Element			
Vel Head (ft)	1.28	Wt. n-Val.		0.025	
E.G. Elev (ft)	2259.03	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2257.75	Flow Area (sq ft)		144.71	
E.G. Slope (ft/ft)	0.006894	Area (sq ft)		144.71	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	57.02	Top Width (ft)		57.02	
Vel Total (ft/s)	9.09	Avg. Vel. (ft/s)		9.09	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		2.54	
Conv. Total (cfs)	15837.5	Conv. (cfs)		15837.5	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		57.91	
Min Ch El (ft)	2254.60	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		9.77	
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)		18.96	
C & E Loss (ft)	0.00	Cum SA (acres)		6.49	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 10500

INPUT
Description: EARTHEN CHANNEL WITH RIP-RAP

HEC-RAS Version 2.1 October 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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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: Equestrian overall
Project File : eqcoall.prj
Run Date and Time: 12/20/98 3:13:58 PM

Project in English units

Project Description:
Overall HecRas evaluations

FLOW DATA

Flow Title: ESQUESTRAIN CHANNEL 2
Flow File : j:\1002005\lomr\eqcoall.f01

Flow Data (cfs)

River	Reach	RS	PF#1
REACH 1	REACH 1	16700	189
REACH 1	REACH 1	16150	915
REACH 1	REACH 1	15000	1046
REACH 1	REACH 1	13250	1315
REACH 1	REACH 1	8200	1438
REACH 1	REACH 1	7450	1494
REACH 1	REACH 1	6037	3058

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
REACH 1	REACH 1	PF#1	Critical	Critical

GEOMETRY DATA

Geometry Title: EQUESTRAIN OVERALL
Geometry File : j:\1002005\lomr\eqcoall.g02

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16700

INPUT
Description: 167+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
124	2382.1	140	2378.1	220	2382.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
124	.025	124	.025	220	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
124	220	150	150	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2379.82	Element			
Vel Head (ft)	0.44	Wt. n-Val.		0.025	
E.G. Elev (ft)	2380.26	Reach Len. (ft)	150.00	150.00	150.00
Crit W.S. (ft)	2379.82	Flow Area (sq ft)		35.58	
E.G. Slope (ft/ft)	0.009832	Area (sq ft)		35.58	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	41.33	Top Width (ft)		41.33	
Vel Total (ft/s)	5.31	Avg. Vel. (ft/s)		5.31	
Max Chl Dpth (ft)	1.72	Hydr. Depth (ft)		0.86	
Conv. Total (cfs)	1906.1	Conv. (cfs)		1906.1	
Length Wtd. (ft)	150.00	Wetted Per. (ft)		41.58	
Min Ch El (ft)	2378.10	Shear (lb/sq ft)		0.53	
Alpha	1.00	Stream Power (lb/ft s)		2.79	
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)		40.24	
C & E Loss (ft)	0.00	Cum SA (acres)		16.88	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16600

INPUT
Description: 166+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev

116	2381.65	140	2375.65	260	2381.65

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
116	.025	116	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
116	260	50	50	50 .1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2377.09	Element			
Vel Head (ft)	0.89	Wt. n-Val.		0.025	
E.G. Elev (ft)	2377.98	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2377.37	Flow Area (sq ft)		24.97	
E.G. Slope (ft/ft)	0.025268	Area (sq ft)		24.97	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	34.62	Top Width (ft)		34.62	
Vel Total (ft/s)	7.57	Avg. Vel. (ft/s)		7.57	
Max Chl Dpth (ft)	1.44	Hydr. Depth (ft)		0.72	
Conv. Total (cfs)	1189.0	Conv. (cfs)		1189.0	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		34.84	
Min Ch El (ft)	2375.65	Shear (lb/sq ft)		1.13	
Alpha	1.00	Stream Power (lb/ft s)		8.56	
Frctn Loss (ft)	2.24	Cum Volume (acre-ft)		40.14	
C & E Loss (ft)	0.04	Cum SA (acres)		16.75	

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16550

INPUT
Description: 165+50
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
116	2380.43	140	2374.43	260	2380.43

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
116	.025	116	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
116	260	50	50	50 .1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2375.88	Element			
Vel Head (ft)	0.86	Wt. n-Val.		0.025	
E.G. Elev (ft)	2376.75	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2376.15	Flow Area (sq ft)		25.33	
E.G. Slope (ft/ft)	0.024331	Area (sq ft)		25.33	
Q Total (cfs)	189.00	Flow (cfs)		189.00	

Top Width (ft)	34.87	Top Width (ft)	34.87
Vel Total (ft/s)	7.46	Avg. Vel. (ft/s)	7.46
Max Chl Dpth (ft)	1.45	Hydr. Depth (ft)	0.73
Conv. Total (cfs)	1211.7	Conv. (cfs)	1211.7
Length Wtd. (ft)	50.00	Wetted Per. (ft)	35.08
Min Ch El (ft)	2374.43	Shear (lb/sq ft)	1.10
Alpha	1.00	Stream Power (lb/ft s)	8.18
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	40.11
C & E Loss (ft)	0.01	Cum SA (acres)	16.71

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16500

INPUT
Description: 165+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
116	2379.2	140	2373.2	260	2379.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
116	.025	116	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
116	260	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2374.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.89	Wt. n-Val.		0.025	
E.G. Elev (ft)	2375.53	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2374.92	Flow Area (sq ft)		25.01	
E.G. Slope (ft/ft)	0.025177	Area (sq ft)		25.01	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	34.65	Top Width (ft)		34.65	
Vel Total (ft/s)	7.56	Avg. Vel. (ft/s)		7.56	
Max Chl Dpth (ft)	1.44	Hydr. Depth (ft)		0.72	
Conv. Total (cfs)	1191.1	Conv. (cfs)		1191.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		34.86	
Min Ch El (ft)	2373.20	Shear (lb/sq ft)		1.13	
Alpha	1.00	Stream Power (lb/ft s)		8.52	
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)		40.08	
C & E Loss (ft)	0.00	Cum SA (acres)		16.67	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16400

INPUT
Description: 164+00

Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
110	2376.75	140	2370.75	260	2376.75

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.025	110	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	260	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2372.17	Element			
Vel Head (ft)	0.88	Wt. n-Val.		0.025	
E.G. Elev (ft)	2373.05	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2372.44	Flow Area (sq ft)		25.09	
E.G. Slope (ft/ft)	0.025606	Area (sq ft)		25.09	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	35.42	Top Width (ft)		35.42	
Vel Total (ft/s)	7.53	Avg. Vel. (ft/s)		7.53	
Max Chl Dpth (ft)	1.42	Hydr. Depth (ft)		0.71	
Conv. Total (cfs)	1181.1	Conv. (cfs)		1181.1	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		35.59	
Min Ch El (ft)	2370.75	Shear (lb/sq ft)		1.13	
Alpha	1.00	Stream Power (lb/ft s)		8.49	
Frctn Loss (ft)	2.50	Cum Volume (acre-ft)		40.02	
C & E Loss (ft)	0.01	Cum SA (acres)		16.59	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16300

INPUT
Description: 163+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
110	2374.3	140	2368.3	260	2374.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.025	110	.025	260	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	260	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2369.73	Element			
Vel Head (ft)	0.85	Wt. n-Val.		0.025	
E.G. Elev (ft)	2370.58	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2369.99	Flow Area (sq ft)		25.52	
E.G. Slope (ft/ft)	0.024483	Area (sq ft)		25.52	
Q Total (cfs)	189.00	Flow (cfs)		189.00	

Top Width (ft)	35.72	Top Width (ft)	35.72
Vel Total (ft/s)	7.41	Avg. Vel. (ft/s)	7.41
Max Chl Dpth (ft)	1.43	Hydr. Depth (ft)	0.71
Conv. Total (cfs)	1207.9	Conv. (cfs)	1207.9
Length Wtd. (ft)	100.00	Wetted Per. (ft)	35.89
Min Ch El (ft)	2368.30	Shear (lb/sq ft)	1.09
Alpha	1.00	Stream Power (lb/ft s)	8.05
Frctn Loss (ft)	2.47	Cum Volume (acre-ft)	39.96
C & E Loss (ft)	0.01	Cum SA (acres)	16.51

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16200

INPUT
Description: 162+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
105	2372.85	140	2365.85	280	2372.85

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
105	.025	105	.025	280	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
105	280	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2369.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.025	
E.G. Elev (ft)	2369.71	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2367.54	Flow Area (sq ft)		184.45	
E.G. Slope (ft/ft)	0.000125	Area (sq ft)		184.45	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	96.03	Top Width (ft)		96.03	
Vel Total (ft/s)	1.02	Avg. Vel. (ft/s)		1.02	
Max Chl Dpth (ft)	3.84	Hydr. Depth (ft)		1.92	
Conv. Total (cfs)	16883.3	Conv. (cfs)		16883.3	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		96.51	
Min Ch El (ft)	2365.85	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)		0.02	
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)		39.72	
C & E Loss (ft)	0.10	Cum SA (acres)		16.36	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note - Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16150

INPUT
Description: 161+50
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
95	2373.63	140	2364.63	230	2373.63

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.025	95	.025	230	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	230	150	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2368.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.		0.025	
E.G. Elev (ft)	2369.53	Reach Len. (ft)	150.00	150.00	150.00
Crit W.S. (ft)	2368.53	Flow Area (sq ft)		114.31	
E.G. Slope (ft/ft)	0.007533	Area (sq ft)		114.31	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	58.56	Top Width (ft)		58.56	
Vel Total (ft/s)	8.00	Avg. Vel. (ft/s)		8.00	
Max Chl Dpth (ft)	3.90	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	10542.5	Conv. (cfs)		10542.5	
Length Wtd. (ft)	150.00	Wetted Per. (ft)		59.14	
Min Ch El (ft)	2364.63	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		7.28	
Frctn Loss (ft)	0.65	Cum Volume (acre-ft)		39.55	
C & E Loss (ft)	0.15	Cum SA (acres)		16.27	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 16000

INPUT
Description: 160+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
95	2368.73	140	2359.73	230	2368.73

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.025	95	.025	230	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
95	230	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2362.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	4.40	Wt. n-Val.		0.025	
E.G. Elev (ft)	2366.82	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2363.63	Flow Area (sq ft)		54.38	
E.G. Slope (ft/ft)	0.054630	Area (sq ft)		54.38	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	40.39	Top Width (ft)		40.39	
Vel Total (ft/s)	16.83	Avg. Vel. (ft/s)		16.83	
Max Chl Dpth (ft)	2.69	Hydr. Depth (ft)		1.35	
Conv. Total (cfs)	3914.8	Conv. (cfs)		3914.8	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		40.79	
Min Ch El (ft)	2359.73	Shear (lb/sq ft)		4.55	
Alpha	1.00	Stream Power (lb/ft s)		76.50	
Frctn Loss (ft)	2.38	Cum Volume (acre-ft)		39.26	
C & E Loss (ft)	0.34	Cum SA (acres)		16.10	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note - Program found supercritical flow starting at this cross section.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15950

INPUT
Description: 159+50
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2369.73	140	2359.73	240	2369.73

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	350	350	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2363.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.53	Wt. n-Val.		0.025	
E.G. Elev (ft)	2364.77	Reach Len. (ft)	350.00	350.00	350.00
Crit W.S. (ft)	2363.64	Flow Area (sq ft)		92.16	
E.G. Slope (ft/ft)	0.013380	Area (sq ft)		92.16	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	52.58	Top Width (ft)		52.58	
Vel Total (ft/s)	9.93	Avg. Vel. (ft/s)		9.93	

Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)	1.75
Conv. Total (cfs)	7910.3	Conv. (cfs)	7910.3
Length Wtd. (ft)	350.00	Wetted Per. (ft)	53.10
Min Ch El (ft)	2359.73	Shear (lb/sq ft)	1.45
Alpha	1.00	Stream Power (lb/ft s)	14.39
Frctn Loss (ft)	1.20	Cum Volume (acre-ft)	39.18
C & E Loss (ft)	0.86	Cum SA (acres)	16.05

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15600

INPUT
Description: 156+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2361.15	140	2351.15	240	2361.15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2354.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.26	Wt. n-Val.		0.025	
E.G. Elev (ft)	2357.31	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2355.05	Flow Area (sq ft)		63.19	
E.G. Slope (ft/ft)	0.036603	Area (sq ft)		63.19	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	43.54	Top Width (ft)		43.54	
Vel Total (ft/s)	14.48	Avg. Vel. (ft/s)		14.48	
Max Chl Dpth (ft)	2.90	Hydr. Depth (ft)		1.45	
Conv. Total (cfs)	4782.6	Conv. (cfs)		4782.6	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		43.97	
Min Ch El (ft)	2351.15	Shear (lb/sq ft)		3.28	
Alpha	1.00	Stream Power (lb/ft s)		47.55	
Frctn Loss (ft)	7.28	Cum Volume (acre-ft)		38.55	
C & E Loss (ft)	0.17	Cum SA (acres)		15.66	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15300

INPUT
Description: 153+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2353.8	140	2343.8	240	2353.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2347.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.05	Wt. n-Val.		0.025	
E.G. Elev (ft)	2349.11	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2347.72	Flow Area (sq ft)		79.59	
E.G. Slope (ft/ft)	0.019782	Area (sq ft)		79.59	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	48.86	Top Width (ft)		48.86	
Vel Total (ft/s)	11.50	Avg. Vel. (ft/s)		11.50	
Max Chl Dpth (ft)	3.26	Hydr. Depth (ft)		1.63	
Conv. Total (cfs)	6505.6	Conv. (cfs)		6505.6	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		49.35	
Min Ch El (ft)	2343.80	Shear (lb/sq ft)		1.99	
Alpha	1.00	Stream Power (lb/ft s)		22.90	
Frctn Loss (ft)	7.85	Cum Volume (acre-ft)		38.06	
C & E Loss (ft)	0.36	Cum SA (acres)		15.34	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 15000

INPUT
Description: 150+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2346.45	140	2336.45	240	2346.45

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2339.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.62	Wt. n-Val.		0.025	
E.G. Elev (ft)	2342.35	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2340.57	Flow Area (sq ft)		80.49	
E.G. Slope (ft/ft)	0.025090	Area (sq ft)		80.49	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	49.14	Top Width (ft)		49.14	
Vel Total (ft/s)	13.00	Avg. Vel. (ft/s)		13.00	
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)		1.64	
Conv. Total (cfs)	6603.5	Conv. (cfs)		6603.5	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		49.63	
Min Ch El (ft)	2336.45	Shear (lb/sq ft)		2.54	
Alpha	1.00	Stream Power (lb/ft s)		33.02	
Frctn Loss (ft)	6.71	Cum Volume (acre-ft)		37.51	
C & E Loss (ft)	0.06	Cum SA (acres)		15.00	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 14700

INPUT
Description: 147+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2339.1	140	2329.1	240	2339.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2332.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.58	Wt. n-Val.		0.025	
E.G. Elev (ft)	2334.97	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2333.22	Flow Area (sq ft)		81.21	
E.G. Slope (ft/ft)	0.024500	Area (sq ft)		81.21	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	49.36	Top Width (ft)		49.36	
Vel Total (ft/s)	12.88	Avg. Vel. (ft/s)		12.88	
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)		1.65	
Conv. Total (cfs)	6682.6	Conv. (cfs)		6682.6	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		49.85	
Min Ch El (ft)	2329.10	Shear (lb/sq ft)		2.49	
Alpha	1.00	Stream Power (lb/ft s)		32.10	
Frctn Loss (ft)	7.39	Cum Volume (acre-ft)		36.95	
C & E Loss (ft)	0.02	Cum SA (acres)		14.66	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 14400

INPUT
Description: 144+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2331.75	140	2321.75	240	2331.75

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	300	300	.1	.3

CROSS SECTION OUTPUT · Profile #PF#1

W.S. Elev (ft)	2325.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.58	Wt. n-Val.		0.025	
E.G. Elev (ft)	2327.62	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2325.87	Flow Area (sq ft)		81.21	
E.G. Slope (ft/ft)	0.024500	Area (sq ft)		81.21	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	49.36	Top Width (ft)		49.36	
Vel Total (ft/s)	12.88	Avg. Vel. (ft/s)		12.88	
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)		1.65	
Conv. Total (cfs)	6682.6	Conv. (cfs)		6682.6	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		49.85	
Min Ch El (ft)	2321.75	Shear (lb/sq ft)		2.49	
Alpha	1.00	Stream Power (lb/ft s)		32.10	
Frctn Loss (ft)	7.35	Cum Volume (acre-ft)		36.39	
C & E Loss (ft)	0.00	Cum SA (acres)		14.32	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 14100

INPUT
Description: 141+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2324.4	140	2314.4	240	2324.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank S[redacted] Left Right Lengths: Left Channel Right [redacted] Coeff Contr. Expan.

90	240		300	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2317.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.58	Wt. n-Val.		0.025	
E.G. Elev (ft)	2320.27	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2318.52	Flow Area (sq ft)		81.21	
E.G. Slope (ft/ft)	0.024500	Area (sq ft)		81.21	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	49.36	Top Width (ft)		49.36	
Vel Total (ft/s)	12.88	Avg. Vel. (ft/s)		12.88	
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)		1.65	
Conv. Total (cfs)	6682.6	Conv. (cfs)		6682.6	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		49.85	
Min Ch El (ft)	2314.40	Shear (lb/sq ft)		2.49	
Alpha	1.00	Stream Power (lb/ft s)		32.10	
Frctn Loss (ft)	7.35	Cum Volume (acre-ft)		35.83	
C & E Loss (ft)	0.00	Cum SA (acres)		13.99	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 13800

INPUT
Description: 138+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2317.05	140	2307.05	240	2317.05

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	550	550	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2310.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.58	Wt. n-Val.		0.025	
E.G. Elev (ft)	2312.92	Reach Len. (ft)	550.00	550.00	550.00
Crit W.S. (ft)	2311.16	Flow Area (sq ft)		81.19	
E.G. Slope (ft/ft)	0.024510	Area (sq ft)		81.19	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	49.35	Top Width (ft)		49.35	
Vel Total (ft/s)	12.88	Avg. Vel. (ft/s)		12.88	
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)		1.65	
Conv. Total (cfs)	6681.3	Conv. (cfs)		6681.3	
Length Wtd. (ft)	550.00	Wetted Per. (ft)		49.84	
Min Ch El (ft)	2307.05	Shear (lb/sq ft)		2.49	
Alpha	1.00	Stream Power (lb/ft s)		32.11	
Frctn Loss (ft)	7.35	Cum Volume (acre-ft)		35.27	
C & E Loss (ft)	0.00	Cum SA (acres)		13.65	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 13250

INPUT
Description: 132+50
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2303.58	140	2293.58	240	2303.58

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
90	240	550	550	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2297.21	Element			
Vel Head (ft)	2.74	Wt. n-Val.		0.025	
E.G. Elev (ft)	2299.95	Reach Len. (ft)	550.00	550.00	550.00
Crit W.S. (ft)	2298.10	Flow Area (sq ft)		98.97	
E.G. Slope (ft/ft)	0.022851	Area (sq ft)		98.97	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	54.49	Top Width (ft)		54.49	
Vel Total (ft/s)	13.29	Avg. Vel. (ft/s)		13.29	
Max Chl Dpth (ft)	3.63	Hydr. Depth (ft)		1.82	
Conv. Total (cfs)	8699.1	Conv. (cfs)		8699.1	
Length Wtd. (ft)	550.00	Wetted Per. (ft)		55.03	
Min Ch El (ft)	2293.58	Shear (lb/sq ft)		2.57	
Alpha	1.00	Stream Power (lb/ft s)		34.09	
Frctn Loss (ft)	12.95	Cum Volume (acre-ft)		34.14	
C & E Loss (ft)	0.02	Cum SA (acres)		12.99	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 12700

INPUT
Description: 127+00
Station Elevation Data num= 3

Sta	Elev	Sta	Elev	Sta	Elev
90	2290.1	140	2280.1	240	2290.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
90	.025	90	.025	240	.025

Bank St[redacted] Left Right Lengths: Left Channel Right [redacted] Coeff Contr. Expan.

90	240		200	200	200	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2283.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.97	Wt. n-Val.		0.025	
E.G. Elev (ft)	2286.63	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	2284.63	Flow Area (sq ft)		95.11	
E.G. Slope (ft/ft)	0.025408	Area (sq ft)		95.11	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	53.42	Top Width (ft)		53.42	
Vel Total (ft/s)	13.83	Avg. Vel. (ft/s)		13.83	
Max Chl Dpth (ft)	3.56	Hydr. Depth (ft)		1.78	
Conv. Total (cfs)	8249.7	Conv. (cfs)		8249.7	
Length Wtd. (ft)	200.00	Wetted Per. (ft)		53.95	
Min Ch El (ft)	2280.10	Shear (lb/sq ft)		2.80	
Alpha	1.00	Stream Power (lb/ft s)		38.67	
Frctn Loss (ft)	13.29	Cum Volume (acre-ft)		32.91	
C & E Loss (ft)	0.02	Cum SA (acres)		12.31	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 12500

INPUT
Description: 125+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2289.1	122.5	2277.1	157.5	2277.1	205.5	2289.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2279.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.62	Wt. n-Val.		0.025	
E.G. Elev (ft)	2282.06	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2280.25	Flow Area (sq ft)		101.31	
E.G. Slope (ft/ft)	0.019642	Area (sq ft)		101.31	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	51.41	Top Width (ft)		51.41	
Vel Total (ft/s)	12.98	Avg. Vel. (ft/s)		12.98	
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)		1.97	
Conv. Total (cfs)	9382.8	Conv. (cfs)		9382.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		52.08	
Min Ch El (ft)	2277.10	Shear (lb/sq ft)		2.39	
Alpha	1.00	Stream Power (lb/ft s)		30.96	
Frctn Loss (ft)	4.46	Cum Volume (acre-ft)		32.46	
C & E Loss (ft)	0.10	Cum SA (acres)		12.07	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 12000

INPUT
Description: 120+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2281.6	122.5	2269.6	157.5	2269.6	205.5	2281.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2272.27	Element			
Vel Head (ft)	1.92	Wt. n-Val.		0.025	
E.G. Elev (ft)	2274.19	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2272.75	Flow Area (sq ft)		118.28	
E.G. Slope (ft/ft)	0.012432	Area (sq ft)		118.28	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	53.67	Top Width (ft)		53.67	
Vel Total (ft/s)	11.12	Avg. Vel. (ft/s)		11.12	
Max Chl Dpth (ft)	2.67	Hydr. Depth (ft)		2.20	
Conv. Total (cfs)	11793.6	Conv. (cfs)		11793.6	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		54.44	
Min Ch El (ft)	2269.60	Shear (lb/sq ft)		1.69	
Alpha	1.00	Stream Power (lb/ft s)		18.75	
Frctn Loss (ft)	7.67	Cum Volume (acre-ft)		31.20	
C & E Loss (ft)	0.21	Cum SA (acres)		11.46	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 11500

INPUT
Description: 115+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2274.1	122.5	2262.1	157.5	2262.1	205.5	2274.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86	.025	86.5	.025	205.5	.025

Bank S	Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
	86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2264.54	Wt. n-Val.		0.025	
Vel Head (ft)	2.38	Reach Len. (ft)	500.00	500.00	500.00
E.G. Elev (ft)	2266.92	Flow Area (sq ft)		106.27	
Crit W.S. (ft)	2265.25	Area (sq ft)		106.27	
E.G. Slope (ft/ft)	0.017047	Flow (cfs)		1315.00	
Q Total (cfs)	1315.00	Top Width (ft)		52.08	
Top Width (ft)	52.08	Avg. Vel. (ft/s)		12.37	
Vel Total (ft/s)	12.37	Hydr. Depth (ft)		2.04	
Max Chl Dpth (ft)	2.44	Conv. (cfs)		10071.7	
Conv. Total (cfs)	10071.7	Wetted Per. (ft)		52.78	
Length Wtd. (ft)	500.00	Shear (lb/sq ft)		2.14	
Min Ch El (ft)	2262.10	Stream Power (lb/ft s)		26.51	
Alpha	1.00	Cum Volume (acre-ft)		29.91	
Frctn Loss (ft)	7.23	Cum SA (acres)		10.86	
C & E Loss (ft)	0.05				

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 11000

INPUT
Description: 110+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2266.6	122.5	2254.6	157.5	2254.6	205.5	2266.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2257.20	Wt. n-Val.		0.025	
Vel Head (ft)	2.05	Reach Len. (ft)	500.00	500.00	500.00
E.G. Elev (ft)	2259.25	Flow Area (sq ft)		114.41	
Crit W.S. (ft)	2257.75	Area (sq ft)		114.41	
E.G. Slope (ft/ft)	0.013712	Flow (cfs)		1315.00	
Q Total (cfs)	1315.00	Top Width (ft)		53.17	
Top Width (ft)	53.17	Avg. Vel. (ft/s)		11.49	
Vel Total (ft/s)	11.49	Hydr. Depth (ft)		2.15	
Max Chl Dpth (ft)	2.60	Conv. (cfs)		11229.7	
Conv. Total (cfs)	11229.7	Wetted Per. (ft)		53.91	
Length Wtd. (ft)	500.00	Shear (lb/sq ft)		1.82	
Min Ch El (ft)	2254.60	Stream Power (lb/ft s)		20.88	
Alpha	1.00				

Frctn Loss (ft)	7.58	Cum Volume (acre-ft)	28.65
C & E Loss (ft)	0.10	Cum SA (acres)	10.25

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 10500

INPUT
Description: 105+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2259.1	122.5	2247.1	157.5	2247.1	205.5	2259.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2249.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.26	Wt. n-Val.		0.025	
E.G. Elev (ft)	2251.85	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2250.25	Flow Area (sq ft)		109.07	
E.G. Slope (ft/ft)	0.015788	Area (sq ft)		109.07	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	52.46	Top Width (ft)		52.46	
Vel Total (ft/s)	12.06	Avg. Vel. (ft/s)		12.06	
Max Chl Dpth (ft)	2.49	Hydr. Depth (ft)		2.08	
Conv. Total (cfs)	10465.6	Conv. (cfs)		10465.6	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		53.17	
Min Ch El (ft)	2247.10	Shear (lb/sq ft)		2.02	
Alpha	1.00	Stream Power (lb/ft s)		24.38	
Frctn Loss (ft)	7.37	Cum Volume (acre-ft)		27.36	
C & E Loss (ft)	0.02	Cum SA (acres)		9.65	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 10000

INPUT
Description: 100+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2251.6	122.5	2239.6	157.5	2239.6	205.5	2251.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank S	Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
	86.5	205.5	500 500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2242.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.12	Wt. n-Val.		0.025	
E.G. Elev (ft)	2244.28	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2242.74	Flow Area (sq ft)		112.57	
E.G. Slope (ft/ft)	0.014383	Area (sq ft)		112.57	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	52.92	Top Width (ft)		52.92	
Vel Total (ft/s)	11.68	Avg. Vel. (ft/s)		11.68	
Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)		2.13	
Conv. Total (cfs)	10964.8	Conv. (cfs)		10964.8	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		53.65	
Min Ch El (ft)	2239.60	Shear (lb/sq ft)		1.88	
Alpha	1.00	Stream Power (lb/ft s)		22.01	
Frctn Loss (ft)	7.53	Cum Volume (acre-ft)		26.09	
C & E Loss (ft)	0.04	Cum SA (acres)		9.04	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 9500

INPUT
Description: 95+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2244.1	122.5	2232.1	157.2	2232.1	205.5	2244.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	86.5	205.5		500 500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2234.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.22	Wt. n-Val.		0.025	
E.G. Elev (ft)	2236.84	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2235.26	Flow Area (sq ft)		109.99	
E.G. Slope (ft/ft)	0.015343	Area (sq ft)		109.99	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	52.44	Top Width (ft)		52.44	
Vel Total (ft/s)	11.96	Avg. Vel. (ft/s)		11.96	
Max Chl Dpth (ft)	2.52	Hydr. Depth (ft)		2.10	
Conv. Total (cfs)	10616.4	Conv. (cfs)		10616.4	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		53.15	
Min Ch El (ft)	2232.10	Shear (lb/sq ft)		1.98	
Alpha	1.00	Stream Power (lb/ft s)		23.70	

Frctn Loss (ft)	7.43	Cum Volume (acre-ft)	24.81
C & E Loss (ft)	0.01	Cum SA (acres)	8.44

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 9000

INPUT
Description: 90+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2236.6	122.5	2224.6	157.5	2224.6	205.5	2236.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86.5	.025	86.5	.025	205.5	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
86.5	205.5	500	500	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2227.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.16	Wt. n-Val.		0.025	
E.G. Elev (ft)	2229.30	Reach Len. (ft)	500.00	500.00	500.00
Crit W.S. (ft)	2227.75	Flow Area (sq ft)		111.42	
E.G. Slope (ft/ft)	0.014825	Area (sq ft)		111.42	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	52.77	Top Width (ft)		52.77	
Vel Total (ft/s)	11.80	Avg. Vel. (ft/s)		11.80	
Max Chl Dpth (ft)	2.54	Hydr. Depth (ft)		2.11	
Conv. Total (cfs)	10800.2	Conv. (cfs)		10800.2	
Length Wtd. (ft)	500.00	Wetted Per. (ft)		53.50	
Min Ch El (ft)	2224.60	Shear (lb/sq ft)		1.93	
Alpha	1.00	Stream Power (lb/ft s)		22.75	
Frctn Loss (ft)	7.53	Cum Volume (acre-ft)		23.54	
C & E Loss (ft)	0.02	Cum SA (acres)		7.83	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 8600

INPUT
Description: 86+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
86.5	2230.6	122.5	2218.6	157.5	2218.6	205.5	2230.6

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
86	.025	86.5	.025	205.5	.025

Bank S	Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
	86.5	205.5	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2222.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.97	Wt. n-Val.		0.025	
E.G. Elev (ft)	2223.09	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2221.74	Flow Area (sq ft)		166.71	
E.G. Slope (ft/ft)	0.004575	Area (sq ft)		166.71	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	59.66	Top Width (ft)		59.66	
Vel Total (ft/s)	7.89	Avg. Vel. (ft/s)		7.89	
Max Chl Dpth (ft)	3.52	Hydr. Depth (ft)		2.79	
Conv. Total (cfs)	19441.3	Conv. (cfs)		19441.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		60.66	
Min Ch El (ft)	2218.60	Shear (lb/sq ft)		0.78	
Alpha	1.00	Stream Power (lb/ft s)		6.19	
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)		21.95	
C & E Loss (ft)	0.01	Cum SA (acres)		7.19	

Note - Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 8500

INPUT
Description: 85+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2233.1	130	2217.1	150	2217.1	214	2233.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	302	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2221.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.03	Wt. n-Val.		0.025	
E.G. Elev (ft)	2222.64	Reach Len. (ft)	302.00	300.00	300.00
Crit W.S. (ft)		Flow Area (sq ft)		161.63	
E.G. Slope (ft/ft)	0.004225	Area (sq ft)		161.63	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	51.60	Top Width (ft)		51.60	
Vel Total (ft/s)	8.14	Avg. Vel. (ft/s)		8.14	
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)		3.13	
Conv. Total (cfs)	20230.4	Conv. (cfs)		20230.4	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		52.89	
Min Ch El (ft)	2217.10	Shear (lb/sq ft)		0.81	
Alpha	1.00	Stream Power (lb/ft s)		6.56	
Frctn Loss (ft)	1.44	Cum Volume (acre-ft)		21.57	

C & E Loss (ft)	0.03	Cum SA (acres)	7.06

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 8200

INPUT
Description: 82+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2231.45	130	2215.45	150	2215.45	214	2231.45

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	400	400	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2219.89	Element			
Vel Head (ft)	1.29	Wt. n-Val.		0.025	
E.G. Elev (ft)	2221.18	Reach Len. (ft)	400.00	400.00	400.00
Crit W.S. (ft)		Flow Area (sq ft)		157.63	
E.G. Slope (ft/ft)	0.005414	Area (sq ft)		157.63	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	51.06	Top Width (ft)		51.06	
Vel Total (ft/s)	9.12	Avg. Vel. (ft/s)		9.12	
Max Chl Dpth (ft)	4.44	Hydr. Depth (ft)		3.09	
Conv. Total (cfs)	19543.4	Conv. (cfs)		19543.4	
Length Wtd. (ft)	400.00	Wetted Per. (ft)		52.32	
Min Ch El (ft)	2215.45	Shear (lb/sq ft)		1.02	
Alpha	1.00	Stream Power (lb/ft s)		9.29	
Frctn Loss (ft)	2.21	Cum Volume (acre-ft)		20.47	
C & E Loss (ft)	0.00	Cum SA (acres)		6.71	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 7800

INPUT
Description: 78+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2229.25	130	2213.25	150	2213.25	214	2229.25

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	350	350	350	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2217.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.32	Wt. n-Val.		0.025	
E.G. Elev (ft)	2218.97	Reach Len. (ft)	350.00	350.00	350.00
Crit W.S. (ft)		Flow Area (sq ft)		155.76	
E.G. Slope (ft/ft)	0.005596	Area (sq ft)		155.76	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	50.80	Top Width (ft)		50.80	
Vel Total (ft/s)	9.23	Avg. Vel. (ft/s)		9.23	
Max Chl Dpth (ft)	4.40	Hydr. Depth (ft)		3.07	
Conv. Total (cfs)	19222.8	Conv. (cfs)		19222.8	
Length Wtd. (ft)	350.00	Wetted Per. (ft)		52.05	
Min Ch El (ft)	2213.25	Shear (lb/sq ft)		1.05	
Alpha	1.00	Stream Power (lb/ft s)		9.65	
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)		19.03	
C & E Loss (ft)	0.10	Cum SA (acres)		6.24	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 7450

INPUT
Description: 74+50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
82	2227.33	130	2211.33	150	2211.33	214	2227.33

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
82	.025	82	.025	214	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
82	214	100	100	105	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2216.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.01	Wt. n-Val.		0.025	
E.G. Elev (ft)	2217.30	Reach Len. (ft)	100.00	100.00	105.00
Crit W.S. (ft)		Flow Area (sq ft)		185.34	
E.G. Slope (ft/ft)	0.003741	Area (sq ft)		185.34	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	54.72	Top Width (ft)		54.72	
Vel Total (ft/s)	8.06	Avg. Vel. (ft/s)		8.06	
Max Chl Dpth (ft)	4.96	Hydr. Depth (ft)		3.39	
Conv. Total (cfs)	24424.9	Conv. (cfs)		24424.9	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		56.14	
Min Ch El (ft)	2211.33	Shear (lb/sq ft)		0.77	
Alpha	1.00	Stream Power (lb/ft s)		6.22	
Frctn Loss (ft)	0.42	Cum Volume (acre-ft)		17.66	

C & E Loss (ft)	0.03	Cum SA (acres)	5.82

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 7350

INPUT
Description: 73+50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
94	2222.78	130	2210.78	150	2210.78	186	2222.78

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
94	.025	94	.025	186	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
94	186	650	650	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2215.58	Element			
Vel Head (ft)	1.27	Wt. n-Val.		0.025	
E.G. Elev (ft)	2216.85	Reach Len. (ft)	650.00	650.00	650.00
Crit W.S. (ft)		Flow Area (sq ft)		165.23	
E.G. Slope (ft/ft)	0.004748	Area (sq ft)		165.23	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	48.81	Top Width (ft)		48.81	
Vel Total (ft/s)	9.04	Avg. Vel. (ft/s)		9.04	
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)		3.38	
Conv. Total (cfs)	21680.8	Conv. (cfs)		21680.8	
Length Wtd. (ft)	650.00	Wetted Per. (ft)		50.37	
Min Ch El (ft)	2210.78	Shear (lb/sq ft)		0.97	
Alpha	1.00	Stream Power (lb/ft s)		8.79	
Frctn Loss (ft)	3.60	Cum Volume (acre-ft)		17.26	
C & E Loss (ft)	0.03	Cum SA (acres)		5.70	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6700

INPUT
Description: 67+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
94	2219.2	130	2207.2	150	2207.2	186	2219.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
94	.025	94	.025	186	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
94	186	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2211.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.60	Wt. n-Val.		0.025	
E.G. Elev (ft)	2213.22	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2211.63	Flow Area (sq ft)		147.31	
E.G. Slope (ft/ft)	0.006527	Area (sq ft)		147.31	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	46.56	Top Width (ft)		46.56	
Vel Total (ft/s)	10.14	Avg. Vel. (ft/s)		10.14	
Max Chl Dpth (ft)	4.43	Hydr. Depth (ft)		3.16	
Conv. Total (cfs)	18492.1	Conv. (cfs)		18492.1	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		48.00	
Min Ch El (ft)	2207.20	Shear (lb/sq ft)		1.25	
Alpha	1.00	Stream Power (lb/ft s)		12.68	
Frctn Loss (ft)	0.75	Cum Volume (acre-ft)		14.93	
C & E Loss (ft)	0.37	Cum SA (acres)		4.99	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6400

INPUT
Description: 64+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
46	2217.55	130	2205.55	150	2205.55	234	2217.55

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
46	.025	46	.025	234	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
46	234	200	200	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2210.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.025	
E.G. Elev (ft)	2211.33	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	2209.25	Flow Area (sq ft)		315.13	
E.G. Slope (ft/ft)	0.001319	Area (sq ft)		315.13	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	96.04	Top Width (ft)		96.04	
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		4.74	

Max Chl Dpth (ft)	5.43	Hydr. Depth (ft)	3.28
Conv. Total (cfs)	41138.6	Conv. (cfs)	41138.6
Length Wtd. (ft)	200.00	Wetted Per. (ft)	96.81
Min Ch El (ft)	2205.55	Shear (lb/sq ft)	0.27
Alpha	1.00	Stream Power (lb/ft s)	1.27
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	13.33
C & E Loss (ft)	0.04	Cum SA (acres)	4.49

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6200

INPUT
Description: 62+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
94	2216.43	130	2204.43	150	2204.43	186	2216.43

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
94	.025	94	.025	186	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
94	186	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2210.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.		0.025	
E.G. Elev (ft)	2210.95	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)		Flow Area (sq ft)		215.44	
E.G. Slope (ft/ft)	0.002286	Area (sq ft)		215.44	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	54.64	Top Width (ft)		54.64	
Vel Total (ft/s)	6.93	Avg. Vel. (ft/s)		6.93	
'Max Chl Dpth (ft)	5.77	Hydr. Depth (ft)		3.94	
Conv. Total (cfs)	31249.4	Conv. (cfs)		31249.4	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		56.51	
Min Ch El (ft)	2204.43	Shear (lb/sq ft)		0.54	
Alpha	1.00	Stream Power (lb/ft s)		3.77	
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)		12.12	
C & E Loss (ft)	0.11	Cum SA (acres)		4.15	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6150

INPUT
Description: 61+50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1[illegible]	2214.15	130	2204.15	150	2204.15	170	2[illegible]4.15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.025	110	.025	170	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	113	113	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2208.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.80	Wt. n-Val.		0.025	
E.G. Elev (ft)	2210.67	Reach Len. (ft)	113.00	113.00	113.00
Crit W.S. (ft)	2208.86	Flow Area (sq ft)		138.62	
E.G. Slope (ft/ft)	0.006494	Area (sq ft)		138.62	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	38.85	Top Width (ft)		38.85	
Vel Total (ft/s)	10.78	Avg. Vel. (ft/s)		10.78	
Max Chl Dpth (ft)	4.71	Hydr. Depth (ft)		3.57	
Conv. Total (cfs)	18539.6	Conv. (cfs)		18539.6	
Length Wtd. (ft)	113.00	Wetted Per. (ft)		41.07	
Min Ch El (ft)	2204.15	Shear (lb/sq ft)		1.37	
Alpha	1.00	Stream Power (lb/ft s)		14.75	
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)		11.91	
C & E Loss (ft)	0.07	Cum SA (acres)		4.09	

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6037

INPUT
Description: 60+37
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2205.53	130	2195.53	150	2195.53	170	2205.53

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	37	37	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2199.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	8.93	Wt. n-Val.		0.015	
E.G. Elev (ft)	2208.88	Reach Len. (ft)	37.00	37.00	37.00
Crit W.S. (ft)	2202.57	Flow Area (sq ft)		127.53	
E.G. Slope (ft/ft)	0.012394	Area (sq ft)		127.53	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	37.69	Top Width (ft)		37.69	
Vel Total (ft/s)	23.98	Avg. Vel. (ft/s)		23.98	
Max Chl Dpth (ft)	4.42	Hydr. Depth (ft)		3.38	
Conv. Total (cfs)	27468.6	Conv. (cfs)		27468.6	
Length Wtd. (ft)	37.00	Wetted Per. (ft)		39.77	
Min Ch El (ft)	2195.53	Shear (lb/sq ft)		2.48	
Alpha	1.00	Stream Power (lb/ft s)		59.49	
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)		11.57	
C & E Loss (ft)	0.71	Cum SA (acres)		4.00	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note - Program found supercritical flow starting at this cross section.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 6000

INPUT
Description: 60+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2204.61	130	2194.61	150	2194.61	170	2204.61

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2198.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	9.41	Wt. n-Val.		0.015	
E.G. Elev (ft)	2208.36	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2201.65	Flow Area (sq ft)		124.20	
E.G. Slope (ft/ft)	0.013355	Area (sq ft)		124.20	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	37.33	Top Width (ft)		37.33	
Vel Total (ft/s)	24.62	Avg. Vel. (ft/s)		24.62	
Max Chl Dpth (ft)	4.33	Hydr. Depth (ft)		3.33	
Conv. Total (cfs)	26461.8	Conv. (cfs)		26461.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		39.38	
Min Ch El (ft)	2194.61	Shear (lb/sq ft)		2.63	
Alpha	1.00	Stream Power (lb/ft s)		64.75	
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)		11.46	

C & E Loss (ft)	0.05	Cum SA (acres)	3.96

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5900

INPUT
Description: 59+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2202.16	130	2192.16	150	2192.16	170	2202.16

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2196.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	10.48	Wt. n-Val.		0.015	
E.G. Elev (ft)	2206.80	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2199.20	Flow Area (sq ft)		117.70	
E.G. Slope (ft/ft)	0.015552	Area (sq ft)		117.70	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	36.63	Top Width (ft)		36.63	
Vel Total (ft/s)	25.98	Avg. Vel. (ft/s)		25.98	
Max Chl Dpth (ft)	4.16	Hydr. Depth (ft)		3.21	
Conv. Total (cfs)	24521.5	Conv. (cfs)		24521.5	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		38.59	
Min Ch El (ft)	2192.16	Shear (lb/sq ft)		2.96	
Alpha	1.00	Stream Power (lb/ft s)		76.94	
Frctn Loss (ft)	1.44	Cum Volume (acre-ft)		11.18	
C & E Loss (ft)	0.11	Cum SA (acres)		3.88	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5800

INPUT
Description: 58+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2199.71	130	2189.71	150	2189.71	170	2199.71

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

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

110	170		50	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2193.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	11.36	Wt. n-Val.		0.015	
E.G. Elev (ft)	2205.10	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2196.75	Flow Area (sq ft)		113.04	
E.G. Slope (ft/ft)	0.017443	Area (sq ft)		113.04	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	36.12	Top Width (ft)		36.12	
Vel Total (ft/s)	27.05	Avg. Vel. (ft/s)		27.05	
Max Chl Dpth (ft)	4.03	Hydr. Depth (ft)		3.13	
Conv. Total (cfs)	23154.1	Conv. (cfs)		23154.1	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		38.02	
Min Ch El (ft)	2189.71	Shear (lb/sq ft)		3.24	
Alpha	1.00	Stream Power (lb/ft s)		87.59	
Frctn Loss (ft)	1.64	Cum Volume (acre-ft)		10.92	
C & E Loss (ft)	0.09	Cum SA (acres)		3.80	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5750

INPUT
Description: 57+50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2195.88	130	2185.88	150	2185.88	170	2195.88

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2189.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	14.27	Wt. n-Val.		0.015	
E.G. Elev (ft)	2203.83	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2192.92	Flow Area (sq ft)		100.88	
E.G. Slope (ft/ft)	0.024128	Area (sq ft)		100.88	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.74	Top Width (ft)		34.74	
Vel Total (ft/s)	30.31	Avg. Vel. (ft/s)		30.31	
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)		2.90	
Conv. Total (cfs)	19686.7	Conv. (cfs)		19686.7	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		36.48	
Min Ch El (ft)	2185.88	Shear (lb/sq ft)		4.17	
Alpha	1.00	Stream Power (lb/ft		126.26	

Frctn Loss (ft)	1.02	Cum Volume (acre-ft)	10.80
C & E Loss (ft)	0.29	Cum SA (acres)	3.75

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5700

INPUT
Description: 57+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2194.86	130	2184.86	150	2184.86	170	2194.86

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2188.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	13.98	Wt. n-Val.		0.015	
E.G. Elev (ft)	2202.56	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2191.90	Flow Area (sq ft)		101.91	
E.G. Slope (ft/ft)	0.023439	Area (sq ft)		101.91	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.86	Top Width (ft)		34.86	
Vel Total (ft/s)	30.01	Avg. Vel. (ft/s)		30.01	
Max Chl Dpth (ft)	3.72	Hydr. Depth (ft)		2.92	
Conv. Total (cfs)	19974.0	Conv. (cfs)		19974.0	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		36.61	
Min Ch El (ft)	2184.86	Shear (lb/sq ft)		4.07	
Alpha	1.00	Stream Power (lb/ft s)		122.21	
Frctn Loss (ft)	1.19	Cum Volume (acre-ft)		10.68	
C & E Loss (ft)	0.09	Cum SA (acres)		3.71	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5600

INPUT
Description: 560+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2192.21	130	2183.21	150	2182.21	170	2192.21

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2186.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	13.86	Wt. n-Val.		0.015	
E.G. Elev (ft)	2200.25	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2189.70	Flow Area (sq ft)		102.37	
E.G. Slope (ft/ft)	0.023523	Area (sq ft)		102.37	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	35.43	Top Width (ft)		35.43	
Vel Total (ft/s)	29.87	Avg. Vel. (ft/s)		29.87	
Max Chl Dpth (ft)	4.18	Hydr. Depth (ft)		2.89	
Conv. Total (cfs)	19938.6	Conv. (cfs)		19938.6	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		37.13	
Min Ch El (ft)	2182.21	Shear (lb/sq ft)		4.05	
Alpha	1.00	Stream Power (lb/ft s)		120.95	
Frctn Loss (ft)	2.34	Cum Volume (acre-ft)		10.45	
C & E Loss (ft)	0.07	Cum SA (acres)		3.63	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5550

INPUT
Description: 55+50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2190.98	130	2180.98	150	2180.98	170	2190.98

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2184.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	14.35	Wt. n-Val.		0.015	
E.G. Elev (ft)	2199.00	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2188.02	Flow Area (sq ft)		100.61	
E.G. Slope (ft/ft)	0.024315	Area (sq ft)		100.61	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.71	Top Width (ft)		34.71	
Vel Total (ft/s)	30.40	Avg. Vel. (ft/s)		30.40	
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)		2.90	
Conv. Total (cfs)	19611.1	Conv. (cfs)		19611.1	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		36.45	

Min Ch El (ft)	2180.98	Shear (lb/sq ft)	4.19
Alph	1.00	Stream Power (lb/ft	127.36
Frct oss (ft)	1.20	Cum Volume (acre-ft)	10.33
C & E Loss (ft)	0.05	Cum SA (acres)	3.59

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5500

INPUT
Description: 55+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2187.15	130	2177.15	150	2177.15	170	2187.15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2180.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	16.80	Wt. n-Val.		0.015	
E.G. Elev (ft)	2197.41	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2184.19	Flow Area (sq ft)		92.97	
E.G. Slope (ft/ft)	0.030487	Area (sq ft)		92.97	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	33.82	Top Width (ft)		33.82	
Vel Total (ft/s)	32.89	Avg. Vel. (ft/s)		32.89	
Max Chl Dpth (ft)	3.45	Hydr. Depth (ft)		2.75	
Conv. Total (cfs)	17513.8	Conv. (cfs)		17513.8	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		35.45	
Min Ch El (ft)	2177.15	Shear (lb/sq ft)		4.99	
Alpha	1.00	Stream Power (lb/ft s)		164.18	
Frctn Loss (ft)	1.36	Cum Volume (acre-ft)		10.22	
C & E Loss (ft)	0.25	Cum SA (acres)		3.55	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5400

INPUT
Description: 54+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2184.7	130	2174.7	150	2174.7	170	2184.7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2178.22				
Vel Head (ft)	16.03	Wt. n-Val.		0.015	
E.G. Elev (ft)	2194.25	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2181.74	Flow Area (sq ft)		95.17	
E.G. Slope (ft/ft)	0.028504	Area (sq ft)		95.17	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.08	Top Width (ft)		34.08	
Vel Total (ft/s)	32.13	Avg. Vel. (ft/s)		32.13	
Max Chl Dpth (ft)	3.52	Hydr. Depth (ft)		2.79	
Conv. Total (cfs)	18112.7	Conv. (cfs)		18112.7	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		35.74	
Min Ch El (ft)	2174.70	Shear (lb/sq ft)		4.74	
Alpha	1.00	Stream Power (lb/ft s)		152.26	
Frctn Loss (ft)	2.94	Cum Volume (acre-ft)		10.00	
C & E Loss (ft)	0.24	Cum SA (acres)		3.48	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5300

INPUT
Description: 53+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2182.25	130	2172.25	150	2172.25	170	2182.25

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

		Element	Left OB	Channel	Right OB
W.S. Elev (ft)	2175.82				
Vel Head (ft)	15.50	Wt. n-Val.		0.015	
E.G. Elev (ft)	2191.32	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2179.29	Flow Area (sq ft)		96.77	
E.G. Slope (ft/ft)	0.027173	Area (sq ft)		96.77	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.27	Top Width (ft)		34.27	

Vel Total (ft/s)	31.60	Avg. Vel. (ft/s)	31.60
Max Chl Dpth (ft)	3.57	Hydr. Depth (ft)	2.82
Conv. Total (cfs)	18551.2	Conv. (cfs)	18551.2
Length Wtd. (ft)	50.00	Wetted Per. (ft)	35.95
Min Ch El (ft)	2172.25	Shear (lb/sq ft)	4.57
Alpha	1.00	Stream Power (lb/ft s)	144.30
Frctn Loss (ft)	2.78	Cum Volume (acre-ft)	9.78
C & E Loss (ft)	0.16	Cum SA (acres)	3.40

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5250

INPUT
Description: 52+50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2178.42	130	2168.42	150	2168.42	170	2178.42

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2171.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	17.90	Wt. n-Val.		0.015	
E.G. Elev (ft)	2189.69	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2175.46	Flow Area (sq ft)		90.08	
E.G. Slope (ft/ft)	0.033384	Area (sq ft)		90.08	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	33.48	Top Width (ft)		33.48	
Vel Total (ft/s)	33.95	Avg. Vel. (ft/s)		33.95	
Max Chl Dpth (ft)	3.37	Hydr. Depth (ft)		2.69	
Conv. Total (cfs)	16736.6	Conv. (cfs)		16736.6	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		35.07	
Min Ch El (ft)	2168.42	Shear (lb/sq ft)		5.35	
Alpha	1.00	Stream Power (lb/ft s)		181.75	
Frctn Loss (ft)	1.50	Cum Volume (acre-ft)		9.67	
C & E Loss (ft)	0.23	Cum SA (acres)		3.36	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5200

INPUT
Description: 52+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2177.26	130	2167.26	150	2167.26	170	2177.26

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2170.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	17.17	Wt. n-Val.		0.015	
E.G. Elev (ft)	2187.86	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2174.30	Flow Area (sq ft)		91.95	
E.G. Slope (ft/ft)	0.031462	Area (sq ft)		91.95	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	33.70	Top Width (ft)		33.70	
Vel Total (ft/s)	33.26	Avg. Vel. (ft/s)		33.26	
Max Chl Dpth (ft)	3.42	Hydr. Depth (ft)		2.73	
Conv. Total (cfs)	17240.3	Conv. (cfs)		17240.3	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		35.32	
Min Ch El (ft)	2167.26	Shear (lb/sq ft)		5.11	
Alpha	1.00	Stream Power (lb/ft s)		170.08	
Frctn Loss (ft)	1.62	Cum Volume (acre-ft)		9.57	
C & E Loss (ft)	0.22	Cum SA (acres)		3.32	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5100

INPUT
Description: 51+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2174.95	130	2164.95	150	2164.95	170	2174.95

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2168.32	Element	Left OB	Channel	Right OB

Vel Head (ft)	17.86	Wt. n-Val.		0.015	
E.G. Elev (ft)	2186.18	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2171.99	Flow Area (sq ft)		90.17	
E.G. Slope (ft/ft)	0.033280	Area (sq ft)		90.17	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	33.49	Top Width (ft)		33.49	
Vel Total (ft/s)	33.91	Avg. Vel. (ft/s)		33.91	
Max Chl Dpth (ft)	3.37	Hydr. Depth (ft)		2.69	
Conv. Total (cfs)	16762.8	Conv. (cfs)		16762.8	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		35.08	
Min Ch El (ft)	2164.95	Shear (lb/sq ft)		5.34	
Alpha	1.00	Stream Power (lb/ft s)		181.12	
Frctn Loss (ft)	1.62	Cum Volume (acre-ft)		9.46	
C & E Loss (ft)	0.07	Cum SA (acres)		3.28	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5050

INPUT
Description: 50+50
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2173.8	130	2163.8	150	2163.8	170	2173.8

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	50	50	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2167.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	17.13	Wt. n-Val.		0.015	
E.G. Elev (ft)	2184.36	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	2170.84	Flow Area (sq ft)		92.07	
E.G. Slope (ft/ft)	0.031349	Area (sq ft)		92.07	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	33.71	Top Width (ft)		33.71	
Vel Total (ft/s)	33.21	Avg. Vel. (ft/s)		33.21	
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)		2.73	
Conv. Total (cfs)	17271.3	Conv. (cfs)		17271.3	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		35.33	
Min Ch El (ft)	2163.80	Shear (lb/sq ft)		5.10	
Alpha	1.00	Stream Power (lb/ft s)		169.39	
Frctn Loss (ft)	1.61	Cum Volume (acre-ft)		9.36	
C & E Loss (ft)	0.22	Cum SA (acres)		3.24	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need

for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 5000

INPUT
Description: 50+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2172.64	130	2162.64	150	2162.64	170	2172.64

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	800	800	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2166.11	Element			
Vel Head (ft)	16.56	Wt. n-Val.		0.015	
E.G. Elev (ft)	2182.67	Reach Len. (ft)	800.00	800.00	800.00
Crit W.S. (ft)	2169.68	Flow Area (sq ft)		93.65	
E.G. Slope (ft/ft)	0.029858	Area (sq ft)		93.65	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	33.90	Top Width (ft)		33.90	
Vel Total (ft/s)	32.65	Avg. Vel. (ft/s)		32.65	
Max Chl Dpth (ft)	3.47	Hydr. Depth (ft)		2.76	
Conv. Total (cfs)	17697.4	Conv. (cfs)		17697.4	
Length Wtd. (ft)	800.00	Wetted Per. (ft)		35.54	
Min Ch El (ft)	2162.64	Shear (lb/sq ft)		4.91	
Alpha	1.00	Stream Power (lb/ft s)		160.39	
Frctn Loss (ft)	1.53	Cum Volume (acre-ft)		9.25	
C & E Loss (ft)	0.18	Cum SA (acres)		3.20	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 4200

INPUT
Description: 42+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2151.22	130	2141.22	150	2141.22	170	2151.22

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2144.82	Element			
Vel Head (ft)	15.14	Wt. n-Val.		0.015	
E.G. Elev (ft)	2159.96	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2148.26	Flow Area (sq ft)		97.94	
E.G. Slope (ft/ft)	0.026257	Area (sq ft)		97.94	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.40	Top Width (ft)		34.40	
Vel Total (ft/s)	31.22	Avg. Vel. (ft/s)		31.22	
Max Chl Dpth (ft)	3.60	Hydr. Depth (ft)		2.85	
Conv. Total (cfs)	18871.9	Conv. (cfs)		18871.9	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		36.10	
Min Ch El (ft)	2141.22	Shear (lb/sq ft)		4.45	
Alpha	1.00	Stream Power (lb/ft s)		138.85	
Frctn Loss (ft)	22.32	Cum Volume (acre-ft)		7.49	
C & E Loss (ft)	0.44	Cum SA (acres)		2.58	

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 3900

INPUT
Description: 39+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2144.3	130	2134.3	150	2134.3	170	2144.3

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	300	300	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2137.99	Element			
Vel Head (ft)	14.23	Wt. n-Val.		0.015	
E.G. Elev (ft)	2152.22	Reach Len. (ft)	300.00	300.00	300.00
Crit W.S. (ft)	2141.34	Flow Area (sq ft)		101.03	
E.G. Slope (ft/ft)	0.024024	Area (sq ft)		101.03	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.76	Top Width (ft)		34.76	
Vel Total (ft/s)	30.27	Avg. Vel. (ft/s)		30.27	
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)		2.91	
Conv. Total (cfs)	19729.3	Conv. (cfs)		19729.3	
Length Wtd. (ft)	300.00	Wetted Per. (ft)		36.50	
Min Ch El (ft)	2134.30	Shear (lb/sq ft)		4.15	

Alpha	1.00	Stream Power (lb/ft s)	125.65
Frctn Loss (ft)	7.51	Cum Volume (acre-ft)	6.81
C & E Loss (ft)	0.29	Cum SA (acres)	2.34

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 3600

INPUT
Description: 36+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2137.38	130	2127.38	150	2127.38	170	2137.38

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	2400	2400	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2131.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	13.92	Wt. n-Val.		0.015	
E.G. Elev (ft)	2145.02	Reach Len. (ft)	2400.00	2400.00	2400.00
Crit W.S. (ft)	2134.44	Flow Area (sq ft)		102.13	
E.G. Slope (ft/ft)	0.023294	Area (sq ft)		102.13	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.89	Top Width (ft)		34.89	
Vel Total (ft/s)	29.94	Avg. Vel. (ft/s)		29.94	
Max Chl Dpth (ft)	3.72	Hydr. Depth (ft)		2.93	
Conv. Total (cfs)	20036.0	Conv. (cfs)		20036.0	
Length Wtd. (ft)	2400.00	Wetted Per. (ft)		36.64	
Min Ch El (ft)	2127.38	Shear (lb/sq ft)		4.05	
Alpha	1.00	Stream Power (lb/ft s)		121.37	
Frctn Loss (ft)	7.10	Cum Volume (acre-ft)		6.11	
C & E Loss (ft)	0.09	Cum SA (acres)		2.10	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 1200

INPUT
Description: 12+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	2082	130	2072	150	2072	170	2082

Manning's n Values num= 3

n Val	Sta	n Val	Sta	n Val
.015	110	.015	170	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	170	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2075.74	Element			
Vel Head (ft)	13.76	Wt. n-Val.		0.015	
E.G. Elev (ft)	2089.50	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2079.06	Flow Area (sq ft)		102.74	
E.G. Slope (ft/ft)	0.022899	Area (sq ft)		102.74	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	34.96	Top Width (ft)		34.96	
Vel Total (ft/s)	29.76	Avg. Vel. (ft/s)		29.76	
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)		2.94	
Conv. Total (cfs)	20208.3	Conv. (cfs)		20208.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		36.72	
Min Ch El (ft)	2072.00	Shear (lb/sq ft)		4.00	
Alpha	1.00	Stream Power (lb/ft s)		119.05	
Frctn Loss (ft)	55.47	Cum Volume (acre-ft)		0.47	
C & E Loss (ft)	0.05	Cum SA (acres)		0.18	

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 1100

INPUT
Description: 11+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	2079.69	120	2069.69	160	2069.69	180	2079.69

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.015	100	.015	180	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100	180	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2071.94	Element			
Vel Head (ft)	14.46	Wt. n-Val.		0.015	
E.G. Elev (ft)	2086.41	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2074.84	Flow Area (sq ft)		100.20	
E.G. Slope (ft/ft)	0.037640	Area (sq ft)		100.20	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	49.01	Top Width (ft)		49.01	
Vel Total (ft/s)	30.52	Avg. Vel. (ft/s)		30.52	
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)		2.04	
Conv. Total (cfs)	15762.1	Conv. (cfs)		15762.1	

Length Wtd. (ft)	100.00	Wetted Per. (ft)	50.07
Min Ch El (ft)	2069.69	Shear (lb/sq ft)	4.70
Alpha	1.00	Stream Power (lb/ft s)	143.52
Frctn Loss (ft)	2.91	Cum Volume (acre-ft)	0.23
C & E Loss (ft)	0.08	Cum SA (acres)	0.08

Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: REACH 1
REACH: REACH 1 RS: 1000

INPUT
Description: 10+00
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	2069.69	120	2059059	160	2059.69	180	2069.69

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.015	100	.015	180	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
100	180	0	0	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2069.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	13.72	Wt. n-Val.		0.015	
E.G. Elev (ft)	2083.55	Reach Len. (ft)			
Crit W.S. (ft)	2073.64	Flow Area (sq ft)		102.89	
E.G. Slope (ft/ft)	0.019482	Area (sq ft)		102.89	
Q Total (cfs)	3058.00	Flow (cfs)		3058.00	
Top Width (ft)	20.00	Top Width (ft)		20.00	
Vel Total (ft/s)	29.72	Avg. Vel. (ft/s)		29.72	
Max Chl Dpth (ft)	10.14	Hydr. Depth (ft)		5.14	
Conv. Total (cfs)	21908.7	Conv. (cfs)		21908.7	
Length Wtd. (ft)		Wetted Per. (ft)		32.65	
Min Ch El (ft)	2059.69	Shear (lb/sq ft)		3.83	
Alpha	1.00	Stream Power (lb/ft s)		113.92	
Frctn Loss (ft)	2.63	Cum Volume (acre-ft)			
C & E Loss (ft)	0.23	Cum SA (acres)			

Warning - Divided flow computed for this cross-section.
Warning - The cross-section end points had to be extended vertically for the computed water surface.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area

Top Width (ft)	Froude # Chl	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)
REACH 1	16700	189.00	2378.10	2379.82	2379.82	2380.26	0.009832	5.31	35.58
41.33	1.01								
REACH 1	16600	189.00	2375.65	2377.09	2377.37	2377.98	0.025268	7.57	24.97
34.62	1.57								
REACH 1	16550	189.00	2374.43	2375.88	2376.15	2376.75	0.024331	7.46	25.33
34.87	1.54								
REACH 1	16500	189.00	2373.20	2374.64	2374.92	2375.53	0.025177	7.56	25.01
34.65	1.57								
REACH 1	16400	189.00	2370.75	2372.17	2372.44	2373.05	0.025606	7.53	25.09
35.42	1.58								
REACH 1	16300	189.00	2368.30	2369.73	2369.99	2370.58	0.024483	7.41	25.52
35.72	1.54								
REACH 1	16200	189.00	2365.85	2369.69	2367.54	2369.71	0.000125	1.02	184.45
96.03	0.13								
REACH 1	16150	915.00	2364.63	2368.53	2368.53	2369.53	0.007533	8.00	114.31
58.56	1.01								
REACH 1	16000	915.00	2359.73	2362.42	2363.63	2366.82	0.054630	16.83	54.38
40.39	2.56								
REACH 1	15950	915.00	2359.73	2363.24	2363.64	2364.77	0.013380	9.93	92.16
52.58	1.32								
REACH 1	15600	915.00	2351.15	2354.05	2355.05	2357.31	0.036603	14.48	63.19
43.54	2.12								
REACH 1	15300	915.00	2343.80	2347.06	2347.72	2349.11	0.019782	11.50	79.59
48.86	1.59								
REACH 1	15000	1046.00	2336.45	2339.73	2340.57	2342.35	0.025090	13.00	80.49
49.14	1.79								
REACH 1	14700	1046.00	2329.10	2332.39	2333.22	2334.97	0.024500	12.88	81.21
49.36	1.77								
REACH 1	14400	1046.00	2321.75	2325.04	2325.87	2327.62	0.024500	12.88	81.21
49.36	1.77								
REACH 1	14100	1046.00	2314.40	2317.69	2318.52	2320.27	0.024500	12.88	81.21
49.36	1.77								
REACH 1	13800	1046.00	2307.05	2310.34	2311.16	2312.92	0.024510	12.88	81.19
49.35	1.77								
REACH 1	13250	1315.00	2293.58	2297.21	2298.10	2299.95	0.022851	13.29	98.97
54.49	1.74								
REACH 1	12700	1315.00	2280.10	2283.66	2284.63	2286.63	0.025408	13.83	95.11
53.42	1.83								
REACH 1	12500	1315.00	2277.10	2279.44	2280.25	2282.06	0.019642	12.98	101.31
51.41	1.63								
REACH 1	12000	1315.00	2269.60	2272.27	2272.75	2274.19	0.012432	11.12	118.28
53.67	1.32								
REACH 1	11500	1315.00	2262.10	2264.54	2265.25	2266.92	0.017047	12.37	106.27
52.08	1.53								
REACH 1	11000	1315.00	2254.60	2257.20	2257.75	2259.25	0.013712	11.49	114.41
53.17	1.38								
REACH 1	10500	1315.00	2247.10	2249.59	2250.25	2251.85	0.015788	12.06	109.07
52.46	1.47								
REACH 1	10000	1315.00	2239.60	2242.16	2242.74	2244.28	0.014383	11.68	112.57
52.92	1.41								
REACH 1	9500	1315.00	2232.10	2234.62	2235.26	2236.84	0.015343	11.96	109.99
52.44	1.45								
REACH 1	9000	1315.00	2224.60	2227.14	2227.75	2229.30	0.014825	11.80	111.42

32.77									
REACH 1	1.43								
59.66	8600								
REACH 1	0.83	1315.00	2218.60	2222.12	2221.74	2223.09	0.004575	7.89	166.71
51.60	8500	1315.00	2217.10	2221.61		2222.64	0.004225	8.14	161.63
REACH 1	0.81	1438.00	2215.45	2219.89		2221.18	0.005414	9.12	157.63
51.06	8200	1438.00	2213.25	2217.65		2218.97	0.005596	9.23	155.76
REACH 1	0.91	1494.00	2211.33	2216.29		2217.30	0.003741	8.06	185.34
50.80	7800	1494.00	2210.78	2215.58		2216.85	0.004748	9.04	165.23
REACH 1	0.93	1494.00	2207.20	2211.63	2211.63	2213.22	0.006527	10.14	147.31
54.72	7450	1494.00	2205.55	2210.98	2209.25	2211.33	0.001319	4.74	315.13
REACH 1	0.77	1494.00	2204.43	2210.20		2210.95	0.002286	6.93	215.44
48.81	7350	1494.00	2204.15	2208.86	2208.86	2210.67	0.006494	10.78	138.62
REACH 1	0.87	3058.00	2195.53	2199.95	2202.57	2208.88	0.012394	23.98	127.53
46.56	6700	3058.00	2194.61	2198.94	2201.65	2208.36	0.013355	24.62	124.20
REACH 1	1.00	3058.00	2192.16	2196.32	2199.20	2206.80	0.015552	25.98	117.70
96.04	6400	3058.00	2189.71	2193.74	2196.75	2205.10	0.017443	27.05	113.04
REACH 1	0.46	3058.00	2185.88	2189.57	2192.92	2203.83	0.024128	30.31	100.88
54.64	6200	3058.00	2184.86	2188.58	2191.90	2202.56	0.023439	30.01	101.91
REACH 1	0.62	3058.00	2182.21	2186.39	2189.70	2200.25	0.023523	29.87	102.37
38.85	6150	3058.00	2180.98	2184.66	2188.02	2199.00	0.024315	30.40	100.61
REACH 1	1.01	3058.00	2177.15	2180.60	2184.19	2197.41	0.030487	32.89	92.97
37.69	6037	3058.00	2174.70	2178.22	2181.74	2194.25	0.028504	32.13	95.17
REACH 1	2.30	3058.00	2172.25	2175.82	2179.29	2191.32	0.027173	31.60	96.77
37.33	6000	3058.00	2168.42	2171.79	2175.46	2189.69	0.033384	33.95	90.08
REACH 1	2.38	3058.00	2167.26	2170.68	2174.30	2187.86	0.031462	33.26	91.95
36.63	5900	3058.00	2164.95	2168.32	2171.99	2186.18	0.033280	33.91	90.17
REACH 1	2.55	3058.00	2163.80	2167.23	2170.84	2184.36	0.031349	33.21	92.07
36.12	5800	3058.00	2162.64	2166.11	2169.68	2182.67	0.029858	32.65	93.65
REACH 1	2.69	3058.00	2141.22	2144.82	2148.26	2159.96	0.026257	31.22	[illegible].94
34.74	5750	3058.00	2134.30	2137.[illegible]	2141.34	2152.22	0.024024	30.27	101.03
REACH 1	3.14								
34.86	5700								
REACH 1	3.09								
35.43	5600								
REACH 1	3.10								
34.71	5550								
REACH 1	3.15								
33.82	5500								
REACH 1	3.50								
34.08	5400								
REACH 1	3.39								
34.27	5300								
REACH 1	3.31								
33.48	5250								
REACH 1	3.65								
33.70	5200								
REACH 1	3.55								
33.49	5100								
REACH 1	3.64								
33.71	5050								
REACH 1	3.54								
33.90	5000								
REACH 1	3.46								
34.40	4200								
REACH 1	3.26								
34.76	3900								
	3.13								

34.89		3058.00	2127.38	1.10	2134.44	2145.02	0.023294	29.94	102.13
REACH 1 34.96	3.08 1200	3058.00	2072.00	2075.74	2079.06	2089.50	0.022899	29.76	102.74
REACH 1 49.01	3.06 1100	3058.00	2069.69	2071.94	2074.84	2086.41	0.037640	30.52	100.20
REACH 1 20.00	3.76 1000	3058.00	2059.69	2069.83	2073.64	2083.55	0.019482	29.72	102.89
	2.31								

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
REACH 1	16700	2380.26	2379.82	0.44	1.47	0.00		189.00		41.33
REACH 1	16600	2377.98	2377.09	0.89	2.24	0.04		189.00		34.62
REACH 1	16550	2376.75	2375.88	0.86	1.23	0.01		189.00		34.87
REACH 1	16500	2375.53	2374.64	0.89	1.23	0.00		189.00		34.65
REACH 1	16400	2373.05	2372.17	0.88	2.50	0.01		189.00		35.42
REACH 1	16300	2370.58	2369.73	0.85	2.47	0.01		189.00		35.72
REACH 1	16200	2369.71	2369.69	0.02	0.08	0.10		189.00		96.03
REACH 1	16150	2369.53	2368.53	0.99	0.65	0.15		189.00		58.56
REACH 1	16000	2366.82	2362.42	4.40	2.38	0.34		915.00		40.39
REACH 1	15950	2364.77	2363.24	1.53	1.20	0.86		915.00		52.58
REACH 1	15600	2357.31	2354.05	3.26	7.28	0.17		915.00		43.54
REACH 1	15300	2349.11	2347.06	2.05	7.85	0.36		915.00		48.86
REACH 1	15000	2342.35	2339.73	2.62	6.71	0.06		1046.00		49.14
REACH 1	14700	2334.97	2332.39	2.58	7.39	0.02		1046.00		59.36
REACH 1	14400	2327.62	2325.04	2.58	7.35	0.00		1046.00		59.36
REACH 1	14100	2320.27	2317.69	2.58	7.35	0.00		1046.00		59.35
REACH 1	13800	2312.92	2310.34	2.58	7.35	0.00		1046.00		59.49
REACH 1	13250	2299.95	2297.21	2.74	12.95	0.02		1315.00		59.42
REACH 1	12700	2286.63	2283.66	2.97	13.29	0.02		1315.00		59.41
	12500	2282.06	2279.44	2.62	4.46	0.10		1315.00		

53.67	12000						
REACH 1 52.08	11500	2274.19	2272.27	1.92	7.67	0.21	1315.00
REACH 1 53.17	11000	2266.92	2264.54	2.38	7.23	0.05	1315.00
REACH 1 52.46	10500	2259.25	2257.20	2.05	7.58	0.10	1315.00
REACH 1 52.92	10000	2251.85	2249.59	2.26	7.37	0.02	1315.00
REACH 1 52.44	9500	2244.28	2242.16	2.12	7.53	0.04	1315.00
REACH 1 52.77	9000	2236.84	2234.62	2.22	7.43	0.01	1315.00
REACH 1 59.66	8600	2229.30	2227.14	2.16	7.53	0.02	1315.00
REACH 1 51.60	8500	2223.09	2222.12	0.97	0.44	0.01	1315.00
REACH 1 51.06	8200	2222.64	2221.61	1.03	1.44	0.03	1315.00
REACH 1 50.80	7800	2221.18	2219.89	1.29	2.21	0.00	1315.00
REACH 1 54.72	7450	2218.97	2217.65	1.32	1.58	0.10	1438.00
REACH 1 48.81	7350	2217.30	2216.29	1.01	0.42	0.03	1438.00
REACH 1 46.56	6700	2216.85	2215.58	1.27	3.60	0.03	1494.00
REACH 1 96.04	6400	2213.22	2211.63	1.60	0.75	0.37	1494.00
REACH 1 54.64	6200	2211.33	2210.98	0.35	0.34	0.04	1494.00
REACH 1 38.85	6150	2210.95	2210.20	0.75	0.18	0.11	1494.00
REACH 1 37.69	6037	2210.67	2208.86	1.80	0.33	0.07	1494.00
REACH 1 37.33	6000	2208.88	2199.95	8.93	1.10	0.71	1494.00
REACH 1 36.63	5900	2208.36	2198.94	9.41	0.48	0.05	3058.00
REACH 1 16.12	5800	2206.80	2196.32	10.48	1.44	0.11	3058.00
REACH 1 4.74	5750	2205.10	2193.74	11.36	1.64	0.09	3058.00
REACH 1 4.86	5700	2203.83	2189.57	14.27	1.02	0.29	3058.00
REACH 1 5.43	5600	2202.56	2188.58	13.98	1.19	0.09	3058.00
REACH 1 .71	5550	2200.25	2186.39	13.86	2.34	0.07	3058.00
REACH 1 .82	5500	2199.00	2184.66	14.35	1.20	0.05	3058.00
REACH 1 .08	5400	2197.41	2180.60	16.80	1.36	0.25	3058.00
EACH 1 27	5300	2194.25	2178.22	16.03	2.94	0.24	3058.00
EACH 1	5250	2191.32	2175.82	15.50	2.78	0.16	3058.00
		2189.69	2171.79	17.90	1.50		3058.00

33.70	5200	2187.86	2170.68	17.17	1.62	0.22	3058.00
REACH 1 33.49	5100	2186.18	2168.32	17.86	1.62	0.07	3058.00
REACH 1 33.71	5050	2184.36	2167.23	17.13	1.61	0.22	3058.00
REACH 1 33.90	5000	2182.67	2166.11	16.56	1.53	0.18	3058.00
REACH 1 34.40	4200	2159.96	2144.82	15.14	22.32	0.44	3058.00
REACH 1 34.76	3900	2152.22	2137.99	14.23	7.51	0.29	3058.00
REACH 1 34.89	3600	2145.02	2131.10	13.92	7.10	0.09	3058.00
REACH 1 34.96	1200	2089.50	2075.74	13.76	55.47	0.05	3058.00
REACH 1 49.01	1100	2086.41	2071.94	14.46	2.91	0.08	3058.00
REACH 1 20.00	1000	2083.55	2069.83	13.72	2.63	0.23	3058.00

APPENDIX F

HEC-RAS CALCULATIONS

Sub-Critical Evaluation

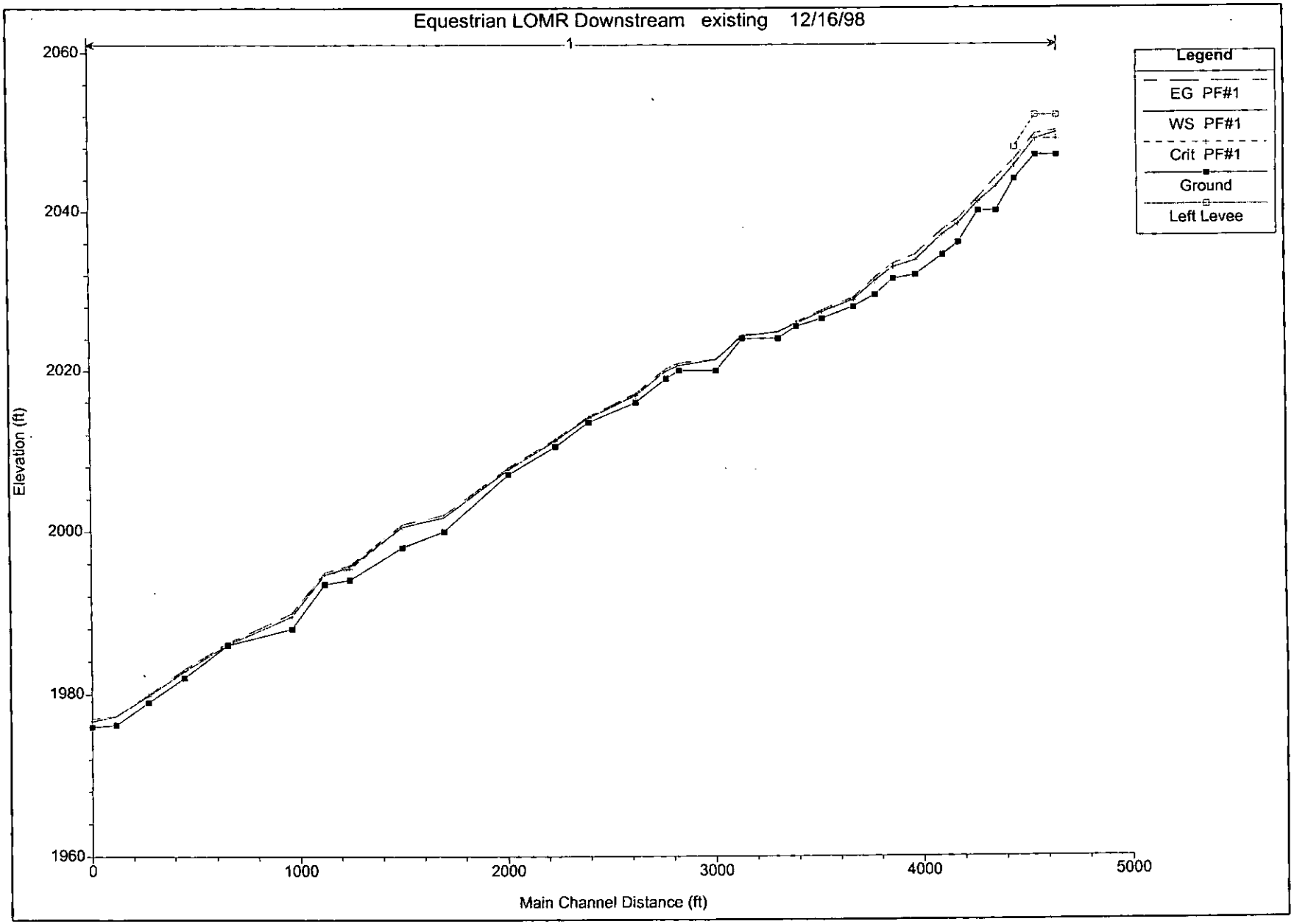
Of Discharge Channel

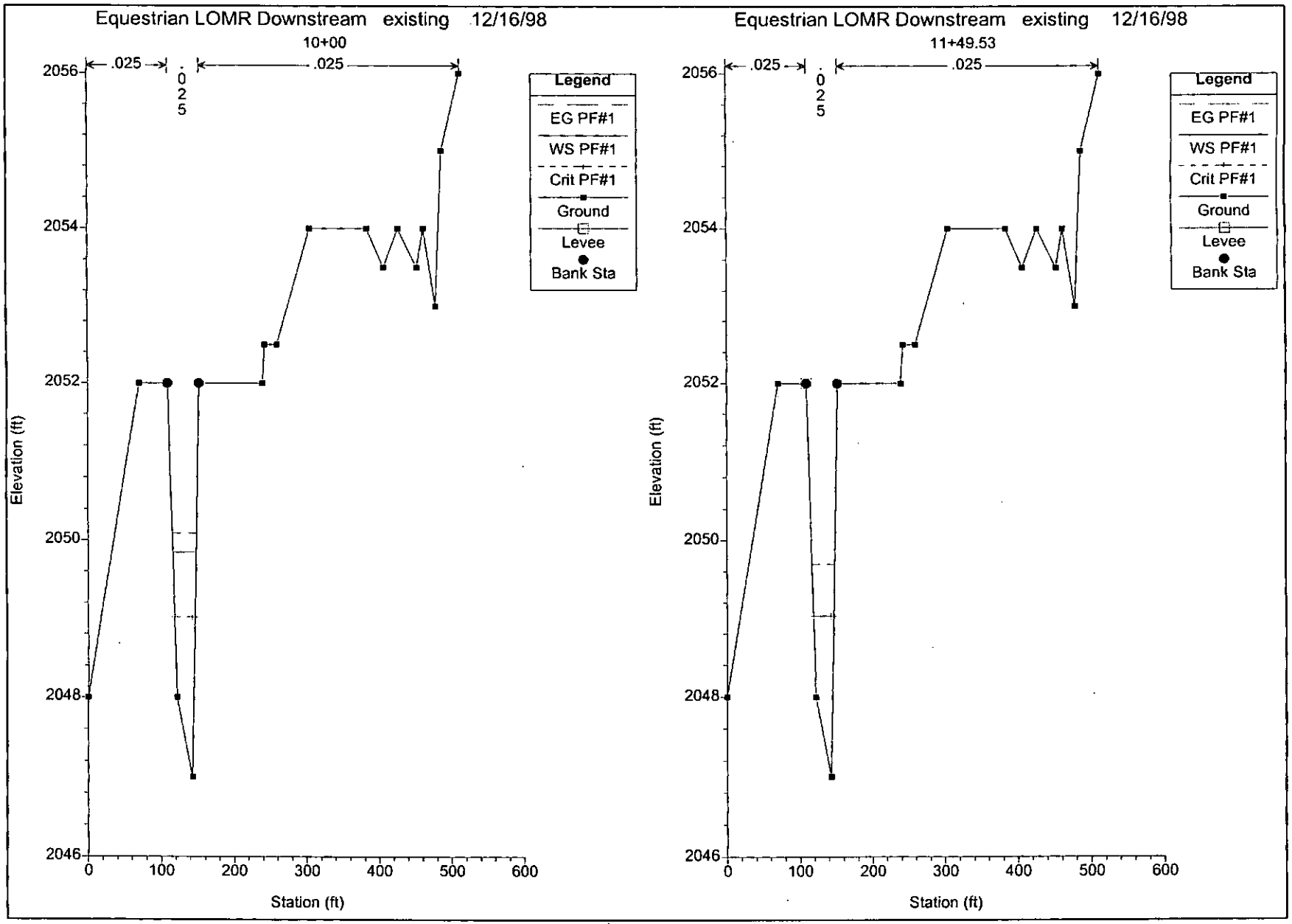
HEC-RAS Plan: BASINOTS River: Equestrian Outfa Reach: 1

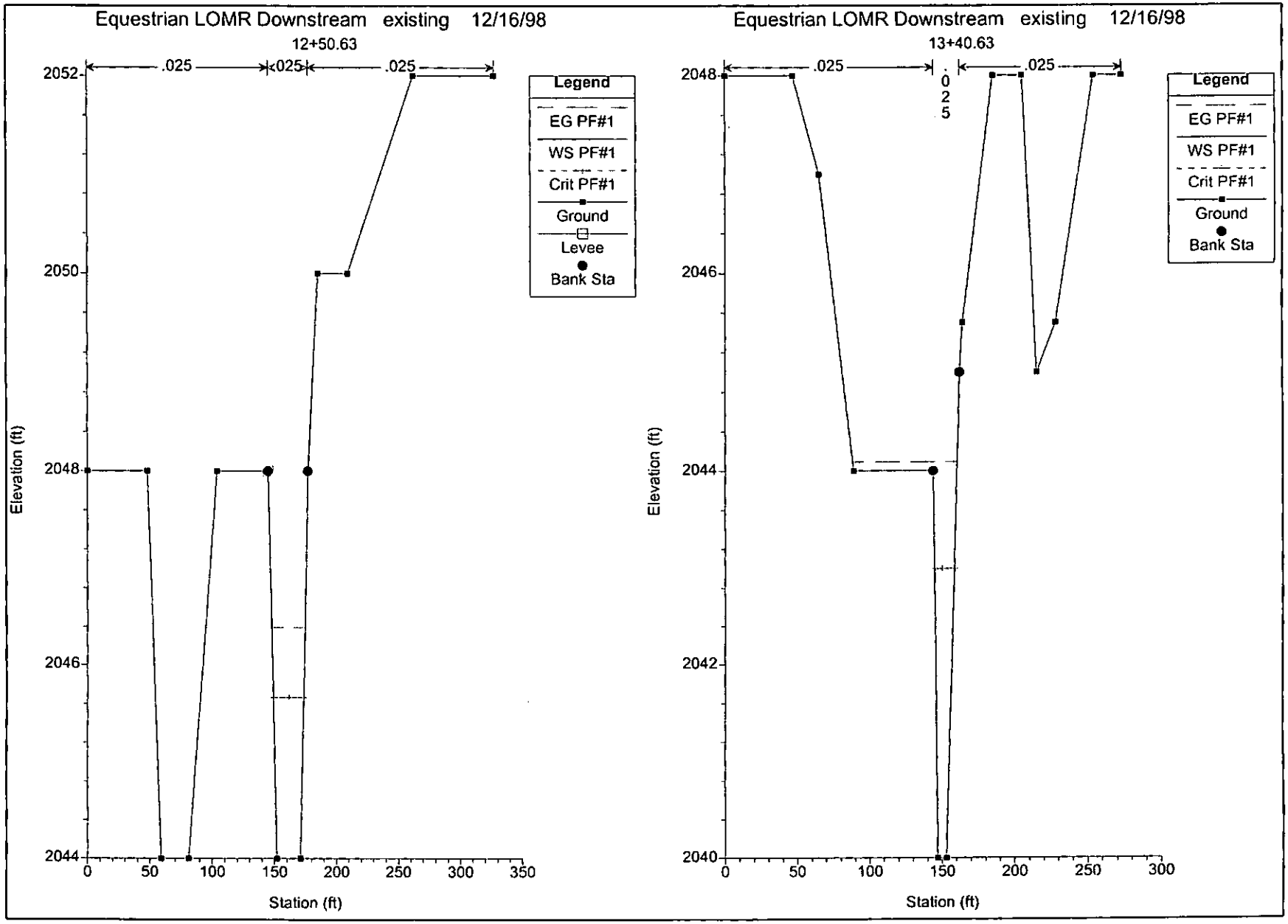
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Max Chl Dpth	Top Width	Sta W.S. Lft	Sta W.S. Rgt	LOB Elev	ROB Elev
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
1	33.2	247.00	2047.00	2049.85	2049.01	2050.09	0.001908	3.95	2.85	32.23	116.46	148.69	2052.00	2052.00
1	32.1	247.00	2047.00	2049.03	2049.03	2049.69	0.008446	6.54	2.03	28.13	118.92	147.05	2052.00	2052.00
1	31.1	247.00	2044.00	2045.66	2045.66	2046.39	0.008276	6.84	1.66	24.41	149.09	173.49	2048.00	2048.00
1	30.1	247.00	2040.00	2043.00	2043.00	2044.09	0.008784	8.39	3.00	13.64	144.75	158.39	2044.00	2045.00
1	29.1	247.00	2040.00	2041.14	2041.14	2041.60	0.009454	5.44	1.14	49.59	126.83	176.42	2044.00	2044.00
1	28.1	247.00	2036.00	2038.35	2038.35	2038.96	0.009408	6.25	2.35	33.88	227.77	261.65	2040.00	2040.00
1	27.1	247.00	2034.50	2037.06	2037.06	2037.59	0.009769	5.84	2.56	40.81	285.94	326.75	2040.00	2040.00
1	26.1	247.00	2032.00	2033.79	2033.79	2034.48	0.008667	6.65	1.79	27.45	316.76	344.21	2036.00	2036.00
1	25.1	247.00	2031.50	2032.97	2032.97	2033.40	0.010056	5.26	1.47	56.36	220.70	277.06	2035.00	2035.00
1	24.1	247.00	2029.50	2031.25	2031.25	2031.61	0.010720	4.80	1.75	74.47	289.59	364.06	2032.00	2032.00
1	23.1	247.00	2028.00	2028.87	2028.85	2029.16	0.009956	4.30	0.87	93.15	195.43	288.58	2030.00	2032.00
1	22.1	247.00	2026.50	2027.35	2027.33	2027.54	0.010782	3.50	0.85	165.18	245.40	410.58	2028.00	2028.00
1	21.1	247.00	2025.50	2025.90	2025.90	2026.07	0.012990	3.33	0.40	214.73	172.90	387.63	2026.00	2026.50
1	20.1	247.00	2024.00	2024.78		2024.81	0.000813	1.35	0.78	259.13	158.01	417.14	2028.00	2026.50
1	19.1	247.00	2024.00	2024.29	2024.29	2024.44	0.013826	3.04	0.29	282.55	111.91	394.46	2027.00	2025.50
1	17.1	247.00	2020.00	2021.37		2021.43	0.001088	2.02	1.37	117.02	183.36	300.38	2024.00	2024.00
1	16.1	247.00	2020.00	2020.67	2020.67	2020.96	0.011049	4.33	0.67	98.72	179.08	277.80	2021.82	2021.50
1	15.1	247.00	2019.00	2019.98	2019.98	2020.25	0.011443	4.18	0.98	110.79	74.13	184.92	2020.00	2020.00
1	14.1	247.00	2016.00	2016.88	2016.88	2017.13	0.011813	4.03	0.88	124.59	197.74	322.32	2017.00	2018.50
1	13.1	247.00	2013.50	2014.03	2014.03	2014.21	0.012960	3.49	0.53	191.20	325.90	523.75	2014.00	2016.00
1	12.1	247.00	2010.50	2011.21	2011.21	2011.42	0.012103	3.73	0.71	163.23	394.90	558.13	2012.00	2011.00
1	11.1	247.00	2007.00	2007.62	2007.62	2007.86	0.011756	3.95	0.62	130.05	352.89	482.94	2008.00	2008.00
1	10.1	247.00	2000.00	2001.73		2002.01	0.004573	4.20	1.73	54.76	364.56	419.32	2004.00	2003.00
1	9.1	247.00	1998.00	2000.56	2000.56	2000.85	0.007363	5.28	2.56	100.69	194.20	325.00	2000.00	2000.00
1	8.1	247.00	1994.00	1995.59	1995.36	1995.78	0.004784	3.48	1.59	91.11	188.70	279.81	1996.00	1996.00
1	7.1	247.00	1993.50	1994.65	1994.65	1994.93	0.011603	4.24	1.15	107.91	210.77	318.69	1995.50	1996.00
1	6.1	247.00	1988.00	1989.51	1989.51	1989.90	0.010023	5.04	1.51	62.67	197.17	259.83	1991.00	1991.50
1	5.1	247.00	1986.00	1986.10	1986.10	1986.31	0.012057	0.87	0.60	165.06	176.81	508.44	1987.00	1988.00
1	4.1	247.00	1982.00	1982.77	1982.77	1983.03	0.011403	4.09	0.77	116.79	350.29	467.08	1983.50	1984.00
1	3.1	247.00	1979.00	1979.81	1979.81	1979.95	0.015324	2.84	1.31	306.42	388.58	695.00	1980.00	1979.75
1	2.1	247.00	1976.25	1977.31		1977.36	0.001269	1.72	1.06	208.63	268.37	477.00	1976.50	1977.00
1	1.1	247.00	1976.00	1976.70	1976.70	1977.01	0.010009	4.68	0.70	88.00	0.00	88.00	1976.00	1976.00

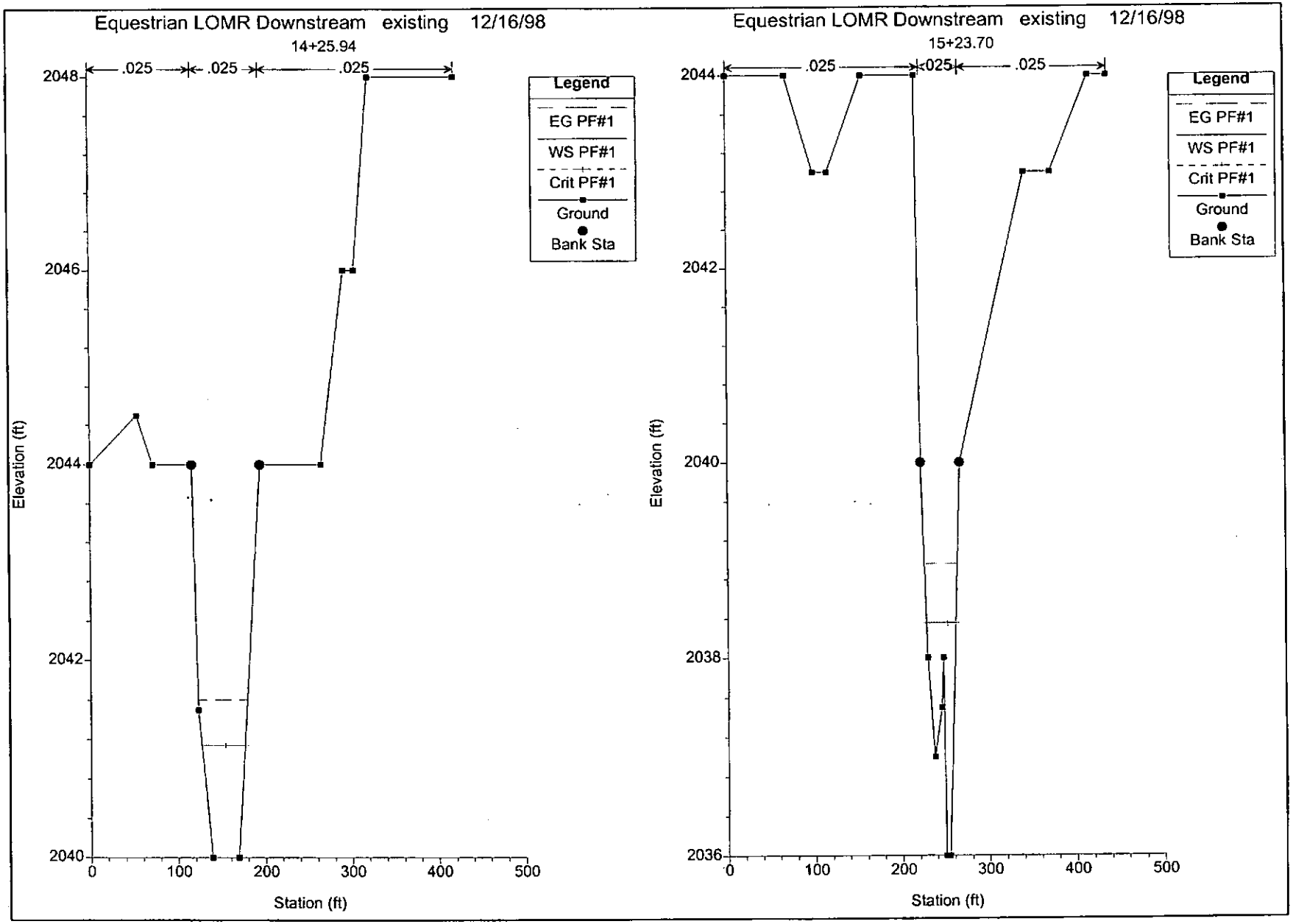
HEC-RAS Plan: BASINOTS River: Equestrian Outfa Reach: 1

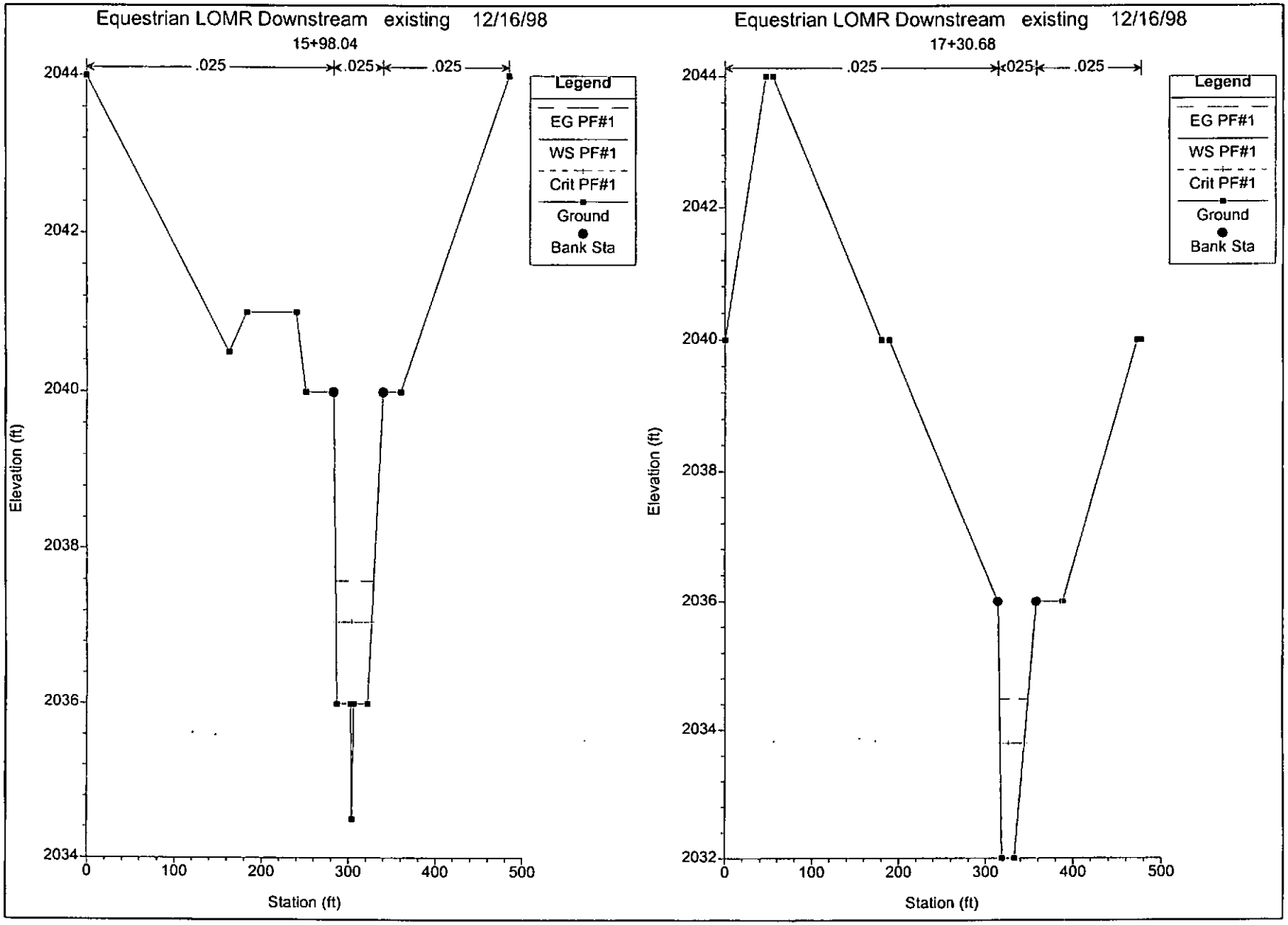
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	33.2	247.00	2047.00	2049.85	2049.01	2050.09	0.001908	3.95	62.46	32.23	0.50
1	32.1	247.00	2047.00	2049.03	2049.03	2049.69	0.008446	6.54	37.75	28.13	1.00
1	31.1	247.00	2044.00	2045.66	2045.66	2046.39	0.008276	6.84	36.09	24.41	0.99
1	30.1	247.00	2040.00	2043.00	2043.00	2044.09	0.008784	8.39	29.43	13.64	1.01
1	29.1	247.00	2040.00	2041.14	2041.14	2041.60	0.009454	5.44	45.41	49.59	1.00
1	28.1	247.00	2036.00	2038.35	2038.35	2038.96	0.009408	6.25	39.53	33.88	1.02
1	27.1	247.00	2034.50	2037.06	2037.06	2037.59	0.009769	5.84	42.29	40.81	1.01
1	26.1	247.00	2032.00	2033.79	2033.79	2034.48	0.008667	6.65	37.16	27.45	1.01
1	25.1	247.00	2031.50	2032.97	2032.97	2033.40	0.010056	5.26	46.99	56.36	1.01
1	24.1	247.00	2029.50	2031.25	2031.25	2031.61	0.010720	4.80	51.43	74.47	1.02
1	23.1	247.00	2028.00	2028.87	2028.85	2029.16	0.009956	4.30	57.48	93.15	0.96
1	22.1	247.00	2026.50	2027.35	2027.33	2027.54	0.010782	3.50	70.56	165.18	0.94
1	21.1	247.00	2025.50	2025.90	2025.90	2026.07	0.012990	3.33	74.11	214.73	1.00
1	20.1	247.00	2024.00	2024.78		2024.81	0.000813	1.35	183.51	259.13	0.28
1	19.1	247.00	2024.00	2024.29	2024.29	2024.44	0.013826	3.04	81.18	282.55	1.00
1	17.1	247.00	2020.00	2021.37		2021.43	0.001088	2.02	122.37	117.02	0.35
1	16.1	247.00	2020.00	2020.67	2020.67	2020.96	0.011049	4.33	57.02	98.72	1.00
1	15.1	247.00	2019.00	2019.98	2019.98	2020.25	0.011443	4.18	59.10	110.79	1.01
1	14.1	247.00	2016.00	2016.88	2016.88	2017.13	0.011813	4.03	61.33	124.59	1.01
1	13.1	247.00	2013.50	2014.03	2014.03	2014.21	0.012960	3.49	70.73	191.20	1.01
1	12.1	247.00	2010.50	2011.21	2011.21	2011.42	0.012103	3.73	66.92	163.23	1.00
1	11.1	247.00	2007.00	2007.62	2007.62	2007.86	0.011756	3.95	62.48	130.05	1.00
1	10.1	247.00	2000.00	2001.73		2002.01	0.004573	4.20	58.76	54.76	0.72
1	9.1	247.00	1998.00	2000.56	2000.56	2000.85	0.007363	5.28	62.34	100.69	0.89
1	8.1	247.00	1994.00	1995.59	1995.36	1995.78	0.004784	3.48	71.01	91.11	0.69
1	7.1	247.00	1993.50	1994.65	1994.65	1994.93	0.011603	4.24	58.22	107.91	1.02
1	6.1	247.00	1988.00	1989.51	1989.51	1989.90	0.010023	5.04	48.97	62.67	1.01
1	5.1	247.00	1986.00	1986.10	1986.10	1986.31	0.012057	0.87	67.61	165.06	0.70
1	4.1	247.00	1982.00	1982.77	1982.77	1983.03	0.011403	4.09	60.41	116.79	1.00
1	3.1	247.00	1979.00	1979.81	1979.81	1979.95	0.015324	2.84	81.41	306.42	1.02
1	2.1	247.00	1976.25	1977.31		1977.36	0.001269	1.72	146.93	208.63	0.35
1	1.1	247.00	1976.00	1976.70	1976.70	1977.01	0.010009	4.68	55.75	88.00	0.99

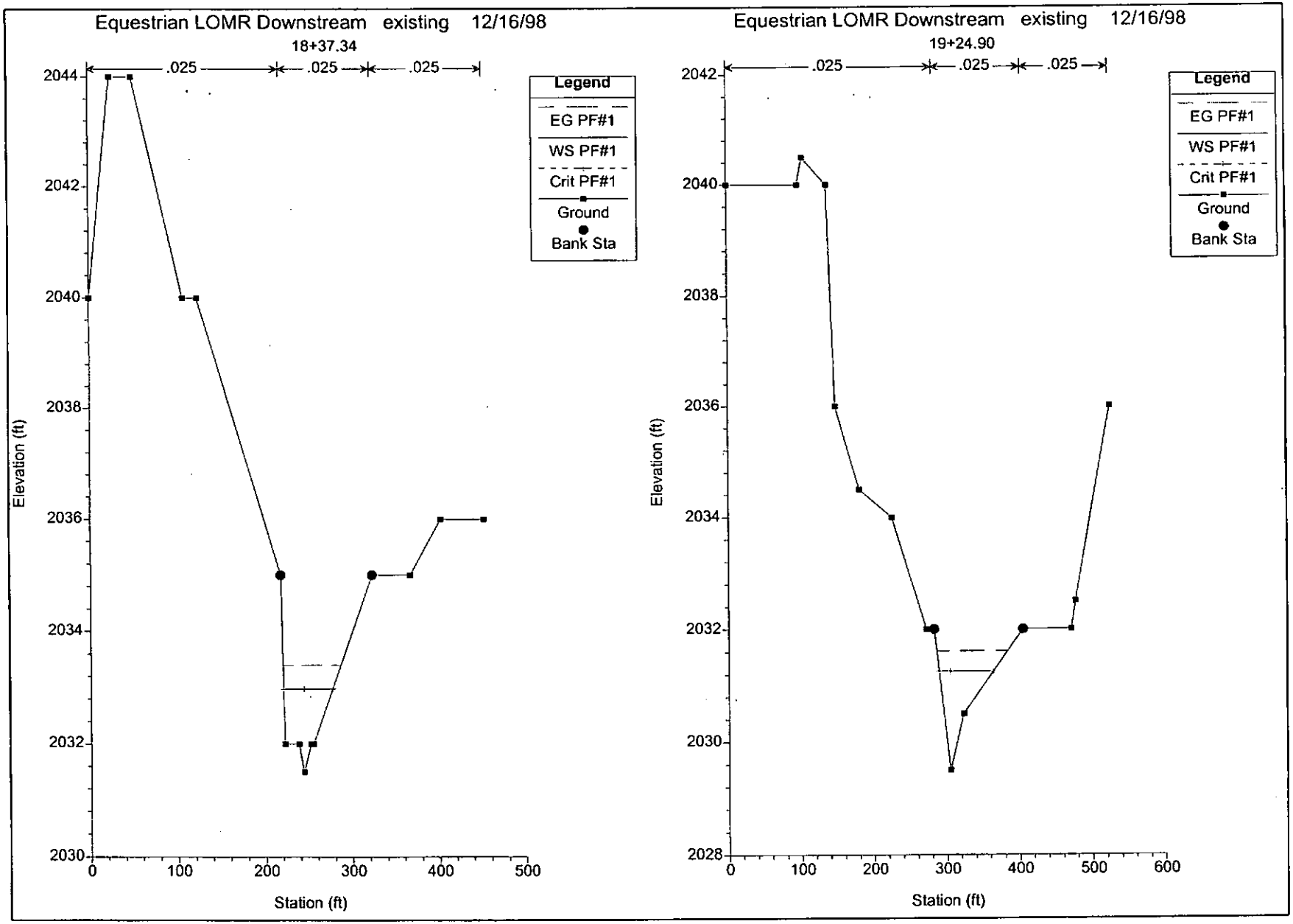

Equestrian LOMR Downstream existing 12/16/98
1
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Left Levee
2060
2040
2020
2000
1980
1960
Elevation (ft)
0
1000
2000
3000
4000
5000
Main Channel Distance (ft)

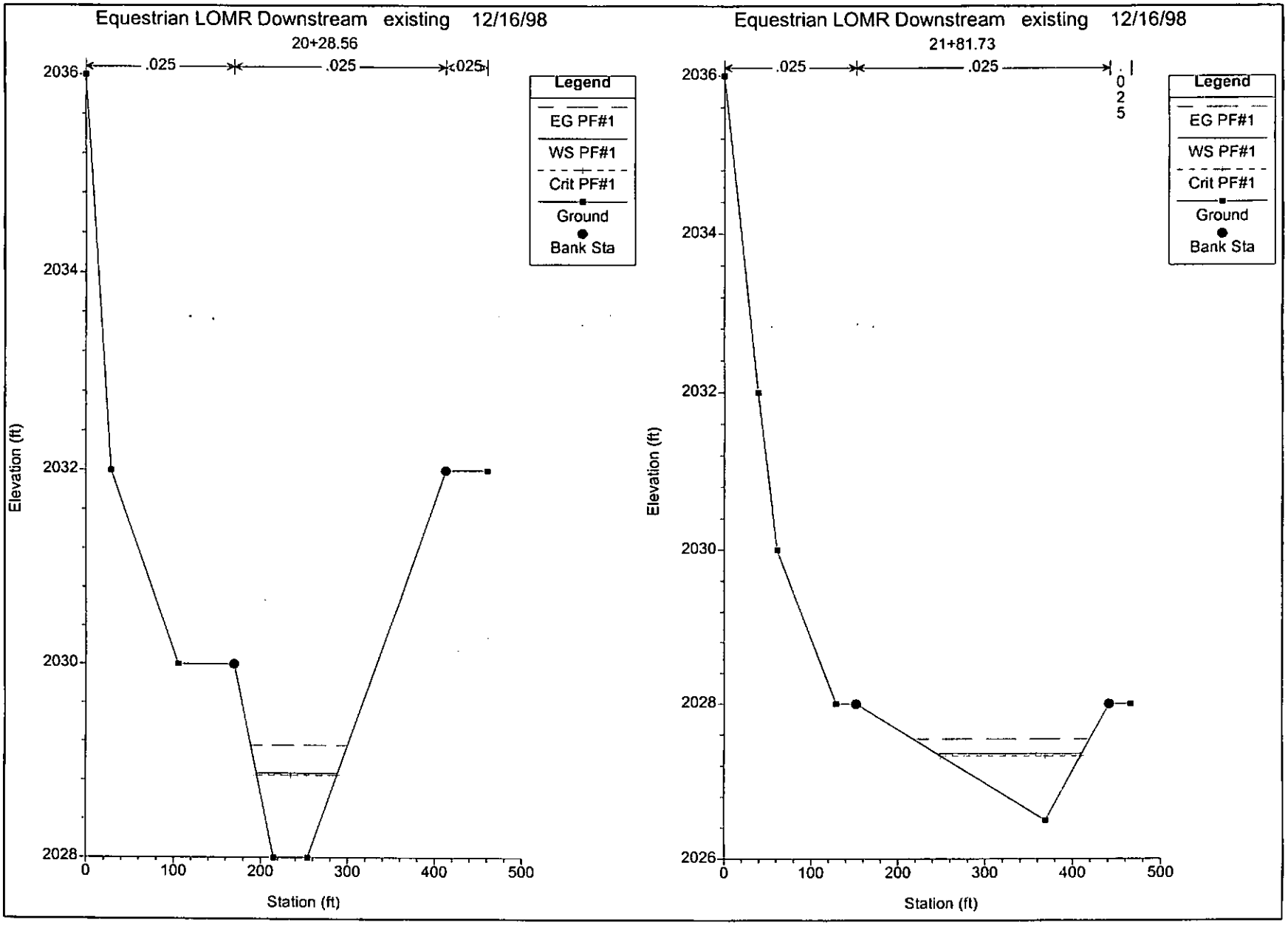

Equestrian LOMR Downstream existing 12/16/98
10+00
.025
.025
.025
2056
2054
2052
2050
2048
2046
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Levee
Bank Sta
Equestrian LOMR Downstream existing 12/16/98
11+49.53
.025
.025
.025
2056
2054
2052
2050
2048
2046
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Levee
Bank Sta

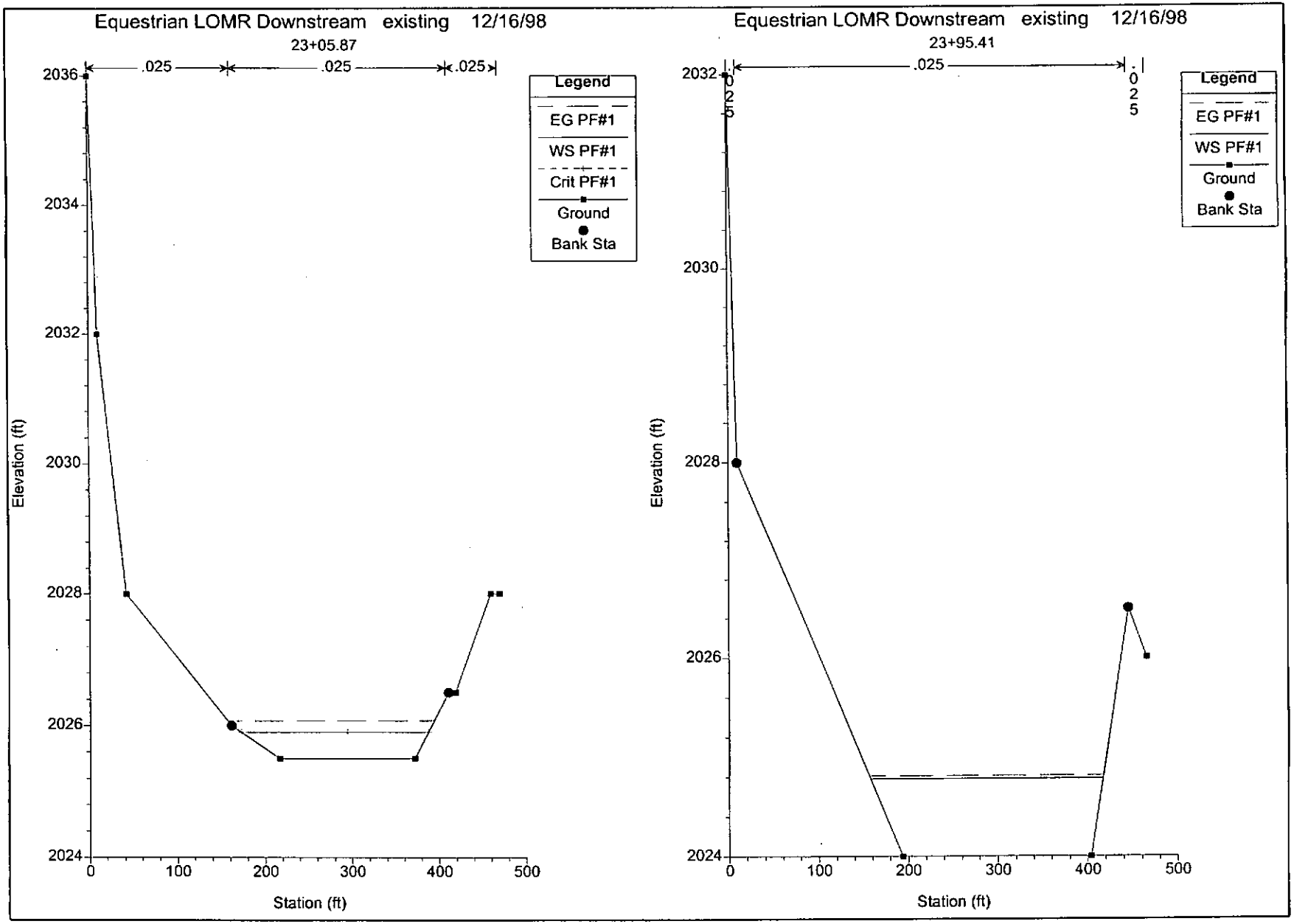

Equestrian LOMR Downstream existing 12/16/98
12+50.63
.025
.025
.025
2052
2050
2048
2046
2044
Elevation (ft)
0
50
100
150
200
250
300
350
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Levee
Bank Sta
Equestrian LOMR Downstream existing 12/16/98
13+40.63
.025
.025
2048
2046
2044
2042
2040
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta

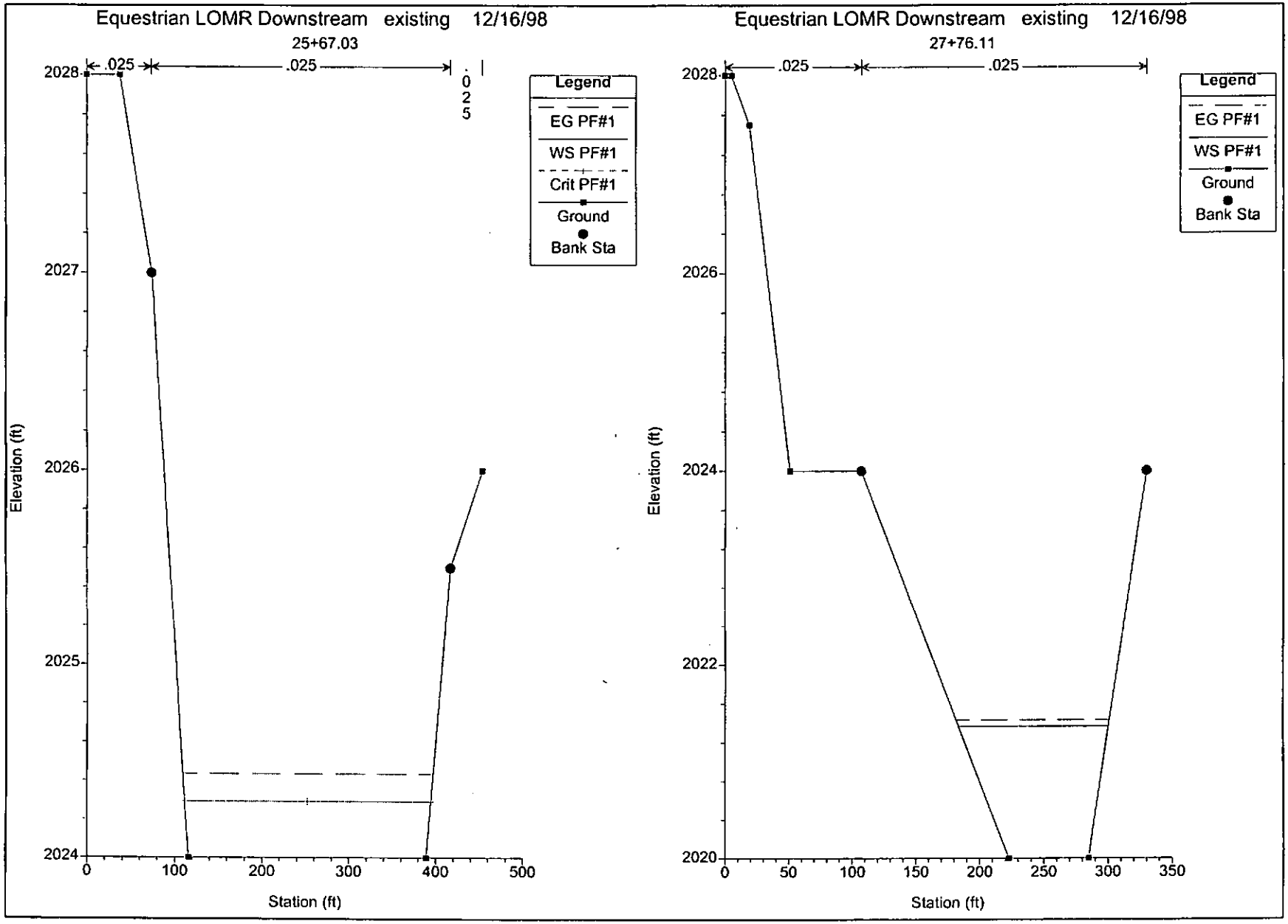

Equestrian LOMR Downstream existing 12/16/98
14+25.94
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2048
2046
2044
2042
2040
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
15+23.70
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2044
2042
2040
2038
2036
0
100
200
300
400
500
Station (ft)

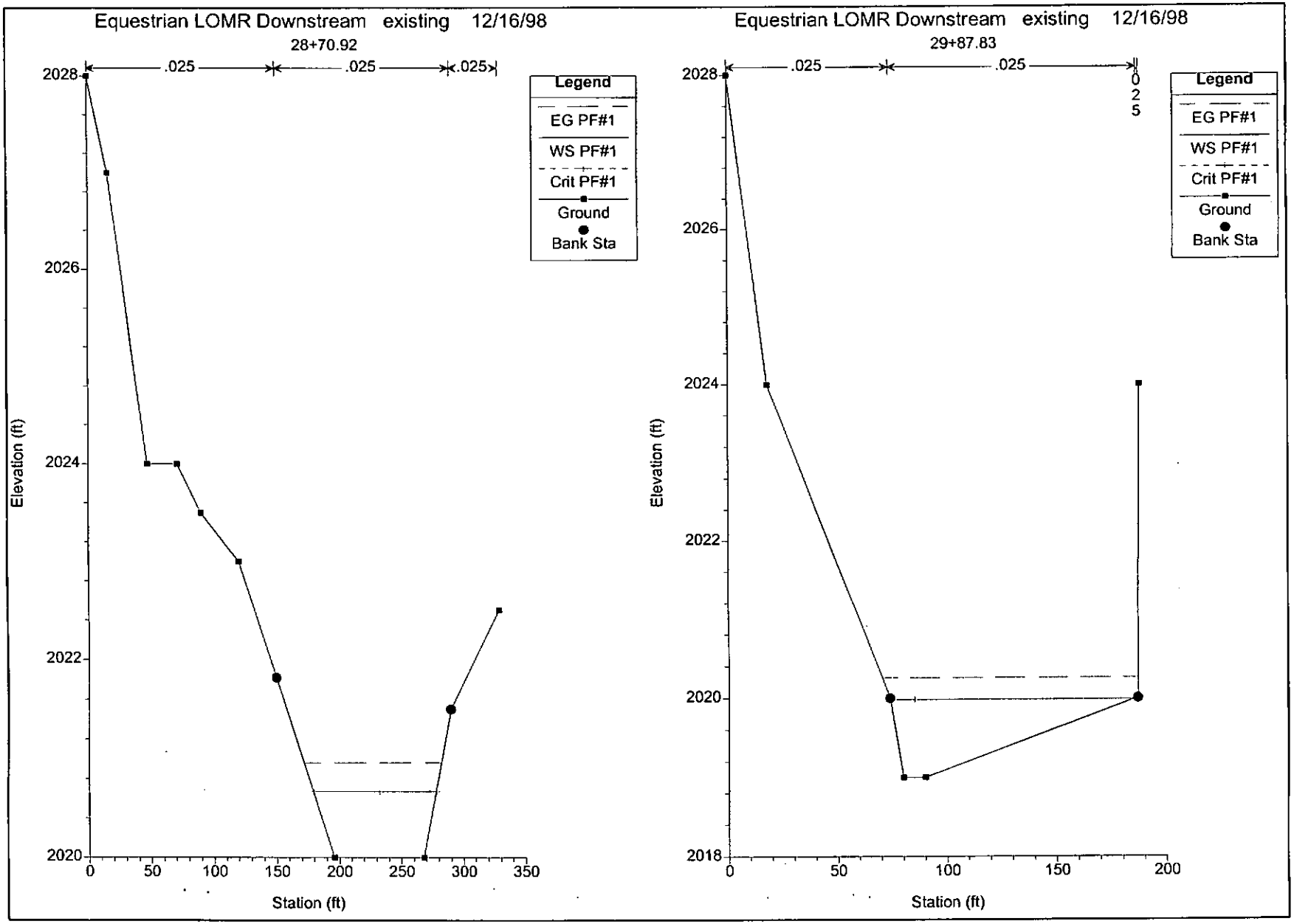

Equestrian LOMR Downstream existing 12/16/98
15+98.04
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2044
2042
2040
2038
2036
2034
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
17+30.68
.025
025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2044
2042
2040
2038
2036
2034
2032
0
100
200
300
400
500

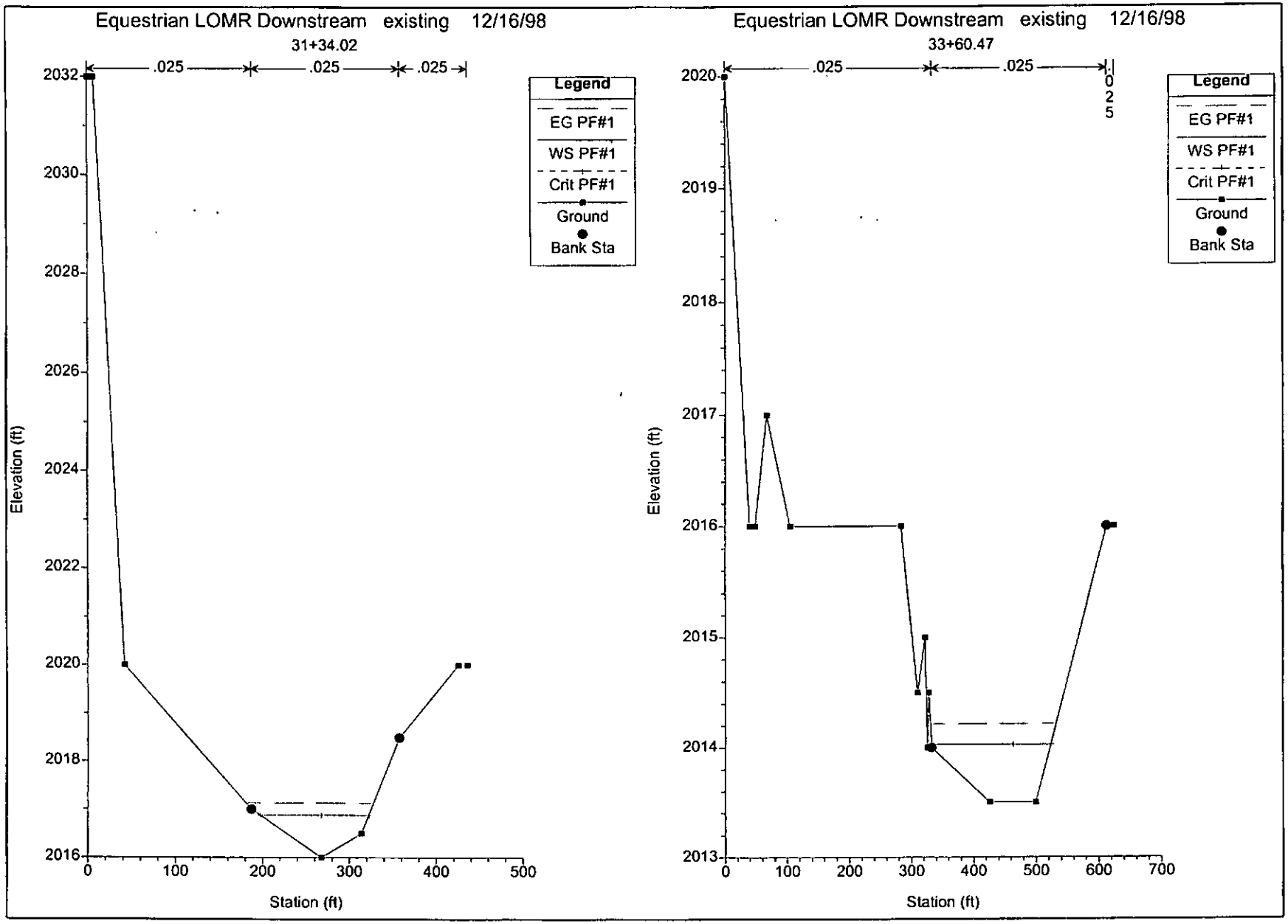

Equestrian LOMR Downstream existing 12/16/98
18+37.34
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2044
2042
2040
2038
2036
2034
2032
2030
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
19+24.90
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2042
2040
2038
2036
2034
2032
2030
2028
0
100
200
300
400
500
600

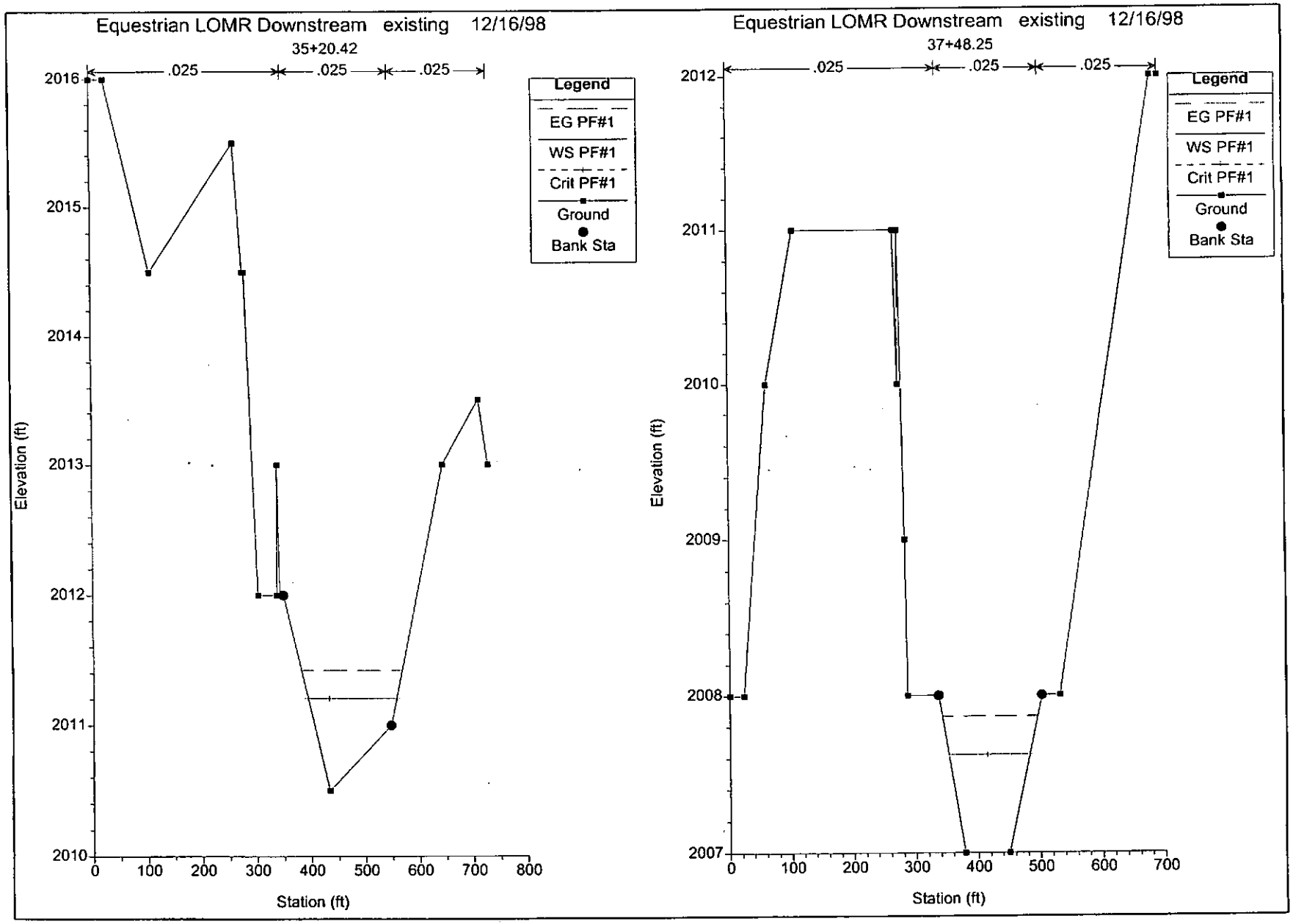

Equestrian LOMR Downstream existing 12/16/98
20+28.56
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2036
2034
2032
2030
2028
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
21+81.73
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2036
2034
2032
2030
2028
2026
0
100
200
300
400
500

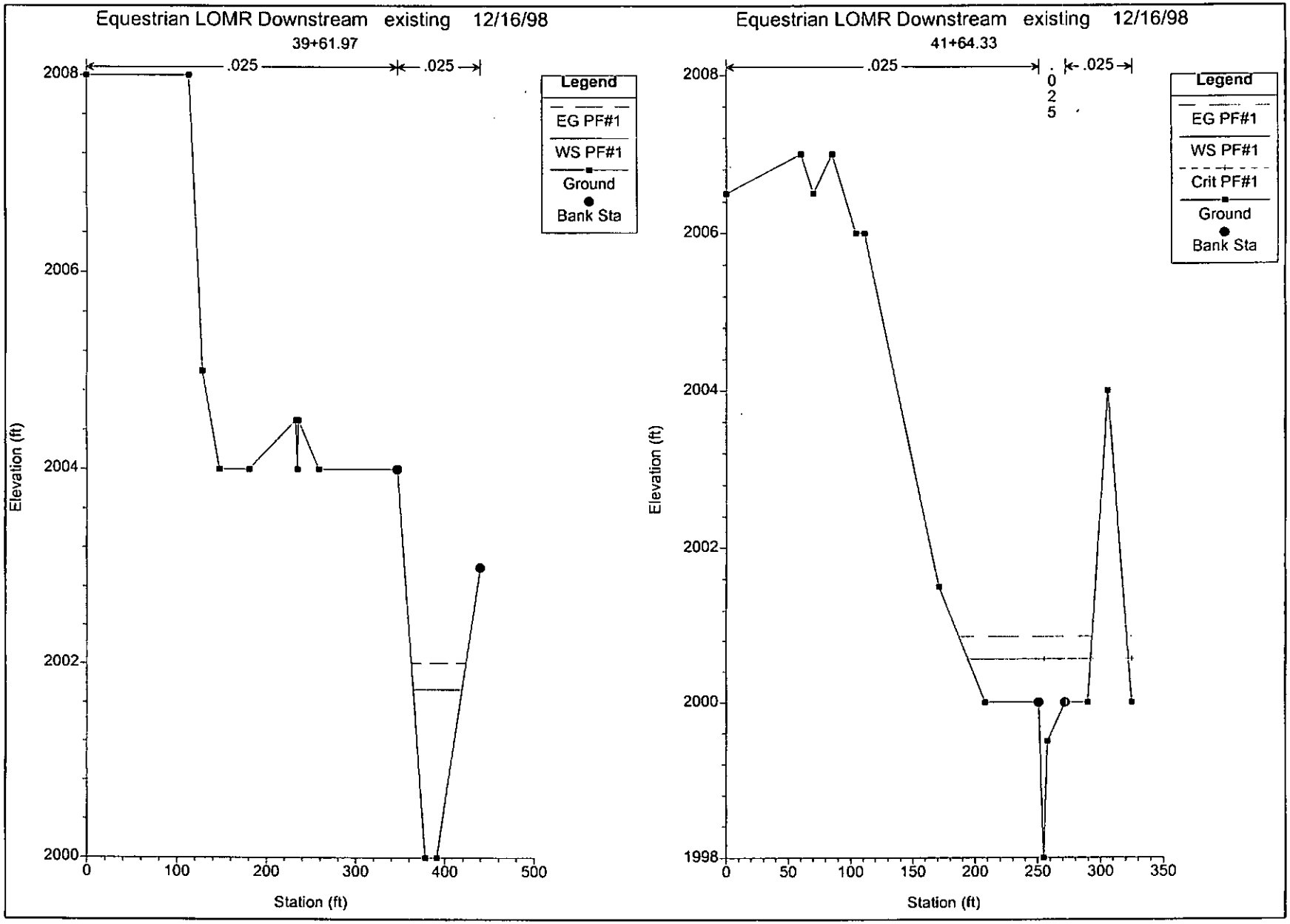

Equestrian LOMR Downstream existing 12/16/98
23+05.87
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2036
2034
2032
2030
2028
2026
2024
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
23+95.41
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
2032
2030
2028
2026
2024
0
100
200
300
400
500
Station (ft)

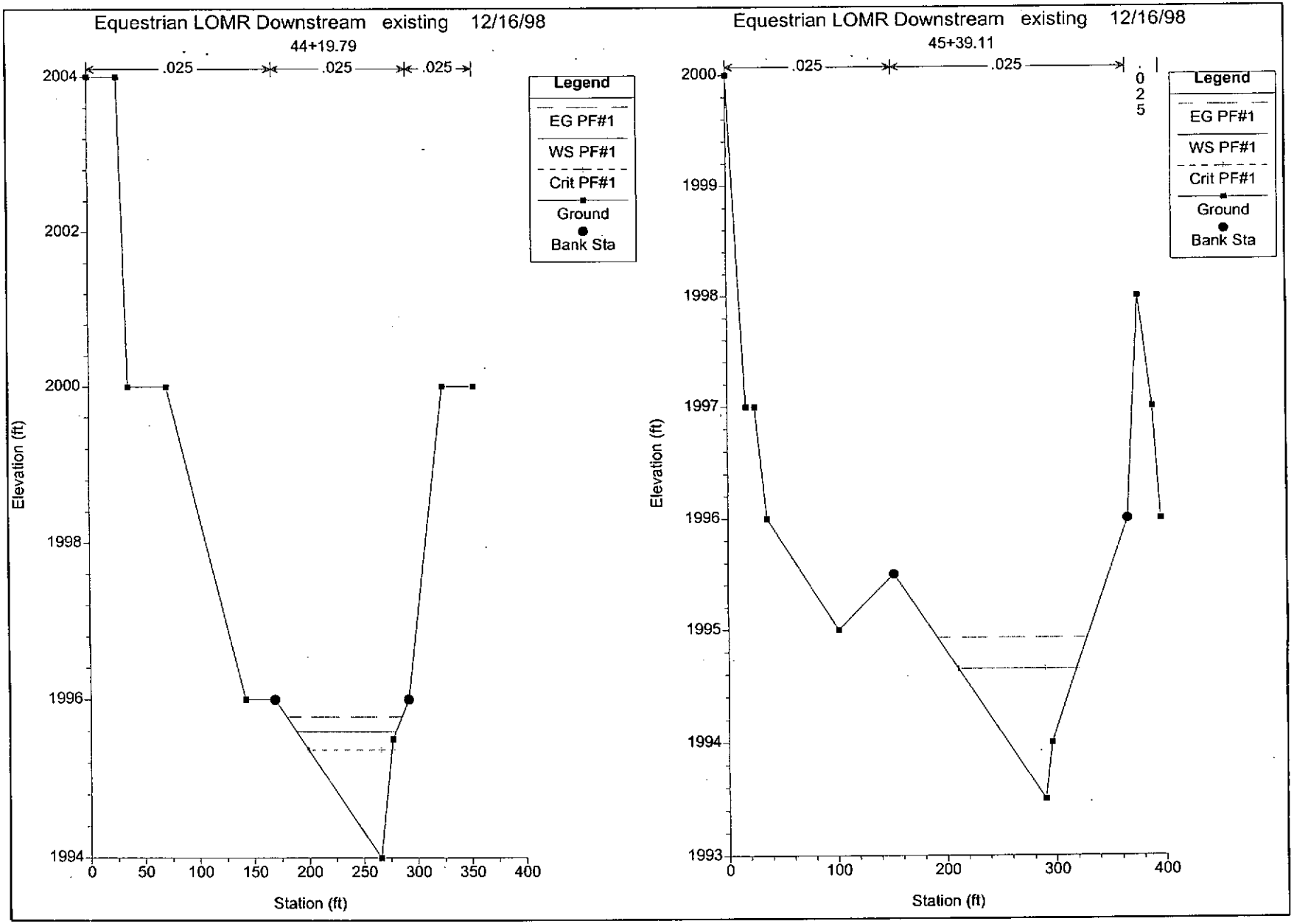

Equestrian LOMR Downstream existing 12/16/98
25+67.03
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2028
2027
2026
2025
2024
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
27+76.11
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2028
2026
2024
2022
2020
0
50
100
150
200
250
300
350

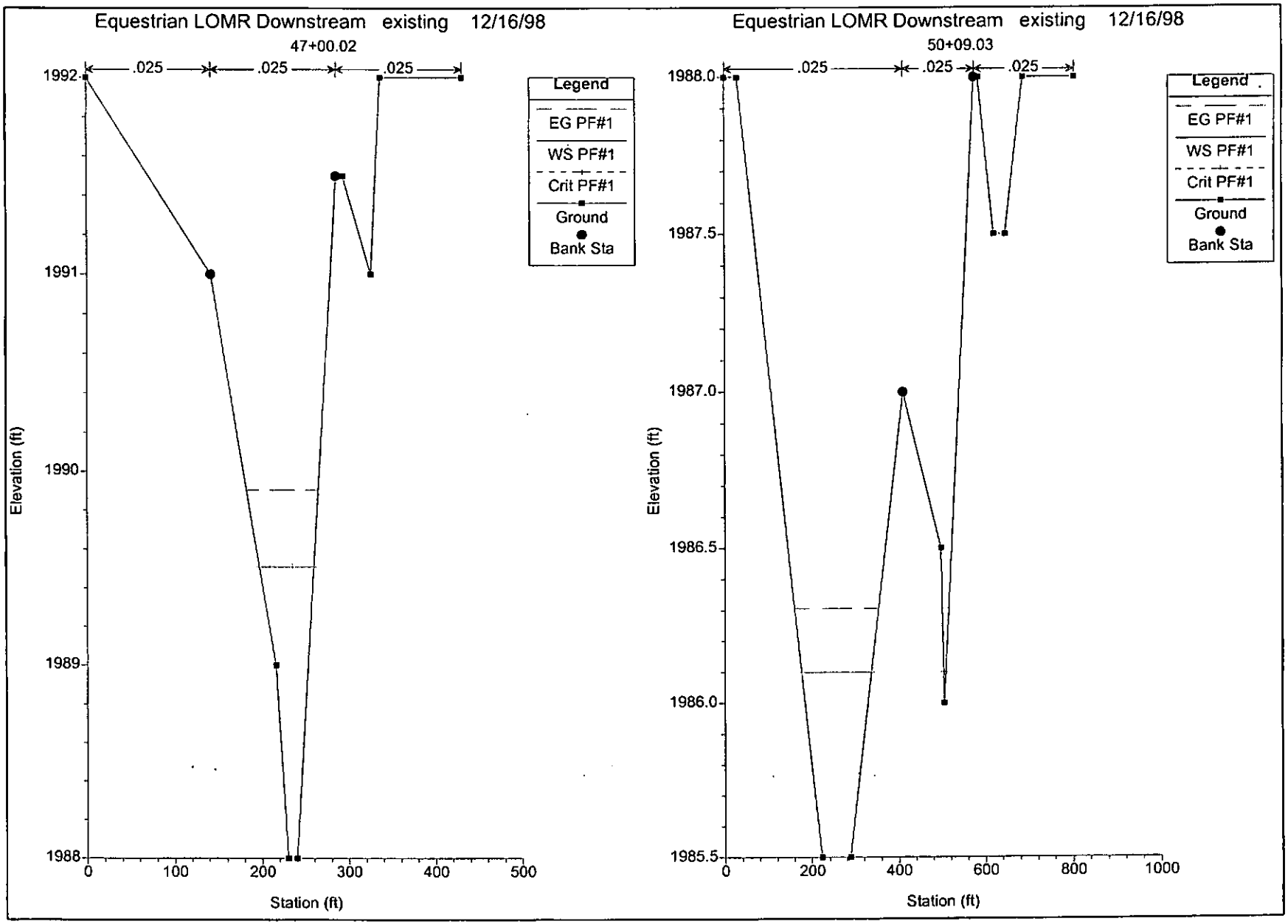

Equestrian LOMR Downstream existing 12/16/98
28+70.92
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2028
2026
2024
2022
2020
0
50
100
150
200
250
300
350
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
29+87.83
.025
.025
0
2
5
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2028
2026
2024
2022
2020
2018
0
50
100
150
200
Station (ft)

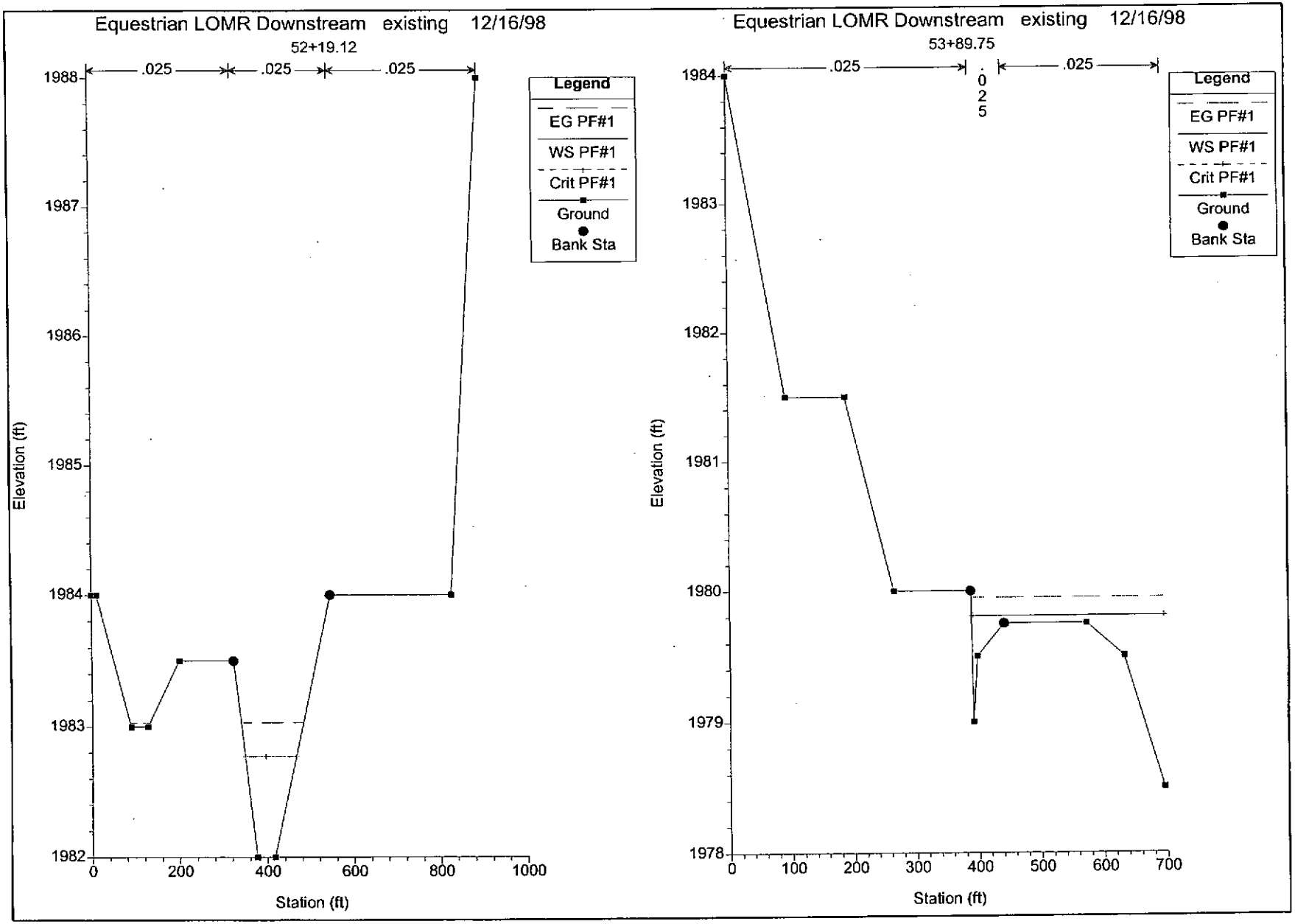

Equestrian LOMR Downstream existing 12/16/98
31+34.02
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2032
2030
2028
2026
2024
2022
2020
2018
2016
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
33+60.47
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2020
2019
2018
2017
2016
2015
2014
2013
0
100
200
300
400
500
600
700

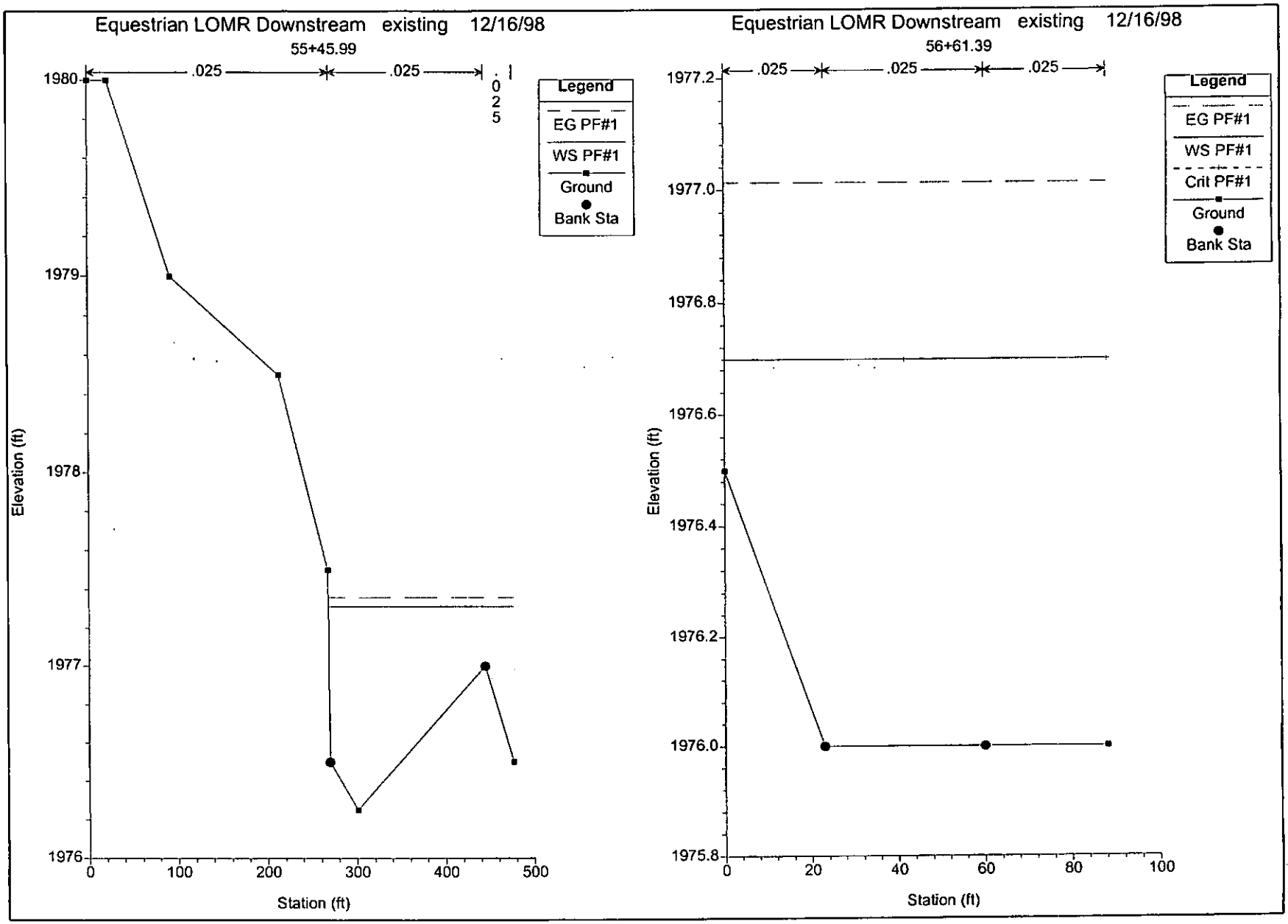

Equestrian LOMR Downstream existing 12/16/98
35+20.42
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2016
2015
2014
2013
2012
2011
2010
0
100
200
300
400
500
600
700
800
Equestrian LOMR Downstream existing 12/16/98
37+48.25
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2012
2011
2010
2009
2008
2007
0
100
200
300
400
500
600
700


Equestrian LOMR Downstream existing 12/16/98
39+61.97
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
2008
2006
2004
2002
2000
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
41+64.33
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2008
2006
2004
2002
2000
1998
0
50
100
150
200
250
300
350
Station (ft)


Equestrian LOMR Downstream existing 12/16/98
44+19.79
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2004
2002
2000
1998
1996
1994
0
50
100
150
200
250
300
350
400
Equestrian LOMR Downstream existing 12/16/98
45+39.11
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2000
1999
1998
1997
1996
1995
1994
1993
0
100
200
300
400


Equestrian LOMR Downstream existing 12/16/98
47+00.02
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1992
1991
1990
1989
1988
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
50+09.03
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1988.0
1987.5
1987.0
1986.5
1986.0
1985.5
0
200
400
600
800
1000
Station (ft)


Equestrian LOMR Downstream existing 12/16/98
52+19.12
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1988
1987
1986
1985
1984
1983
1982
0
200
400
600
800
1000
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
53+89.75
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1984
1983
1982
1981
1980
1979
1978
0
100
200
300
400
500
600
700
Station (ft)


Equestrian LOMR Downstream existing 12/16/98
55+45.99
.025
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1980
1979
1978
1977
1976
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
56+61.39
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1977.2
1977.0
1976.8
1976.6
1976.4
1976.2
1976.0
1975.8
0
20
40
60
80
100

HEC-RAS Version 2.1 October 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X     X    X   X
XXXXXXX  XXXX     X       XXX XXXX      XXXXXX   XXXX
X     X  X        X           X  X      X    X       X
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X     X  XXXXXX    XXXX       X    X    X    X   XXXXX
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PROJECT DATA
Project Title: Equestrian LOMR Downstream
Project File : equstds.prj
Run Date and Time: 12/16/98 11:45:20 AM

Project in English units

Project Description:
Equestrian LOMR Basin Discharge ******* Softdesk, Inc. HEC-2 Input Data file
****

 ************   Minimum
Data Input   **************

****

PLAN DATA

Plan Title: existing
Plan File : j:\1002005\HECRAS\equstds.p02

Geometry Title: EXISTING CONDITIONS
Geometry File : j:\1002005\HECRAS\equstds.g02

Flow Title : Imported Flow 01
Flow File : j:\1002005\HECRAS\equstds.f01

Plan Summary Information:
Number of: Cross Sections = 32 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

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

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Imported Flow 01
Flow File : j:\1002005\HECRAS\equstds.f01

Flow Data (cfs)

River	Reach	RS	PF#1
Equestrian Outfal		33.2	247
Equestrian Outfal		1.1	247

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Equestrian Outfa1		PF#1	Critical	Critical

GEOMETRY DATA

Geometry Title: EXISTING CONDITIONS
Geometry File : j:\1002005\HECRAS\equstds.g02

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 33.2

INPUT
Description: 10+00
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	71	2052	110	2052	122	2048	143	2047
153	2052	240	2052	243	2052.5	260	2052.5	305	2054
384	2054	407	2053.5	427	2054	453	2053.5	462	2054
479	2053	487	2055	512	2056				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	110	.025	153	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	153	75 101.1	125	.1	.3

Left Levee Station= 110 Elevation= 2052

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2049.85	Element			
Vel Head (ft)	0.24	Wt. n-Val.		0.025	
E.G. Elev (ft)	2050.09	Reach Len. (ft)	75.00	101.10	125.00
Crit W.S. (ft)	2049.01	Flow Area (sq ft)		62.46	
E.G. Slope (ft/ft)	0.001908	Area (sq ft)		62.46	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	32.23	Top Width (ft)		32.23	
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)		3.95	

Max Chl Dpth (ft)	2.85	Hydr. Depth (ft)		1.94	
Conv. Total (cfs)	5655.1	Conv. (cfs)		5655.1	
Length Wtd. (ft)	101.10	Wetted Per. (ft)		33.22	
Min Ch El (ft)	2047.00	Shear (lb/sq ft)		0.22	
Alpha	1.00	Stream Power (lb/ft s)		0.89	
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	0.61	6.25	0.35
C & E Loss (ft)	0.04	Cum SA (acres)	1.41	10.54	1.06

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 32.1

INPUT
Description: 11+49.53
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	71	2052	110	2052	122	2048	143	2047
153	2052	240	2052	243	2052.5	260	2052.5	305	2054
384	2054	407	2053.5	427	2054	453	2053.5	462	2054
479	2053	487	2055	512	2056				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	110	.025	153	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	153	75 101.1	125	.1	.3

Left Levee Station= 110 Elevation= 2052

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2049.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.		0.025	
E.G. Elev (ft)	2049.69	Reach Len. (ft)	75.00	101.10	125.00
Crit W.S. (ft)	2049.03	Flow Area (sq ft)		37.75	
E.G. Slope (ft/ft)	0.008446	Area (sq ft)		37.75	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	28.13	Top Width (ft)		28.13	
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)		6.54	
Max Chl Dpth (ft)	2.03	Hydr. Depth (ft)		1.34	

Conv. Total (cfs)	2687.6	Conv. (cfs)		2687.6	
Length Wtd. (ft)	101.10	Wetted Per. (ft)		28.80	
Min Ch El (ft)	2047.00	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		4.52	
Frctn Loss (ft)	0.85	Cum Volume (acre-ft)	0.61	6.13	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	10.47	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 31.1

INPUT
Description: 12+50.63
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	48	2048	59	2044	81	2044	104	2048
145	2048	152	2044	171	2044	177	2048	185	2050
209	2050	262	2052	327	2052				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	145	.025	177	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
145	177	110	90	50	.1 .3

Left Levee Station= 145 Elevation= 2048

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2045.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.		0.025	

E.G. Elev (ft)	2046.39	Reach Len. (ft)	110.00	90.00	50.00
Crit W.S. (ft)	2045.66	Flow Area (sq ft)		36.09	
E.G. Slope (ft/ft)	0.008276	Area (sq ft)		36.09	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	24.41	Top Width (ft)		24.41	
Vel Total (ft/s)	6.84	Avg. Vel. (ft/s)		6.84	
Max Chl Dpth (ft)	1.66	Hydr. Depth (ft)		1.48	
Conv. Total (cfs)	2715.0	Conv. (cfs)		2715.0	
Length Wtd. (ft)	90.00	Wetted Per. (ft)		25.35	
Min Ch El (ft)	2044.00	Shear (lb/sq ft)		0.74	
Alpha	1.00	Stream Power (lb/ft s)		5.03	
Frctn Loss (ft)	0.77	Cum Volume (acre-ft)	0.61	6.05	0.35
C & E Loss (ft)	0.04	Cum SA (acres)	1.41	10.41	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 30.1

INPUT
Description: 13+40:63
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	47	2048	65	2047	89	2044	144	2044
147	2040	153	2040	162	2045	164	2045.5	185	2048
205	2048	215	2045	228	2045.5	254	2048	273	2048

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	144	.025	162	.025

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

144	162		85	85.31	85	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2043.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.09	Wt. n-Val.		0.025	
E.G. Elev (ft)	2044.09	Reach Len. (ft)	85.00	85.31	85.00
Crit W.S. (ft)	2043.00	Flow Area (sq ft)		29.43	
E.G. Slope (ft/ft)	0.008784	Area (sq ft)		29.43	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	13.64	Top Width (ft)		13.64	
Vel Total (ft/s)	8.39	Avg. Vel. (ft/s)		8.39	
Max Chl Dpth (ft)	3.00	Hydr. Depth (ft)		2.16	
Conv. Total (cfs)	2635.4	Conv. (cfs)		2635.4	
Length Wtd. (ft)	85.31	Wetted Per. (ft)		15.92	
Min Ch El (ft)	2040.00	Shear (lb/sq ft)		1.01	
Alpha	1.00	Stream Power (lb/ft s)		8.51	
Frctn Loss (ft)	0.78	Cum Volume (acre-ft)	0.61	5.98	0.35
C & E Loss (ft)	0.19	Cum SA (acres)	1.41	10.37	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 29.1

INPUT
Description: 14+25.94
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2044	54	2044.5	72	2044	117	2044	123	2041.5
139	2040	169	2040	195	2044	265	2044	292	2046
304	2046	321	2048	420	2048				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	117	.025	195	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117	195	110 97.76	65	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2041.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.		0.025	
E.G. Elev (ft)	2041.60	Reach Len. (ft)	110.00	97.76	65.00
Crit W.S. (ft)	2041.14	Flow Area (sq ft)		45.41	
E.G. Slope (ft/ft)	0.009454	Area (sq ft)		45.41	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	49.59	Top Width (ft)		49.59	
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)		5.44	
Max Chl Dpth (ft)	1.14	Hydr. Depth (ft)		0.92	
Conv. Total (cfs)	2540.4	Conv. (cfs)		2540.4	
Length Wtd. (ft)	97.76	Wetted Per. (ft)		49.73	
Min Ch El (ft)	2040.00	Shear (lb/sq ft)		0.54	
Alpha	1.00	Stream Power (lb/ft s)		2.93	
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	0.61	5.91	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	10.31	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 28.1

INPUT
Description: 15+23.70
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2044	68	2044	100	2043	116	2043	156	2044

217	2044	222	2040	229	2038	237	2037	245	2037.5
247	2038	250	2036	254	2036	267	2040	342	2043
372	2043	416	2044	437	2044				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	222	.025	267	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
222	267	50 74.34	120	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2038.35	Element			
Vel Head (ft)	0.61	Wt. n-Val.		0.025	
E.G. Elev (ft)	2038.96	Reach Len. (ft)	50.00	74.34	120.00
Crit W.S. (ft)	2038.35	Flow Area (sq ft)		39.53	
E.G. Slope (ft/ft)	0.009408	Area (sq ft)		39.53	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	33.88	Top Width (ft)		33.88	
Vel Total (ft/s)	6.25	Avg. Vel. (ft/s)		6.25	
Max Chl Dpth (ft)	2.35	Hydr. Depth (ft)		1.17	
Conv. Total (cfs)	2546.6	Conv. (cfs)		2546.6	
Length Wtd. (ft)	74.34	Wetted Per. (ft)		35.03	
Min Ch El (ft)	2036.00	Shear (lb/sq ft)		0.66	
Alpha	1.00	Stream Power (lb/ft s)		4.14	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.61	5.81	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	10.22	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 27.1

INPUT
Description: 15+98.04
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2044	163	2040.5	183	2041	240	2041	251	2040
283	2040	287	2036	303	2036	304	2034.5	306	2036
322	2036	340	2040	360	2040	485	2044		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	283	.025	340	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	340	132 132.64	132	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2037.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.		0.025	
E.G. Elev (ft)	2037.59	Reach Len. (ft)	132.00	132.64	132.00
Crit W.S. (ft)	2037.06	Flow Area (sq ft)		42.29	
E.G. Slope (ft/ft)	0.009769	Area (sq ft)		42.29	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	40.81	Top Width (ft)		40.81	
Vel Total (ft/s)	5.84	Avg. Vel. (ft/s)		5.84	
Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)		1.04	
Conv. Total (cfs)	2499.0	Conv. (cfs)		2499.0	
Length Wtd. (ft)	132.64	Wetted Per. (ft)		42.67	
Min Ch El (ft)	2034.50	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		3.53	
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)	0.61	5.74	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	10.15	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 26.1

INPUT
Description: 17+30.68
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2040	47	2044	55	2044	180	2040	189	2040
314	2036	319	2032	333	2032	358	2036	388	2036
473	2040	477	2040						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	314	.025	358	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
314	358	110 106.66	90	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2033.79	Element			
Vel Head (ft)	0.69	Wt. n-Val.		0.025	
E.G. Elev (ft)	2034.48	Reach Len. (ft)	110.00	106.66	90.00
Crit W.S. (ft)	2033.79	Flow Area (sq ft)		37.16	
E.G. Slope (ft/ft)	0.008667	Area (sq ft)		37.16	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	27.45	Top Width (ft)		27.45	
Vel Total (ft/s)	6.65	Avg. Vel. (ft/s)		6.65	
Max Chl Dpth (ft)	1.79	Hydr. Depth (ft)		1.35	
Conv. Total (cfs)	2653.1	Conv. (cfs)		2653.1	
Length Wtd. (ft)		Wetted Per. (ft)		28.22	
Min Ch El (ft)	2032.00	Shear (lb/sq ft)		0.71	
Alpha	1.00	Stream Power (lb/ft s)		4.74	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.61	5.62	0.35
C & E Loss (ft)		Cum SA (acres)	1.41	10.05	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa

REACH: 1 RS: 25.1

INPUT
Description: 18+37.34
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2040	25	2044	50	2044	107	2040	123	2040
218	2035	222	2032	238	2032	244	2031.5	252	2032
255	2032	323	2035	367	2035	402	2036	452	2036

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	218	.025	323	.025

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
218	323		87	87.56	87	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2032.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.025	
E.G. Elev (ft)	2033.40	Reach Len. (ft)	87.00	87.56	87.00
Crit W.S. (ft)	2032.97	Flow Area (sq ft)		46.99	
E.G. Slope (ft/ft)	0.010056	Area (sq ft)		46.99	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	56.36	Top Width (ft)		56.36	
Vel Total (ft/s)	5.26	Avg. Vel. (ft/s)		5.26	
Max Chl Dpth (ft)	1.47	Hydr. Depth (ft)		0.83	
Conv. Total (cfs)	2463.1	Conv. (cfs)		2463.1	
Length Wtd. (ft)	87.56	Wetted Per. (ft)		56.74	
Min Ch El (ft)	2031.50	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.73	
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.61	5.52	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	9.95	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that

there is
not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 24.1

INPUT
Description: 19+24.90
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2040	97	2040	104	2040.5	137	2040	148	2036
181	2034.5	226	2034	272	2032	283	2032	305	2029.5
323	2030.5	405	2032	471	2032	477	2032.5	525	2036

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	283	.025	405	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	405	85 103.66	115	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2031.25	Element			
Vel Head (ft)	0.36	Wt. n-Val.		0.025	
E.G. Elev (ft)	2031.61	Reach Len. (ft)	85.00	103.66	115.00
Crit W.S. (ft)	2031.25	Flow Area (sq ft)		51.43	
E.G. Slope (ft/ft)	0.010720	Area (sq ft)		51.43	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	74.47	Top Width (ft)		74.47	
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)		4.80	
Max Chl Dpth (ft)	1.75	Hydr. Depth (ft)		0.69	
Conv. Total (cfs)	2385.6	Conv. (cfs)		2385.6	
Length Wtd. (ft)	103.66	Wetted Per. (ft)		74.60	
Min Ch El (ft)	2029.50	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		2.22	
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.61	5.42	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	9.82	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 23.1

INPUT
Description: 20+28.56

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2036	29	2032	106	2030	170	2030	215	2028
254	2028	413	2032	461	2032				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	170	.025	413	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	413	80 153.17	190	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2028.87	Element			
Vel Head (ft)	0.29	Wt. n-Val.		0.025	
E.G. Elev (ft)	2029.16	Reach Len. (ft)	80.00	153.17	190.00
Crit W.S. (ft)	2028.85	Flow Area (sq ft)		57.48	
E.G. Slope (ft/ft)	0.009956	Area (sq ft)		57.48	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	93.15	Top Width (ft)		93.15	
Vel Total (ft/s)	4.30	Avg. Vel. (ft/s)		4.30	
Max Chl Dpth (ft)	0.87	Hydr. Depth (ft)		0.62	
Conv. Total (cfs)	2475.5	Conv. (cfs)		2475.5	
Length Wtd. (ft)	153.17	Wetted Per. (ft)		93.18	
Min Ch El (ft)	2028.00	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.65	
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	0.61	5.29	0.35
C & E Loss (ft)	0.03	Cum SA (acres)	1.41	9.62	1.06

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 22.1

INPUT
Description: 21+81.73
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2036	39	2032	61	2030	129	2028	152	2028
369	2026.5	442	2028	466	2028				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	152	.025	442	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152	442	60 124.14	130	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2027.35	Element			
Vel Head (ft)	0.19	Wt. n-Val.		0.025	
E.G. Elev (ft)	2027.54	Reach Len. (ft)	60.00	124.14	130.00
Crit W.S. (ft)	2027.33	Flow Area (sq ft)		70.56	
E.G. Slope (ft/ft)	0.010782	Area (sq ft)		70.56	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	165.18	Top Width (ft)		165.18	
Vel Total (ft/s)	3.50	Avg. Vel. (ft/s)		3.50	
Max Chl Dpth (ft)	0.85	Hydr. Depth (ft)		0.43	
Conv. Total (cfs)	2378.7	Conv. (cfs)		2378.7	
Length Wtd. (ft)	124.14	Wetted Per. (ft)		165.19	
Min Ch El (ft)	2026.50	Shear (lb/sq ft)		0.29	
Alpha	1.00	Stream Power (lb/ft s)		1.01	
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)	0.61	5.06	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	9.16	1.06

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 21.1

INPUT
Description: 23+05.87
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2036	10	2032	42	2028	162	2026	217	2025.5
372	2025.5	411	2026.5	419	2026.5	460	2028	470	2028

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	162	.025	411	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	411	89 89.54	89	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2025.90	Element		0.025	
Vel Head (ft)	0.17	Wt. n-Val.			
E.G. Elev (ft)	2026.07	Reach Len. (ft)	89.00	89.54	89.00
Crit W.S. (ft)	2025.90	Flow Area (sq ft)		74.11	
E.G. Slope (ft/ft)	0.012990	Area (sq ft)		74.11	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	214.73	Top Width (ft)		214.73	
Vel Total (ft/s)	3.33	Avg. Vel. (ft/s)		3.33	
Max Chl Dpth (ft)	0.40	Hydr. Depth (ft)		0.35	
Conv. Total (cfs)	2167.2	Conv. (cfs)		2167.2	
Length Wtd. (ft)	89.54	Wetted Per. (ft)		214.74	
Min Ch El (ft)	2025.50	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)		0.93	
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	0.61	4.86	0.35
C & E Loss (ft)	0.04	Cum SA (acres)	1.41	8.62	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is

not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 20.1

INPUT
Description: 23+95.41
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2032	10	2028	194	2024	404	2024	446	2026.5
466	2026								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	10	.025	446	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10	446	100 171.62	180	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2024.78	Element			
Vel Head (ft)	0.03	Wt. n-Val.		0.025	
E.G. Elev (ft)	2024.81	Reach Len. (ft)	100.00	171.62	180.00
Crit W.S. (ft)		Flow Area (sq ft)		183.51	
E.G. Slope (ft/ft)	0.000813	Area (sq ft)		183.51	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	259.13	Top Width (ft)		259.13	
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)		1.35	
Max Chl Dpth (ft)	0.78	Hydr. Depth (ft)		0.71	
Conv. Total (cfs)	8665.2	Conv. (cfs)		8665.2	
Length Wtd. (ft)	171.62	Wetted Per. (ft)		259.16	
Min Ch El (ft)	2024.00	Shear (lb/sq ft)		0.04	
Alpha	1.00	Stream Power (lb/ft s)		0.05	
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	0.61	4.59	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	8.13	1.06

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 19.1

INPUT
Description: 25+67.03
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	38	2028	74	2027	116	2024	389	2024
417	2025.5	454	2026						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	74	.025	417	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
74	417	50 127.18	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2024.29	Element			
Vel Head (ft)	0.14	Wt. n-Val.		0.025	
E.G. Elev (ft)	2024.44	Reach Len. (ft)	50.00	127.18	150.00
Crit W.S. (ft)	2024.29	Flow Area (sq ft)		81.18	
E.G. Slope (ft/ft)	0.013826	Area (sq ft)		81.18	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	282.55	Top Width (ft)		282.55	
Vel Total (ft/s)	3.04	Avg. Vel. (ft/s)		3.04	
Max Chl Dpth (ft)	0.29	Hydr. Depth (ft)		0.29	
Conv. Total (cfs)	2100.6	Conv. (cfs)		2100.6	
Length Wtd. (ft)	127.18	Wetted Per. (ft)		282.56	
Min Ch El (ft)	2024.00	Shear (lb/sq ft)		0.25	
Alpha	1.00	Stream Power (lb/ft s)		0.75	
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)	0.61	4.07	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	7.07	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is

not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 17.1

INPUT
Description: 27+76.11
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	5	2028	19	2027.5	51	2024	107	2024
223	2020	285	2020	330	2024				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	107	.025	330	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
107	330	190 176.7	90	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2021.37	Element			
Vel Head (ft)	0.06	Wt. n-Val.		0.025	
E.G. Elev (ft)	2021.43	Reach Len. (ft)	190.00	176.70	90.00
Crit W.S. (ft)		Flow Area (sq ft)		122.37	
E.G. Slope (ft/ft)	0.001088	Area (sq ft)		122.37	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	117.02	Top Width (ft)		117.02	
Vel Total (ft/s)	2.02	Avg. Vel. (ft/s)		2.02	
Max Chl Dpth (ft)	1.37	Hydr. Depth (ft)		1.05	
Conv. Total (cfs)	7489.4	Conv. (cfs)		7489.4	
Length Wtd. (ft)	176.70	Wetted Per. (ft)		117.11	
Min Ch El (ft)	2020.00	Shear (lb/sq ft)		0.07	
Alpha	1.00	Stream Power (lb/ft s)		0.14	
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	0.61	3.78	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	6.48	1.06

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 16.1

INPUT
Description: 28+70.92
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	16	2027	47	2024	71	2024	90	2023.5
120	2023	1502021.816		196	2020	268	2020	290	2021.5
329	2022.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	150	.025	290	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
150	290	70 62.62	40	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2020.67	Element			
Vel Head (ft)	0.29	Wt. n-Val.		0.025	
E.G. Elev (ft)	2020.96	Reach Len. (ft)	70.00	62.62	40.00
Crit W.S. (ft)	2020.67	Flow Area (sq ft)		57.02	
E.G. Slope (ft/ft)	0.011049	Area (sq ft)		57.02	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	98.72	Top Width (ft)		98.72	
Vel Total (ft/s)	4.33	Avg. Vel. (ft/s)		4.33	
Max Chl Dpth (ft)	0.67	Hydr. Depth (ft)		0.58	
Conv. Total (cfs)	2349.8	Conv. (cfs)		2349.8	
Length Wtd. (ft)	62.62	Wetted Per. (ft)		98.75	
Min Ch El (ft)	2020.00	Shear (lb/sq ft)		0.40	
Alpha	1.00	Stream Power (lb/ft s)		1.73	
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	0.61	3.41	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	6.05	1.06

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 15.1

INPUT
Description: 29+87.83
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	18	2024	74	2020	80	2019	90	2019

187	2020	188	2024

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	74	.025	187	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
74	187	130 146.19	170	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2019.98	Element			
Vel Head (ft)	0.27	Wt. n-Val.		0.025	
E.G. Elev (ft)	2020.25	Reach Len. (ft)	130.00	146.19	170.00
Crit W.S. (ft)	2019.98	Flow Area (sq ft)		59.10	
E.G. Slope (ft/ft)	0.011443	Area (sq ft)		59.10	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	110.79	Top Width (ft)		110.79	
Vel Total (ft/s)	4.18	Avg. Vel. (ft/s)		4.18	
Max Chl Dpth (ft)	0.98	Hydr. Depth (ft)		0.53	
Conv. Total (cfs)	2309.1	Conv. (cfs)		2309.1	
Length Wtd. (ft)	146.19	Wetted Per. (ft)		110.87	
Min Ch El (ft)	2019.00	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.59	
Frctn Loss (ft)	1.70	Cum Volume (acre-ft)	0.61	3.33	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	5.89	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 14.1

INPUT
Description: 31+34.02
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2032	7	2032	42	2020	188	2017	268	2016
314	2016.5	358	2018.5	426	2020	436	2020		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	188	.025	358	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
188	358	180 226.45	270	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2016.88	Element			
Vel Head (ft)	0.25	Wt. n-Val.		0.025	
E.G. Elev (ft)	2017.13	Reach Len. (ft)	180.00	226.45	270.00
Crit W.S. (ft)	2016.88	Flow Area (sq ft)		61.33	
E.G. Slope (ft/ft)	0.011813	Area (sq ft)		61.33	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	124.59	Top Width (ft)		124.59	
Vel Total (ft/s)	4.03	Avg. Vel. (ft/s)		4.03	
Max Chl Dpth (ft)	0.88	Hydr. Depth (ft)		0.49	
Conv. Total (cfs)	2272.6	Conv. (cfs)		2272.6	
Length Wtd. (ft)	226.45	Wetted Per. (ft)		124.60	
Min Ch El (ft)	2016.00	Shear (lb/sq ft)		0.36	
Alpha	1.00	Stream Power (lb/ft s)		1.46	
Frctn Loss (ft)	2.80	Cum Volume (acre-ft)	0.61	3.13	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	5.50	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 13.1

INPUT
Description: 33+60.47

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2020	39	2016	48	2016	67	2017	104	2016
283	2016	310	2014.5	322	2015	326	2014	328	2014.5
333	2014	426	2013.5	500	2013.5	613	2016	625	2016

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	333	.025	613	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
333	613	159 159.95	159	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2014.03	Element			
Vel Head (ft)	0.19	Wt. n-Val.	0.025	0.025	
E.G. Elev (ft)	2014.21	Reach Len. (ft)	159.00	159.95	159.00
Crit W.S. (ft)	2014.03	Flow Area (sq ft)	0.01	70.73	
E.G. Slope (ft/ft)	0.012960	Area (sq ft)	0.01	70.73	
Q Total (cfs)	247.00	Flow (cfs)	0.00	247.00	
Top Width (ft)	191.20	Top Width (ft)	0.46	190.75	
Vel Total (ft/s)	3.49	Avg. Vel. (ft/s)	0.36	3.49	
Max Chl Dpth (ft)	0.53	Hydr. Depth (ft)	0.01	0.37	
Conv. Total (cfs)	2169.7	Conv. (cfs)	0.0	2169.7	
Length Wtd. (ft)	159.95	Wetted Per. (ft)	0.46	190.75	
Min Ch El (ft)	2013.50	Shear (lb/sq ft)	0.01	0.30	
Alpha	1.00	Stream Power (lb/ft s)	0.00	1.05	
Frctn Loss (ft)	2.00	Cum Volume (acre-ft)	0.61	2.78	0.35
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	4.68	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - Divided flow computed for this cross-section.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 12.1

INPUT
Description: 35+20.42
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2016	26	2016	108	2014.5	263	2015.5	279	2014.5
282	2014.5	304	2012	339	2012	340	2013	344	2012
351	2012	434	2010.5	548	2011	646	2013	713	2013.5
730	2013								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	351	.025	548	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
351	548	170 227.83	290	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2011.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.025	0.025
E.G. Elev (ft)	2011.42	Reach Len. (ft)	170.00	227.83	290.00
Crit W.S. (ft)	2011.21	Flow Area (sq ft)		65.88	1.05
E.G. Slope (ft/ft)	0.012103	Area (sq ft)		65.88	1.05
Q Total (cfs)	247.00	Flow (cfs)		245.49	1.51
Top Width (ft)	163.23	Top Width (ft)		153.10	10.13
Vel Total (ft/s)	3.69	Avg. Vel. (ft/s)		3.73	1.44
Max Chl Dpth (ft)	0.71	Hydr. Depth (ft)		0.43	0.10
Conv. Total (cfs)	2245.2	Conv. (cfs)		2231.5	13.7
Length Wtd. (ft)	228.02	Wetted Per. (ft)		153.11	10.13
Min Ch El (ft)	2010.50	Shear (lb/sq ft)		0.33	0.08
Alpha	1.01	Stream Power (lb/ft s)		1.21	0.11
Frctn Loss (ft)	2.72	Cum Volume (acre-ft)	0.61	2.53	0.35
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	4.05	1.05

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 11.1

INPUT
Description: 37+48.25
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2008	23	2008	61	2010	106	2011	268	2011
274	2010	275	2011	284	2009	287	2008	337	2008
379	2007	450	2007	503	2008	532	2008	682	2012
694	2012								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	337	.025	503	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
337	503	270 312.72	170	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2007.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.025	
E.G. Elev (ft)	2007.86	Reach Len. (ft)	270.00	312.72	170.00
Crit W.S. (ft)	2007.62	Flow Area (sq ft)		62.48	
E.G. Slope (ft/ft)	0.011756	Area (sq ft)		62.48	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	130.05	Top Width (ft)		130.05	
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)		3.95	
Max Chl Dpth (ft)	0.62	Hydr. Depth (ft)		0.48	
Conv. Total (cfs)	2278.1	Conv. (cfs)		2278.1	
Length Wtd. (ft)	312.72	Wetted Per. (ft)		130.06	
Min Ch El (ft)	2007.00	Shear (lb/sq ft)		0.35	
Alpha	1.00	Stream Power (lb/ft s)		1.39	
Frctn Loss (ft)	2.17	Cum Volume (acre-ft)	0.61	2.20	0.34
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	3.31	1.01

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 10.1

INPUT
Description: 39+61.97
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2008	114	2008	129	2005	148	2004	181	2004
233	2004.5	235	2004	236	2004.5	259	2004	347	2004
378	2000	391	2000	440	2003				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	347	.025	440	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
347	440	230 202.36	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2001.73	Element			
Vel Head (ft)	0.27	Wt. n-Val.		0.025	
E.G. Elev (ft)	2002.01	Reach Len. (ft)	230.00	202.36	150.00
Crit W.S. (ft)		Flow Area (sq ft)		58.76	
E.G. Slope (ft/ft)	0.004573	Area (sq ft)		58.76	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	54.76	Top Width (ft)		54.76	
Vel Total (ft/s)	4.20	Avg. Vel. (ft/s)		4.20	
Max Chl Dpth (ft)	1.73	Hydr. Depth (ft)		1.07	
Conv. Total (cfs)	3652.6	Conv. (cfs)		3652.6	
Length Wtd. (ft)	203.40	Wetted Per. (ft)		54.93	

Min Ch El (ft)	2000.00	Shear (lb/sq ft)		0.31	
Alpha	1.00	Stream Power (lb/ft s)		1.28	
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	0.61	1.76	0.34
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	2.65	1.01

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 9.1

INPUT
Description: 41+64.33
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2006.5	60	2007	70	2006.5	85	2007	104	2006
111	2006	171	2001.5	208	2000	251	2000	255	1998
258	1999.5	272	2000	290	2000	306	2004	325	2000

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	251	.025	272	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
251	272	260 255.46	230	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2000.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.025	0.025	0.025
E.G. Elev (ft)	2000.85	Reach Len. (ft)	260.00	255.46	230.00
Crit W.S. (ft)	2000.56	Flow Area (sq ft)	27.91	23.00	11.44
E.G. Slope (ft/ft)	0.007363	Area (sq ft)	27.91	23.00	11.44
Q Total (cfs)	247.00	Flow (cfs)	88.62	121.40	36.98
Top Width (ft)	100.69	Top Width (ft)	56.80	21.00	22.89
Vel Total (ft/s)	3.96	Avg. Vel. (ft/s)	3.18	5.28	3.23
Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)	0.49	1.10	0.50
Conv. Total (cfs)	2878.6	Conv. (cfs)	1032.8	1414.8	430.9
Length Wtd. (ft)	254.37	Wetted Per. (ft)	56.81	21.84	23.58
Min Ch El (ft)	1998.00	Shear (lb/sq ft)	0.23	0.48	0.22
Alpha	1.20	Stream Power (lb/ft s)	0.72	2.56	0.72
Frctn Loss (ft)	1.49	Cum Volume (acre-ft)	0.54	1.57	0.32

C & E Loss (ft)	0.03	Cum SA (acres)	1.25	2.47	0.97

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - Divided flow computed for this cross-section.
Warning - The cross-section end points had to be extended vertically for the computed water surface.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 8.1

INPUT
Description: 44+19.79
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2004	27	2004	36	2000	71	2000	142	1996
169	1996	266	1994	277	1995.5	292	1996	324	2000
353	2000								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	169	.025	292	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
169	292	80 119.32	170	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1995.59	Element			
Vel Head (ft)	0.19	Wt. n-Val.		0.025	
E.G. Elev (ft)	1995.78	Reach Len. (ft)	80.00	119.32	170.00
Crit W.S. (ft)	1995.36	Flow Area (sq ft)		71.01	
E.G. Slope (ft/ft)	0.004784	Area (sq ft)		71.01	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	91.11	Top Width (ft)		91.11	
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)		3.48	
Max Chl Dpth (ft)	1.59	Hydr. Depth (ft)		0.78	

Conv. Total (cfs)	3571.3	Conv. (cfs)		3571.3	
Length Wtd. (ft)	119.32	Wetted Per. (ft)		91.23	
Min Ch El (ft)	1994.00	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)		0.81	
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	0.46	1.30	0.29
C & E Loss (ft)	0.01	Cum SA (acres)	1.08	2.14	0.91

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 7.1

INPUT
Description: 45+39.11
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2000	17	1997	25	1997	36	1996	101	1995
152	1995.5	290	1993.5	296	1994	366	1996	376	1998
389	1997	396	1996						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	152	.025	366	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152	366	200 160.91	120	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1994.65	Element			
Vel Head (ft)	0.28	Wt. n-Val.		0.025	
E.G. Elev (ft)	1994.93	Reach Len. (ft)	200.00	160.91	120.00
Crit W.S. (ft)	1994.65	Flow Area (sq ft)		58.22	
E.G. Slope (ft/ft)	0.011603	Area (sq ft)		58.22	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	107.91	Top Width (ft)		107.91	
Vel Total (ft/s)	4.24	Avg. Vel. (ft/s)		4.24	
Max Chl Dpth (ft)	1.15	Hydr. Depth (ft)		0.54	
Conv. Total (cfs)	2293.1	Conv. (cfs)		2293.1	
Length Wtd. (ft)	160.91	Wetted Per. (ft)		107.95	
Min Ch El (ft)	1993.50	Shear (lb/sq ft)		0.39	

Alpha	1.00	Stream Power (lb/ft s)		1.66	
Frctn Loss (ft)	1.73	Cum Volume (acre-ft)	0.46	1.12	0.29
C & E Loss (ft)	0.01	Cum SA (acres)	1.08	1.87	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 6.1

INPUT
Description: 47+00.02
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1992	142	1991	216	1989	230	1988	240	1988
286	1991.5	294	1991.5	326	1991	337	1992	431	1992

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	142	.025	286	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
142	286	320 309.01	270	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1989.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.		0.025	
E.G. Elev (ft)	1989.90	Reach Len. (ft)	320.00	309.01	270.00
Crit W.S. (ft)	1989.51	Flow Area (sq ft)		48.97	
E.G. Slope (ft/ft)	0.010023	Area (sq ft)		48.97	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	62.67	Top Width (ft)		62.67	
Vel Total (ft/s)	5.04	Avg. Vel. (ft/s)		5.04	
Max Chl Dpth (ft)	1.51	Hydr. Depth (ft)		0.78	
Conv. Total (cfs)	2467.1	Conv. (cfs)		2467.1	

Length Wtd. (ft)	314.50	Wetted Per. (ft)		62.77	
Min Ch El (ft)	1988.00	Shear (lb/sq ft)		0.49	
Alpha	1.00	Stream Power (lb/ft s)		2.46	
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)	0.46	0.92	0.29
C & E Loss (ft)	0.06	Cum SA (acres)	1.08	1.55	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 5.1

INPUT
Description: 50+09.03

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1988	30	1988	223	1985.5	288	1985.5	411	1987
498	1986.5	505	1986	575	1988	584	1988	620	1987.5
646	1987.5	687	1988	805	1988				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	411	.025	575	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
411	575	250 210.09	160	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1986.10	Element			
Vel Head (ft)	0.21	Wt. n-Val.	0.025	0.025	
E.G. Elev (ft)	1986.31	Reach Len. (ft)	250.00	210.09	160.00
Crit W.S. (ft)	1986.10	Flow Area (sq ft)	67.38	0.24	
E.G. Slope (ft/ft)	0.012057	Area (sq ft)	67.38	0.24	
Q Total (cfs)	247.00	Flow (cfs)	246.79	0.21	

Top Width (ft)	165.06	Top Width (ft)	160.24	4.82	
Vel Total (ft/s)	3.65	Avg. Vel. (ft/s)	3.66	0.87	
Max Chl Dpth (ft)	0.60	Hydr. Depth (ft)	0.42	0.05	
Conv. Total (cfs)	2249.5	Conv. (cfs)	2247.6	1.9	
Length Wtd. (ft)	230.03	Wetted Per. (ft)	160.25	4.82	
Min Ch El (ft)	1986.00	Shear (lb/sq ft)	0.32	0.04	
Alpha	1.00	Stream Power (lb/ft s)	1.16	0.03	
Frctn Loss (ft)	2.70	Cum Volume (acre-ft)	0.21	0.75	0.29
C & E Loss (ft)	0.01	Cum SA (acres)	0.50	1.31	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - Divided flow computed for this cross-section.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 4.1

INPUT
Description: 52+19.12
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1984	12	1984	89	1983	127	1983	200	1983.5
325	1983.5	377	1982	417	1982	547	1984	826	1984
893	1988								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	325	.025	547	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
325	547	230 170.63	110	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1982.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.025	

E.G. Elev (ft)	1983.03	Reach Len. (ft)	230.00	170.63	110.00
Crit W.S. (ft)	1982.77	Flow Area (sq ft)		60.41	
E.G. Slope (ft/ft)	0.011403	Area (sq ft)		60.41	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	116.79	Top Width (ft)		116.79	
Vel Total (ft/s)	4.09	Avg. Vel. (ft/s)		4.09	
Max Chl Dpth (ft)	0.77	Hydr. Depth (ft)		0.52	
Conv. Total (cfs)	2313.1	Conv. (cfs)		2313.1	
Length Wtd. (ft)	144.71	Wetted Per. (ft)		116.81	
Min Ch El (ft)	1982.00	Shear (lb/sq ft)		0.37	
Alpha	1.00	Stream Power (lb/ft s)		1.51	
Frctn Loss (ft)	1.90	Cum Volume (acre-ft)	0.02	0.60	0.29
C & E Loss (ft)	0.03	Cum SA (acres)	0.04	1.02	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 3.1

INPUT
Description: 53+89.75
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1984	92	1981.5	188	1981.5	265	1980	388	1980
391	1979	398	1979.5	441	1979.75	572	1979.75	632	1979.5
695	1978.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	388	.025	441	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
388	441	156 156.24	156	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1979.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.025	0.025
E.G. Elev (ft)	1979.95	Reach Len. (ft)	156.00	156.24	156.00
Crit W.S. (ft)	1979.81	Flow Area (sq ft)		12.61	68.80
E.G. Slope (ft/ft)	0.015324	Area (sq ft)		12.61	68.80
Q Total (cfs)	247.00	Flow (cfs)		35.83	211.17
Top Width (ft)	306.42	Top Width (ft)		52.42	254.00
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)		2.84	3.07
Max Chl Dpth (ft)	1.31	Hydr. Depth (ft)		0.24	0.27
Conv. Total (cfs)	1995.3	Conv. (cfs)		289.5	1705.8
Length Wtd. (ft)	156.12	Wetted Per. (ft)		52.57	255.31
Min Ch El (ft)	1979.00	Shear (lb/sq ft)		0.23	0.26
Alpha	1.00	Stream Power (lb/ft s)		0.65	0.79
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	0.02	0.46	0.21
C & E Loss (ft)	0.03	Cum SA (acres)	0.04	0.69	0.59

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The cross-section end points had to be extended vertically for the computed water surface.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 2.1

INPUT
Description: 55+45.99
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1980	22	1980	92	1979	213	1978.5	268	1977.5
270	1976.5	301	1976.25	445	1977	477	1976.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	270	.025	445	.025

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
270	445	115	115.4	115	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1977.31	Element			
Vel Head (ft)	0.04	Wt. n-Val.	0.025	0.025	0.025
E.G. Elev (ft)	1977.36	Reach Len. (ft)	115.00	115.40	115.00
Crit W.S. (ft)		Flow Area (sq ft)	0.66	128.23	18.03
E.G. Slope (ft/ft)	0.001269	Area (sq ft)	0.66	128.23	18.03
Q Total (cfs)	247.00	Flow (cfs)	0.71	220.68	25.61
Top Width (ft)	208.63	Top Width (ft)	1.63	175.00	32.00
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)	1.08	1.72	1.42
Max Chl Dpth (ft)	1.06	Hydr. Depth (ft)	0.41	0.73	0.56
Conv. Total (cfs)	6933.8	Conv. (cfs)	20.0	6194.8	718.9
Length Wtd. (ft)	115.28	Wetted Per. (ft)	1.82	175.00	32.82
Min Ch El (ft)	1976.25	Shear (lb/sq ft)	0.03	0.06	0.04
Alpha	1.01	Stream Power (lb/ft s)	0.03	0.10	0.06
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	0.01	0.20	0.05
C & E Loss (ft)	0.03	Cum SA (acres)	0.03	0.28	0.08

Warning - The cross-section end points had to be extended vertically for the computed water surface.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 1.1

INPUT
Description: 56+61.39
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1976.5	23	1976	60	1976	88	1976

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	23	.025	60	.025

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
23	60	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1976.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.025	0.025	0.025
E.G. Elev (ft)	1977.01	Reach Len. (ft)			
Crit W.S. (ft)	1976.70	Flow Area (sq ft)	10.32	25.86	19.57
E.G. Slope (ft/ft)	0.010009	Area (sq ft)	10.32	25.86	19.57
Q Total (cfs)	247.00	Flow (cfs)	35.78	121.09	90.14
Top Width (ft)	88.00	Top Width (ft)	23.00	37.00	28.00
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)	3.47	4.68	4.61
Max Chl Dpth (ft)	0.70	Hydr. Depth (ft)	0.45	0.70	0.70
Conv. Total (cfs)	2468.9	Conv. (cfs)	357.6	1210.3	901.0
Length Wtd. (ft)		Wetted Per. (ft)	23.20	37.00	28.70
Min Ch El (ft)	1976.00	Shear (lb/sq ft)	0.28	0.44	0.43
Alpha	1.03	Stream Power (lb/ft s)	0.96	2.04	1.96
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Equestrian Outfa

Reach	River Sta.	n1	n2	n3
1	33.2	.025	.025	.025
1	32.1	.025	.025	.025
1	31.1	.025	.025	.025
1	30.1	.025	.025	.025
1	29.1	.025	.025	.025
1	28.1	.025	.025	.025
1	27.1	.025	.025	.025
1	26.1	.025	.025	.025
1	25.1	.025	.025	.025
1	24.1	.025	.025	.025
1	23.1	.025	.025	.025
1	22.1	.025	.025	.025
1	21.1	.025	.025	.025
1	20.1	.025	.025	.025
1	19.1	.025	.025	.025
1	17.1	.025	.025	.025

1	16.1	.025	.025	.025
1	15.1	.025	.025	.025
1	14.1	.025	.025	.025
1	13.1	.025	.025	.025
1	12.1	.025	.025	.025
1	11.1	.025	.025	.025
1	10.1	.025	.025	.025
1	9.1	.025	.025	.025
1	8.1	.025	.025	.025
1	7.1	.025	.025	.025
1	6.1	.025	.025	.025
1	5.1	.025	.025	.025
1	4.1	.025	.025	.025
1	3.1	.025	.025	.025
1	2.1	.025	.025	.025
1	1.1	.025	.025	.025

SUMMARY OF REACH LENGTHS

River: Equestrian Outfa

Reach	River Sta.	Left	Channel	Right
1	33.2	75	101.1	125
1	32.1	75	101.1	125
1	31.1	110	90	50
1	30.1	85	85.31	85
1	29.1	110	97.76	65
1	28.1	50	74.34	120
1	27.1	132	132.64	132
1	26.1	110	106.66	90
1	25.1	87	87.56	87
1	24.1	85	103.66	115
1	23.1	80	153.17	190
1	22.1	60	124.14	130
1	21.1	89	89.54	89
1	20.1	100	171.62	180
1	19.1	50	127.18	150
1	17.1	190	176.7	90
1	16.1	70	62.62	40

1	15.1	130	146.19	170
1	14.1	180	226.45	270
1	13.1	159	159.95	159
1	12.1	170	227.83	290
1	11.1	270	312.72	170
1	10.1	230	202.36	150
1	9.1	260	255.46	230
1	8.1	80	119.32	170
1	7.1	200	160.91	120
1	6.1	320	309.01	270
1	5.1	250	210.09	160
1	4.1	230	170.63	110
1	3.1	156	156.24	156
1	2.1	115	115.4	115
1	1.1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Equestrian Outfa

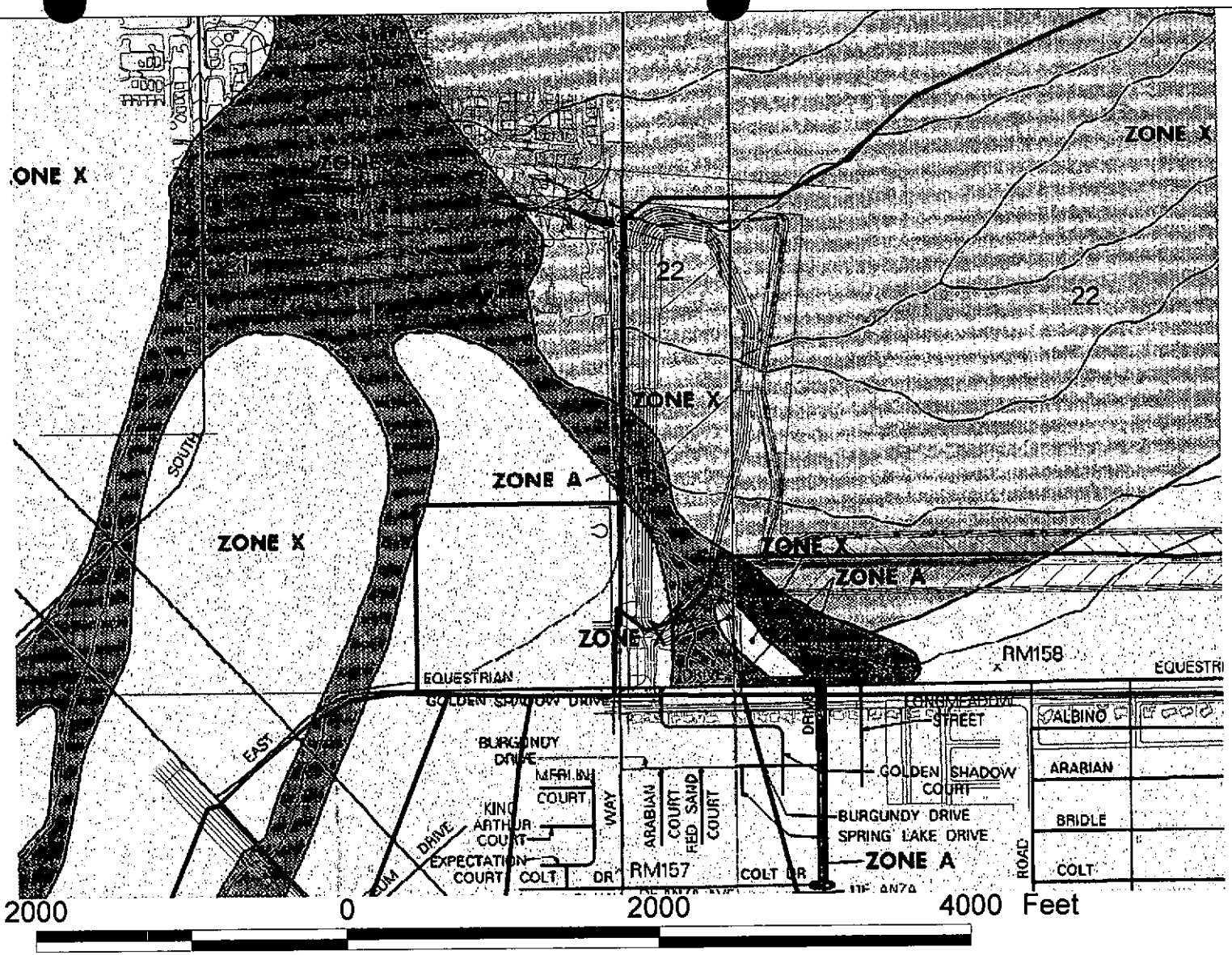
Reach	River Sta.	Contr.	Expan.
1	33.2	.1	.3
1	32.1	.1	.3
1	31.1	.1	.3
1	30.1	.1	.3
1	29.1	.1	.3
1	28.1	.1	.3
1	27.1	.1	.3
1	26.1	.1	.3
1	25.1	.1	.3
1	24.1	.1	.3
1	23.1	.1	.3
1	22.1	.1	.3
1	21.1	.1	.3
1	20.1	.1	.3
1	19.1	.1	.3
1	17.1	.1	.3
1	16.1	.1	.3
1	15.1	.1	.3

1	14.1	.1	.3
1	13.1	.1	.3
1	12.1	.1	.3
1	11.1	.1	.3
1	10.1	.1	.3
1	9.1	.1	.3
1	8.1	.1	.3
1	7.1	.1	.3
1	6.1	.1	.3
1	5.1	.1	.3
1	4.1	.1	.3
1	3.1	.1	.3
1	2.1	.1	.3
1	1.1	.1	.3

APPENDIX G

DOWNSTREAM MAPPING

AND F.I.R.M.'s

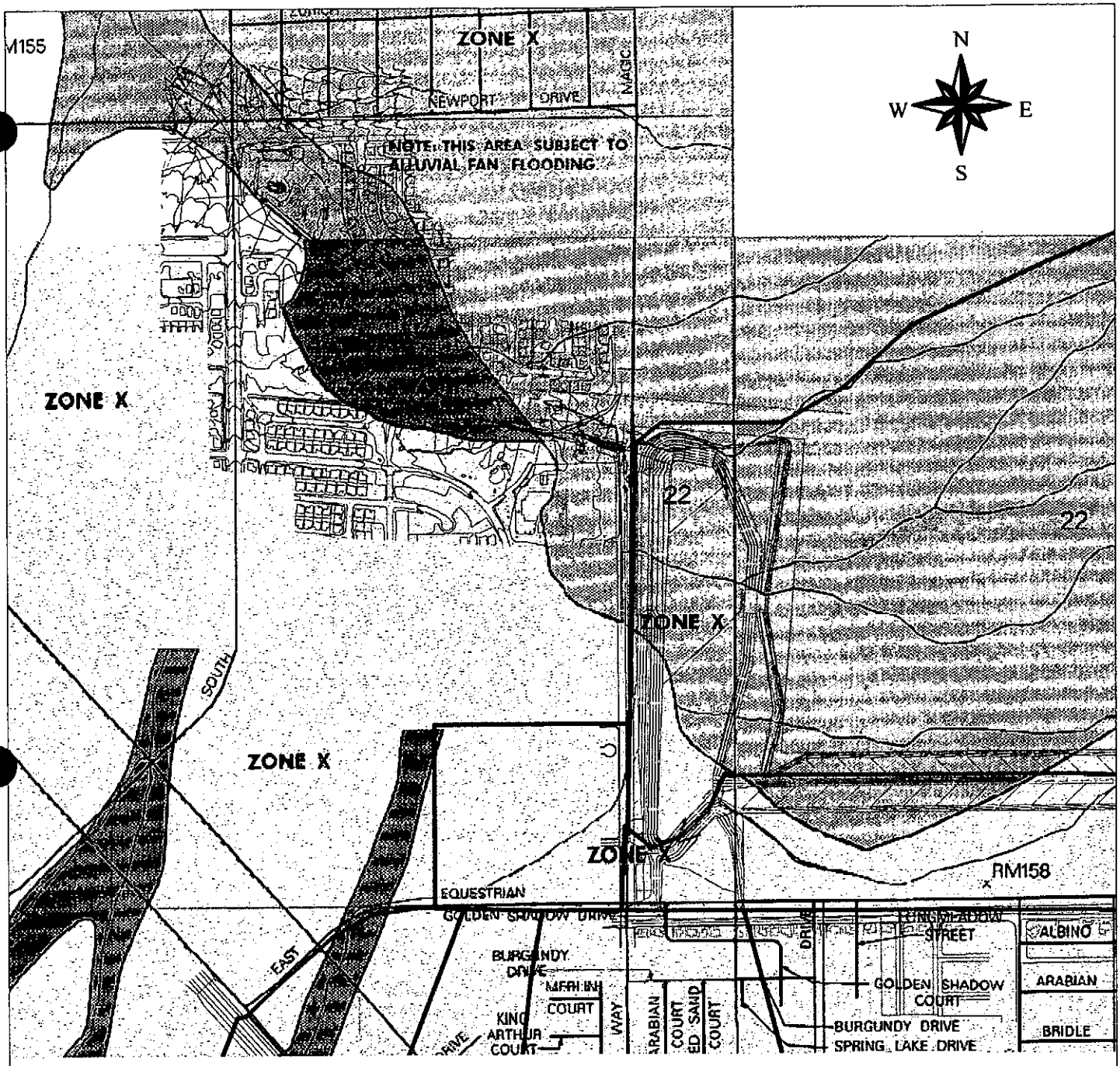


CITY OF HENDERSON
EQUESTRIAN DETENTION BASIN
A PORTION OF
FIRM 325276C2615
AUGUST 16, 1995

POGGEMEYER DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS
2601 North Tenaya Way
Las Vegas , Nevada 89128
(702) 255-8100 FAX (702) 255-8375
PDG-LV@POGGEMEYER.COM

PDG# 1002005

FIGURE Ca
FIRM MAP



2000 0 2000 Feet

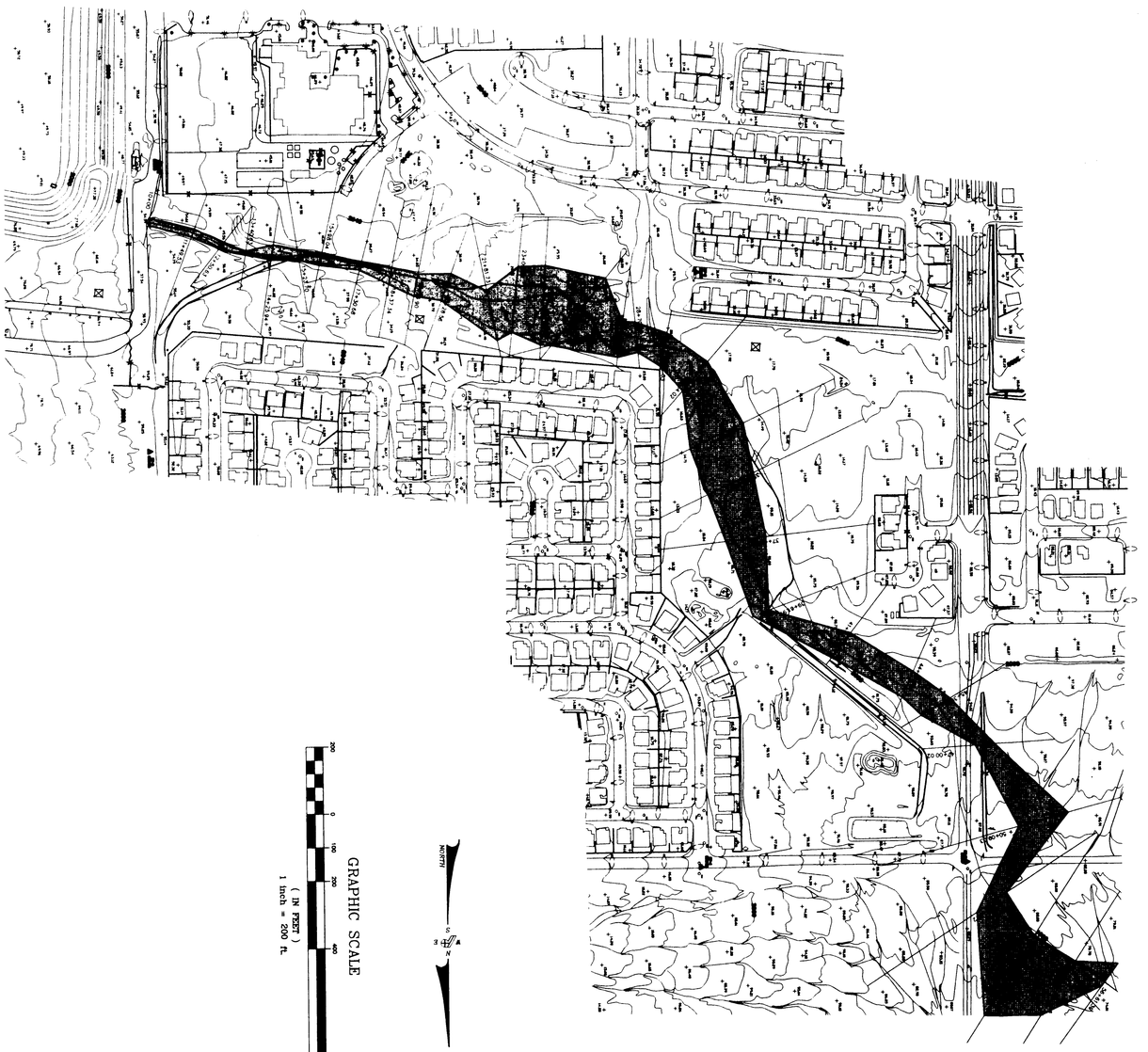
CITY OF HENDERSON
EQUESTRIAN DETENTION BASIN
A PORTION OF
FIRM 325276C2615
AUGUST 16, 1995

POGGEMEYER DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS
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Las Vegas , Nevada 89128
(702) 255-8100 FAX (702) 255-8375
PDG-LV@POGGEMEYER.COM

PDG# 1002005

FIGURE Cb
REVISED
FIRM MAP

FILENAME AIRPOT
PATH G:\1002005\AERIAL
XREF'S
PS
SHT_NAMES
LAST_REV_BY SLW
LAST_REV_DATE 12/18/98



GRAPHIC SCALE
(IN FEET)
1 inch = 200 ft.

NORTH

OUTLET TOPOGRAPHY

EQUESTRIAN DETENTION BASIN
LETTER OF MAP REVISION
CITY OF HENDERSON

STAMP

STEPHEN L. WEITHERMAN
No. 12269
STATE OF NEVADA
PROFESSIONAL ENGINEER

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

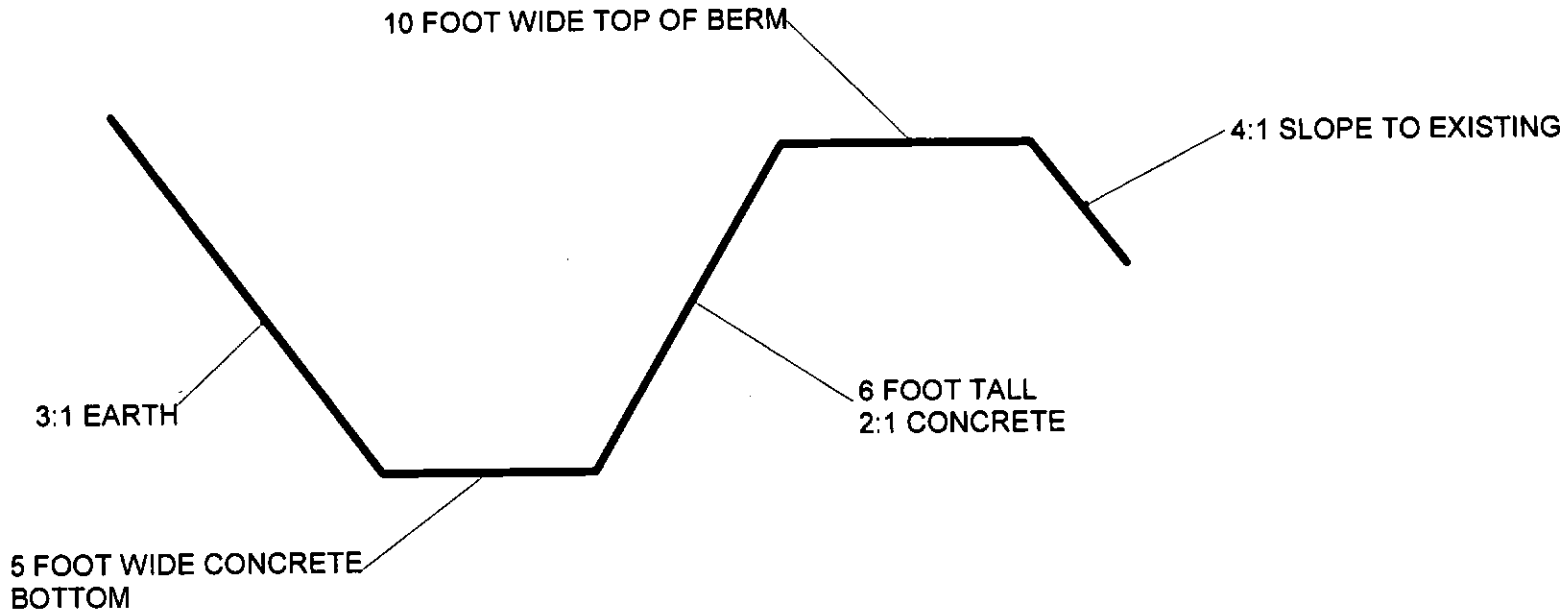
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JOB NUMBER	1002005
DESIGNED BY	SLW
DRAWN BY	SLW
CHECKED BY	SLW
DATE	12/18/98
SHEET NUMBER	1 OF 1

APPENDIX H

EXISTING CHANNEL SECTION

AND EROSION CALCULATIONS



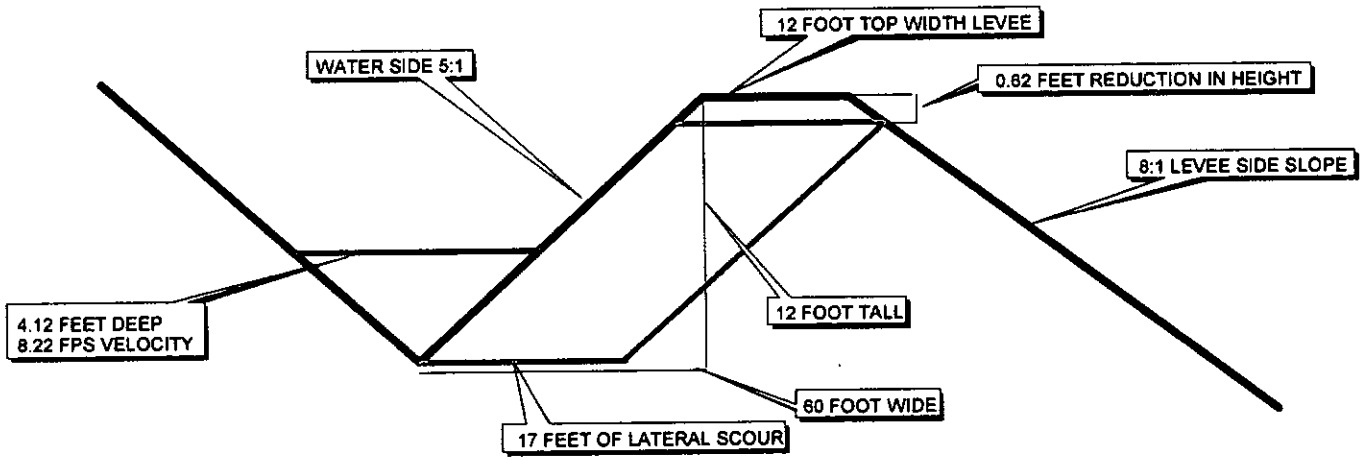
AS BUILT OF EXISTING UPSTREAM
BOULDER HIGHWAY CHANNEL

CITY OF HENDERSON
EQUESTRIAN DETENTION BASIN
LOMR SUBMISSION

POGGEMEYER DESIGN GROUP
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PDG# 1002005

FIGURE D



WORST CASE SCOUR
STATION 150+00

CITY OF HENDERSON
EQUESTRIAN DETENTION BASIN
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PDG# 1002005

FIGURE E

STATION	INVERT EL.	W.S. ELEV.	EGL	TOP OF BANK	T.O.B. W.S.E.	T.O.B. E.G.L.
10+00.00	2059.69	2069.99	2083.92	2069.69	(0.30)	(14.23)
11+00.00	2069.69	2072.00	2086.76	2079.69	7.69	(7.07)
12+00.00	2072.00	2075.82	2089.86	2082.00	6.18	(7.86)
36+00.00	2127.38	2131.18	2145.43	2137.38	6.20	(8.05)
39+00.00	2134.30	2138.07	2152.63	2144.30	6.23	(8.33)
42+00.00	2141.22	2144.89	2160.40	2151.22	6.33	(9.18)
50+00.00	2162.64	2166.19	2183.07	2172.64	6.45	(10.43)
50+50.00	2163.80	2167.31	2184.75	2173.80	6.49	(10.95)
51+00.00	2164.95	2168.40	2186.57	2174.95	6.55	(11.62)
52+00.00	2167.26	2170.76	2188.25	2177.26	6.50	(10.99)
52+50.00	2168.42	2171.87	2190.04	2178.42	6.55	(11.62)
53+00.00	2172.25	2175.89	2191.73	2182.25	6.36	(9.48)
54+00.00	2174.70	2178.30	2194.66	2184.70	6.40	(9.96)
55+00.00	2177.15	2180.69	2197.78	2187.15	6.46	(10.63)
55+50.00	2180.98	2184.74	2199.38	2190.98	6.24	(8.40)
56+00.00	2182.21	2186.48	2200.52	2192.21	5.73	(8.31)
57+00.00	2184.86	2188.67	2202.80	2194.86	6.19	(7.94)
57+50.00	2185.88	2189.67	2204.03	2195.88	6.21	(8.15)
58+00.00	2189.71	2193.83	2205.38	2199.71	5.88	(5.67)
59+00.00	2192.16	2196.41	2207.06	2202.16	5.75	(4.90)
60+00.00	2194.61	2199.04	2208.60	2204.61	5.57	(3.99)
60+37.00	2195.53	2200.05	2209.12	2205.53	5.48	(3.59)
61+50.00	2204.15	2209.06	2210.93	2214.15	5.09	3.22
62+00.00	2204.43	2210.45	2211.21	2216.43	5.98	5.22
64+00.00	2205.55	2211.23	2211.58	2217.55	6.32	5.97
67+00.00	2207.20	2211.80	2213.45	2219.20	7.40	5.75
73+50.00	2210.78	2215.76	2217.08	2222.78	7.02	5.70
74+50.00	2211.33	2216.49	2217.53	2227.33	10.84	9.80
78+00.00	2213.25	2217.81	2219.27	2229.25	11.44	9.98
82+00.00	2215.45	2220.17	2221.49	2231.45	11.28	9.96
85+00.00	2217.10	2221.81	2222.95	2233.10	11.29	10.15
86+00.00	2218.60	2222.42	2223.41	2230.60	8.18	7.19
90+00.00	2224.60	2227.30	2229.64	2236.60	9.30	6.96
95+00.00	2232.10	2234.80	2237.17	2244.10	9.30	6.93
100+00.00	2239.60	2242.33	2244.61	2251.60	9.27	6.99
105+00.00	2247.10	2249.76	2252.18	2259.10	9.34	6.92
110+00.00	2254.60	2257.36	2259.58	2266.60	9.24	7.02
115+00.00	2262.10	2264.71	2267.25	2274.10	9.39	6.85
120+00.00	2269.60	2272.44	2274.51	2281.60	9.16	7.09
125+00.00	2277.10	2279.61	2282.41	2289.10	9.49	6.69
127+00.00	2280.10	2283.82	2286.95	2292.10	8.28	5.15
132+50.00	2293.58	2297.36	2300.29	2305.58	8.22	5.29
138+00.00	2307.05	2310.55	2313.36	2319.05	8.50	5.69
141+00.00	2314.40	2317.90	2320.70	2326.40	8.50	5.70
144+00.00	2321.75	2325.26	2328.03	2333.75	8.49	5.72
147+00.00	2329.10	2332.60	2335.40	2341.10	8.50	5.70
150+00.00	2336.45	2339.94	2342.78	2348.45	8.51	5.67
153+00.00	2343.80	2347.26	2349.56	2355.80	8.54	6.24
156+00.00	2351.15	2354.29	2357.66	2361.15	6.86	3.49
159+50.00	2359.73	2363.43	2365.19	2369.73	6.30	4.54
160+00.00	2359.73	2362.63	2367.26	2368.73	6.10	1.47
161+50.00	2364.63	2368.82	2369.89	2373.63	4.81	3.74
162+00.00	2365.85	2370.04	2370.08	2372.85	2.81	2.77
163+00.00	2368.30	2370.08	2371.23	2374.30	4.22	3.07
164+00.00	2370.75	2372.53	2373.68	2376.75	4.22	3.07
165+00.00	2373.20	2375.00	2376.18	2379.20	4.20	3.02
165+50.00	2374.43	2376.22	2377.44	2380.43	4.21	2.99
166+00.00	2375.65	2377.65	2378.43	2381.65	4.00	3.22
167+00.00	2378.10	2379.99	2380.97	2382.10	2.11	1.13

STATION	INVERT EL.	W.S. ELEV.	DEPTH	EGL	TOP OF BANK	T.O.B. W.S.E.	T.O.B. E.G.L.
60+37.00	2195.53	2202.59	7.06	2205.09	2205.53	2.94	0.44
61+50.00	2204.15	2208.86	4.71	2210.67	2214.15	5.29	3.48
62+00.00	2204.43	2210.20	5.77	2210.95	2216.43	6.23	5.48
64+00.00	2205.55	2210.98	5.43	2211.33	2217.55	6.57	6.22
67+00.00	2207.20	2211.63	4.43	2213.22	2219.20	7.57	5.98
73+50.00	2210.78	2215.58	4.80	2216.85	2222.78	7.20	5.93
74+50.00	2211.33	2216.29	4.96	2217.30	2227.33	11.04	10.03
78+00.00	2213.25	2217.65	4.40	2218.97	2229.25	11.60	10.28
82+00.00	2215.45	2219.89	4.44	2221.18	2231.45	11.56	10.27
85+00.00	2217.10	2221.61	4.51	2222.64	2233.10	11.49	10.46
86+00.00	2218.60	2222.12	3.52	2223.09	2230.60	8.48	7.51
90+00.00	2224.60	2227.75	3.15	2229.03	2236.60	8.85	7.57
95+00.00	2232.10	2235.26	3.16	2236.54	2244.10	8.84	7.56
100+00.00	2239.60	2242.74	3.14	2244.03	2251.60	8.86	7.57
105+00.00	2247.10	2250.25	3.15	2251.53	2259.10	8.85	7.57
110+00.00	2254.60	2257.75	3.15	2259.03	2266.60	8.85	7.57
115+00.00	2262.10	2265.25	3.15	2266.53	2274.10	8.85	7.57
120+00.00	2269.60	2272.75	3.15	2274.03	2281.60	8.85	7.57
125+00.00	2277.10	2280.25	3.15	2281.53	2289.10	8.85	7.57
127+00.00	2280.10	2284.63	4.53	2285.76	2292.10	7.47	6.34
132+50.00	2293.58	2298.10	4.52	2299.24	2305.58	7.48	6.34
138+00.00	2307.05	2311.16	4.11	2312.22	2319.05	7.89	6.83
141+00.00	2314.40	2318.52	4.12	2319.57	2326.40	7.88	6.83
144+00.00	2321.75	2325.87	4.12	2326.92	2333.75	7.88	6.83
147+00.00	2329.10	2333.50	4.40	2334.27	2341.10	7.60	6.83
150+00.00	2336.45	2340.57	4.12	2341.62	2348.45	7.88	6.83
153+00.00	2343.80	2347.72	3.92	2348.70	2355.80	8.08	7.10
156+00.00	2351.15	2355.05	3.90	2356.41	2361.15	6.10	4.74
159+50.00	2359.73	2363.64	3.91	2364.63	2369.73	6.09	5.10
160+00.00	2359.73	2364.42	4.69	2364.90	2368.73	4.31	3.83
161+50.00	2364.63	2368.53	3.90	2369.53	2373.63	5.10	4.10
162+00.00	2365.85	2369.69	3.84	2369.71	2372.85	3.16	3.14
163+00.00	2368.30	2369.69	1.39	2370.43	2374.30	4.61	3.87
164+00.00	2370.75	2372.44	1.69	2372.88	2376.75	4.31	3.87
165+00.00	2373.20	2374.92	1.72	2375.36	2379.20	4.28	3.84
165+50.00	2374.43	2376.15	1.72	2376.59	2380.43	4.28	3.84
166+00.00	2375.65	2377.37	1.72	2377.81	2381.65	4.28	3.84
167+00.00	2378.10	2379.82	1.72	2380.26	2382.10	2.28	1.84

STA	VEL	SLOPE	DEPTH	BOTTOM WIDTH	SIDE SLOPE L	SIDE SLOPE R	TOP WIDTH	AREA	HYDRA DEPTH	Zgs	Za	Zls	Zbs	Zlfl	Zt
6150.0	10.78	0.004	4.71	20.00	2	2	38.84	98.910	2.547	2.955	1.592	0.000	0.000	2.000	8.511
6200.0	6.93	0.002	5.77	20.00	3	3	54.62	124.055	2.271	2.947	0.658	0.000	0.000	2.000	7.286
6400.0	4.65	0.007	5.43	20.00	7	7	96.02	127.605	1.329	0.000	0.296	0.000	0.000	2.000	2.985
6700.0	10.14	0.001	4.43	20.00	3	3	46.58	95.245	2.045	6.414	1.409	0.000	0.000	2.000	12.769
7350.0	9.04	0.005	4.80	20.00	3	3	48.80	103.200	2.115	2.092	1.120	0.000	0.000	2.000	6.775
7450.0	8.06	0.004	4.96	20.00	3	4	54.72	109.120	1.994	2.182	0.890	0.000	0.000	2.000	6.593
8500.0	8.14	0.004	4.51	20.00	3	4	51.57	99.220	1.924	1.896	0.908	0.000	0.000	2.000	6.245
8600.0	7.89	0.003	3.52	35.00	3	4	59.64	130.240	2.184	1.470	0.853	0.000	0.000	2.000	5.619
12500.0	9.09	0.022	3.15	35.00	3	4	57.05	116.550	2.043	0.000	1.132	0.000	0.000	2.000	4.072
12700.0	8.55	0.025	4.53	0.01	5	10	67.96	22.695	0.334	3.298	1.002	0.000	0.000	2.000	8.190
13250.0	8.57	0.004	4.52	0.01	5	10	67.81	22.645	0.334	8.670	1.006	0.000	0.000	2.000	15.179
15000.1	8.22	0.002	4.12	0.01	5	10	61.81	20.641	0.334	10.510	0.926	0.000	0.000	2.000	17.466
16150.0	8.00	0.008	3.90	0.01	5	10	58.51	19.539	0.334	5.179	0.877	0.000	0.000	2.000	10.473
16200.0	1.00	0.024	3.84	0.01	5	20	96.01	38.438	0.400	0.000	0.014	0.000	0.000	2.000	2.618
16500.0	5.27	0.020	1.72	0.01	4	20	41.29	17.217	0.417	0.232	0.380	0.000	0.000	2.000	3.397
16550.0	5.31	0.024	1.72	0.01	4	20	41.29	17.217	0.417	0.138	0.386	0.000	0.000	2.000	3.282
16700.0	5.31	0.021	1.72	0.01	4	20	41.29	17.217	0.417	0.237	0.386	0.000	0.000	2.000	3.410

STATION		LT	LTOF	LB	LBOF	RB	RBOF	RT	RTOF	DEPTH	BW	SSL	SSR
1000	2059.69	2069.69	100.0	2059.69	120.0	2059.69	160.0	2069.69	180.0	10	40	2	2
1100	2069.69	2079.69	100.0	2069.69	120.0	2069.69	160.0	2079.69	180.0	10	40	2	2
1200	2072.00	2082.00	110.0	2072.00	130.0	2072.00	150.0	2082.00	170.0	10	20	2	2
3600	2127.38	2137.38	110.0	2127.38	130.0	2127.38	150.0	2137.38	170.0	10	20	2	2
3900	2134.30	2144.30	110.0	2134.30	130.0	2134.30	150.0	2144.30	170.0	10	20	2	2
4200	2141.22	2151.22	110.0	2141.22	130.0	2141.22	150.0	2151.22	170.0	10	20	2	2
5000	2162.64	2172.64	110.0	2162.64	130.0	2162.64	150.0	2172.64	170.0	10	20	2	2
5050	2163.80	2173.80	110.0	2163.80	130.0	2163.80	150.0	2173.80	170.0	10	20	2	2
5100	2164.95	2174.95	110.0	2164.95	130.0	2164.95	150.0	2174.95	170.0	10	20	2	2
5200	2167.26	2177.26	110.0	2167.26	130.0	2167.26	150.0	2177.26	170.0	10	20	2	2
5250	2168.42	2178.42	110.0	2168.42	130.0	2168.42	150.0	2178.42	170.0	10	20	2	2
5300	2172.25	2182.25	110.0	2172.25	130.0	2172.25	150.0	2182.25	170.0	10	20	2	2
5400	2174.70	2184.70	110.0	2174.70	130.0	2174.70	150.0	2184.70	170.0	10	20	2	2
5500	2177.15	2187.15	110.0	2177.15	130.0	2177.15	150.0	2187.15	170.0	10	20	2	2
5550	2180.98	2190.98	110.0	2180.98	130.0	2180.98	150.0	2190.98	170.0	10	20	2	2
5600	2182.21	2192.21	110.0	2182.21	130.0	2182.21	150.0	2192.21	170.0	10	20	2	2
5700	2184.86	2194.86	110.0	2184.86	130.0	2184.86	150.0	2194.86	170.0	10	20	2	2
5750	2185.88	2195.88	110.0	2185.88	130.0	2185.88	150.0	2195.88	170.0	10	20	2	2
5800	2189.71	2199.71	110.0	2189.71	130.0	2189.71	150.0	2199.71	170.0	10	20	2	2
5900	2192.16	2202.16	110.0	2192.16	130.0	2192.16	150.0	2202.16	170.0	10	20	2	2
6000	2194.61	2204.61	110.0	2194.61	130.0	2194.61	150.0	2204.61	170.0	10	20	2	2
6037	2195.53	2205.53	110.0	2195.53	130.0	2195.53	150.0	2205.53	170.0	10	20	2	2
6150	2204.15	2214.15	110.0	2204.15	130.0	2204.15	150.0	2214.15	170.0	10	20	2	2
6200	2204.43	2216.43	94.0	2204.43	130.0	2204.43	150.0	2216.43	186.0	12	20	3	3
6400	2205.55	2217.55	46.0	2205.55	130.0	2205.55	150.0	2217.55	234.0	12	20	7	7
6700	2207.20	2219.20	94.0	2207.20	130.0	2207.20	150.0	2219.20	186.0	12	20	3	3
7350	2210.78	2222.78	94.0	2210.78	130.0	2210.78	150.0	2222.78	186.0	12	20	3	3
7450	2211.33	2227.33	82.0	2211.33	130.0	2211.33	150.0	2227.33	214.0	16	20	3	4
7800	2213.25	2229.25	82.0	2213.25	130.0	2213.25	150.0	2229.25	214.0	16	20	3	4
8200	2215.45	2231.45	82.0	2215.45	130.0	2215.45	150.0	2231.45	214.0	16	20	3	4
8500	2217.10	2233.10	82.0	2217.10	130.0	2217.10	150.0	2233.10	214.0	16	20	3	4
8600	2218.60	2230.60	86.5	2218.60	122.5	2218.60	157.5	2230.60	205.5	12	35	3	4
9000	224.60	236.60	86.5	224.60	122.5	224.60	157.5	236.60	205.5	12	35	3	4
9500	2232.10	2244.10	86.5	2232.10	122.5	2232.10	157.5	2244.10	205.5	12	35	3	4
10000	2239.60	2251.60	86.5	2239.60	122.5	2239.60	157.5	2251.60	205.5	12	35	3	4

STATION		LT	LTOF	LB	LBOF	RB	RBOF	RT	RTOF	DEPTH	BW	SSL	SSR
10500	2247.10	2259.10	86.5	2247.10	122.5	2247.10	157.5	2259.10	205.5	12	35	3	4
11000	2254.60	2266.60	86.5	2254.60	122.5	2254.60	157.5	2266.60	205.5	12	35	3	4
11500	2262.10	2274.10	86.5	2262.10	122.5	2262.10	157.5	2274.10	205.5	12	35	3	4
12000	2269.60	2281.60	86.5	2269.60	122.5	2269.60	157.5	2281.60	205.5	12	35	3	4
12500	2277.10	2289.10	86.5	2277.10	122.5	2277.10	157.5	2289.10	205.5	12	35	3	4
12700	2280.10	2292.10	80.0	2280.10	140.0	2280.10	140.0	2292.10	260.0	12	0	5	10
13250	2293.58	2305.58	80.0	2293.58	140.0	2293.58	140.0	2305.58	260.0	12	0	5	10
13800	2307.05	2319.05	80.0	2307.05	140.0	2307.05	140.0	2319.05	260.0	12	0	5	10
14100	2314.40	2326.40	80.0	2314.40	140.0	2314.40	140.0	2326.40	260.0	12	0	5	10
14400	2321.75	2333.75	80.0	2321.75	140.0	2321.75	140.0	2333.75	260.0	12	0	5	10
14700	2329.10	2341.10	80.0	2329.10	140.0	2329.10	140.0	2341.10	260.0	12	0	5	10
15000	2336.45	2348.45	80.0	2336.45	140.0	2336.45	140.0	2348.45	260.0	12	0	5	10
15300	2343.80	2355.80	80.0	2343.80	140.0	2343.80	140.0	2355.80	260.0	12	0	5	10
15550	2349.93	2359.93	90.0	2349.93	140.0	2349.93	140.0	2359.93	240.0	10	0	5	10
15600	2351.15	2361.15	90.0	2351.15	140.0	2351.15	140.0	2361.15	240.0	10	0	5	10
15950	2359.73	2369.73	90.0	2359.73	140.0	2359.73	140.0	2369.73	240.0	10	0	5	10
16000	2359.73	2368.73	95.0	2359.73	140.0	2359.73	140.0	2368.73	230.0	9	0	5	10
16150	2364.63	2373.63	95.0	2364.63	140.0	2364.63	140.0	2373.63	230.0	9	0	5	10
16200	2365.85	2372.85	105.0	2365.85	140.0	2365.85	140.0	2372.85	280.0	7	0	5	20
16300	2368.30	2374.30	110.0	2368.30	140.0	2368.30	140.0	2374.30	260.0	6	0	5	20
16400	2370.75	2376.75	110.0	2370.75	140.0	2370.75	140.0	2376.75	260.0	6	0	5	20
16500	2373.20	2379.20	116.0	2373.20	140.0	2373.20	140.0	2379.20	260.0	6	0	4	20
16550	2374.43	2380.43	116.0	2374.43	140.0	2374.43	140.0	2380.43	260.0	6	0	4	20
16600	2375.65	2381.65	116.0	2375.65	140.0	2375.65	140.0	2381.65	260.0	6	0	4	20
16700	2378.10	2382.10	124.0	2378.10	140.0	2378.10	140.0	2382.10	220.0	4	0	4	20

APPENDIX I

BASINS SEDIMENT DEPOSITION

The flow rates were taken from the Modified Stage-Time Stage-Outflow (HEC-1) section 1 of the Supplemental Design Calculations for the EDB. The inflow sediment data was extracted from the HEC-6 evaluation used for the sediment transport evaluation of the unlined channel.

SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS

Q = 25 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	104.07	2,671.13	0.00	2,775.20
SANDS	155.32	47.13	22.06	15.03	11.45	250.99
GRAVELS	2.10	0.28	0.00	0.00	0.00	2.38
						3,028.57

Q = 37 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	117.65	3,019.56	0.00	3,137.21
SANDS	316.33	101.06	46.96	32.08	24.67	521.10
GRAVELS	5.10	3.89	0.00	0.00	0.00	8.99
						3,667.30

Q = 274 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	1,864.26	47,849.34	0.00	49,713.60
SANDS	10,138.40	3,112.92	1,399.14	960.39	764.06	16,374.91
GRAVELS	68.28	135.50	215.61	115.22	0.00	534.61
						66,623.12

Q = 593 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	4,464.20	114,581.00	0.00	119,045.20
SANDS	36,022.68	11,123.62	4,809.07	3,201.88	2,516.73	57,673.98
GRAVELS	138.92	299.01	559.88	489.02	157.21	1,644.04
						178,363.22

Q = 2,434 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	19,549.47	501,769.73	0.00	521,319.20
SANDS	217,988.88	95,688.32	41,308.67	27,070.24	20,726.05	402,782.16
GRAVELS	474.87	1,094.64	2,330.25	2,728.08	2,549.92	9,177.76
						933,279.12

Q = 1,795 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	13,843.56	355,318.04	0.00	369,161.60
SANDS	161,242.01	58,449.02	25,363.35	16,646.19	12,782.17	274,482.74
GRAVELS	342.24	783.96	1,648.10	1,874.85	1,616.53	6,265.68
						649,910.02

SCOUR AND DEPOSITION IN RIVERS AND RESERVOIRS

Q = 873 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	5,911.31	151,723.50	0.00	157,634.81
SANDS	54,207.86	16,734.22	7,062.22	4,611.36	3,602.11	86,217.77
GRAVELS	155.31	343.94	677.28	664.56	359.31	2,200.40
						246,052.98

Q = 1,612 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	12,340.10	316,729.11	0.00	329,069.21
SANDS	144,251.05	48,578.05	20,474.78	13,084.30	9,987.89	236,376.07
GRAVELS	260.83	600.03	1,258.91	1,406.03	1,123.74	4,649.54
						570,094.82

Q = 341 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	2,134.03	54,773.56	0.00	56,907.59
SANDS	12,369.46	3,614.43	1,443.35	979.56	787.19	19,193.99
GRAVELS	59.94	121.85	200.55	115.81	0.00	498.15
						76,599.73

Q = 89 CFS TRANSPORT CAPACITY

	Very Fine	Fine	Medium	Coarse	Very Coarse	TOTAL
SILT	0.00	0.00	378.75	9,721.25	0.00	10,100.00
SANDS	1,225.50	366.03	171.92	120.23	95.63	1,979.31
GRAVELS	14.89	22.13	14.46	0.00	0.00	51.48
						12,130.79

Time	Inflow Q	Outflow Q	Storage	Storage	Stage	Storage	Section 1	Section 1	Section 1	Section 2	Section 2	Section 2	Section 3	Section 3	Section 3	Section 4	Section 4	Section 4	Section 5	Section 5	Section 5	SILT		SAND		GRAVEL	
							Area at	Velocity	Depth at	Area at	Velocity	Depth at	Area at	Velocity	Depth at	Area at	Velocity	Depth at	Area at	Velocity	Depth at	M	C	M	C	VF	F	M	F	VF	M
56	1	0.0	0.0	0.0																		0.00135	0.00523	0.0594O	0.135	0.280	0.003	0.002	0.000	0.000
3		0.0	0.14	1.45																									
3		0.0	0.22	3.58																		VELOCITY							
3		0.0	0.22	3.58																									
3		0.0	0.22	3.58																		FALL							
3		0.0	0.22	3.58																	

| Time | Inflow Q | Outflow Q | Storage | Storage | Section 1 | Section 1 | Section 2 | Section 2 | Section 3 | Section 3 | Section 4 | Section 4 | Section 5 | Section 5 | Section 5

| | | |

C	VC	M	C	VF	F	M	C	VC	VF	F	M	C	VC	M	C	VF	F	M	C	VC	VF	F	M	C	VC	M	C	VF	F	M
0.000	0.000	0.0000	2.5971	0.1510	0.0458	0.0214	0.0146	0.0111	0.0020	0.000272	0.000000	0.000000	0.000000	0.1012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1012	0.0000	0.0000	0.0000	0.0000
0.000	0.000	0.0809	2.0777	0.1208	0.0367	0.0172	0.0117	0.0089	0.0016	0.000218	0.000000	0.000000	0.000000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

SECTION 4	GRAVEL				SILT		SAND						GRAVEL											
	C	VC	F	M	C	VC	F	M	C	VC	VF	F	M	C	VC	VF	F	M	C	VC	VF	F	M
0.280	0.474	0.706	1.020	1.443	2.040	2.887																		
							PASS THROUGH																	

SECTION 4	SECTION 4	SECTION 4	SECTION 4	SECTION 4	SECTION 4	SECTION 4	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3	SECTION 3
0.280	0.474	0.706	1.020	1.443	2.040	2.887	0.00135	0.00523	0.01940	0.05950	0.135	0.280	0.474	0.706	1.020	1.443	2.040	2.887						

| | | |

| SILT | | |

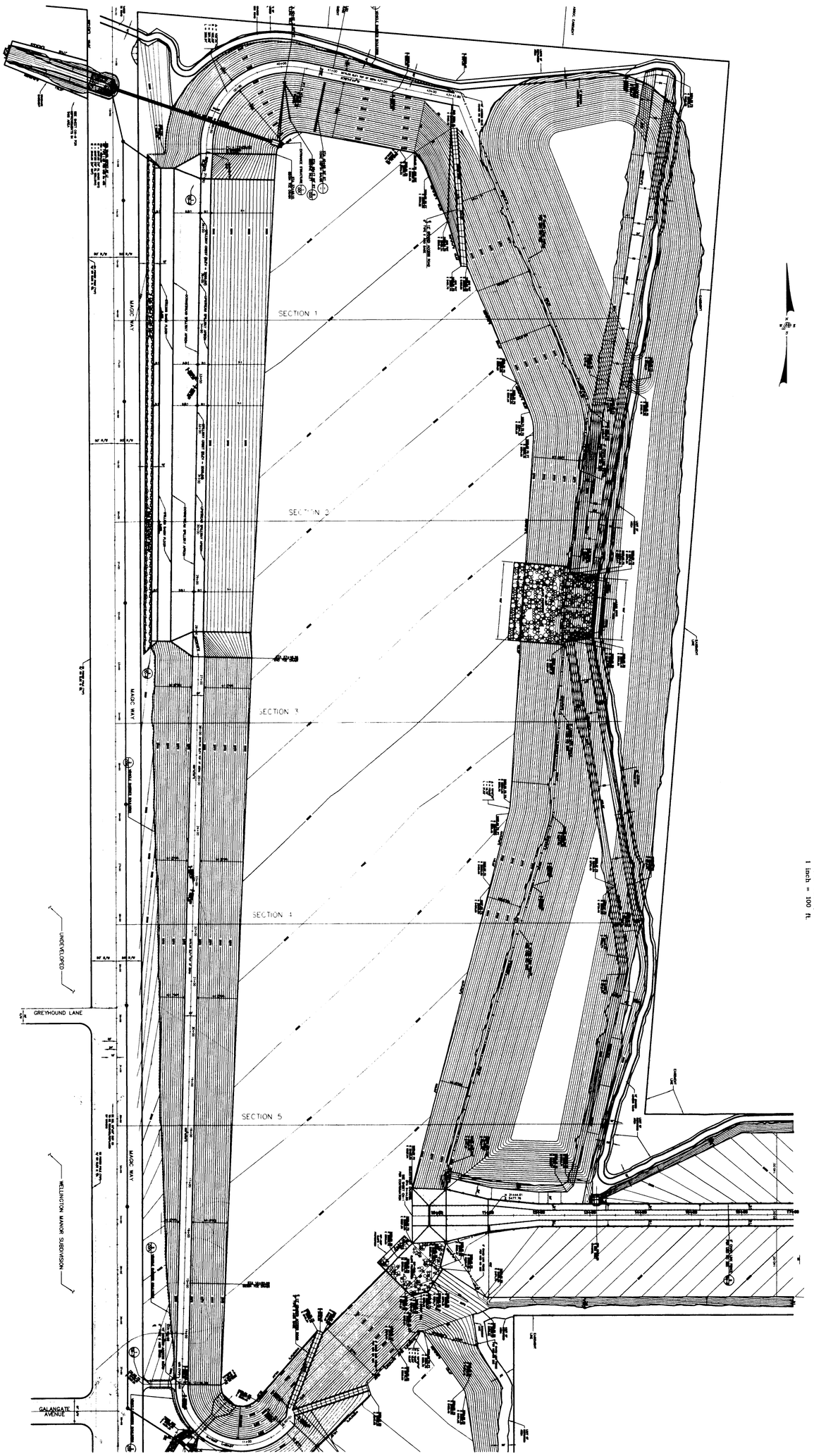
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Poggemeyer Design Group

GRAVEL					SAND					SILT	GRAVEL					SAND					SILT									
VF	F	M	C	VC	VF	F	M	C	VC	M	VC	F	VF	C	M	VC	F	VF	C	M	SECTION 1	SECTION 1	SECTION 1	SECTION 1	SECTION 1	SECTION 1	SECTION 1	SECTION 1	SECTION 1	SECTION 1
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.00135	0.00523	0.01940	0.05950	0.135	0.280	0.474	0.706	1.020	1.443	2.040	2.887
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000									

| | | |

FILENAME DALL1
PATH J:\1002005\AUTOCAD
REF'S
DWG
ATT_NAMES
LAST_REV_BY SLW
LAST_REV_DATE 12/20/98



STEPHEN L. MEITHEPMAN
9828
STATE OF NEVADA
PROFESSIONAL ENGINEER
CIVIL

SHEET NUMBER 1 OF 1

JOB NUMBER 1002005
DESIGNED BY SLW
DRAWN BY SLW
CHECKED BY SLW
DATE 12/21/98

SEDIMENT DEPOSITION

CITY OF HENDERSON
EQUESTRIAN DETENTION BASIN
LOMR APPLICATION

STAMP

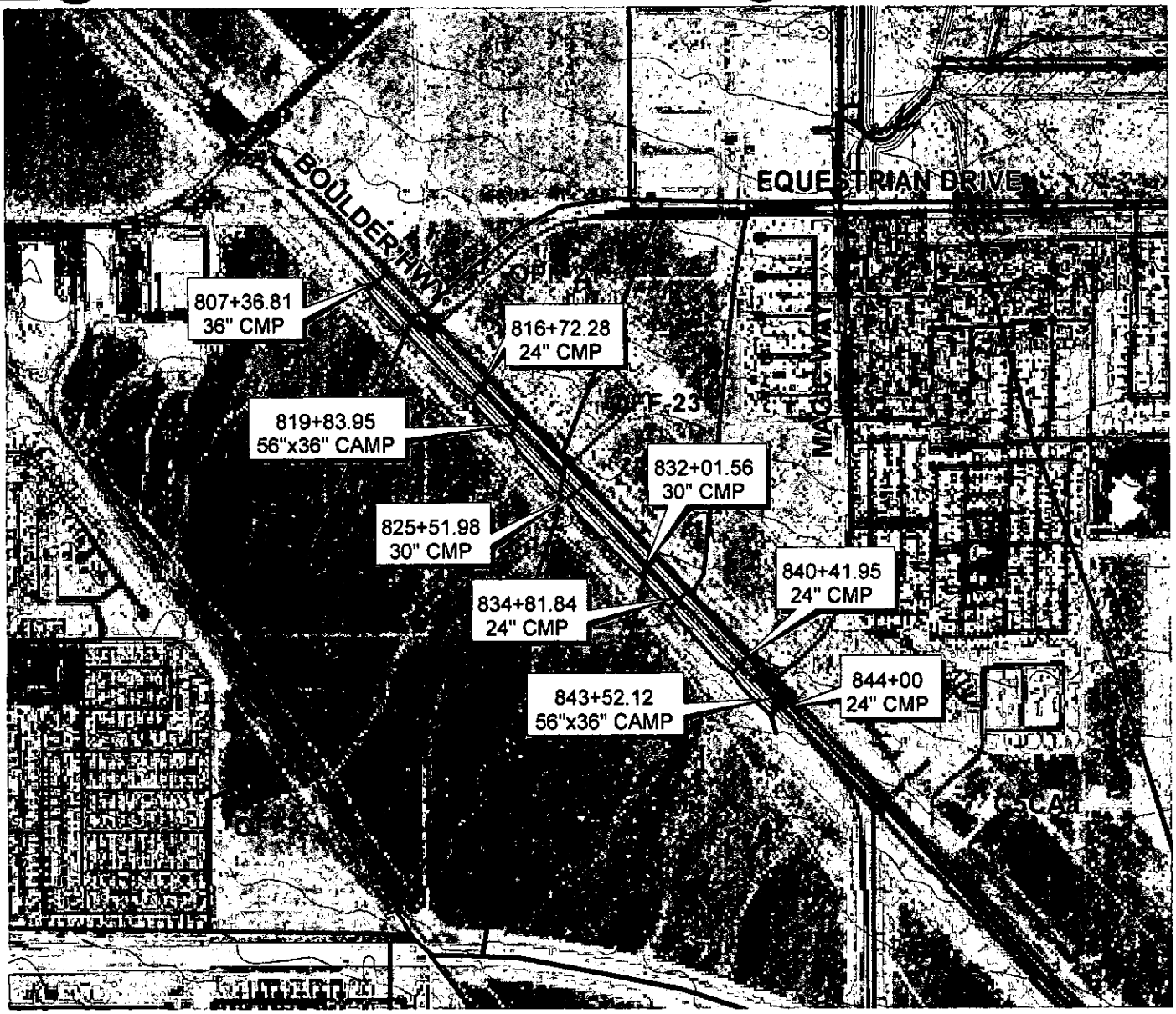
POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

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APPENDIX J

BOULDER HIGHWAY CULVERTS



N
W E
S

500 0 500 1000 1500 Feet

CITY OF HENDERSON
DEPARTMENT OF PUBLIC WORKS
EQUESTRIAN DETENTION BASIN
BOULDER HIGHWAY CULVERTS

POGGEMEYER DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS
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Las Vegas , Nevada 89128
(702) 255-8100 FAX (702) 255-8375
PDG-LV@POGGEMEYER.COM

PDG# 1002005

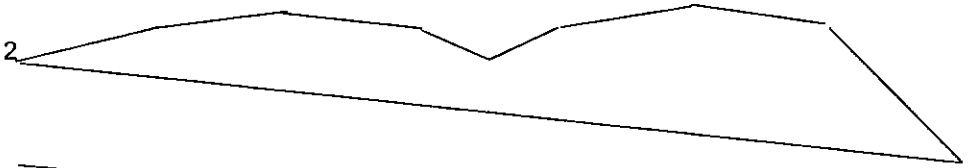
FIGURE D
CULVERTS

SIDE WEIR FLOW CALCULATIONS ON EAST SIDE OF EXISTING CHANNEL

				CHANNEL		AVERAGE		
		WEIR	WS	FLOW	DEPTH	DEPTH	AREA	FLOW OUT
	84500	2167.26	2167.01	1255.00	0.00			
100	84400	2165.12	2164.75		0.00	0.00	0.00	0.00
90	84310	2164.75	2164.25		0.00	0.00	0.00	0.00
168	84142	2162.98	2163.08		0.10	0.05	8.40	0.06
100	84042	2162.14	2161.32		0.00	0.05	5.00	0.03
100	83942	2161.28	2160.55		0.00	0.00	0.00	0.00
361	83581	2156.08	2157.50		1.42	0.71	256.31	92.00
100	83481	2155.93	2154.67		0.00	0.71	71.00	25.49
100	83381	2155.52	2153.87		0.00	0.00	0.00	0.00
81	83300	2154.46	2152.24		0.00	0.00	0.00	0.00
100	83200	2152.52	2150.47		0.00	0.00	0.00	0.00
100	83100	2151.05	2149.72		0.00	0.00	0.00	0.00
449	82651	2145.89	2145.60		0.00	0.00	0.00	0.00
100	82551	2144.57	2144.01		0.00	0.00	0.00	0.00
100	82451	2143.57	2143.38		0.00	0.00	0.00	0.00
368	82083	2140.57	2140.20		0.00	0.00	0.00	0.00
100	81983	2139.24	2138.02		0.00	0.00	0.00	0.00
100	81883	2136.37	2137.41		1.04	0.52	52.00	11.70
112	81771	2136.74	2136.21		0.00	0.52	58.24	13.10
100	81671	2135.56	2134.83		0.00	0.00	0.00	0.00
100	81571	2134.64	2134.19		0.00	0.00	0.00	0.00
737	80834	2127.05	2126.76		0.00	0.00	0.00	0.00
100	80734	2166.06	2125.46		0.00	0.00	0.00	0.00
100	80634	2125.06	2124.90		0.00	0.00	0.00	0.00

BOLDER HIGHWAY CULVERTS FIELD INFORMATION CHART

Location	STA 844+00 BOULDER HIGHWAY		84400
Type	24" ROUND CMP		
Rise	24"	24	
Width	24"		
Lane CL	2166.12	Lane CL	2164.51



TOP PIPE 2163.12

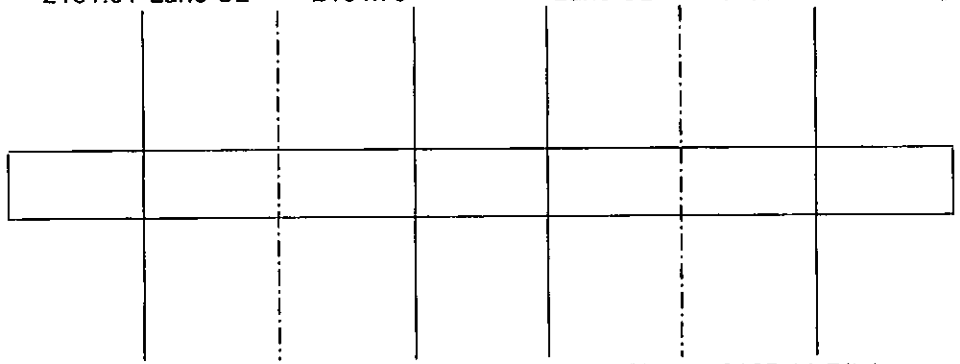
TOP PIPE 2160.73

Inv in 2161.12

Slope 1/1 0.019913

Length 120.02

Inv out 2158.73



Ditch 2161.61 Lane CL 2164.75 Lane CL 2165.11 Ditch 2160.51

100'

100'

Ditch 2164.86 Lane CL 2167.28 Lane CL 2165.44 Ditch 2163.49

CURRENT DATE: 12-11-1998
CURRENT TIME: 08:33:02

FILE DATE: 12-11-1998
FILE NAME: B84400

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CU LV 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	2161.12	2158.73	120.02	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: B84400 DATE: 12-11-1998

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2161.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2162.93	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2164.55	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2166.20	30.0	23.0	0.0	0.0	0.0	0.0	0.0	6.79	16
2166.27	40.0	23.1	0.0	0.0	0.0	0.0	0.0	16.70	7
2166.32	50.0	23.2	0.0	0.0	0.0	0.0	0.0	26.34	5
2166.37	60.0	23.2	0.0	0.0	0.0	0.0	0.0	36.42	5
2166.41	70.0	23.2	0.0	0.0	0.0	0.0	0.0	46.15	4
2166.45	80.0	23.2	0.0	0.0	0.0	0.0	0.0	56.22	4
2166.49	90.0	23.3	0.0	0.0	0.0	0.0	0.0	66.29	4
2166.52	100.0	23.3	0.0	0.0	0.0	0.0	0.0	76.33	4
2166.12	22.8	22.8	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B84400 DATE: 12-11-1998

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2161.12	0.000	0.00	0.00	0.00
2162.93	0.000	10.00	0.00	0.00
2164.55	0.000	20.00	0.00	0.00
2166.20	-0.003	30.00	0.25	0.83
2166.27	-0.001	40.00	0.23	0.57
2166.32	-0.003	50.00	0.49	0.98
2166.37	-0.002	60.00	0.35	0.58
2166.41	-0.004	70.00	0.62	0.89
2166.45	-0.004	80.00	0.55	0.69
2166.49	-0.003	90.00	0.46	0.51
2166.52	-0.003	100.00	0.38	0.38

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:33:02 FILE NAME: B84400

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

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	2161.12	0.00	-2.39	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2162.93	1.81	0.27	1-S2n	1.09	1.13	1.03	0.57	6.15	4.78
20.00	2164.55	3.43	3.33	2-M2c	2.00	1.60	1.60	0.79	7.40	5.76
22.95	2166.20	4.11	5.08	2-M2c	2.00	1.69	1.69	0.96	8.13	6.41
23.07	2166.27	4.14	5.15	2-M2c	2.00	1.70	1.70	1.10	8.15	6.90
23.17	2166.32	4.17	5.20	2-M2c	2.00	1.70	1.70	1.21	8.18	7.31
23.23	2166.35	4.18	5.23	2-M2c	2.00	1.70	1.70	1.32	8.19	7.66
23.23	2166.35	4.18	5.23	2-M2c	2.00	1.70	1.70	1.41	8.19	7.97
23.23	2166.53	4.18	5.41	7-M2c	2.00	1.70	1.70	1.50	8.19	8.24
23.25	2166.49	4.19	5.37	2-M2c	2.00	1.70	1.70	1.58	8.20	8.49
23.29	2166.51	4.20	5.39	2-M2c	2.00	1.70	1.70	1.65	8.20	8.72

El. inlet face invert 2161.12 ft El. outlet invert 2158.73 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	2161.12 ft
OUTLET STATION	120.00 ft
OUTLET ELEVATION	2158.73 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0199
CULVERT LENGTH ALONG SLOPE	120.02 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

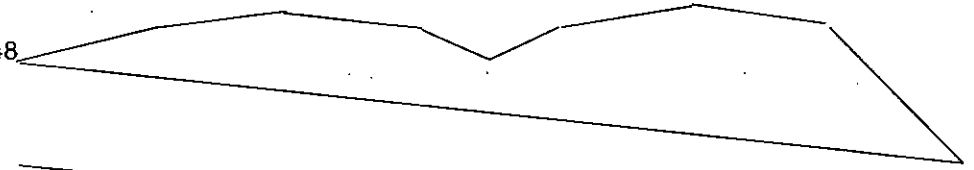
CURRENT DATE: 12-11-1998
CURRENT TIME: 08:33:02

FILE DATE: 12-11-1998
FILE NAME: B84400

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BOLDER HIGHWAY CULVERTS FIELD INFORMATION CHART

Location	STA 843+52 BOULDER HIGHWAY		84352
Type	ARCH CMAP		
Rise	36"	36	
Width	56"		
Lane CL	2166.12	Lane CL	2165.11



TOP PIPE 2161.48

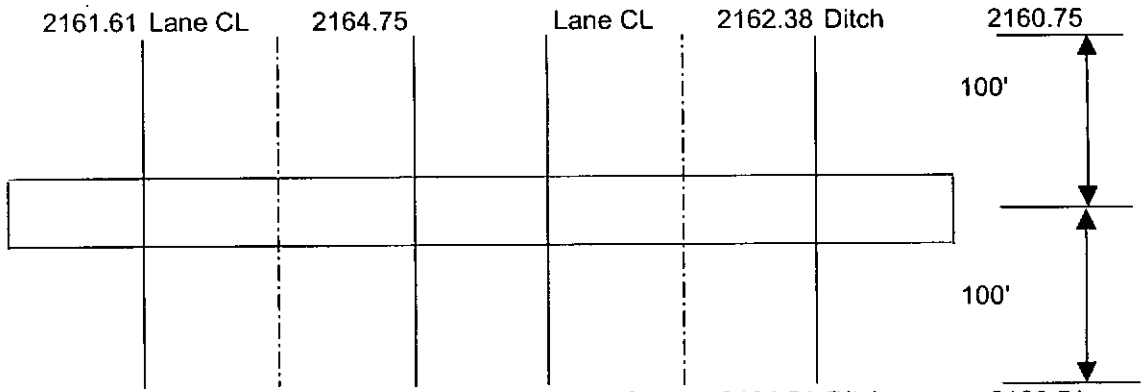
TOP PIPE 2160.03

Inv in 2161.48

Slope 1/1 0.022932

Length 194.05

Inv out 2157.03



CURRENT DATE: 12-11-1998
CURRENT TIME: 09:00:40

FILE DATE: 12-11-1998
FILE NAME: B84352

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

SITE DATA — CULVERT SHAPE, MATERIAL, INLET

CULVERT NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2161.48	2157.03	194.05	1 CMPA	4.82	2.96	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: B84352 DATE: 12-11-1998

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2161.48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2162.33	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2162.76	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2163.14	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2163.51	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2163.87	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2164.23	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2164.60	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2164.99	80.0	80.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2165.41	90.0	90.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2165.86	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2166.12	105.3	105.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B84352 DATE: 12-11-1998

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2161.48	0.000	0.00	0.00	0.00
2162.33	0.000	10.00	0.00	0.00
2162.76	0.000	20.00	0.00	0.00
2163.14	0.000	30.00	0.00	0.00
2163.51	0.000	40.00	0.00	0.00
2163.87	0.000	50.00	0.00	0.00
2164.23	0.000	60.00	0.00	0.00
2164.60	0.000	70.00	0.00	0.00
2164.99	0.000	80.00	0.00	0.00
2165.41	0.000	90.00	0.00	0.00
2165.86	0.000	100.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 09:00:40 FILE NAME: B84352

PERFORMANCE CURVE FOR CULVERT 1 - 1(4.82 (ft) BY 2.96 (ft)) CMPA

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	2161.48	0.00	-4.45	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2162.33	0.85	-2.60	1-S2n	0.52	0.62	0.42	0.38	6.62	4.27
20.00	2162.76	1.28	-2.26	1-S2n	0.76	0.93	0.63	0.56	8.19	5.32
30.00	2163.14	1.66	-1.83	1-S2n	0.97	1.18	0.88	0.70	8.22	6.02
40.00	2163.51	2.03	-1.29	1-S2n	1.16	1.39	1.09	0.82	8.56	6.55
50.00	2163.87	2.39	-0.64	1-S2n	1.34	1.59	1.29	0.92	8.94	6.99
60.00	2164.23	2.75	0.13	1-S2n	1.53	1.78	1.52	1.01	9.02	7.36
70.00	2164.60	3.12	1.01	1-S2n	1.71	1.94	1.64	1.10	9.78	7.68
80.00	2164.99	3.51	2.02	1-S2n	1.92	2.10	1.80	1.18	10.21	7.97
90.00	2165.41	3.93	3.13	5-S2n	2.14	2.23	2.03	1.25	10.27	8.24
100.00	2165.86	4.38	4.25	2-M2c	2.45	2.37	2.37	1.32	10.05	8.48

El. inlet face invert 2161.48 ft El. outlet invert 2157.03 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	2161.48 ft
OUTLET STATION	194.00 ft
OUTLET ELEVATION	2157.03 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0229
CULVERT LENGTH ALONG SLOPE	194.05 ft

***** CULVERT DATA SUMMARY **********

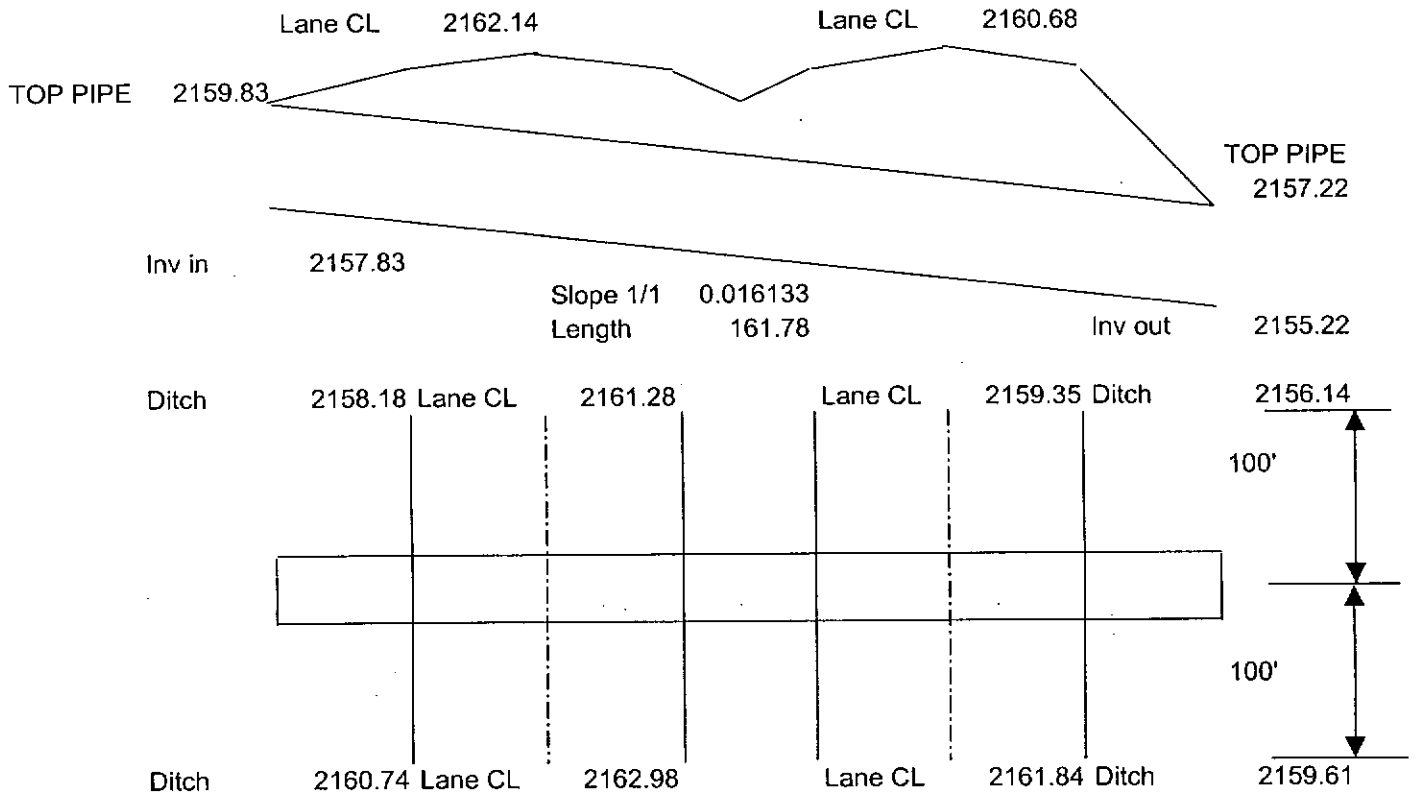
BARREL SHAPE	PIPE ARCH
BARREL SPAN	4.82 ft
BARREL RISE	2.96 ft
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	MITERED
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-1998
CURRENT TIME: 09:00:40

FILE DATE: 12-11-1998
FILE NAME: B84352

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Location STA 840+42 BOULDER HIGHWAY 84041.95
Type 24" ROUND CMP
Rise 24" 24
Width 24"



CURRENT DATE: 12-11-1998
CURRENT TIME: 08:35:19

FILE DATE: 12-11-1998
FILE NAME: B84042

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULVERT NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2157.83	2155.22	161.80	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: B84042 DATE: 12-11-1998

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2157.83	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2159.84	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2161.91	20.0	19.6	0.0	0.0	0.0	0.0	0.0	0.00	30
2162.25	30.0	19.8	0.0	0.0	0.0	0.0	0.0	9.93	13
2162.30	40.0	19.9	0.0	0.0	0.0	0.0	0.0	19.72	6
2162.35	50.0	20.0	0.0	0.0	0.0	0.0	0.0	29.54	5
2162.40	60.0	20.1	0.0	0.0	0.0	0.0	0.0	39.59	5
2162.44	70.0	20.1	0.0	0.0	0.0	0.0	0.0	49.28	4
2162.48	80.0	20.2	0.0	0.0	0.0	0.0	0.0	59.32	4
2162.52	90.0	20.3	0.0	0.0	0.0	0.0	0.0	69.35	4
2162.55	100.0	20.4	0.0	0.0	0.0	0.0	0.0	79.26	4
2162.14	19.8	19.8	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B84042 DATE: 12-11-1998

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2157.83	0.000	0.00	0.00	0.00
2159.84	0.000	10.00	0.00	0.00
2161.91	-0.002	20.00	0.42	2.10
2162.25	-0.002	30.00	0.23	0.77
2162.30	-0.002	40.00	0.34	0.85
2162.35	-0.003	50.00	0.45	0.90
2162.40	-0.002	60.00	0.34	0.57
2162.44	-0.004	70.00	0.57	0.81
2162.48	-0.004	80.00	0.47	0.59
2162.52	-0.003	90.00	0.38	0.42
2162.55	-0.002	100.00	0.36	0.36

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:35:19 FILE NAME: B84042

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

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	2157.83	0.00	-2.61	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2159.84	1.82	2.01	2-M2c	1.17	1.13	1.13	0.57	5.48	4.78
19.58	2161.91	3.35	4.08	2-M2c	2.00	1.59	1.59	0.79	7.32	5.76
19.84	2162.25	3.40	4.42	2-M2c	2.00	1.60	1.60	0.96	7.36	6.41
19.94	2162.31	3.42	4.48	2-M2c	2.00	1.60	1.60	1.10	7.39	6.90
20.01	2162.35	3.44	4.52	2-M2c	2.00	1.60	1.60	1.21	7.40	7.31
20.07	2162.39	3.45	4.56	2-M2c	2.00	1.61	1.61	1.32	7.42	7.66
20.15	2162.44	3.47	4.61	2-M2c	2.00	1.61	1.61	1.41	7.43	7.97
20.21	2162.48	3.48	4.65	2-M2c	2.00	1.61	1.61	1.50	7.45	8.24
20.27	2162.51	3.49	4.68	2-M2c	2.00	1.61	1.61	1.58	7.46	8.49
20.38	2162.54	3.52	4.71	3-M2t	2.00	1.62	1.65	1.65	7.37	8.72

El. inlet face invert 2157.83 ft El. outlet invert 2155.22 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	2157.83 ft
OUTLET STATION	161.78 ft
OUTLET ELEVATION	2155.22 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0161
CULVERT LENGTH ALONG SLOPE	161.80 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

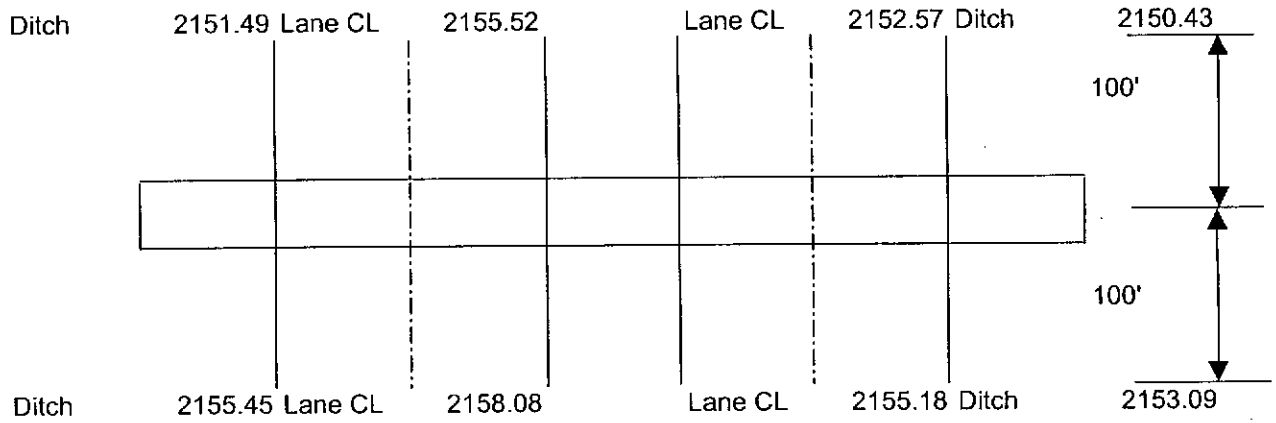
CURRENT DATE: 12-11-1998
CURRENT TIME: 08:35:19

FILE DATE: 12-11-1998
FILE NAME: B84042

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Location STA 834+82 BOULDER HIGHWAY 83482
Type 24" ROUND
Rise 24" 24
Width 24"
Lane CL 2156.93 Lane CL 2153.91





CURRENT DATE: 12-11-1998
CURRENT TIME: 08:52:35

FILE DATE: 12-11-1998
FILE NAME: B834282

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2152.06	2148.49	158.93	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

FILE: B834282 CULVERT HEADWATER ELEVATION (ft) DATE: 12-11-1998

DISCHARGE (cfs)	1	2	3	4	5	6	ROADWAY
0	2152.06	0.00	0.00	0.00	0.00	0.00	0.00
10	2153.87	0.00	0.00	0.00	0.00	0.00	0.00
20	2155.49	0.00	0.00	0.00	0.00	0.00	0.00
30	2162.61	0.00	0.00	0.00	0.00	0.00	0.00
40	2172.11	0.00	0.00	0.00	0.00	0.00	0.00
50	2184.28	0.00	0.00	0.00	0.00	0.00	0.00
60	2199.14	0.00	0.00	0.00	0.00	0.00	0.00
70	2216.71	0.00	0.00	0.00	0.00	0.00	0.00
80	2236.98	0.00	0.00	0.00	0.00	0.00	0.00
90	2259.95	0.00	0.00	0.00	0.00	0.00	0.00
100	2285.63	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The last row, if not 0, is for a point above the roadway.

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:52:35 FILE NAME: B834282

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

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	2152.06	0.00	-3.57	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2153.87	1.81	-0.65	1-S2n	1.05	1.13	0.93	0.57	7.01	4.78
20.00	2155.49	3.43	2.23	2-M2c	2.00	1.60	1.60	0.79	7.40	5.76
30.00	2162.61	6.22	10.55	2-M2c	2.00	1.90	1.90	0.96	9.81	6.41
40.00	2172.11	10.33	20.05	6-FFc	2.00	2.00	2.00	1.10	12.73	6.90
50.00	2184.28	15.40	32.22	6-FFc	2.00	2.00	2.00	1.21	15.92	7.31
60.00	2199.14	20.96	47.08	6-FFc	2.00	2.00	2.00	1.32	19.10	7.66
70.00	2216.71	26.78	64.65	6-FFc	2.00	2.00	2.00	1.41	22.28	7.97
80.00	2236.98	33.24	84.92	6-FFc	2.00	2.00	2.00	1.50	25.46	8.24
90.00	2259.95	41.73	107.89	6-FFc	2.00	2.00	2.00	1.58	28.65	8.49
100.00	2285.63	54.98	133.57	6-FFc	2.00	2.00	2.00	1.65	31.83	8.72

El. inlet face invert 2152.06 ft El. outlet invert 2148.49 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	2152.06 ft
OUTLET STATION	158.89 ft
OUTLET ELEVATION	2148.49 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0225
CULVERT LENGTH ALONG SLOPE	158.93 ft

***** CULVERT DATA SUMMARY **********

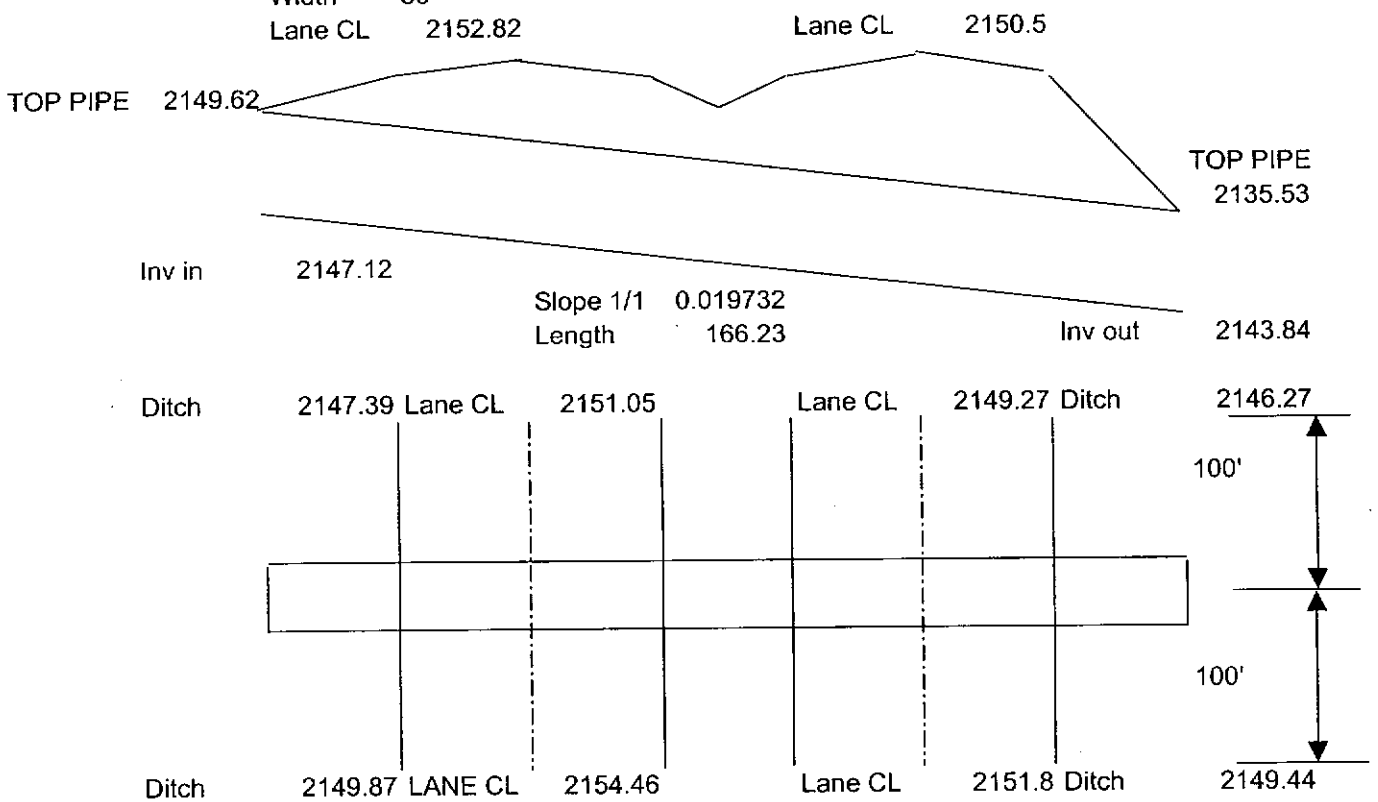
BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-1998
CURRENT TIME: 08:52:35

FILE DATE: 12-11-1998
FILE NAME: B834282

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Location STA 832+01 BOULDER HIGHWAY 83202
Type 30" ROUND CMP
Rise 30"
Width 30"



CURRENT DATE: 12-11-1998
CURRENT TIME: 08:40:06

FILE DATE: 12-11-1998
FILE NAME: B83202

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS	SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2147.12	2143.84	166.23	1	CSP	2.50	2.50	.024	CONVENTIONAL
2									
3									
4									
5									
6									

FILE: B83202 CULVERT HEADWATER ELEVATION (ft) DATE: 12-11-1998

DISCHARGE (cfs)	1	2	3	4	5	6	ROADWAY
0	2147.12	0.00	0.00	0.00	0.00	0.00	0.00
10	2148.71	0.00	0.00	0.00	0.00	0.00	0.00
20	2149.62	0.00	0.00	0.00	0.00	0.00	0.00
30	2150.72	0.00	0.00	0.00	0.00	0.00	0.00
40	2153.36	0.00	0.00	0.00	0.00	0.00	0.00
50	2157.72	0.00	0.00	0.00	0.00	0.00	0.00
60	2162.80	0.00	0.00	0.00	0.00	0.00	0.00
70	2168.75	0.00	0.00	0.00	0.00	0.00	0.00
80	2175.61	0.00	0.00	0.00	0.00	0.00	0.00
90	2183.38	0.00	0.00	0.00	0.00	0.00	0.00
100	2192.07	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The last row, if not 0, is for a point above the roadway.

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:40:06 FILE NAME: B83202

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.50 (ft) BY 2.50 (ft)) CSP

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	2147.12	0.00	-3.28	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2148.71	1.59	-1.05	1-S2n	0.97	1.05	0.85	0.52	6.75	4.71
20.00	2149.62	2.50	0.56	1-S2n	1.45	1.52	1.32	0.74	7.64	5.70
30.00	2150.72	3.60	3.52	2-M2c	1.97	1.86	1.86	0.91	7.68	6.36
40.00	2153.36	5.13	6.24	2-M2c	2.50	2.11	2.11	1.04	9.07	6.86
50.00	2157.72	7.20	10.60	2-M2c	2.50	2.32	2.32	1.15	10.57	7.27
60.00	2162.80	9.82	15.68	6-FFc	2.50	2.50	2.50	1.26	12.22	7.63
70.00	2168.75	12.95	21.63	6-FFc	2.50	2.50	2.50	1.35	14.26	7.93
80.00	2175.61	16.48	28.49	6-FFc	2.50	2.50	2.50	1.43	16.30	8.21
90.00	2183.38	20.28	36.26	6-FFc	2.50	2.50	2.50	1.51	18.33	8.47
100.00	2192.07	24.25	44.95	6-FFc	2.50	2.50	2.50	1.58	20.37	8.70

El. inlet face invert 2147.12 ft El. outlet invert 2143.84 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	2147.12 ft
OUTLET STATION	166.20 ft
OUTLET ELEVATION	2143.84 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0197
CULVERT LENGTH ALONG SLOPE	166.23 ft

***** CULVERT DATA SUMMARY **********

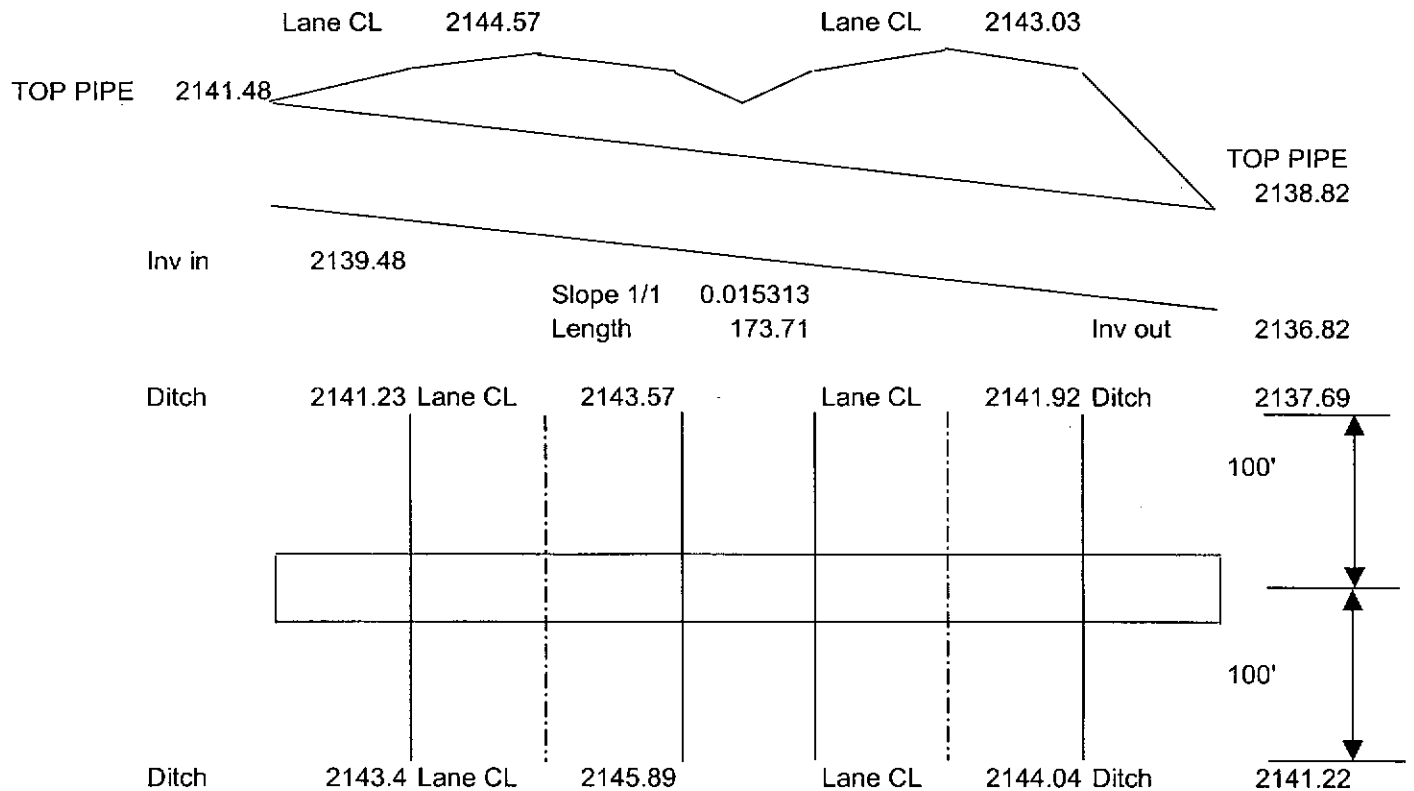
BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.50 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-1998
CURRENT TIME: 08:40:06

FILE DATE: 12-11-1998
FILE NAME: B83202

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Location	STA 825+52 BOULDER HIGHWAY	82551
Type	30" ROUND CMP	
Rise	24" 24	
Width	24"	



CURRENT DATE: 12-11-1998
CURRENT TIME: 08:42:23

FILE DATE: 12-11-1998
FILE NAME: B82551

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULVERT NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2139.48	2136.82	173.72	1 CSP	2.50	2.50	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SITE DATA

CULVERT SHAPE, MATERIAL, INLET

SUMMARY OF CULVERT FLOWS (cfs) FILE: B82551 DATE: 12-11-1998

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2139.48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2141.07	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2142.15	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2143.09	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2144.63	40.0	35.1	0.0	0.0	0.0	0.0	0.0	4.55	21
2144.70	50.0	35.3	0.0	0.0	0.0	0.0	0.0	14.44	7
2144.76	60.0	35.4	0.0	0.0	0.0	0.0	0.0	24.03	5
2144.81	70.0	35.5	0.0	0.0	0.0	0.0	0.0	34.14	5
2144.85	80.0	35.6	0.0	0.0	0.0	0.0	0.0	43.73	4
2144.89	90.0	35.7	0.0	0.0	0.0	0.0	0.0	53.68	4
2144.93	100.0	35.8	0.0	0.0	0.0	0.0	0.0	63.74	4
2144.57	34.9	34.9	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B82551 DATE: 12-11-1998

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2139.48	0.000	0.00	0.00	0.00
2141.07	0.000	10.00	0.00	0.00
2142.15	0.000	20.00	0.00	0.00
2143.09	0.000	30.00	0.00	0.00
2144.63	-0.003	40.00	0.36	0.90
2144.70	-0.002	50.00	0.28	0.56
2144.76	-0.003	60.00	0.58	0.97
2144.81	-0.002	70.00	0.34	0.49
2144.85	-0.004	80.00	0.64	0.80
2144.89	-0.004	90.00	0.58	0.64
2144.93	-0.003	100.00	0.43	0.43

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:42:23 FILE NAME: B82551

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.50 (ft) BY 2.50 (ft)) CSP

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	2139.48	0.00	-2.66	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2141.07	1.59	-0.41	1-S2n	1.04	1.05	0.95	0.52	5.82	4.71
20.00	2142.15	2.51	2.67	2-M2c	1.58	1.52	1.52	0.74	6.42	5.70
30.00	2143.09	3.61	3.53	2-M2c	2.50	1.86	1.86	0.91	7.68	6.36
35.09	2144.64	4.32	5.16	2-M2c	2.50	2.01	2.01	1.04	8.30	6.86
35.28	2144.71	4.35	5.23	2-M2c	2.50	2.01	2.01	1.15	8.32	7.27
35.39	2144.76	4.37	5.28	2-M2c	2.50	2.02	2.02	1.26	8.34	7.63
35.52	2144.80	4.38	5.32	2-M2c	2.50	2.02	2.02	1.35	8.36	7.93
35.63	2144.85	4.40	5.37	2-M2c	2.50	2.02	2.02	1.43	8.38	8.21
35.74	2144.89	4.42	5.41	2-M2c	2.50	2.02	2.02	1.51	8.39	8.47
35.84	2144.92	4.43	5.44	2-M2c	2.50	2.02	2.02	1.58	8.41	8.70

El. inlet face invert 2139.48 ft El. outlet invert 2136.82 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	2139.48 ft
OUTLET STATION	173.70 ft
OUTLET ELEVATION	2136.82 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0153
CULVERT LENGTH ALONG SLOPE	173.72 ft

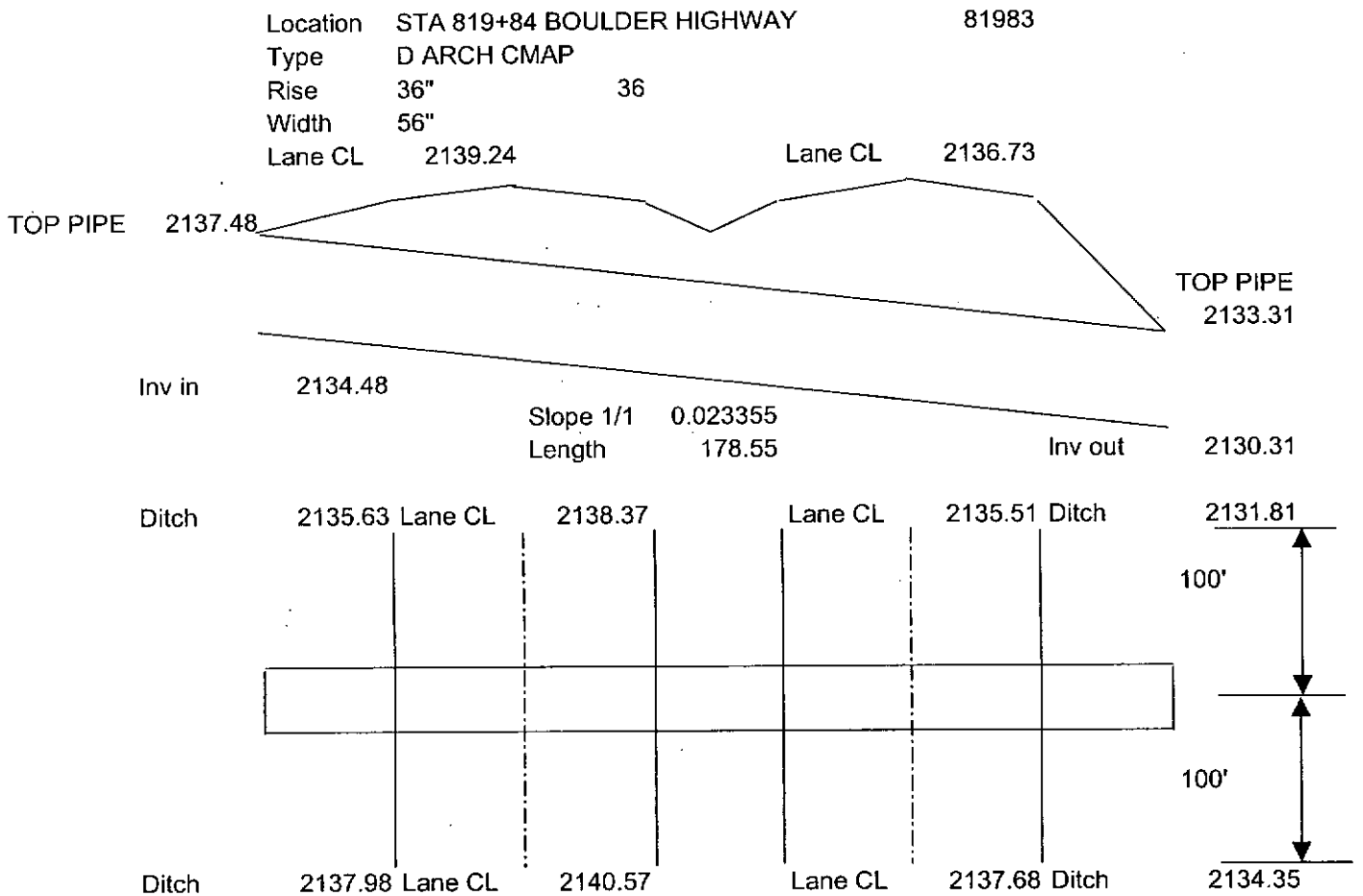
***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.50 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-1998
CURRENT TIME: 08:42:23

FILE DATE: 12-11-1998
FILE NAME: B82551

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Location STA 819+84 BOULDER HIGHWAY 81983
Type D ARCH CMAP
Rise 36" 36
Width 56"
Lane CL 2139.24
Lane CL 2136.73
TOP PIPE 2137.48
TOP PIPE 2133.31
Inv in 2134.48
Slope 1/1 0.023355
Length 178.55
Inv out 2130.31
Ditch 2135.63 Lane CL 2138.37 Lane CL 2135.51 Ditch 2131.81
100'
100'
Ditch 2137.98 Lane CL 2140.57 Lane CL 2137.68 Ditch 2134.35

CURRENT DATE: 12-11-1998
CURRENT TIME: 08:58:47

FILE DATE: 12-11-1998
FILE NAME: B81983

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2134.48	2130.31	178.55	1	CMPA	4.82	2.96	.024	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: B81983 DATE: 12-11-1998

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2134.48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2135.36	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2135.79	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2139.41	60.0	40.0	0.0	0.0	0.0	0.0	0.0	19.72	12
2139.50	80.0	40.0	0.0	0.0	0.0	0.0	0.0	39.42	5
2139.58	100.0	40.0	0.0	0.0	0.0	0.0	0.0	59.06	4
2139.65	120.0	40.0	0.0	0.0	0.0	0.0	0.0	79.34	4
2139.72	140.0	40.0	0.0	0.0	0.0	0.0	0.0	99.47	4
2139.78	160.0	40.0	0.0	0.0	0.0	0.0	0.0	119.62	4
2139.83	180.0	40.0	0.0	0.0	0.0	0.0	0.0	138.67	3
2139.89	200.0	40.0	0.0	0.0	0.0	0.0	0.0	158.57	3
2139.24	40.0	40.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B81983 DATE: 12-11-1998

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2134.48	0.000	0.00	0.00	0.00
2135.36	0.000	20.00	0.00	0.00
2135.79	0.000	40.00	0.00	0.00
2139.41	-0.003	60.00	0.28	0.47
2139.50	-0.004	80.00	0.58	0.72
2139.58	-0.007	100.00	0.94	0.94
2139.65	-0.006	120.00	0.66	0.55
2139.72	-0.004	140.00	0.52	0.37
2139.78	-0.004	160.00	0.38	0.24
2139.83	-0.003	180.00	1.33	0.74
2139.89	-0.003	200.00	1.43	0.71

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:58:47 FILE NAME: B81983

PERFORMANCE CURVE FOR CULVERT 1 - 1(4.82 (ft) BY 2.96 (ft)) CMPA

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	2134.48	0.00	-4.17	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
20.00	2135.36	0.88	-2.01	1-S2n	0.75	0.93	0.63	0.56	8.19	5.32
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	0.82	8.56	6.55
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.01	8.56	7.36
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.18	8.56	7.97
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.32	8.56	8.48
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.44	8.56	8.91
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.56	8.56	9.30
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.66	8.56	9.64
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.76	8.56	9.94
40.00	2135.79	1.31	-1.11	1-S2n	1.15	1.39	1.09	1.85	8.56	10.23

El. inlet face invert 2134.48 ft El. outlet invert 2130.31 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	2134.48 ft
OUTLET STATION	178.50 ft
OUTLET ELEVATION	2130.31 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0234
CULVERT LENGTH ALONG SLOPE	178.55 ft

***** CULVERT DATA SUMMARY **********

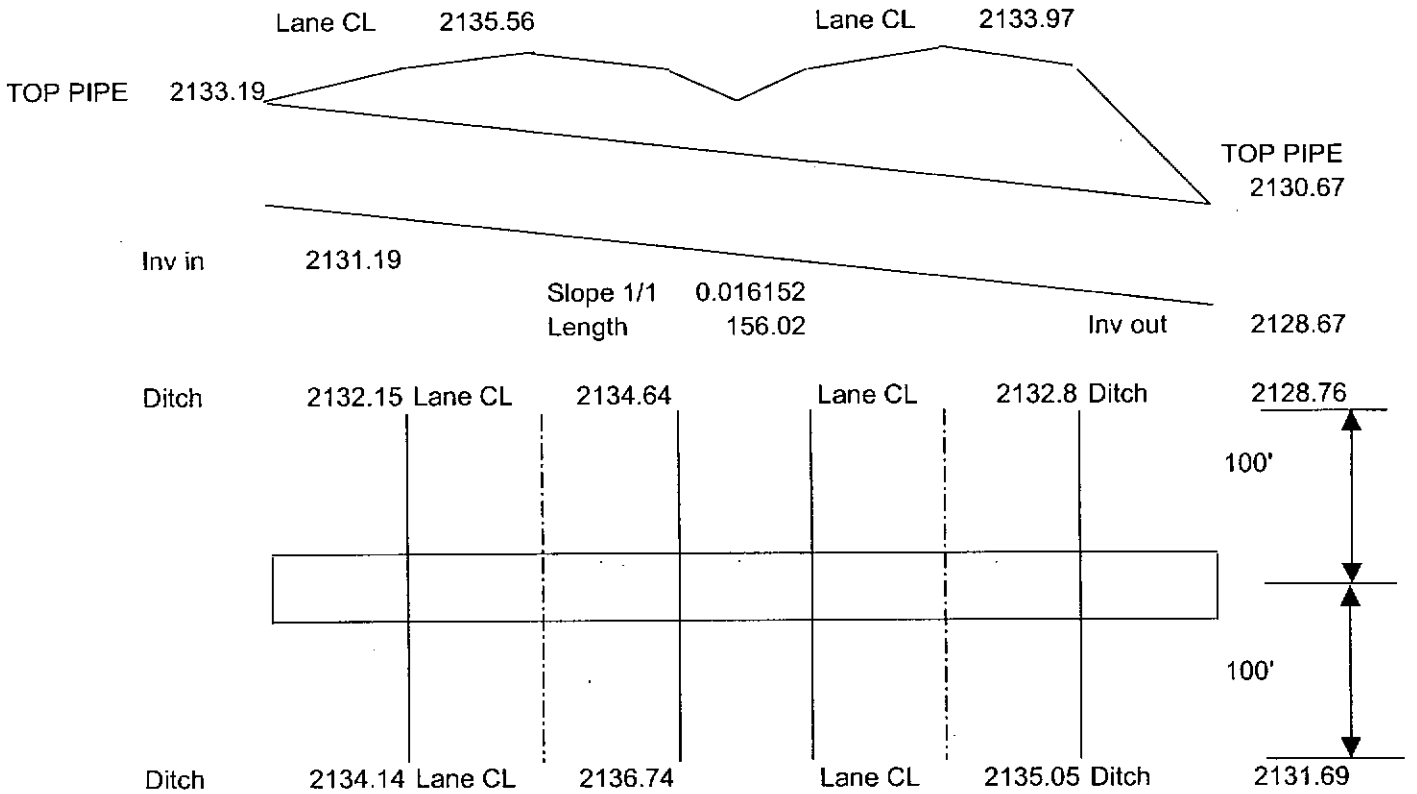
BARREL SHAPE	PIPE ARCH
BARREL SPAN	4.82 ft
BARREL RISE	2.96 ft
BARREL MATERIAL	STEEL OR ALUMINUM
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-1998
CURRENT TIME: 08:58:47

FILE DATE: 12-11-1998
FILE NAME: B81983

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Location	STA 816+72 BOULDER HIGHWAY	81617
Type	24" ROUND CMP	
Rise	24" 24	
Width	24"	



CURRENT DATE: 12-11-1998
CURRENT TIME: 08:45:30

FILE DATE: 12-11-1998
FILE NAME: B81617

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

C U L V 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	2131.19	2128.67	156.02	1 CSP	2.00	2.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

FILE: B81617 CULVERT HEADWATER ELEVATION (ft) DATE: 12-11-1998

DISCHARGE (cfs)	1	2	3	4	5	6	ROADWAY
0	2131.19	0.00	0.00	0.00	0.00	0.00	0.00
10	2133.20	0.00	0.00	0.00	0.00	0.00	0.00
20	2135.64	0.00	0.00	0.00	0.00	0.00	0.00
30	2142.63	0.00	0.00	0.00	0.00	0.00	0.00
40	2151.98	0.00	0.00	0.00	0.00	0.00	0.00
50	2163.97	0.00	0.00	0.00	0.00	0.00	0.00
60	2178.63	0.00	0.00	0.00	0.00	0.00	0.00
70	2195.94	0.00	0.00	0.00	0.00	0.00	0.00
80	2215.93	0.00	0.00	0.00	0.00	0.00	0.00
90	2238.57	0.00	0.00	0.00	0.00	0.00	0.00
100	2263.88	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The last row, if not 0, is for a point above the roadway.

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:45:30 FILE NAME: B81617

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (ft)) CSP

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	2131.19	0.00	-2.52	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2133.20	1.82	2.01	2-M2c	1.16	1.13	1.13	0.57	5.48	4.78
20.00	2135.64	3.44	4.45	2-M2c	2.00	1.60	1.60	0.79	7.40	5.76
30.00	2142.63	6.23	11.44	2-M2c	2.00	1.90	1.90	0.96	9.81	6.41
40.00	2151.98	10.33	20.79	6-FFc	2.00	2.00	2.00	1.10	12.73	6.90
50.00	2163.97	15.41	32.78	6-FFc	2.00	2.00	2.00	1.21	15.92	7.31
60.00	2178.63	20.97	47.44	6-FFc	2.00	2.00	2.00	1.32	19.10	7.66
70.00	2195.94	26.78	64.76	6-FFc	2.00	2.00	2.00	1.41	22.28	7.97
80.00	2215.93	33.25	84.74	6-FFc	2.00	2.00	2.00	1.50	25.46	8.24
90.00	2238.57	41.74	107.38	6-FFc	2.00	2.00	2.00	1.58	28.65	8.49
100.00	2263.88	54.99	132.69	6-FFc	2.00	2.00	2.00	1.65	31.83	8.72

El. inlet face invert 2131.19 ft El. outlet invert 2128.67 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	2131.19 ft
OUTLET STATION	156.00 ft
OUTLET ELEVATION	2128.67 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0162
CULVERT LENGTH ALONG SLOPE	156.02 ft

***** CULVERT DATA SUMMARY **********

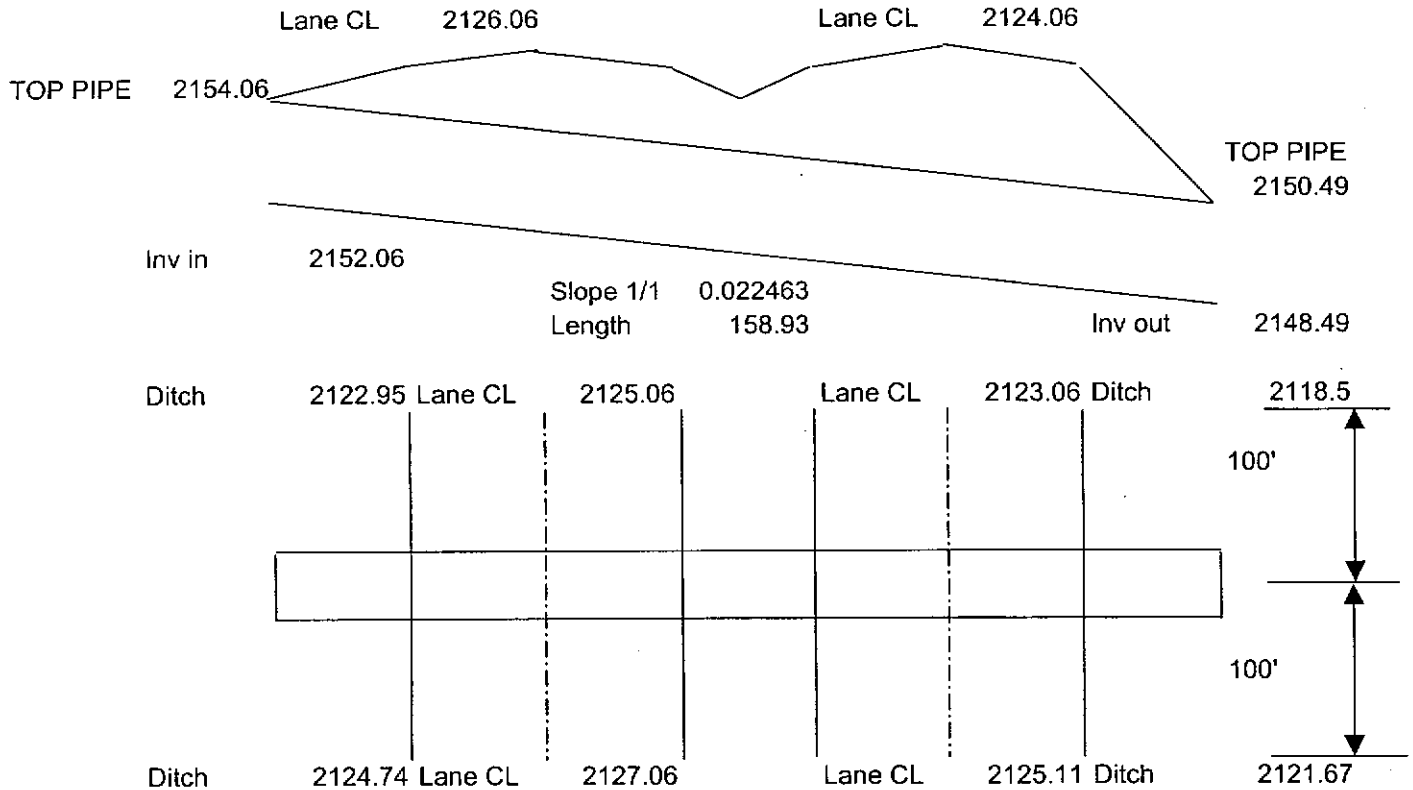
BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-1998
CURRENT TIME: 08:45:30

FILE DATE: 12-11-1998
FILE NAME: B81617

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Location	STA 807+37 BOULDER HIGHWAY	80736.81
Type	24" ROUND CMP	
Rise	24" 24	
Width	24"	



CURRENT DATE: 12-07-1998
CURRENT TIME: 09:21:15

FILE DATE: 12-07-1998
FILE NAME: B80734

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

C U L V	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2120.36	2117.65	160.01	1 RCP	3.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: B80734 DATE: 12-07-1998

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2120.36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2121.69	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2122.38	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2122.91	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2123.42	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2123.99	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2124.68	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2125.50	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2126.11	80.0	76.4	0.0	0.0	0.0	0.0	0.0	3.04	17
2126.18	90.0	77.2	0.0	0.0	0.0	0.0	0.0	12.19	6
2126.24	100.0	77.7	0.0	0.0	0.0	0.0	0.0	21.70	5
2126.06	75.9	75.9	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B80734 DATE: 12-07-1998

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2120.36	0.000	0.00	0.00	0.00
2121.69	0.000	10.00	0.00	0.00
2122.38	0.000	20.00	0.00	0.00
2122.91	0.000	30.00	0.00	0.00
2123.42	0.000	40.00	0.00	0.00
2123.99	0.000	50.00	0.00	0.00
2124.68	0.000	60.00	0.00	0.00
2125.50	0.000	70.00	0.00	0.00
2126.11	-0.004	80.00	0.53	0.66
2126.18	-0.003	90.00	0.65	0.72
2126.24	-0.004	100.00	0.58	0.58

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-07-1998 FILE DATE: 12-07-1998
CURRENT TIME: 09:21:15 FILE NAME: B80734

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) RCP

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	2120.36	0.00	-2.71	0-NF	0.00	0.00	0.00	-0.22	0.00	0.00
10.00	2121.69	1.33	-0.65	1-S2n	0.65	0.99	0.59	0.26	10.11	4.69
20.00	2122.38	2.02	-0.23	1-S2n	0.94	1.43	0.95	0.47	10.37	5.72
30.00	2122.91	2.55	0.28	1-S2n	1.16	1.77	1.19	0.63	11.47	6.39
40.00	2123.42	3.06	0.90	1-S2n	1.36	2.06	1.41	0.76	12.29	6.91
50.00	2123.99	3.63	1.63	1-S2n	1.55	2.29	1.61	0.87	12.92	7.34
60.00	2124.68	4.32	2.47	1-S2n	1.74	2.49	1.81	0.97	13.50	7.70
70.00	2125.50	5.14	3.43	5-S2n	1.93	2.65	2.01	1.06	13.95	8.02
76.43	2126.11	5.75	4.12	5-S2n	2.05	2.75	2.13	1.14	14.24	8.30
77.16	2126.18	5.82	4.20	5-S2n	2.07	2.76	2.15	1.22	14.24	8.56
77.72	2126.24	5.88	4.27	5-S2n	2.08	2.77	2.16	1.29	14.29	8.80

El. inlet face invert 2120.36 ft El. outlet invert 2117.65 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** EMBANKMENT TOE **********

UPSTREAM STATION	0.00 ft
UPSTREAM ELEVATION	2120.55 ft
UPSTREAM EMBANKMENT SLOPE (X:1)	4.00
DOWMSTREAM STATION	184.10 ft
DOWNSTREAM ELEVATION	2117.43 ft
DOWNSTREAM EMBANKMENT SLOPE (X:1)	4.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END PROJECTION
INLET DEPRESSION	NONE

CURRENT DATE: 12-07-1998
CURRENT TIME: 09:21:15

FILE DATE: 12-07-1998
FILE NAME: B80734

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CURRENT DATE: 12-11-1998
CURRENT TIME: 08:48:44

FILE DATE: 12-11-1998
FILE NAME: B29624

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULVERT NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	BARRELS: SHAPE & MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	2227.85	2226.79	212.00	1 CSP	3.00	3.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: B29624 DATE: 12-11-1998

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
2227.85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2229.49	10.0	10.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2230.31	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2231.12	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2232.49	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.00	1
2234.48	50.0	48.4	0.0	0.0	0.0	0.0	0.0	1.54	5
2234.56	60.0	48.8	0.0	0.0	0.0	0.0	0.0	10.82	7
2234.62	70.0	49.0	0.0	0.0	0.0	0.0	0.0	20.34	5
2234.67	80.0	49.3	0.0	0.0	0.0	0.0	0.0	30.31	5
2234.71	90.0	49.5	0.0	0.0	0.0	0.0	0.0	39.82	4
2234.75	100.0	49.6	0.0	0.0	0.0	0.0	0.0	49.71	4
2234.45	48.3	48.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: B29624 DATE: 12-11-1998

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
2227.85	0.000	0.00	0.00	0.00
2229.49	0.000	10.00	0.00	0.00
2230.31	0.000	20.00	0.00	0.00
2231.12	0.000	30.00	0.00	0.00
2232.49	0.000	40.00	0.00	0.00
2234.48	-0.001	50.00	0.06	0.12
2234.56	-0.002	60.00	0.42	0.70
2234.62	-0.004	70.00	0.64	0.91
2234.67	-0.003	80.00	0.41	0.51
2234.71	-0.005	90.00	0.72	0.80
2234.75	-0.004	100.00	0.65	0.65

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:48:44 FILE NAME: B29624

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) CSP

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	2227.85	0.00	-1.06	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00	2229.49	1.49	1.64	2-M2c	1.30	0.99	0.99	0.38	4.89	4.27
20.00	2230.31	2.22	2.46	2-M2c	2.00	1.43	1.43	0.56	6.01	5.32
30.00	2231.12	2.91	3.27	2-M2c	3.00	1.77	1.77	0.70	6.90	6.02
40.00	2232.49	3.68	4.64	2-M2c	3.00	2.06	2.06	0.82	7.75	6.55
48.39	2234.48	4.45	6.63	2-M2c	3.00	2.26	2.26	0.92	8.51	6.99
48.76	2234.56	4.49	6.71	2-M2c	3.00	2.26	2.26	1.01	8.54	7.36
49.02	2234.62	4.51	6.77	2-M2c	3.00	2.27	2.27	1.10	8.56	7.68
49.28	2234.68	4.54	6.83	2-M2c	3.00	2.28	2.28	1.18	8.58	7.97
49.47	2234.72	4.56	6.87	2-M2c	3.00	2.28	2.28	1.25	8.60	8.24
49.64	2234.76	4.57	6.91	2-M2c	3.00	2.28	2.28	1.32	8.61	8.48

El. inlet face invert 2227.85 ft El. outlet invert 2226.79 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	2227.85 ft
OUTLET STATION	212.00 ft
OUTLET ELEVATION	2226.79 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0050
CULVERT LENGTH ALONG SLOPE	212.00 ft

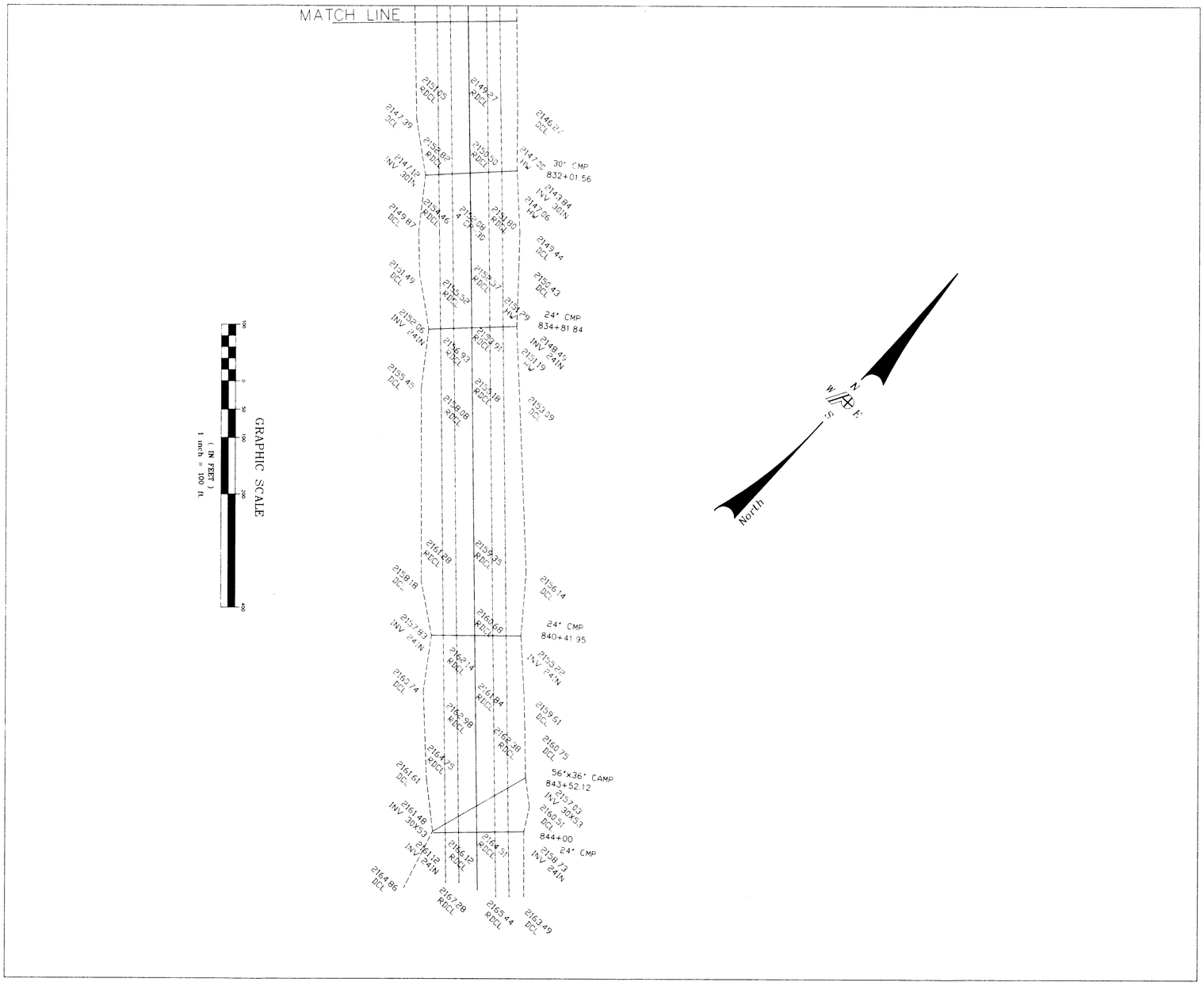
***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 12-11-1998 FILE DATE: 12-11-1998
CURRENT TIME: 08:48:44 FILE NAME: B29624

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LAST_REV_DATE LAST_REV_DATE



STEPHEN WEITHERMAN
No. 9295
STATE OF NEVADA
PROFESSIONAL ENGINEER
12/15/98

SHEET NUMBER	DB-1
	Sheet 1 of 2
DATE	12/15/98
CHECKED BY	SLW
DRAWN BY	SLW
DESIGNED BY	SLW
JOB NUMBER	1002005

BOULDER HIGHWAY CULVERTS

CITY OF HENDERSON
EQUESTRIAN DETENTION BASIN
LOMR APPLICATION

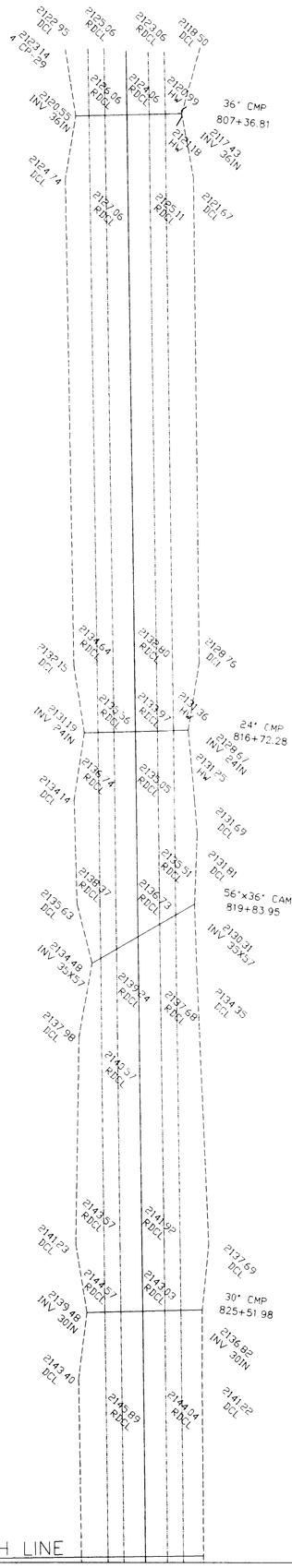
STAMP

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 N. TENAYA WAY LAS VEGAS, NV 89128 (702) 255-8100

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12/17/98

PROFESSIONAL ENGINEER STATE OF NEVADA No. 9288 STEPHEN L. WEISSMAN

BOULDER HIGHWAY CULVERTS

CITY OF HENDERSON
EQUESTRIAN DETENTION BASIN
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CHECKED BY	SLW
DATE	12/15/98
SHEET NUMBER	DB-2

Sheet 2 of 2

APPENDIX K

SOIL REPORT

KLEINFELDER

Geotechnical Investigation
Equestrian Detention Basin
Sections 22, 23, 26 and 35,
Township 22 North, Range 62 East
Clark County, Nevada

Prepared for: Poggemeyer Design Group
2601 North Tenaya Way
Las Vegas, Nevada 89128

Attention: Mr. Tim Pinter, P.E.

Kleinfelder Project No. 31-128834-001
January 19, 1994

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KLEINFELDER

January 19, 1994
Project No. 31-128834-001

Mr. Tim Pinter, P.E.
Poggemeyer Design Group
2601 North Tenaya Way
Las Vegas, Nevada 89128

Subject: **Geotechnical Investigation**
Proposed Equestrian Detention Basin
Sections 22, 23, 26 and 35,
Township 22 North, Range 63 East
Clark County, Nevada

Dear Mr. Pinter:

Enclosed please find our geotechnical investigation report for the proposed Equestrian Detention Basin site. The report details our field exploration and laboratory testing program for the proposed basin, embankments, diversion structures and energy dissipaters. The report presents our analyses, opinions and recommendations for design and construction of the proposed flood control structures.

We appreciate this opportunity to be of service on this phase of the project and look forward to providing additional services as the project progresses. If you have any questions, please do not hesitate to contact this office at your convenience.

Respectfully submitted,

KLEINFELDER, INC.

Walter E. Vanderpool, P.E.
Senior Engineer

Alan E. Money, P.E.
Geotechnical Engineering Manager

WEV/kmk

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KLEINFELDER 6650 South Paradise Road, Las Vegas, NV 89119 (702) 736-2936

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1.0 INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical investigation for the proposed Equestrian Detention Basin flood control structures in Henderson, Nevada. The site was located in Sections 22, 23, 26 and 35 of Township 22 North, Range 63 East, Clark County, Nevada, as shown on the General Vicinity Map (Plate 1).

The purposes of this investigation were to evaluate the surface and subsurface soil conditions and general site geology, and to provide recommendations for design and construction of a storm detention basin, runoff interception channel/dike, energy dissipaters, overflow spillway and outlet structures. This report presents recommendations for suitable embankment construction, foundations, site grading, trench backfill, compaction, earth pressures, moisture protection, soil corrosion and construction considerations.

The investigation included site reconnaissance, subsurface exploration, representative soil sampling, field and laboratory testing, engineering analyses, and preparation of this report.

The recommendations contained in this report are subject to the limitations presented herein. Attention is directed to the "Limitations" section of this report. In addition, a brochure prepared by ASFE (The Association of Firms Practicing in the Geosciences) has been included following this report. We recommend that all individuals reading this report also read the attached document.

1.2 PROJECT DESCRIPTION

The proposed Equestrian Detention Basin will consist of excavating a storm detention basin, constructing an embankment, overflow spillway and outlet structure. The

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improvements will also include construction of an interception channel and dike and placement of energy dissipating structures. Recommendations to control erosion are also provided.

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2.0 FIELD EXPLORATION

2.1 SITE RECONNAISSANCE

At the time of our field exploration the site including the detention basin and area of the interception channel/dike was undeveloped desert. Wildfire has recently burned the vegetation from an area in the northwest corner of Section 26. Other areas of the site do not appear to have been significantly altered in the recent past. Remnants of a breached embankment were observed along the west edge of the Detention Basin site. The site was located approximately as shown on the General Vicinity Map, Figure 1.

Natural vegetation consisted of creosote bush, white bursage and Indian rice grass. Some choya cactus were noted particularly at the higher elevations on the alluvial fan. Numerous braided rill erosion channels cut the site. Most of these channels were less than two feet deep. However, the erosion channels along the east edge of the site and particularly at the southern end were more active and more deeply incised. No surface water was present during our site reconnaissance. The site has a gentle overall gradient down toward the west and southwest. Surface elevations ranged from approximately 2050 feet MSL near the northwest corner to approximately 2380 feet at the southern end of the proposed interception channel/dike.

2.2 DRILLING EXPLORATION

The subsurface soil conditions in the area of the detention basin embankment were explored by drilling five (5) borings to depths of approximately 15 to 31 feet below existing site grade. Logs of the subsurface conditions, as encountered in the borings, were recorded at the time of drilling and are presented on the Log of Test Boring summary sheets, Plate A-1 through A-5, in Appendix A. The borings were located approximately as shown on Figure 2, Location of Explorations. A Key to Soil

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Symbols and Terms used with this report is presented on Plate A-33 following the Log of exploration summary sheets in Appendix A.

Drilling was accomplished with a truck-mounted rotary air drill rig equipped for soil sampling. Representative soil samples were obtained by bulk methods and with a ring-lined 2.63 inch inside diameter (ID) sampler. The ring-lined sampler was driven with a 350 pound hammer free-falling through a distance of 30 inches. The sampler driving resistance was recorded as number of blows per inches of penetration. The Penetration Test results are presented on the Log of Test Boring summary sheets at the sampling point. Representative soil samples from the borings were classified in the field by the field geologist and representative portions of each sample were packaged and transported to our laboratory for additional testing, as appropriate.

2.3 TRENCH EXPLORATION

The subsurface conditions within the proposed detention basin and along the proposed interception channel/dike were explored by excavating 26 trenches to depths of 8 to 10 feet below existing site grade. Logs of the subsurface conditions as encountered in the trenches were recorded at the time of excavation and are presented on the trench logs, Plate A-6 through A-31.

The trench explorations were located approximately as shown on Figure 2, following the text of this report. The trench explorations were backfilled and compacted to the extent possible with the equipment available. However, the compaction may not meet the minimum compacted density recommendations presented in Section 6 of this report. If structures will be founded over the trench explorations the backfill should be removed and replaced in accordance with the recommendations presented in Section 6.

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2.4 IN-SITU INFILTRATION TESTING

A two-inch (I.D.) well was installed in Boring B-5 upon completion of drilling. The bottom of the well was caped and the well extended to a total depth of 14 feet below existing site grade. The well consisted of 0.02 inch slotted PVC pipe from the bottom to a point nine feet below existing grade. The remainder of the pipe consisted of solid two-inch PVC pipe. The boring annulus was backfilled to 8.5 feet below existing grade with coarse, poorly graded sand pack. The slotted well and sand pack was then sealed with a two foot layer of powdered bentonite and the remainder of the boring annulus was backfilled with drill cuttings.

The infiltration tests were performed on November 9, 1993, approximately 24 hours after well construction.

The test procedure consisted of filling the well with potable water to the wellhead one foot above existing grade. The well casing was filled and maintained full for a period of 15 minutes. The feed water was then shut off and the time vs head data was collected as water infiltrated into the subgrade. The test was repeated six more times. The final data set was collected 2-1/4 hours after initial flooding of the well.

The water level vs time data for the seven tests are presented on Plates B-11 through B-17 in Appendix B.

The test was not run to steady state, however, the infiltration rate roughly calculates to a permeability of 0.00002 centimeters per second or approximately one half the rate observed in laboratory permeability tests on the 1/4 inch and finer fraction of remolded soils.

A second well was constructed at boring location B-4, however, the well was vandalized before the test could be performed. The well was subsequently backfilled and abandoned.

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3.0 LABORATORY TESTING

Representative soil samples from the borings were tested in the laboratory to evaluate their pertinent engineering properties. The laboratory tests include natural moisture content and dry unit weight tests. These test results are presented on the boring and trench logs at the sampling point.

3.1 SIEVE ANALYSES

Nine sieve analyses were performed on soil samples from the trench explorations. The sieve analyses characterize grainsize distribution along the interception channel/dike alignment and in the detention basin. The test results are presented on Plates B-1 through B-3 in Appendix B.

3.2 ATTERBERG LIMITS TESTS

Atterberg limits tests were performed on each sieve sample. All of the soils encountered during our field exploration were non-plastic.

3.3 DIRECT SHEAR STRENGTH TESTS

Direct shear strength tests were performed on seven soil samples. The strength tests were performed on remolded samples which were scalped to remove material larger than 1/4 inch. The test results are presented on Plates B-4 through B-6 in Appendix B.

3.4 OPTIMUM MOISTURE/DRY DENSITY TESTS

Optimum moisture/dry density tests were performed on two soil samples from the trench explorations. The tests were performed in accordance with the Modified Proctor Method, ASTM Test Method D-1557. The test results are presented on Plates B-7 and B-8.

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3.5 LABORATORY PERMEABILITY TESTS

Laboratory permeability tests were performed on three soil samples from the trench explorations. The tests were performed by a falling head method on remolded samples scalped to remove soil larger than 1/4 inch. The test results are presented in Table No. 1 on Plate B-9.

3.6 RESISTIVITY TESTS.

Resistivity tests were performed by the Miller Soil Box Method on two soil samples from the test pits. The resistivity test results are presented in Table No. 2 on Plate B-10.

3.7 CHEMICAL ANALYSES

Eight soil samples were submitted for chemical analyses. The corrosivity tests were performed by Atlas Chemical Testing Laboratories. The test results are presented following Plate B-17 in Appendix B.

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4.0 GENERAL SITE CONDITIONS

4.1 SURFACE CONDITIONS

At the time of our exploration, the Equestrian Detention Basin site was an undeveloped, gently sloping alluvial fan. Vegetation was sparse. Surficial soils consisted of medium to coarse sand, gravel, cobbles, and some boulders up to two feet in nominal diameter. The surface materials were coated with desert varnish.

4.2 SUBSURFACE CONDITIONS

The native soil consisted of coarse grained alluvially deposited soil to the depths explored. All of the soils encountered were coarse grained and non-plastic. The alluvial detritus was volcanic in origin. The soils were generally loose at the surface and progressively more dense with depth. Very dense granular soil was encountered within three to seven feet of the present ground surface throughout the site. Partially cemented soils were encountered in one trench (T-17). Trench T-17 was one of the explorations located closest to bedrock outcrops along the interception channel/dike alignment. Numerous alluvially deposited lenses and strata of poorly graded fine sand to coarse gravel were observed throughout the soil profile at each exploration location. There was no consistent pattern to the sequence in which each soil type was encountered within each exploration or between explorations. However, the native soils generally became finer grained with decreasing elevation on the alluvial fan.

Groundwater was not encountered in any of the explorations at this site to the depth explored. Moisture content was low throughout the soil profile and throughout the site.

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5.0 GENERAL SITE GEOLOGY

5.1 GEOLOGIC SETTING

The proposed Equestrian Detention Basin site is located along the southeastern rim of the Las Vegas Valley. The Las Vegas Valley is filled with Quaternary and Tertiary age normally consolidated alluvial sediments derived from the surrounding mountains. The Valley floor sediments consist of alluvial and playa deposits surrounded by progressively more steeply sloping alluvial aprons. The major source of the alluvium at this site is the River Mountains located on the southeast side of the Valley. Generally, the sediments become progressively finer grained with increasing distance from the source area and with decreasing elevation. The alluvial and playa sediments can be several thousand feet thick in the Central Valley floor. However, bedrock outcrops at the apex of the fan along the east edge of the site. The thickness of the alluvium at this site is unknown. At this site the sediments appear to consist primarily of sand and gravel deposits of volcanic origin with trace amounts to some silt. Secondary cemented deposits of calcium carbonate (cemented sand and gravel) were encountered at one location.

5.2 TECTONIC FAULTING AND SEISMICITY

Numerous shocks of Richter magnitude 3.0 or greater have been recorded in the Las Vegas area. Most were a probable result of underground blasting (some as high as Richter magnitude 5.8) at the Nevada Test Site which remains the major source of seismic activity in the Las Vegas area. Tectonic shocks having epicenters within southern Nevada have been minimal.

5.3 NON-TECTONIC FEATURES

The Las Vegas Valley contains numerous step-like features known as "compaction faults". The origin of the compaction faults is uncertain. A currently held theory is

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that they may have originated from tectonic processes and are part of a valley wide fault system (Bell and Others, 1992). Other theories suggest that they are the result of prehistoric large scale reductions in groundwater levels within the Las Vegas Valley and/or differential consolidation of earth materials across narrow zones. It is also possible that a combination of factors could have resulted in these features. No historic earthquakes have been attributed to any compaction fault in the Las Vegas Valley (Slemmons, 1990). Gradual vertical and horizontal movement or "creep" along many of the compaction faults has historically been recognized and attributed to subsidence related to groundwater withdrawal. In addition, stresses resulting in fissures have in many cases been localized near compaction faults. This also has been attributed to subsidence related to groundwater withdrawal. The nearest mapped compaction fault is located approximately 5-1/2 miles northwest of the site (Bell and Price, 1991, Plate 2, 1:62,500).

Stress resulting in fissures has in some cases been localized near compaction faults. This also has been attributed to subsidence related to groundwater withdrawal. The nearest mapped fissure zone fault is located approximately six miles northwest of the site (Bell and Price, 1991, Plate 2, 1:62,500).

Areal subsidence continues to occur in many parts of the Las Vegas Valley. However, no indication of significant differential subsidence or ground displacement which might adversely affect the proposed development was observed at the project site.

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6.0 ENGINEERING ANALYSES AND RECOMMENDATIONS

6.1 GENERAL

Based upon the results of our field exploration and laboratory testing, no unusual difficulties are anticipated in constructing embankments or channels, or in armoring channels to resist erosion at this site. The native soils will provide suitable support for energy dissipation structures, embankments or buried pipe. Suitable support for the proposed structures may be provided by properly placed and compacted fill, undisturbed soil, or granular pipe bedding. Any areas of disturbed, loose or soft soils, if encountered, are unsuitable for support of the proposed embankments, foundations or pipe. The allowable bearing pressures, soil modulus, lateral earth pressures, and estimated settlement are based on the assumption that subgrade preparation, pipe bedding, backfill and compaction is performed in accordance with the recommendations contained in this report.

6.2 SEEPAGE ANALYSES

The results from the field infiltration test and the remolded laboratory permeability tests indicate that horizontal permeability in the native soil deposits will be on the order of two times slower than remolded soils in the embankment. However, variable lenses and intermittent strata of more and less permeable soil are anticipated. For our analyses, the undisturbed native soil was assumed to have a horizontal permeability 5 times greater than the vertical permeability of $2X10^{-5}$ cm/sec. The permeability of soil cement facing was not considered in our analyses.

Based on our analyses for the design event where the basin is filled in approximately eight hours to the spillway elevation and drained in the following 96 hours, seepage does not reach the down-stream embankment toe and therefore no toe drain, seepage cutoff wall or low permeability embankment core would be necessary. Based upon our

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analyses of the proposed embankment, a toe drain and collection gallery will not be required for the proposed embankment with a crest 15 feet or less above the existing site grade.

6.3 SLOPE STABILITY ANALYSES

Slope stability analyses were performed for the proposed embankment using the soil strength values obtained by laboratory tests. The factor of safety against slope failure for an embankment consisting of on-site granular soil constructed in accordance with recommendations provided and with side slopes of 3:1 (horizontal:vertical) was found to be greater than 2.0. During rapid drawdown from a steady state condition, the factor of safety against slope failure was greater than 1.5. An earth fill embankment using on-site soils with 3:1 or flatter slopes is considered adequate at this site.

An embankment constructed from on-site soils with a slope of 3:1 (horizontal:vertical) would provide adequate safety against rapid drawdown slope failure without the soil cement facing. However, some surface armoring would be necessary for erosion control. This could consist of a riprap or soil cement cover. The thickness of this layer would depend on weathering and erosion characteristics of the soil cement design or riprap material.

6.4 FOUNDATIONS

Conventional shallow foundations would be appropriate for the proposed energy dissipation or headwall structures bearing on medium dense to very dense alluvial sand and gravel. Foundations for the proposed structures which bear on medium dense native soils should be established at a depth of one or more feet below the lowest

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adjacent final compacted subgrade. Additional embedment may be required for erosion protection.

Foundations for the proposed structures which bear on native soil with the above referenced embedments may be proportioned for a maximum bearing pressure of 3000 pounds per square foot (psf). An additional 500 psf for each additional foot of foundation embedment greater than two feet may be utilized. However, a minimum footing width of one foot and a maximum net allowable bearing pressure of 10,000 psf should be observed. Foundations for head walls or spillway structures at the Detention Basin site established on properly placed and compacted fill as described in Sections 6.6.2 and 6.6.3 may be proportioned for a maximum net bearing pressure of 3000 psf.

Prior to placing forms or pouring concrete, the footing excavation should be observed by a representative of Kleinfelder, Inc. to establish whether suitable bearing soils have been exposed and the bottom of excavations are free of loose and disturbed soils.

6.4.1 SETTLEMENT

Settlement of properly designed and constructed footings located one foot or more below the lowest adjacent final compacted subgrade which bear on properly placed and compacted structural fill or undisturbed soil should be less than one-inch.

However, large fill embankments compacted in accordance with the recommendations provided in this report should be expected to compress approximately 0.25 percent of the fill height. This long-term compression of structural fill could be minimized by compaction to a higher standard such as 100 percent of ASTM D-1557. In addition, the embankment fills will induce some settlement in the native soil profile. Settlement due to the embankment fill at the Equestrian Detention Basin site will be minimal due

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to the presence of thick, dense alluvial beds. The estimated embankment induced settlement is 1/2 inch or less at this site.

6.4.2 SEISMIC DESIGN RECOMMENDATIONS

Based upon results of sieve analyses and Atterberg limit test results, the depth to groundwater and the extent of cemented soil deposits encountered during trenching and drilling, the subsurface soils at this site are not considered to be susceptible to liquefaction due to either man-induced or earthquake induced shaking.

For seismic design analyses a seismic lateral coefficient (K_h) of $K_h=0.08$ would be appropriate for yielding retaining walls. A seismic lateral coefficient of at least $K_h=0.2$ is recommended for non-yielding structures. Earth retaining structures should be designed to slide rather than tilt due to seismic loads, to the extent possible. The above referenced seismic lateral coefficient values (K_h) would be appropriate for analysis by the Mononobe-Okabe method (AASHTO, 1983). The values provided for bearing capacity and resistance to sliding may be increased by 1/3 for transient loads, wind and seismic loads.

6.5 RETAINING STRUCTURES & LATERAL LOADS

Cantilevered retaining walls with level backfill, no surcharge load and no seepage or groundwater should be designed to resist backfill soil pressures in the active case (i.e. where some lateral movement of the top of the wall is permitted during or after backfill placement). For design purposes a backfill soil pressure equivalent to that developed by a fluid with a density of 30 pounds per cubic foot (pcf) would be appropriate for the on-site granular soils. If the retained soil can potentially become saturated, the wall should be designed to resist the hydrostatic forces acting on the wall. Where surcharge

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loads are anticipated the horizontal load due to the surcharge may be taken as 0.3 times the surcharge load.

Non-yielding retaining walls which cannot deflect to mobilize the active soil pressure should be designed for the at-rest or K_o lateral earth pressure state. A lateral earth pressure design value of 0.55 times the moist unit weight of the retained soil would be appropriate for a clayey sand backfill. A K_o value of 0.38 would be appropriate if backfill soils consist of Clark County Type II aggregate base or equivalent coarse grained soil. A moist unit weight of 135 pcf would be appropriate for properly placed and compacted clayey sand or Clark County Type II aggregate base backfill soils. Additional testing would be required once the backfill soil is selected to establish an appropriate value for other backfill soils.

Horizontal loads acting on foundations cast in open excavations against undisturbed native soil or properly placed and compacted fill will be resisted by friction acting along the base of the footing and by passive earth pressures against the loaded side of the footing. If design makes use of passive earth pressure against backfill, it is important that a representative of Kleinfelder, Inc. be present to monitor and test backfill placement compaction.

The friction acting along the base of footings founded on suitable undisturbed foundation soils or properly placed and compacted granular structural fill may be computed by using an allowable coefficient of friction of 0.40 with the normal dead load. Footings established on cemented deposits may be designed using an allowable coefficient of friction of 0.45 with the normal dead load. The allowable passive lateral earth pressure may be computed by using an equivalent fluid with a density of 450 pcf for backfill consisting of on-site granular soil or Clark County Type II aggregate base.

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The passive case equivalent fluid density should be reduced to 350 pcf for clayey sand or equivalent backfill. Passive pressure capacity in the upper foot should be ignored unless confined by concrete slab-on-grade or pavement. The backfill material designed to resist passive pressure should extend a distance of at least two times the wall height behind the wall.

6.6 SITE PREPARATION AND GRADING

After stripping to remove all vegetation, demolition of existing pavement or structures and relocation or properly abandoning utility lines, any debris, existing uncontrolled fill or other deleterious materials should be excavated and disposed of off-site at an approved landfill. In addition, any disturbed, loose, soft or medium stiff soils should be excavated from beneath embankments, foundations or pipe subgrade and areas to receive structural fill. The excavations should extend laterally two feet beyond the proposed structure.

6.6.1 EXCAVATIONS

Based upon observations made during trench exploration, we do not anticipate difficulty will be encountered during excavation of the non-cemented granular soils. Some sloughing should be anticipated. Construction excavations slopes 1:1 or flatter should be stable. Cemented soils were encountered in one exploration. Cemented soils, if encountered, may require the use of a crane and headache ball or hydraulic hammer. Trench excavations greater than five feet deep should be sloped or properly shored.

6.6.2 EMBANKMENTS AND STRUCTURAL FILL

Structural fill for embankments should be free of vegetation and debris, and contain no

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rocks or clumps larger than four inches nominal diameter. Structural fill should be placed in six to eight inch thick loose lifts, brought to about optimum moisture content and compacted to at least 90 percent of maximum dry density.

We anticipate that most of the on-site natural soils may be reused as structural fill, although some sorting may be necessary to remove oversize material and some blending with low solubility and low plasticity imported material may be required if gypsiferous or expansive soils are encountered in excavations. Imported materials should meet the requirements for structural fill, should be free of vegetation and debris, and should not contain any rocks larger than four inches. Imported fill placed beneath soil cement or concrete slabs-on-grade should contain less than 0.2 percent sodium sulfate salts.

Imported materials should meet the requirements for structural fill, should be free of vegetation and debris, and should not contain any rocks larger than four inches. Imported structural fill material used within one foot of design subgrade in any proposed pavement areas should have a minimum R-value of 45. Any imported fill materials should be approved at the source by Kleinfelder, Inc. prior to importing.

6.6.3 FILL PLACEMENT AND COMPACTION

Structural fill required to bring the site to grade should consist of low plasticity (expansion potential less than four percent under 60 psf surcharge), low solubility (solubility less than three percent) non salt-laden granular soils (sodium sulfate less than 0.2 percent).

Structural fill should be placed in loose lifts a maximum of 8 inches thick, brought to about optimum moisture for granular soils, and compacted to at least 90 percent of maximum dry density. Structural fills containing clayey soils should be moistened to

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one to three percent above the optimum moisture content and compacted to between 88 and 92 percent of maximum dry density. All compaction recommendations presented in this report refer to procedures established by ASTM D-1557.

6.7 EROSION CONTROL

6.7.1 OVERFLOW SPILLWAY

We anticipate that a concrete slab-on-grade or soil cement overflow structure will be constructed at this site. Conventional reinforced concrete or roller compacted concrete could also be used. However, the on-site soils are reasonably well suited for use in soil cement provided the mix design properly addresses the moderately corrosive nature of the on-site soil.

The on-site granular soils would be appropriate for use in a soil cement mix design with minimal processing. A soil cement mix design with a minimum 28 day compressive strength of 750 psi and maximum permeability through a compacted lift of 1×10^{-5} cm/sec. is recommended. The mix design should be tested for durability against freeze-thaw action and for wet-dry stability. These physical properties of the mix design must be verified for the final mix design.

Soil-cement should be batched in an approved continuous flow central plant or batch-type pugmill mixer. The plant should be equipped with metering and feeding devices that will supply the soil, cement and water into the mixer in the specified quantities. If the actual quantities in the mix deviate more than three percent by weight from the specified quantities, the engineer may require such changes in the plant operation as will provide the required accuracy.

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The mixing time should be that which is required to secure an intimate uniform mixture of the soil, cement and water.

The contractor should protect the soil-cement mixture whenever it is transported during unfavorable weather.

The total elapsed time between the addition of water to the soil and cement and the start of compaction should not exceed 60 minutes.

The contractor should take all necessary precautions to avoid damage to completed soil-cement by equipment. Immediately prior to placement of the soil-cement, the receiving surface should be in a moist condition. The mixture should be placed with spreading equipment that will produce layers of such widths and thicknesses as are necessary for compaction to the specified dimensions of the completed soil-cement.

Optimum moisture and maximum density for the section being placed and compacted should be established during construction by moisture-density test ASTM D-558 on representative samples of soil-cement mixture obtained from the area being processed at the time compaction begins. At time of compaction, the moisture content should not be below optimum or less than that quantity which will cause the soil-cement to become unstable during compaction and finishing operations and should not be more than two percentage points above optimum.

Soil-cement should be placed in horizontal lifts no more than six inches in loose thickness and uniformly compacted to at least 96 percent of maximum density as established by ASTM Test Method D-558.

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At the start of compaction, the soil-cement mixture should be in a loose condition for its full depth. No section should be left undisturbed for longer than 30 minutes during compaction operations.

As compaction nears completion, the surface of the soil-cement should be shaped to the specified lines, grades and cross sections. As necessary or as required by the engineer, the surface should be lightly scarified to remove imprints left by equipment or to prevent compaction planes. During the finishing process, the surface should be kept moist by means of fog-type sprays.

Compaction and finishing should be done in such a manner as to produce, in not longer than two hours, a smooth, dense surface free of compaction planes, cracks, ridges or loose material.

After completion of final finishing the surface should be cured by application of a bituminous sealing membrane, or by being kept continuously moist for a period of seven days with a fog-type water spray that will not erode the surface of the soil-cement.

At the end of each day's work, or whenever construction operations are interrupted for more than three hours, a formed construction joint should be made. Such joints should be full-depth vertical joints full width across the fill lift.

The engineer, with the assistance of and in cooperation with the contractor, should make such inspections and tests as he deems necessary to ensure the conformance of the work to the contract plans and specifications. The inspections and tests may include, but should not be limited to (1) the close observation of the operation of all equipment

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used on the work, and (2) the taking of test samples of the soil-cement and its individual components at all stages of processing and after compaction and curing.

All testing of soil-cement or its individual components, should be in accordance with the latest applicable ASTM or AASHTO specifications.

The overflow spillway could also consist of a concrete slab-on-grade with channel training walls energy dissipaters. Recommendations for embankment construction are presented in Section 6.6. Recommendations for foundation design presented in Section 6.4 would be appropriate for a spillway structure. Recommendations for design of retaining structures to resist lateral loads are presented in Section 6.5. Special provisions provided in Section 6.7.2 to control seepage, limit hydrostatic pressure and resist erosion should be applied to design of a concrete slab-on-grade spillway.

6.7.2 CHANNEL LINING

It is our understanding that the interception channel/dike will be lined with concrete. We would recommend that the subgrade along the alignment be prepared in accordance with recommendations provided for utility trenches. The prepared subgrade should be covered with a minimum of four inches of Clark County Type II Aggregate Base Course compacted to a minimum of 90 percent of the maximum dry density (ASTM D-1557). Concrete channel liner should include a transverse cut-off wall at each panel to reduce seepage beneath the channel. In addition, weepholes should be constructed at intervals to relieve any hydrostatic pressure from behind the channel walls and channel bottom. The weepholes could be nominally two to four inches in diameter and backed by a drain gravel pocket wrapped in filter fabric to aid in pressure relief. The crest of the channel walls should be turned down or otherwise embedded to control erosion and prevent undermining along the edge of the channel.

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6.7.3 ENERGY DISSIPATERS

Foundations for energy dissipation structures should be located a minimum of one foot below the lowest adjacent final compacted subgrade or as necessary to control scour and erosion.

Horizontal loads acting on energy dissipaters will be resisted by friction acting along the base of the structure and by passive earth pressures acting against the sides of embedded walls and footings. The friction acting along the base of footings and slabs-on-grade may be computed using an allowable coefficient of friction of 0.40 with the normal dead load. An allowable lateral passive earth pressure may be computed using an equivalent fluid density of 400 pounds per cubic foot for the sides of the footing or slab placed against undisturbed soil or properly placed and compacted fill. The maximum design passive pressure for channel walls should be limited to 1200 pounds per lineal foot. Passive pressure capacity in the upper two foot should be ignored unless the material is confined by concrete slab-on-grade or otherwise protected from erosion. The above referenced lateral resistance design values may be increased by one-third for transient wind or seismic loads.

6.8 PIPE BEDDING

At least six inches of bedding material should be placed between the pipe and the subgrade soils. The bedding should surround the pipe and extend to at least 12 inches above the pipe crown. This zone is also referred to as the pipe backfill zone.

Bedding and pipe zone backfill material should consist of granular soils such as well graded clean sands or sand and gravel mixtures. A gradation similar to Clark County Type II Aggregate base would provide suitable bedding material. Based upon the field

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explorations and the results of laboratory tests, it appears that some of the native soils along the alignment will be suitable for use as bedding and pipe zone backfill material.

During placement, the bedding and pipe zone backfill should be placed in lifts with a maximum loose thickness of eight inches and compacted to a minimum of 90 percent of the maximum dry density. All compaction recommendations stated in this report refer to methods established by the ASTM D-1557 test method. The bedding should be manually placed and hand compacted under the pipe haunches to provide uniform pipe support below the spring line. Bedding material above the spring line may be compacted with hand operated power equipment. However, care should be taken to not damage the pipe during compaction of bedding.

6.9 TRENCH BACKFILL

Backfill materials with a plasticity index greater than 10, if used, should be placed at two to four percent above the optimum moisture content. In addition, these materials should be compacted to between 88 percent and 93 percent of maximum dry density. It should also be understood that overexcavation of expansive clay soils placed as trench backfill may be required when future improvements are made.

Flooding and jetting is an acceptable alternative method of compaction for some materials, provided it is performed correctly and sufficient time is allowed for drainage and settlement to occur. However, it is our experience that satisfactory results are difficult to achieve. We recommend that flooding and jetting be used only in areas where future development over the trench is not anticipated. If used, flooding and jetting should only be employed for lower lift levels. All backfill placed within three feet of final subgrade in areas of future improvements should be compacted with vibratory mechanical equipment. If flooding or jetting is utilized, we recommend that

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a granular backfill containing less than 30 percent passing the No. 50 sieve and less than 10 percent passing the No. 200 sieve be utilized. Based upon observations made during our site investigation and laboratory testing, it appears that some of the in-place natural soils at the site meet these gradational requirements.

6.10 SOIL MODULUS AND EARTH PRESSURES

A soil modulus value, E', of 2000 psi would be appropriate for the in-place native soils. A soil modulus of 1200 psi may be used for properly compacted sand and gravel materials placed as bedding and in the pipe zone. Due to the significant variation between the moduli of the native soils and the pipe zone backfill, some modification of the design modulus value may be necessary. The recommended modification will depend on the pipe diameter (O.D.) and the proposed trench width. For a minimum trench width of 1.5 times the pipe diameter, a modulus of 1500 psi may be used. The soil modulus for bedding material would be appropriate where the horizontal pipe bedding thickness exceeds one pipe diameter. The soil modulus for undisturbed native soil would be appropriate where the trench width is less than 1.2 times the pipe diameter.

Horizontal loads acting on pipe bedded in suitable soil or properly placed and compacted fill will be resisted by friction acting along the projected base of the pipe and by passive earth pressures against the loaded side projection of the pipe. If design makes use of passive earth pressure against backfill, it is important that a representative of Kleinfelder, Inc. be present to monitor and test backfill placement and compaction.

The friction acting along the base of pipe founded on suitable bedding and subgrade soils may be computed using an allowable coefficient of friction of 0.40 with the normal dead load. An allowable lateral passive earth pressure may be computed using

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an equivalent fluid weighing 400 pounds per cubic foot (pcf) for the projected sides of pipe bedded in properly placed and compacted backfill. The maximum allowable passive pressure for buried pipe should not exceed 800 pounds per square foot of projected surface. Passive pressure within one foot of finish grade should be discounted unless confined by concrete slab-on-grade or pavement. The values given above may be increased by one-third for transient wind or seismic loads.

6.11 SOIL CORROSION

Based upon the laboratory test results and previous studies in the vicinity of the site, soils on this site contain salts in sufficient concentration to be considered corrosive to metal and concrete. Therefore, all concrete in contact with the on-site soils should contain Type V, or equivalent sulfate resistant cement, and should be placed with a maximum four-inch slump. Special protection to buried metal pipes and water lines is important for long-term performance of these underground utilities. Consideration should be given to cathodic protection.

6.12 CONSTRUCTION CONSIDERATIONS

As indicated earlier, moderately hard cemented soils were encountered in one of our field explorations. We anticipate that excavations for the channel, basin and outfall pipe may encounter cemented soils which will require the use of heavy duty earthwork equipment. It is possible that some of the hard deposits may be removed by ripping. We anticipate that the use of a headache ball or a backhoe mounted hydraulic or pneumatic hammer may be required.

There will be material loss due to clearing and grubbing operations. Also, there will be shrinkage losses when excavating and compacting the on-site soils and scarifying and recompacting native soils. The shrinkage factor for the surficial, medium dense soils

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will likely be between 0 and 10 percent. A subsidence factor of 0.05 feet/foot for recompacted soil should be used in areas where the exposed surficial soils are scarified and recompacted. Some bulking may occur in those areas where cemented soils are excavated.

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7.0 CLOSURE

7.1 LIMITATIONS

The recommendations contained in this report are based on our field explorations, laboratory tests, and our understanding of the proposed construction. The subsurface data used in the preparation of this report were obtained from the 26 trenches and five borings drilled during the field investigation. It is anticipated that some variations in the soils and groundwater conditions will exist between the points explored. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at this site which are different from those described in this report, our firm should be immediately notified so that we may make any necessary revisions to recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, our firm should also be notified. This report was prepared in accordance with generally accepted standard of practice at the time the report was written. No warranty, express or implied is made. It is the Client's responsibility to see that all parties to the project including the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on-site and off-site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report

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be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

7.2 ADDITIONAL SERVICES

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during the construction to verify compliance with these recommendations. These tests and observations should include, but not necessarily be limited to the following:

- Observations and testing during site preparation and earthwork.
- Observation and testing during embankment construction.
- Observation of pipe bedding, backfill placement and compaction.
- Observation and testing of foundation soils.
- Consultation as may be required during construction.

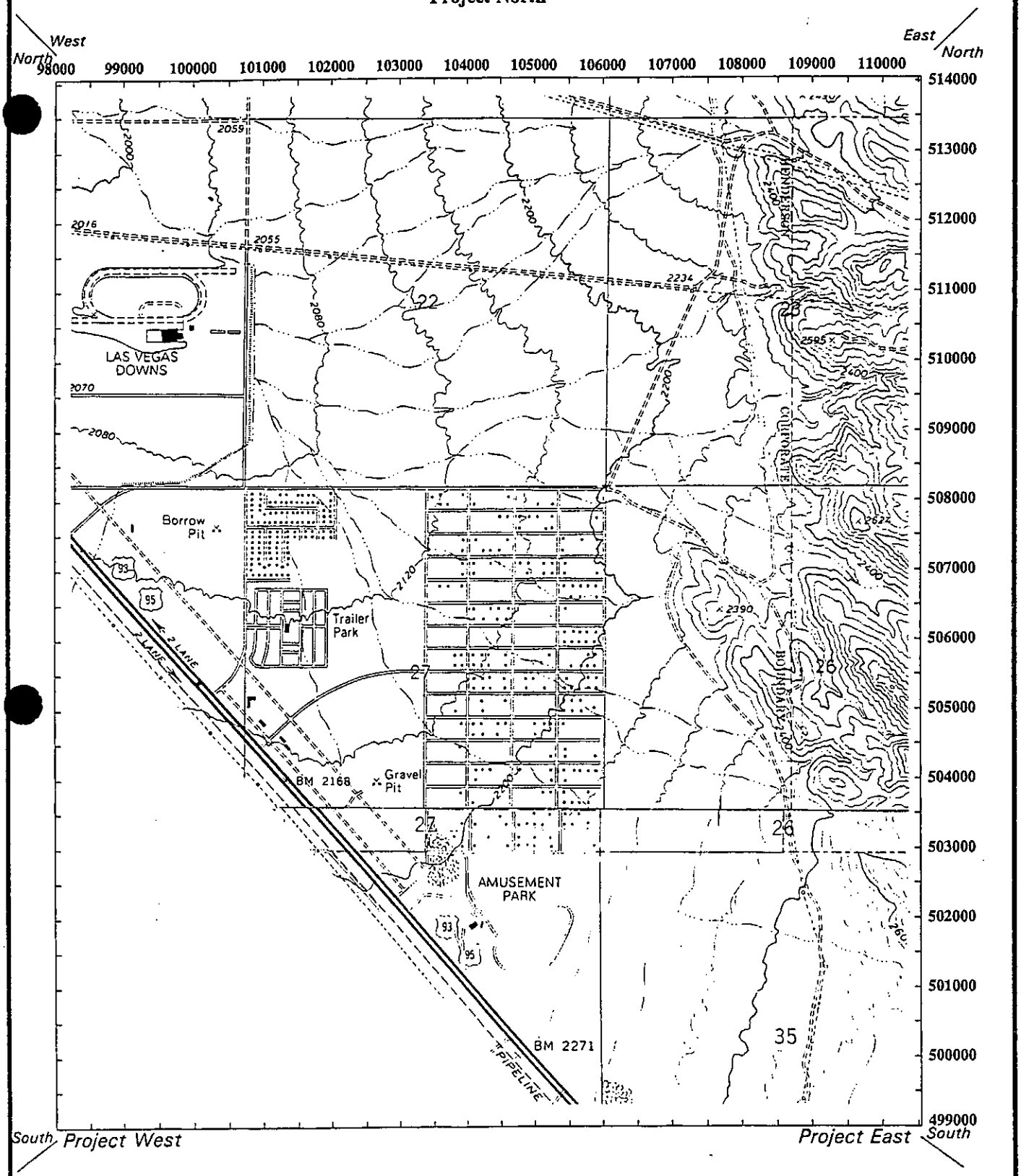
We also recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations. Additional information concerning the scope and cost of these services can be obtained from our office.

We appreciate the opportunity to be of service on this project. Should you have any questions regarding this report or wish to discuss additional services, please do not hesitate to contact us.

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● - Approximate Exploration Location

Scale : Approximately 1" = 2000 '

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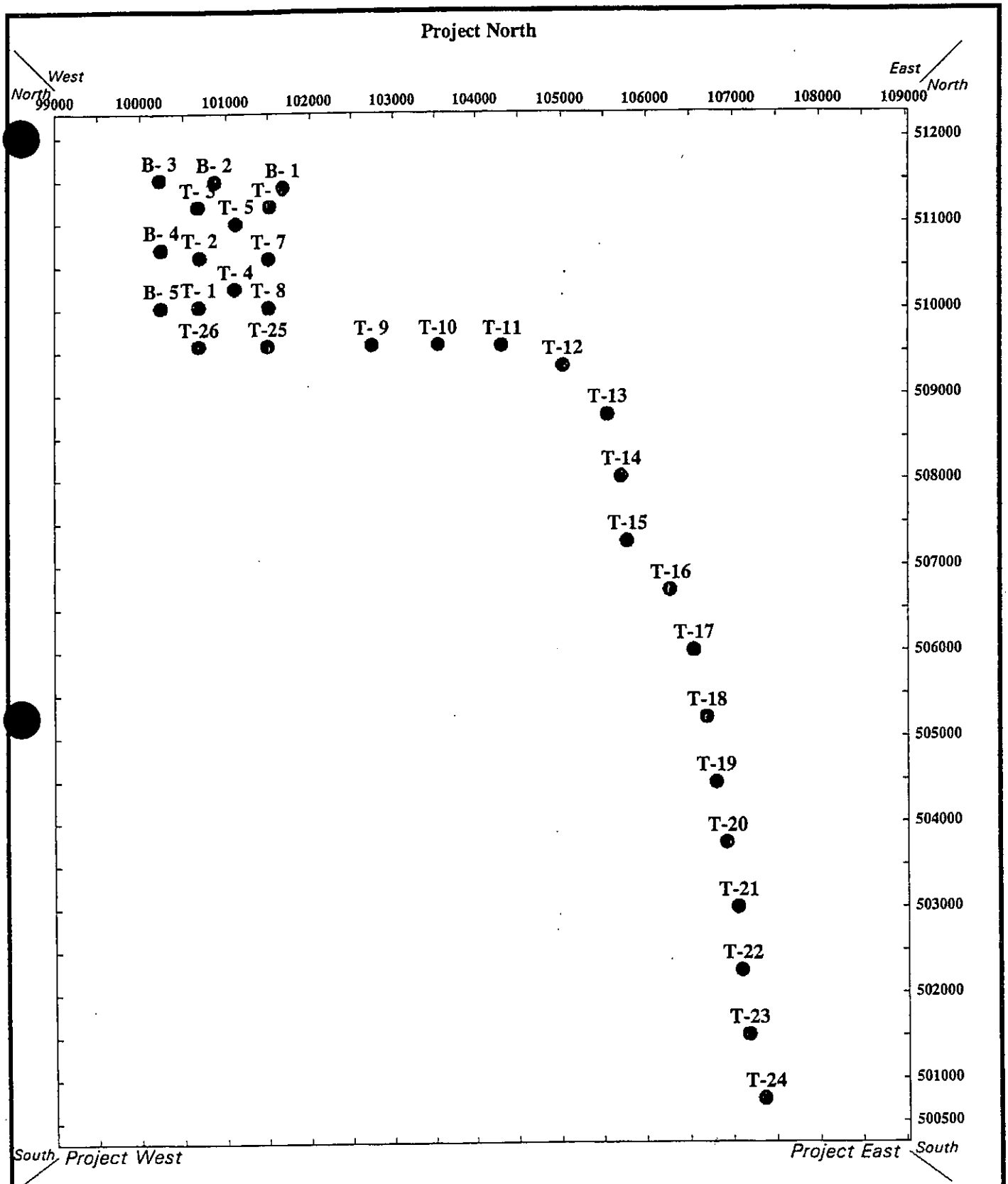
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PROJECT: Equestrian Detention Basin

GENERAL SITE LOCATION MAP

PLATE

1



● - Approximate Exploration Location

Scale : Approximately 1" = 1600 '

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LOCATION OF EXPLORATIONS

PLATE 2

DATE DRILLED: 11/9/93

LOCATION: See Plate 2

BORING NO. B- 1

ELEVATION: Approx. 2090. feet

** HAMMER WEIGHT: 350 lb.

Northing - 511420
Easting - 101680

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2090.00 / 0							**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles, light brown matrix, gray to pink mottled volcanic stone, angular to subangular	dry to slightly moist	loose to medium dense
									medium dense
									dense
									very dense
2085.00 / 5	3	115		50/5					
								slightly moist	dense
2080.00 / 10	4	110		39/12					
							POORLY GRADED, SILTY GRAVEL (GP-GM) - angular to subangular, light brown		very dense
	3			50/6					
2075.00 / 15							Bottom at 15 feet.		

* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D. | Shelby Tube | Bulk | Ca. S.S. Sample 1.925" I. D. | SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

BY:

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BORING LOG AND TEST SUMMARY

PLATE A-1

DATE DRILLED: 11/9/93

LOCATION: See Plate 2

BORING NO. B- 2

ELEVATION: Approx. 2075. feet

** HAMMER WEIGHT: 350 lb.

Northing - 511490
Easting - 100870

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2075.00 / 0							**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel, occasional cobbles approximately 3" to 5" diameter, light brown	slightly moist	loose to medium dense
								slightly moist	
							- subangular gravel and small cobbles, volcanic detritus, some alluvial sorting		medium dense to dense
							- angular to subangular volcanic stone		
2070.00 / 5				25/12			- 3 inch cobble sluff wedged in spoon shoe.		very dense
							POORLY GRADED SAND (SP) - very little fines, trace gravel, light brown		
2065.00 / 10				35/12					
							POORLY GRADED, SILTY SAND (SP-SM) - some gravel, occasional cobbles, light brown		
							- hole caving, unable to obtain representative penetration test results		
2060.00 / 15				20/12 sluff					
2055.00 / 20									

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D. | Shelby Tube | Bulk | Ca. S.S. Sample 1.925" I. D. | SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

BORING LOG AND TEST SUMMARY

PLATE A-2a

DATE DRILLED: 11/9/93
LOCATION: See Plate 2

BORING NO. B- 2

ELEVATION: Approx. 2075. feet
** HAMMER WEIGHT: 350 lb.

Northing - 511490
Easting - 100870

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2055.00 / 20							- POORLY GRADED, SILTY SAND (SP-SM) - cont. - some gravel and cobbles, hole caving, no cementation	slightly moist	very dense
2050.00 / 25									
2045.00 / 30							- hole caving, unable to sample		
							Bottom at 31 feet.		

* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D. | Shelby Tube | Bulk | Ca. S.S. Sample 1.925" I. D. | SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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PROJECT: Equestrian Detention Basin

BORING LOG AND TEST SUMMARY

PLATE A-2b

DATE DRILLED: 11/9/93
LOCATION: See Plate 2

BORING NO. B- 3

ELEVATION: Approx. 2055 feet
** HAMMER WEIGHT: 350 lb.

Northing - 511520
Easting - 100230

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2055.00 / 0							**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel, occasional cobbles to approximately 5" diameter, light brown	slightly moist	loose to medium dense
								slightly moist	
							- some alluvial sorting		medium dense to dense
							- angular to subangular volcanic stone		
2050.00 / 5				20/12 sluff			- 3 inch cobble sluff wedged in spoon shoe.		very dense
							POORLY GRADED SAND (SP) - very little fines, trace gravel, light brown		
2045.00 / 10									
							POORLY GRADED, SILTY SAND (SP-SM) - some gravel, occasional cobbles, light brown		
							- hole caving, unable to obtain representative penetration test results		
2040.00 / 15									
2035.00 / 20									

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

BY:

* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D. | Shelby Tube | Bulk | Ca. S.S. Sample 1.925" I. D. | SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

KLEINFELDER
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

BORING LOG AND TEST SUMMARY

PLATE A-3a

DATE DRILLED: 11/9/93

LOCATION: See Plate 2

BORING NO. B- 3

ELEVATION: Approx. 2055 feet

** HAMMER WEIGHT: 350 lb.

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	Northing - 511520 Easting - 100230 SOIL DESCRIPTION	MOISTURE	CONSIST.
2035.00 / 20							- POORLY GRADED, SILTY SAND (SP-SM) - cont. - some gravel and cobbles, hole caving, no cementation	slightly moist	very dense
2030.00 / 25									
2025.00 / 30							Bottom at 30 feet.		

* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D.; Shelby Tube; Bulk; Ca. S.S. Sample 1.925" I. D.; SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

BORING LOG AND TEST SUMMARY

PLATE A-3b

DATE DRILLED: 11/9/93
LOCATION: See Plate 2

BORING NO. B- 4

ELEVATION: Approx. 2053 feet
** HAMMER WEIGHT: 350 lb.

Northing - 510700
Easting - 100250

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2053.00 / 0							**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel, occasional cobbles to approximately 5" diameter, light brown	dry to slightly moist	loose to medium dense
									medium dense
								slightly moist	dense
							- some alluvial sorting		
							- angular to subangular volcanic stone		
2048.00 / 5	5	125		7/6 38/12					
									very dense
							- partially cemented coarse sand		
2043.00 / 10	5	127		50/11					
							- some gravel		
				50/12					
2038.00 / 15	3								
2033.00 / 20									

* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D. | Shelby Tube | Bulk | Ca. S.S. Sample 1.925" I. D. | SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

BORING LOG AND TEST SUMMARY

PLATE A-4a

DATE DRILLED: 11/9/93

LOCATION: See Plate 2

BORING NO. B- 4

ELEVATION: Approx. 2053 feet

** HAMMER WEIGHT: 350 lb.

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2033.00 / 20				40/12			Northing - 510700 Easting - 100250 - POORLY GRADED, SILTY SAND (SP-SM) - cont. - some gravel and cobbles, hole caving, no cementation	slightly moist	very dense
2028.00 / 25				43/12					
2023.00 / 30							Bottom at 30 feet.		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION

APPROV:

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* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D. | Shelby Tube | Bulk | Ca. S.S. Sample 1.925" I. D. | SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

BORING LOG AND TEST SUMMARY

PLATE A-4b

DATE DRILLED: 11/8/93

LOCATION: See Plate 2

BORING NO. B- 5

ELEVATION: Approx. 2058 feet

** HAMMER WEIGHT: 350 lb.

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	DRY DENSITY (pcf)	LAB TESTS *	BLOWS/ INCHES **	SAMPLER +	SYMBOL	Northing - 510020 Easting - 100250 SOIL DESCRIPTION	MOISTURE	CONSIST.
2058.00 / 0							**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel, occasional cobbles to approximately 5" diameter, light brown	dry to slightly moist	loose to medium dense
									medium dense
								slightly moist	dense
							- some alluvial sorting		
							- angular to subangular volcanic stone		
2053.00 / 5	3	120		35/12					
									very dense
							- partially cemented coarse sand		
2048.00 / 10	4	132		50/4					
			Infil. Test				- some gravel		
	4	116		50/8					
2043.00 / 15							Bottom at 15 feet.		

* LAB TESTS: NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D.; Shelby Tube; Bulk; Ca. S.S. Sample 1.925" I. D.; SPT Sample 1.375" I.D.

NOTES: Groundwater not encountered during drilling.

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION OF THIS LOCATION

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

BORING LOG AND TEST SUMMARY

PLATE A-5

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T- 1

ELEVATION: Approx. 2067 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2067.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel, occasional cobbles, desert pavement surface with dark desert varnish, light brown	dry to slightly moist	loose to medium dense	
					medium dense	
			- angular to subangular alluvium, volcanic stone		dense	S,Ch
			- alluvial sorting poorly defined	slightly moist		
			POORLY GRADED SAND (SP) - light brown		very dense	
2062.00 / 5			**POORLY GRADED, SILTY SAND (SP-SM)** - light brown			
			POORLY GRADED SAND (SP) - light brown			
			POORLY GRADED, SILTY SAND (SP-SM) - light brown			
2057.00 / 10			Bottom at 10 feet.			
2052.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-6

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T- 2

ELEVATION: Approx. 2063 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2063.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel, occasional cobbles, light brown	dry to slightly moist	loose to medium dense	
					medium dense	
			- angular to subangular alluvium, volcanic stone		dense	
			- alluvial sorting poorly defined	slightly moist		
			POORLY GRADED SAND (SP) - light brown		very dense	G,A
2058.00 / 5			**POORLY GRADED, SILTY SAND (SP-SM)** - light brown			
			POORLY GRADED SAND (SP) - light brown			
			POORLY GRADED, SILTY SAND (SP-SM) - light brown			
			Bottom at 9 feet.			
2053.00 / 10						
2048.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION OF THIS LOCATION

APPROV:

BY:

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-7

DATED EXCAVATED: 11/4/93

TRENCH NO. T- 3

ELEVATION: Approx. 2065 feet

LOCATION: See Plate 2

EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2065.00 / 0			**POORLY GRADED, SILTY GRAVEL (GP-GM)** - some sand, occasional cobbles, light brown	dry to slightly moist	loose to medium dense	
			POORLY GRADED SAND (SP) - light brown		medium dense	
			POORLY GRADED, SILTY SAND (SP-SM) - light brown		dense	
			POORLY GRADED SAND (SP) - light brown			
			POORLY GRADED, SILTY GRAVEL (GP-GM) - light brown - angular to subangular alluvium, volcanic stone - alluvial sorting well defined	slightly moist	very dense	S, D1557
2060.00 / 5			**POORLY GRADED SAND (SP)** - light brown			
			POORLY GRADED, SILTY SAND (SP-SM) - light brown			
			POORLY GRADED SAND (SP) - light brown			
			POORLY GRADED, SILTY SAND (SP-SM) - light brown			
2055.00 / 10			Bottom at 10 feet.			
2050.00 / 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION OF THIS LOCATION

APPROV:

BY:

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-8

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T- 4

ELEVATION: Approx. 2075 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2075.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - angular to subangular volcanic stone, light pink stone with gray to light brown matrix	dry to slightly moist	loose to medium dense medium dense dense	
2070.00 / 5			**POORLY GRADED SAND (SP)** - some gravel and cobbles, light brown - partially cemented, reddish brown, easily crumbled by hand, coarse sand matrix	slightly moist	dense very dense	G,A, Ch
			Bottom at 9 feet.			
2065.00 / 10						
2060.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-9

DATED EXCAVATED: 11/4/93

TRENCH NO. T- 5

ELEVATION: Approx. 2078 feet

LOCATION: See Plate 2

EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2078.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - desert pavement, some desert varnish, light brown matrix - angular to subangular volcanic stone up to 5 inch diameter - frequent alluvially sorted, poorly graded sand layers to four feet	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
				slightly moist		
					very dense	
2073.00 / 5			- alluvial sorting less distinct, poorly sorted			
2068.00 / 10			Bottom at 10 feet.			
2063.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION

APPROV:

BY:

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-10

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T- 6

ELEVATION: Approx. 2095 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2095.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles up to 8 inch diameter, light brown	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
				slightly moist		
			POORLY GRADED SAND (SP) - light brown - alluvially sorted, coarse sand		very dense	S, G,A
2090.00 / 5			POORLY GRADED, SILTY SAND (SP-SM) - angular to subangular volcanic stone, some angular gravel to 3 inch diameter, light brown			
			SILTY SAND (SM) - some gravel, weakly cemented, light brown			
2085.00 / 10			Bottom at 10 feet.			
2080.00 / 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS AT THIS LOCATION

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

APPROV:

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-11

DATED EXCAVATED: 11/4/93

TRENCH NO. T- 7

ELEVATION: Approx. 2086 feet

LOCATION: See Plate 2

EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2086.00 / 0			**POORLY GRADED, SILTY GRAVEL (GP-GM)** - some cobbles to 8 inch diameter, some sand, desert pavement on surface, light brown matrix - angular to subangular volcanic stone, mottled gray to pink stone with light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
			POORLY GRADED SAND (SP) - coarse grained, light brown - alluvially sorted		dense	
			POORLY GRADED, SILTY SAND (SP-SM) - light brown	slightly moist		
2081.00 / 5					very dense	Ch
			POORLY GRADED, SILTY GRAVEL (GP-GM) - some sand, light brown - occasional alluvially sorted coarse sand lenses 2 to 10 inches thick			
			Bottom at 9 feet.			
2076.00 / 10						
2071.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION

APPROV:

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-12

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T- 8

ELEVATION: Approx. 2085 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2085.00 / 0			**POORLY GRADED, SILTY GRAVEL (GP-GM)** - angular to subangular volcanic gravel and cobble size stone, 4 inch maximum size, mottled gray to pink stone with light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	G,A
			- occasional thin alluvially sorted **POORLY GRADED SAND (SP)** lenses	slightly moist		
2080.00 / 5			- four sorted sand horizons in upper 6 feet		very dense	
			POORLY GRADED, SILTY SAND (SP-SM) - some gravel, partially cemented, light brown			
2075.00 / 10			Bottom at 10 feet.			
2070.00 / 15						

NR = No Recovery, C = Consolidation, A = Atterberg, Ch = Chemical test, S = Direct Shear, G = Grain-Size, E = Expansion, Sol = Solubility, Res = Resistivity, R = R-Value, ASTM D1557 = Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

BY:

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-13

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T- 9

ELEVATION: Approx. 2112 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2112.00 / 0			**POORLY GRADED, SILTY GRAVEL (GP-GM)** - coarse desert pavement with heavy desert varnish, some angular to subangular cobbles to 6 inch diameter, light brown matrix	dry to slightly moist	loose to medium dense	
			- poorly graded coarse sand old alluvial surface		medium dense	
			- some caving		dense	
				slightly moist		S
2107.00 / 5			- no caving, partially cemented		very dense	
			POORLY GRADED, SILTY SAND (SP-SM) - partially cemented, light reddish brown			
			Bottom at 9 feet.			
2102.00 / 10						
2097.00 / 15						

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

APPROV:
BY:

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-14

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T-10

ELEVATION: Approx. 2130 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2130.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some cobbles and boulders up to 18 " diameter, light brown matrix, angular to subangular volcanic stone - alluvial sorting well defined in thin lenses of poorly graded sand	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	Ch
				slightly moist		
					very dense	
2125.00 / 5			- hole walls standing with little slumping.			
2120.00 / 10			Bottom at 10 feet.			
2115.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

BY:

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-15

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T-11

ELEVATION: Approx. 2147 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2147.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some cobbles up to approximately 8" diameter, increasing vegetation ground cover, light brown matrix	dry to slightly moist	loose to medium dense	
			POORLY GRADED SAND (SP) - alluvially sorted lense		medium dense	
			POORLY GRADED SAND (SP) - alluvially sorted lense		dense	
			POORLY GRADED SAND (SP) - alluvially sorted lense	slightly moist		G,A
			.m=sp - some caving above 4 feet.		very dense	
2142.00 / 5			**POORLY GRADED SAND (SP)** - alluvially sorted lense			
			POORLY GRADED SAND (SP) - alluvially sorted lense			
2137.00 / 10			Bottom at 10 feet.			
2132.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

BY:

KLEINFELDER
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-16

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T-12

ELEVATION: Approx. 2166 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2166.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some cobbles and boulders to 16" diameter, angular to subangular volcanic stone, light brown fine to coarse sand matrix - braided alluvial surface	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
				slightly moist		Perm.
			- alluvial sorting poorly defined		very dense	
2161.00 / 5						
2156.00 / 10			Bottom at 10 feet.			
2151.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-17

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T-13

ELEVATION: Approx. 2189 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2189.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - desert pavement surface, angular to subangular gravel and cobbles up to 6" diameter, volcanic stone, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
			- very little caving, no cementation, tight interlocking		dense	S
				slightly moist		
2184.00 / 5			- alluvial sorting on 6" to 16" poorly defined intervals		very dense	
2179.00 / 10			Bottom at 10 feet.			
2174.00 / 15						

NR = No Recovery, C = Consolidation, A = Atterberg, Ch = Chemical test, S = Direct Shear, G = Grain-Size, E = Expansion, Sol = Solubility, Res = Resistivity, R = R-Value, ASTM D1557 = Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-18

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-14

ELEVATION: Approx. 2215 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2215.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some cobbles and boulders up to 20" diameter, surface cleared of vegetation by wild fire, surface detritus sorted by windrows to ridges of very coarse angular cobbles and boulders, and braided alluvial rills of coarse sand and fine gravel with very little fines, gray-brown to mottled pink-black volcanic stone with light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	Res
				slightly moist		
2210.00 / 5			- alluvial sorting in 3" to 12" layers		very dense	
2205.00 / 10			Bottom at 10 feet.			
2200.00 / 15						

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NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

APPROV:

BY:

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-19

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-15

ELEVATION: Approx. 2219 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2219.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** some boulders to 20" diameter, surface cleared of vegetation by wild fire, angular volcanic stone, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- less cobbles and boulders below 3 feet.	slightly moist		
2214.00 / 5					very dense	G,A
2209.00 / 10			Bottom at 10 feet.			
2204.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-20

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-16

ELEVATION: Approx. 2214 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2214.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - vegetation cover approximately 70 percent, (Creosote bush, White Bursage and Indian rice grass, some cobbles up to approximately 8" diameter, light brown - some weak to moderately hard cementation - alluvial sorting poorly defined	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
				slightly moist		
			- angular to subangular volcanic stone		very dense	D1557, Ch
2209.00 / 5			- less cementation			
			Bottom at 8 feet.			
2204.00 / 10						
2199.00 / 15						

NR = No Recovery, C = Consolidation, A = Atterberg, Ch = Chemical test, S = Direct Shear, G = Grain-Size, E = Expansion, Sol = Solubility, Res = Resistivity, R = R-Value, ASTM D1557 = Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. ▮ Bulk ▨

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV: BY:

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-21

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-17

ELEVATION: Approx. 2235 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2235.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - angular volcanic stone up to approximately 10" diameter, light brown	dry to slightly moist	loose to medium dense	
					medium dense	
			- alluvial sorting poorly defined		dense	
			- some weak cementation in upper 3 feet	slightly moist		S
2230.00 / 5			- three well defined alluvially sorted beds approximately 6" thick between 5 and 7 feet		very dense	
			Bottom at 8 feet. Backhoe refusal in very dense, partially cemented sand and small gravel.			
2225.00 / 10						
2220.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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APPROV: BY:

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-22

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-18

ELEVATION: Approx. 2261 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2261.00 / 0			**POORLY GRADED, SILTY SAND (SM)** - some gravel and cobbles up to approximately 6" diameter, angular volcanic detritus, light brown matrix - alluvial sorting in thin lenses	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- more coarse grained below 3 feet	slightly moist		
2256.00 / 5					very dense	Res
			Bottom at 8 feet.			
2251.00 / 10						
2246.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-23

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-19

ELEVATION: Approx. 2287 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2287.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)**	dry to slightly moist	loose to medium dense	
			- some gravel and cobbles, angular volcanic stone, light brown matrix		medium dense	
			- angular cobbles up to approximately 6" diameter		dense	
			- occasional alluvially sorted lenses of coarse sand/fine gravel	slightly moist		
					very dense	
2282.00 / 5						G,A
2277.00 / 10			Bottom at 10 feet.			
2272.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

NOTES: Groundwater not encountered during trenching.

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-24

DATED EXCAVATED: 11/5/93

TRENCH NO. T-20

ELEVATION: Approx. 2303 feet

LOCATION: See Plate 2

EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2303.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles up to 6" diameter, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- occasional 4" alluvially sorted lenses	slightly moist		
					very dense	Ch
2298.00 / 5			- some fine roots to 6 feet.			
			- more coarse grained below 5 feet.			
2293.00 / 10			Bottom at 10 feet.			
2288.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS AT THIS LOCATION.

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-25

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-21

ELEVATION: Approx. 2320 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2320.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - angular gravel and cobbles up to 10" diameter, light brown matrix - alluvial volcanic stone detritus	dry to slightly moist	loose to medium dense	
					medium dense	
			- poorly defined alluvial sorting		dense	
				slightly moist		
2315.00 / 5					very dense	Perm.
			Bottom at 9 feet.			
2310.00 / 10						
2305.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION OF THIS LOCATION

APPROV:
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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-26

DATED EXCAVATED: 11/5/99

TRENCH NO. T-22

EQUIPMENT: Case 580 Backhoe

LOCATION: See Plate 2

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2342.00 / 0			**POORLY SORTED, SILTY SAND (SP-SM)** - coarse varnished desert pavement, some gravel and cobbles up to 6" diameter, alluvial volcanic stone, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- poorly defined alluvial sorting, little change in grading with depth	slightly moist		
2337.00 / 5					very dense	Ch
			Bottom at 9 feet.			
2332.00 / 10						
2327.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION OF THIS LOCATION

APPROV:

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-27

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-23

ELEVATION: Approx. 2357 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	+ SAMPLES	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2357.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles to 6" diameter, light brown	dry to slightly moist	loose to medium dense	
					medium dense	
			WELL GRADED, SILTY SAND (SW-SM) - some gravel and cobbles, angular volcanic stone, light brown matrix		dense	
				slightly moist		
2352.00 / 5			- frequent lenses of well sorted coarse sand & line gravel with little or no fines		very dense	G,A
			Bottom at 8 feet.			
2347.00 / 10						
2342.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-28

DATED EXCAVATED: 11/5/95

TRENCH NO. T-24

EQUIPMENT: Case 580 Backhoe

LOCATION: See Plate 2

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2375.00 / 0			**WELL GRADED, SILTY SAND (SW-SM)** - heavily varnished desert pavement, old alluvial surface, some cobbles and boulders up to 20" diameter, light brown matrix - angular volcanic detritus	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			indistinct alluvial sorting	slightly moist		
					very dense	
2370.00 / 5						S
			- partially cemented, hard digging			
			Bottom at 9 feet.			
2365.00 / 10						
2360.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION

APPROV:

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-29

DATED EXCAVATED: 11/4/93 **TRENCH NO. T-25** ELEVATION: Approx. 2085 feet
LOCATION: See Plate 2 EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2085.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and small cobbles up to 4" diameter, light brown matrix - angular to subangular volcanic detritus	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			WELL GRADED, SILTY SAND (SW-SM) - light brown matrix	slightly moist		
					very dense	
2080.00 / 5			- poorly defined alluvial sorting			
			WELL GRADED, SILTY SAND (SW-SM)			G,A, Ch
			Bottom at 9 feet.			
2075.00 / 10						
2070.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE WITH TIME. DATA PRESENTED IS A SIMPLIFICATION

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-30

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T-26

ELEVATION: Approx. 2068 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2068.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles up to 6" diameter, light brown to mottled pink-gray angular to subangular volcanic detritus - alluvial sorting poorly defined	dry to slightly moist	loose to medium dense	
					medium dense	
			WELL GRADED, SILTY SAND (SW-SM) - mottled pink-gray to light brown, some gravel and cobbles - some roots, little caving		dense	
				slightly moist		
					very dense	
2063.00 / 5			- thin alluvially well sorted lenses 1" to 4" thick at 6" to 20" intervals			
2058.00 / 10			Bottom at 10 feet.			
2053.00 / 15						

NR = No Recovery, C = Consolidation, A = Atterberg, Ch = Chemical test, S = Direct Shear, G = Grain-Size, E = Expansion, Sol = Solubility, Res = Resistivity, R = R-Value, ASTM D1557 = Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-31

Date Completed: 11/8/93

Logged By:

Total Depth: 15.00 feet

Surface Conditions:

Groundwater: Groundwater not encountered during drilling.

Elevation	Depth, ft.	FIELD: Sample Type	FIELD: Blows/inches	FIELD: Moisture (wt.%)	FIELD: Dry Density (PCF)	TEST	SYMBOL	DESCRIPTION	Well Constr.
								Approximate Surface Elevation (ft): 2058	
								POORLY GRADED, SILTY SAND (SP-SM) - some gravel, occasional cobbles to approximately 5" diameter, light brown	
								- some alluvial sorting	
								- angular to subangular volcanic stone	
2053.0			35/12	3	120				
								- partially cemented coarse sand	
2048.0			50/4	4	132				
								- some gravel	
			50/8	4	116				
2043.0								Bottom at 15 feet.	

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

LOG OF INFILTRATION TEST WELL
B- 5
Equestrian Detention Basin
Henderson, Nv.

PLATE
B-32

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THE UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			Group Symbols	TYPICAL NAMES
COARSE GRAINED SOIL — More than 50% of the material is LARGER than the No. 200 Sieve.	GRAVELS — More than 50% of coarse part is LARGER than the No. 4 Sieve.	CLEAN GRAVELS — Less than 5% finer than No. 200 Sieve.	GW	Well graded gravels, gravel - sand mixtures, little or no fines, Cu > 4 & 1 < Cc > 3
			GP	Poorly graded gravels or gravel - sand mixtures, little or no fines Cu < 4 or 1 > Cc < 3
		GRAVEL with fines — More than 12% Finer than No. 200 Sieve. PI < 4	GM	Silty gravels, gravel - sand - silt mixtures
		PI > 7	GC	Clayey gravels, gravel - sand - clay mixtures
	SANDS — More than 50 % of coarse part is SMALLER than the No. 4 Sieve.	CLEAN SANDS — Less than 5% Finer than No. 200 Sieve.	SW	Well graded sands, gravelly sands, little or no fines. Cu > 6& 1 < Cc > 3
			SP	Poorly graded sands or gravelly sands, little or no fines. Cu < 6 or 1 > Cc < 3
		SAND with fines — More than 12% Finer than No. 200 Sieve. PI < 5	SM	Silty sands, sand - silt mixtures
		PI > 7	SC	Clayey sands, sand - clay mixtures
FINE GRAINED SOIL — More than 50 % of the material is SMALLER than the No. 200 Sieve	SILTS & CLAYS — Liquid Limit LESS than 50	PI - Below A - Line	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with low plasticity
		PI - Above A - Line	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic clays of low plasticity
	SILTS & CLAYS — Liquid Limit GREATER than 50	PI - Below A - line	MH	Inorganic silts, Micaceous or diatomaceous fine sands or silty soils, elastic silts
		PI - Above A - Line	CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		Fine	Medium	Coarse	Fine	Coarse		

0.002 mm #200 #40 #10 #4 3/4" 3" 12"

U. S. Standard Sieve Size

Descriptive Terms Used With Soils

CONSISTANCY			Moisture Content
	SILTS & CLAYS	SANDS & GRAVELS	
Strongest ↑	Very Stiff	Very Dense	Wettest ↑ Wet
	Stiff	Dense	Very Moist
	Medium Stiff	Medium Dense	Moist
	Soft	Loose	Slightly Moist
Weakest ↓			Driest ↓ Dry

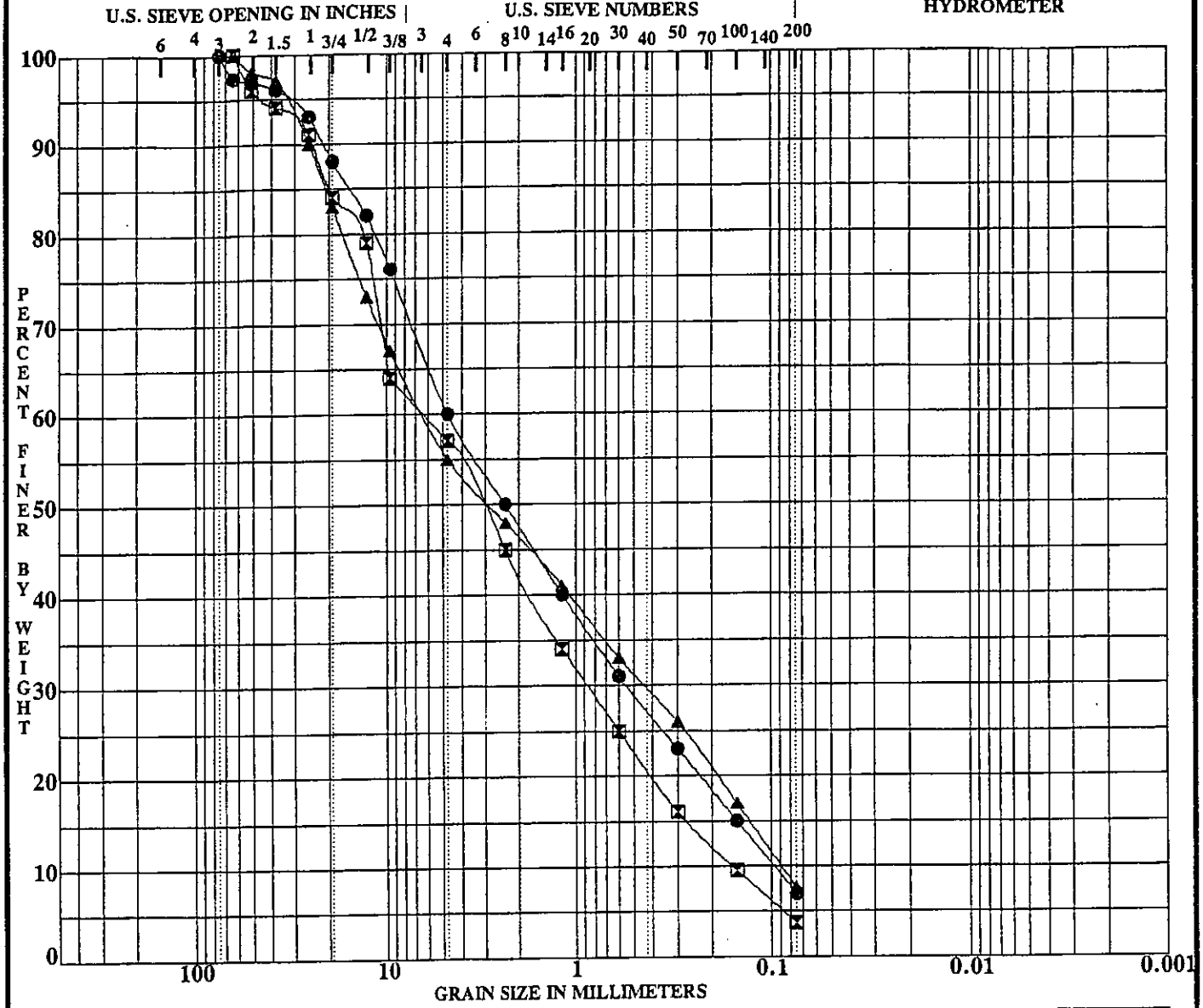
	CALICHE	Cemented Sand & Gravel	
Strongest ↑	Very Hard	Very Hard	Difficult to scratch or break
	Hard	Hard	Scratches leave only dust, Requires many hammer blows to break
	Moderately Hard	Moderately Hard	Readily cut by knife, Crumbles with several hammer blows
Weakest ↓	Partially cemented	Partially cemented	Gouges easily with knife, Crumbles readily with few hammer blows

KEY TO SOIL SYMBOLS AND TERMS

PROJECT : Equestrian Detention Basin

PROJECT NO: 31-128834-001

PLATE NO: A-33



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	T- 2	4.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.66	48.8
⊠	T- 4	3.0	POORLY GRADED SAND with GRAVEL (SP)	NP	NP	NP	0.75	40.5
▲	T- 6	4.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.35	70.9

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	T- 2	4.0	75.00	4.75	0.550	0.0973	40.0	53.0	7.0	
⊠	T- 4	3.0	63.50	6.40	0.874	0.1582	43.0	53.3	3.7	
▲	T- 6	4.0	63.50	6.35	0.446	0.0895	45.0	47.4	7.6	

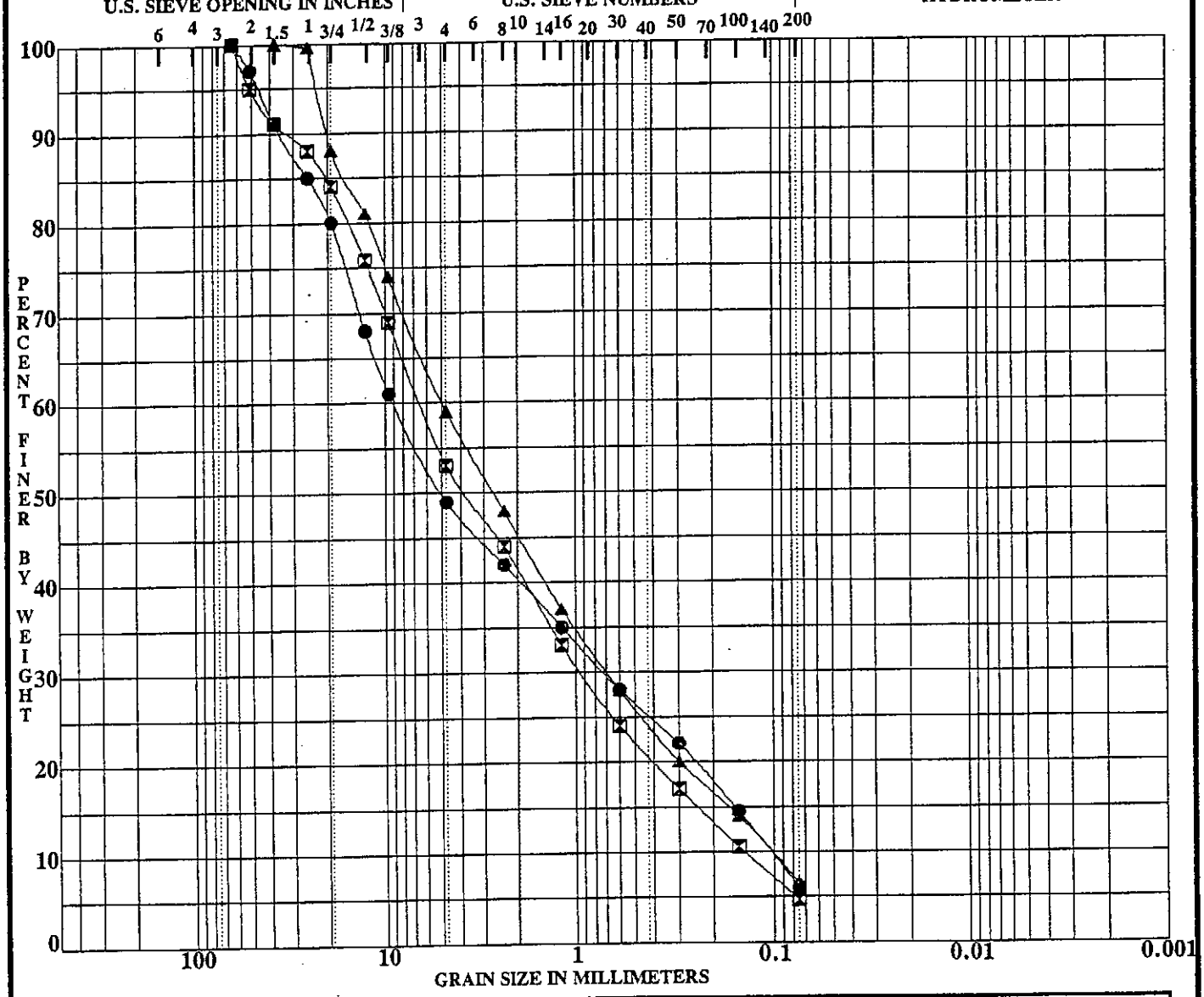
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

GRAIN SIZE ANALYSES

PLATE
B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	T- 8	2.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NP	NP	NP	0.57	86.9
⊠	T-11	3.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.99	46.1
▲	T-15	4.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.94	48.0

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	T- 8	2.0	63.50	8.99	0.728	0.1035	51.0	42.9	6.1	
⊠	T-11	3.0	63.50	6.44	0.942	0.1398	47.0	48.3	4.7	
▲	T-15	4.0	38.10	4.98	0.697	0.1036	41.0	52.5	6.5	

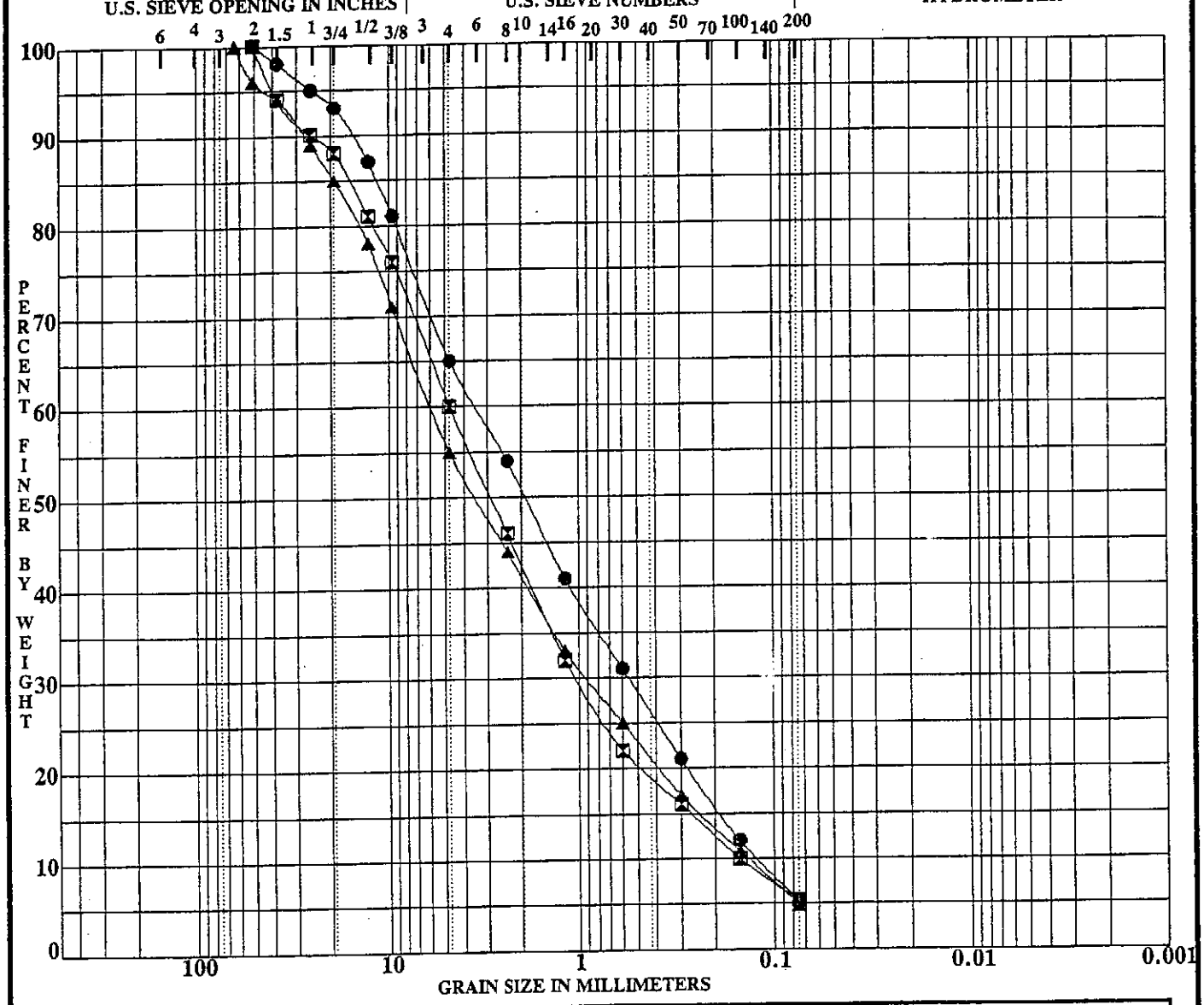
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

GRAIN SIZE ANALYSES

PLATE
B-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	T-19	8.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.74	28.3
⊠	T-23	4.0	WELL GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	1.49	31.7
▲	T-25	6.0	WELL GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	1.04	43.2

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	T-19	8.0	50.80	3.46	0.560	0.1220	35.0	59.7	5.3	
⊠	T-23	4.0	50.80	4.75	1.031	0.1500	40.0	54.6	5.4	
▲	T-25	6.0	63.50	5.91	0.916	0.1365	45.0	50.1	4.9	

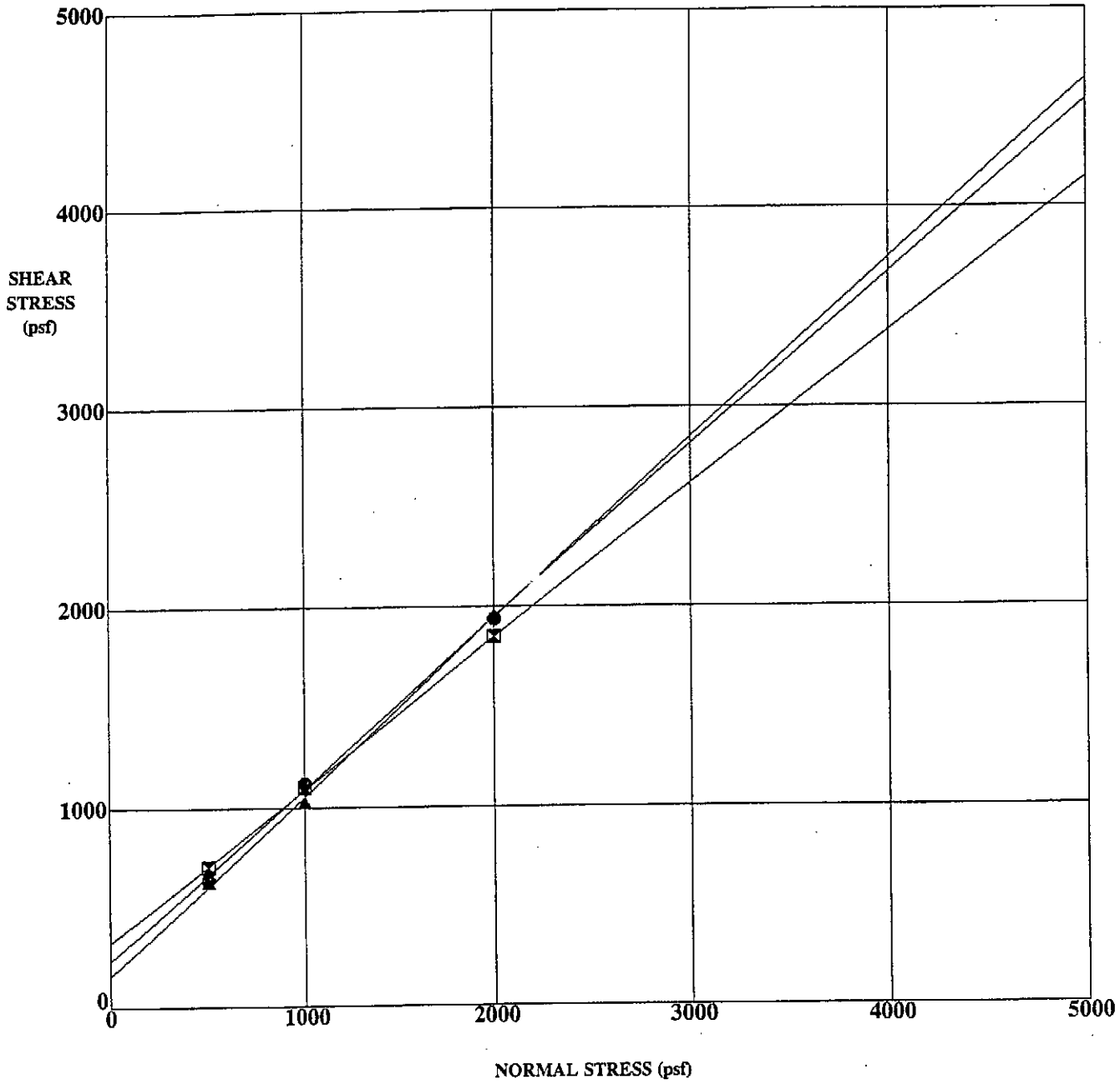
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PROJECT: Equestrian Detention Basin

GRAIN SIZE ANALYSES

PLATE
B-3

PROJECT NO. 31-128834-001



Exploration No.	Depth (ft.)	Soil Description	PHI Angle Degrees	Cohesion (psf)
● T-1	2.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	41	230
⊠ T-3	4.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	37	325
▲ T-6	4.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	42	157

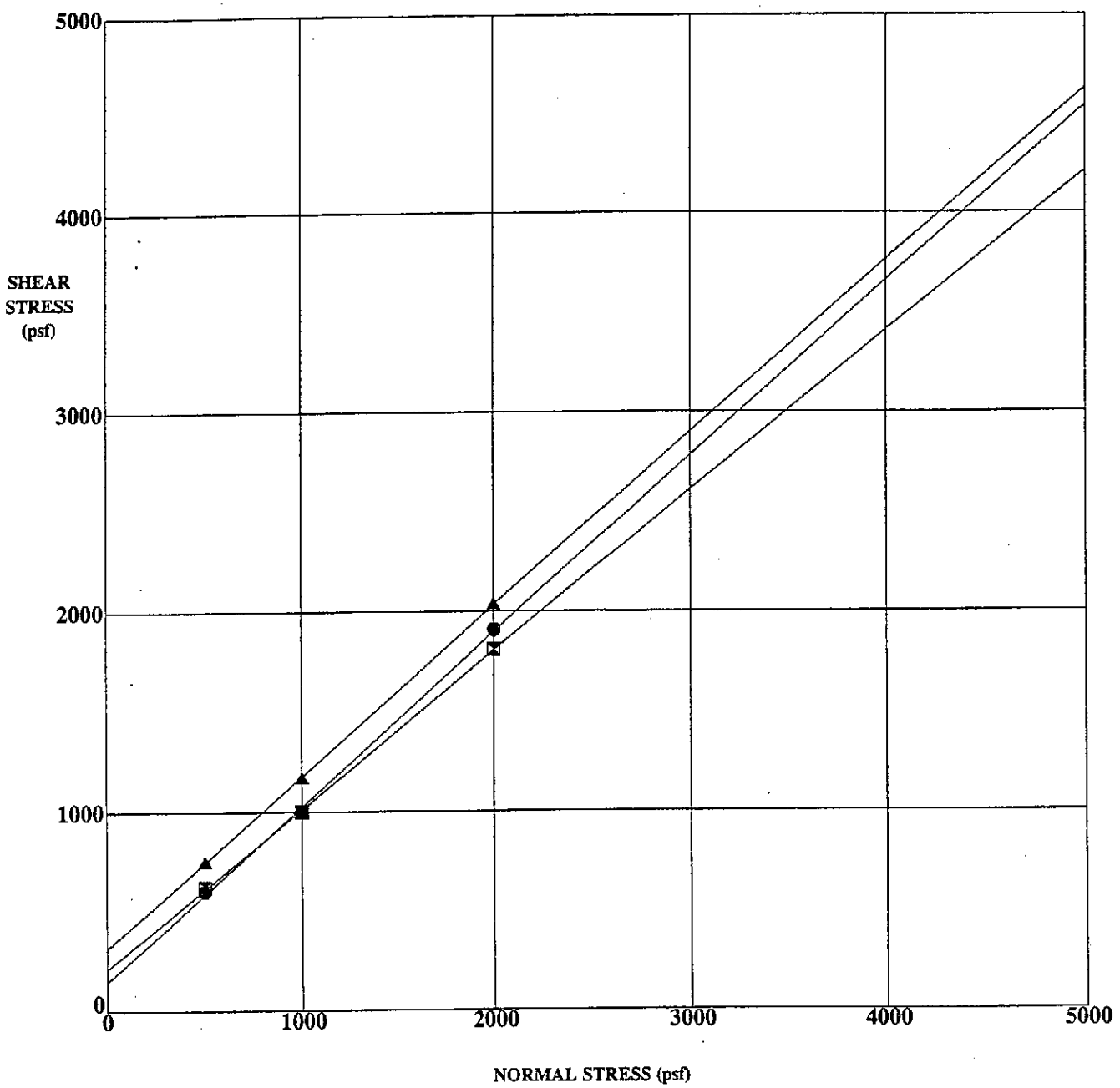
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

DIRECT SHEAR TEST RESULTS

PLATE
B-4



Exploration No.	Depth (ft.)	Soil Description	PHI Angle Degrees	Cohesion (psf)
● T- 9	3.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	41	145
⊠ T-13	2.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	39	213
▲ T-17	3.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	41	315

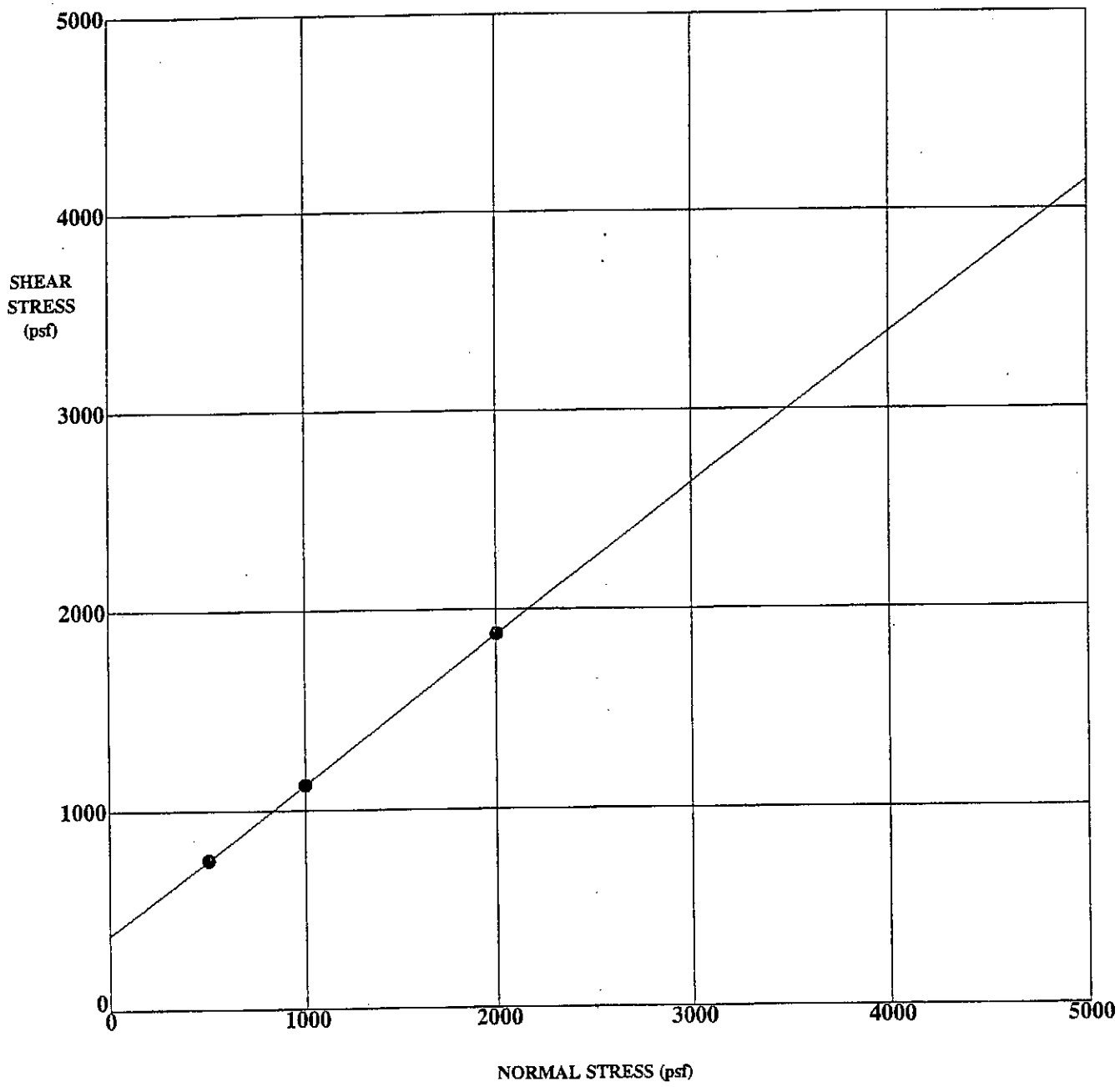
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

DIRECT SHEAR TEST RESULTS

PLATE
B-5



Exploration No.	Depth (ft.)	Soil Description	PHI Angle Degrees	Cohesion (psf)
● T-24	5.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	37	373

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

DIRECT SHEAR TEST RESULTS

PLATE
B-6

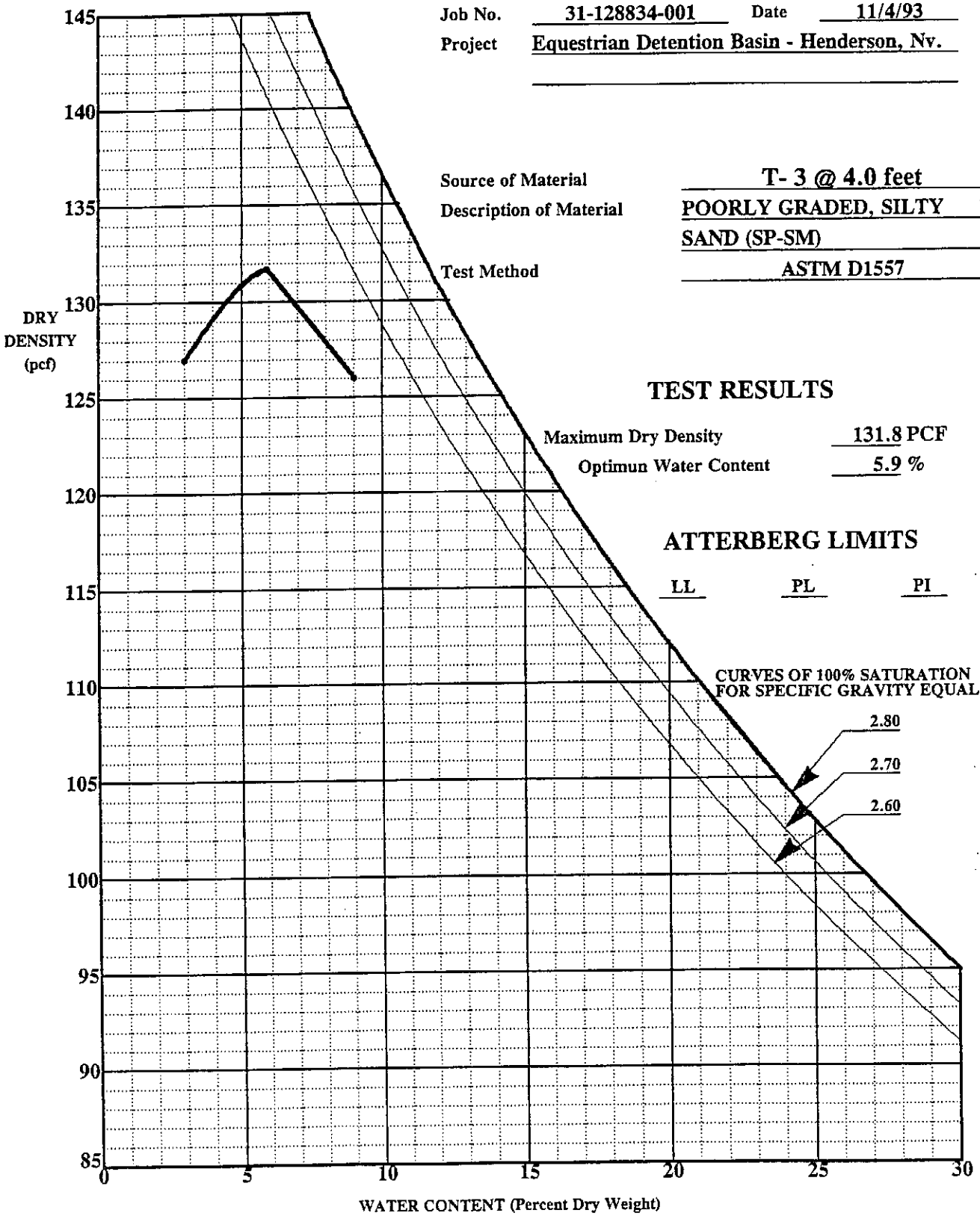
Job No. 31-128834-001 Date 11/4/93

Project Equestrian Detention Basin - Henderson, Nv.

Source of Material T- 3 @ 4.0 feet

Description of Material POORLY GRADED, SILTY SAND (SP-SM)

Test Method ASTM D1557



TEST RESULTS

Maximum Dry Density 131.8 PCF

Optimun Water Content 5.9 %

ATTERBERG LIMITS

LL PL PI

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

MOISTURE-DENSITY RELATIONSHIP

PLATE B-7

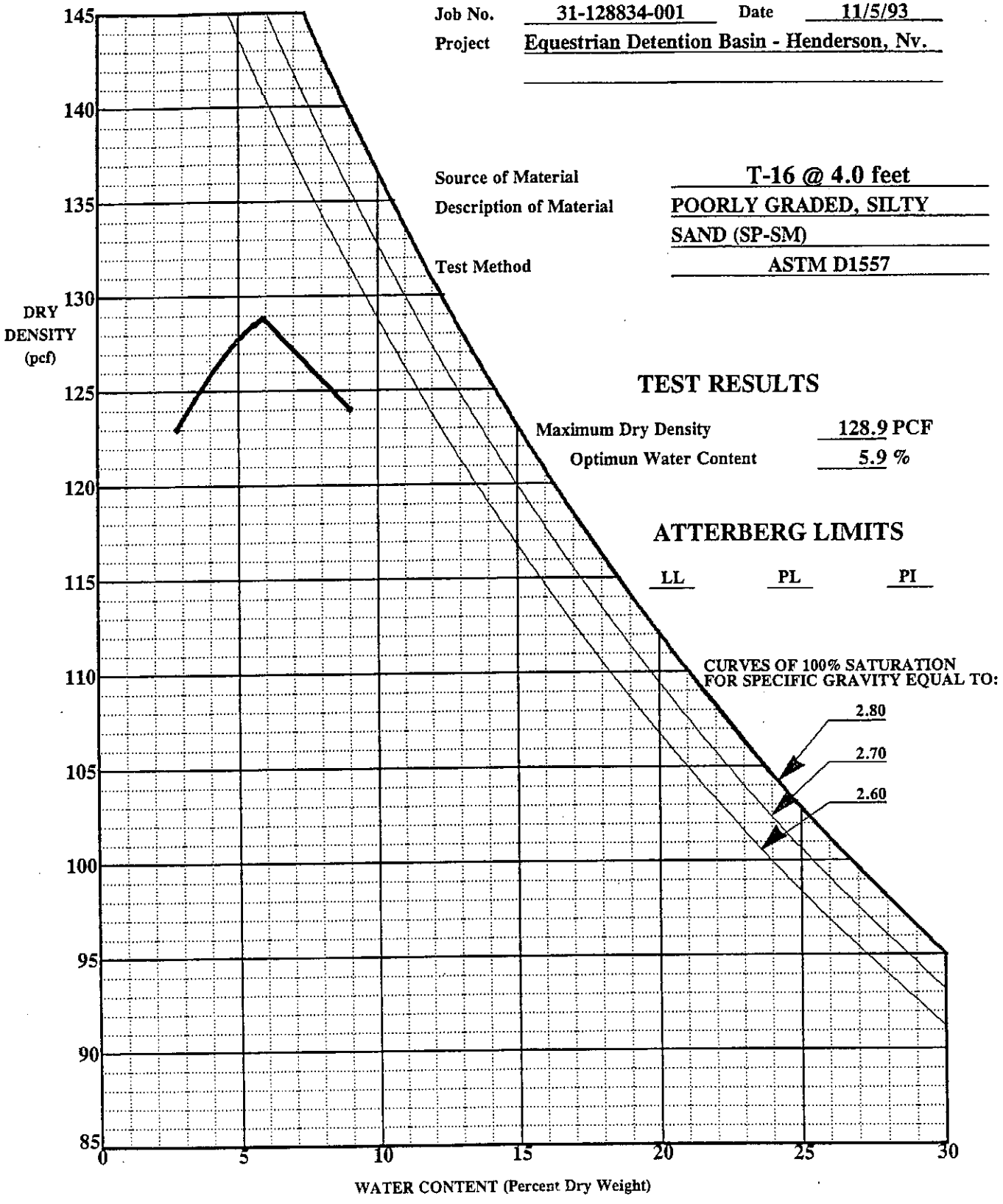
Job No. 31-128834-001 Date 11/5/93

Project Equestrian Detention Basin - Henderson, Nv.

Source of Material T-16 @ 4.0 feet

Description of Material POORLY GRADED, SILTY SAND (SP-SM)

Test Method ASTM D1557



TEST RESULTS

Maximum Dry Density 128.9 PCF

Optimun Water Content 5.9 %

ATTERBERG LIMITS

LL PL PI

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

MOISTURE-DENSITY RELATIONSHIP

PLATE B-8

Table No. : 1

PERMEABILITY TEST RESULTS

Project : Equestrian Detention Basin, Henderson, Nv.

Exploration Point	Sample Depth (ft.)	SOIL DESCRIPTION	Permeability K (cm/sec)	Moist. (%)	Density (PCF)	Sat. %	Test Head (mm)
T- 5	2.00	POORLY GRADED, SILTY SAND (SP-SM)	4.8E-5	16.5	113	98	1343
T-12	3.00	POORLY GRADED, SILTY SAND (SP-SM)	5.7E-5	15.8	115	100	1428
T-21	4.00	POORLY GRADED, SILTY SAND (SP-SM)	4.3E-5	17.7	111	99	1436

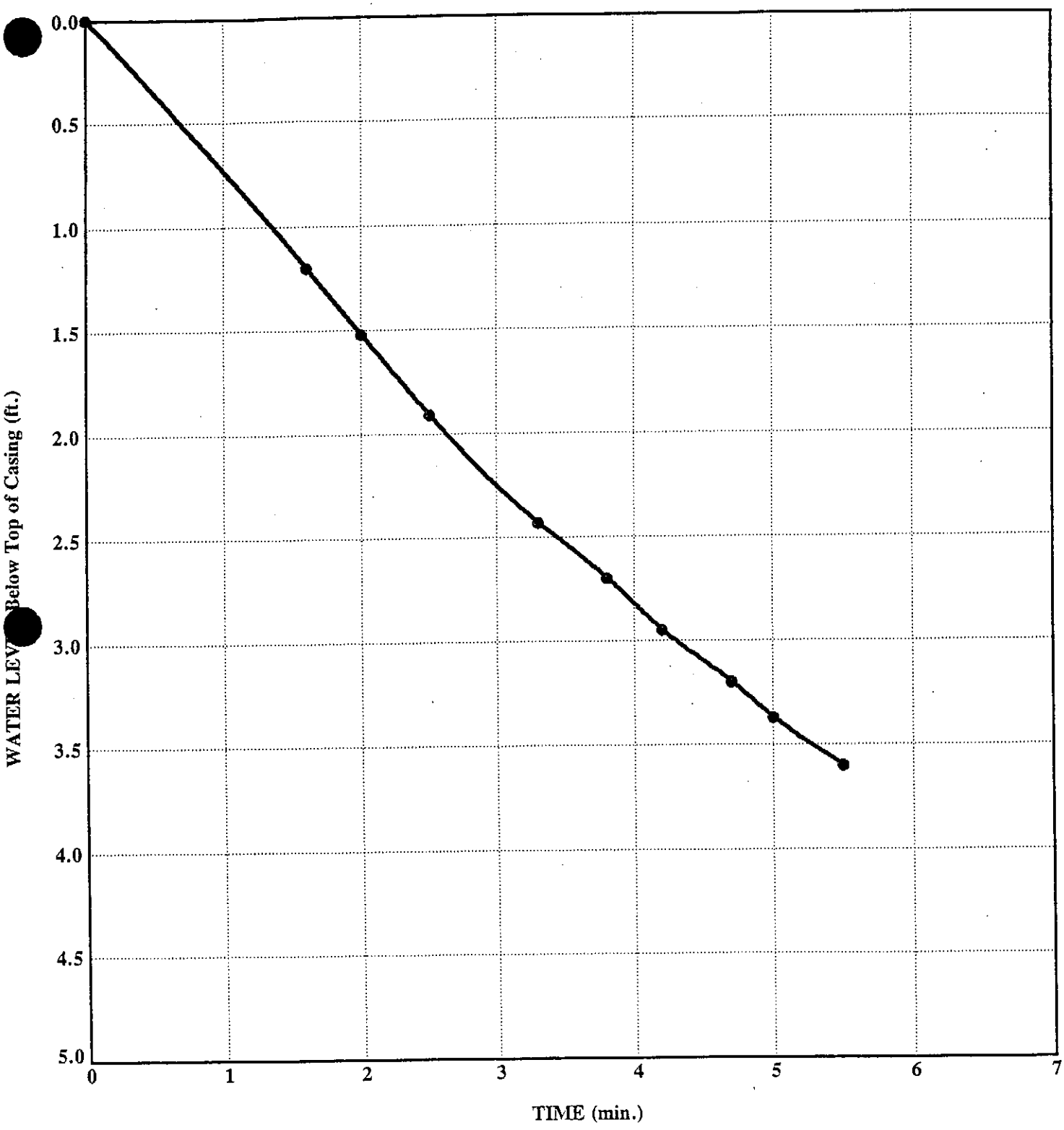
Table No. : 2

RESISTIVITY TEST RESULTS

Project : **Equestrian Detention Basin**

Exploration Point	Sample Depth (ft.)	SOIL DESCRIPTION	RESISTIVITY Nat. Moisture ohm-cm	RESISTIVITY Saturated ohm-cm
T-14	2.0	SILTY SAND (SP-SM)	583000	13970
T-18	4.0	SILTY SAND (SP-SM)	2499250	10350

BORING No. B- 5



Starting time and date: Nov. 9, 1993, 2:10 pm

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SOILS AND MATERIALS TESTING

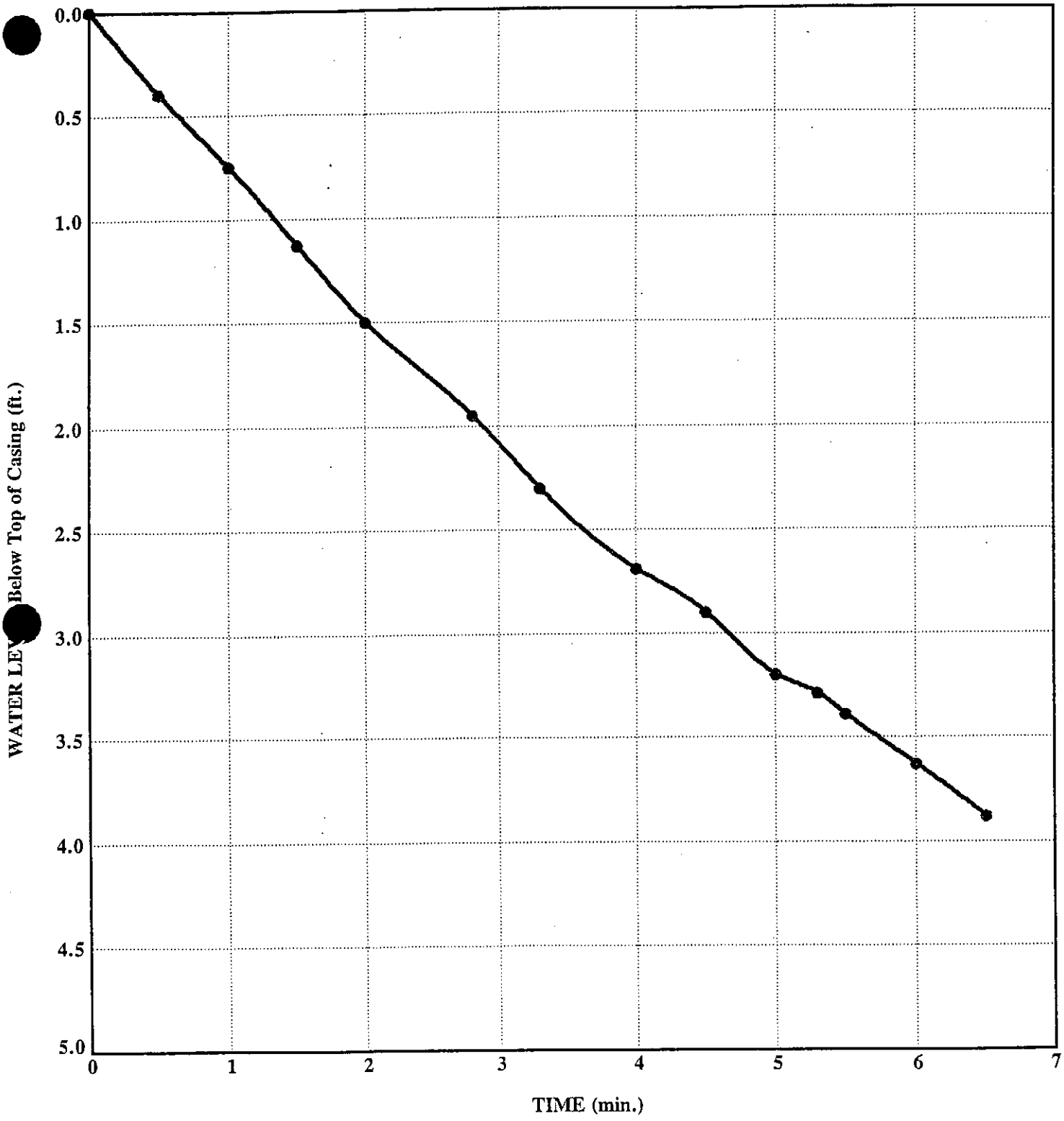
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

FIELD INFILTRATION TEST RESULTS

PLATE
B-11

BORING No. B- 5



Starting time and date: Nov. 9, 1993, 2:16 pm

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SOILS AND MATERIALS TESTING

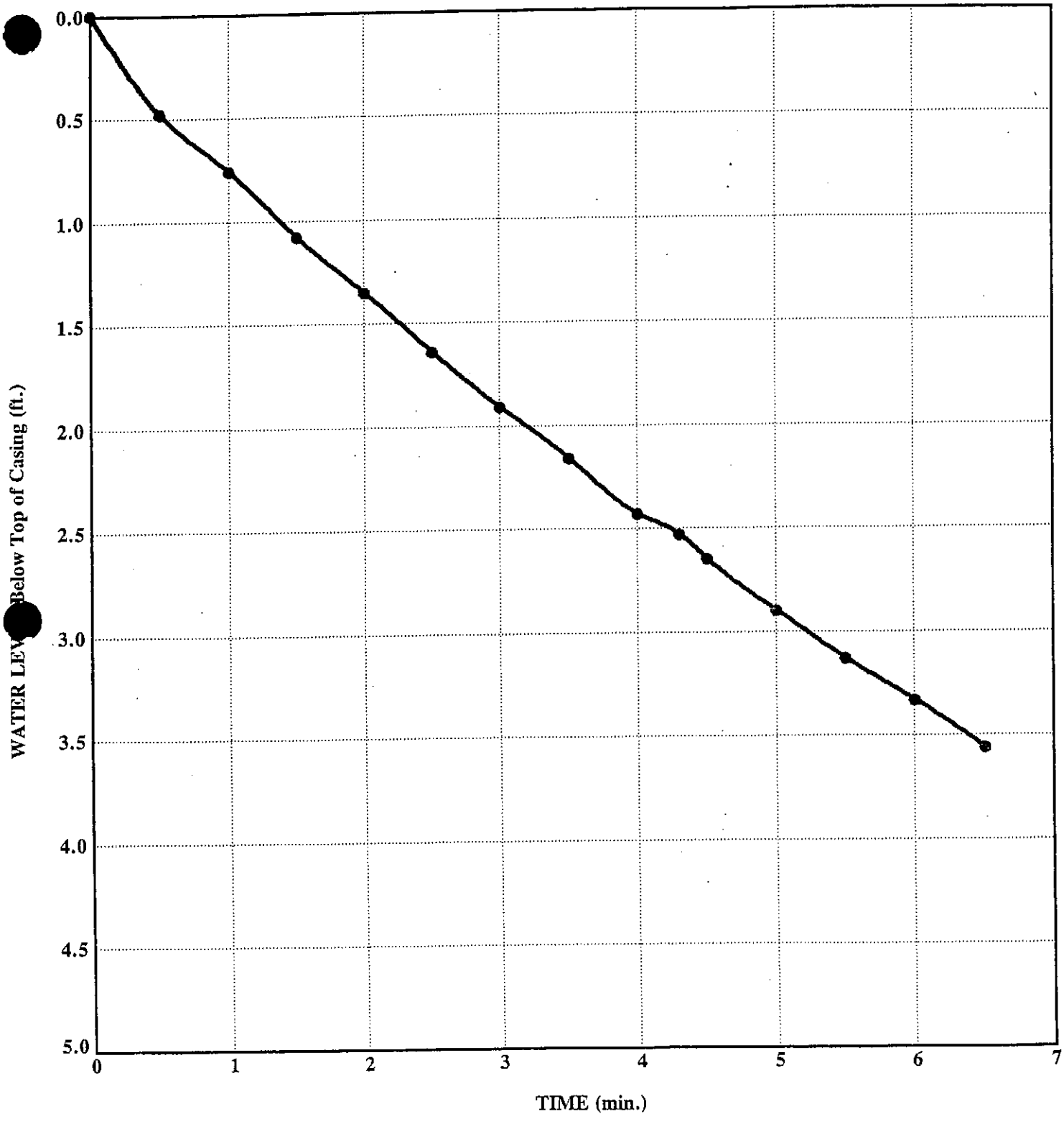
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

FIELD INFILTRATION TEST RESULTS

PLATE
B-12

BORING No. B- 5



Starting time and date: Nov. 9, 1993, 3:05 pm

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SOILS AND MATERIALS TESTING

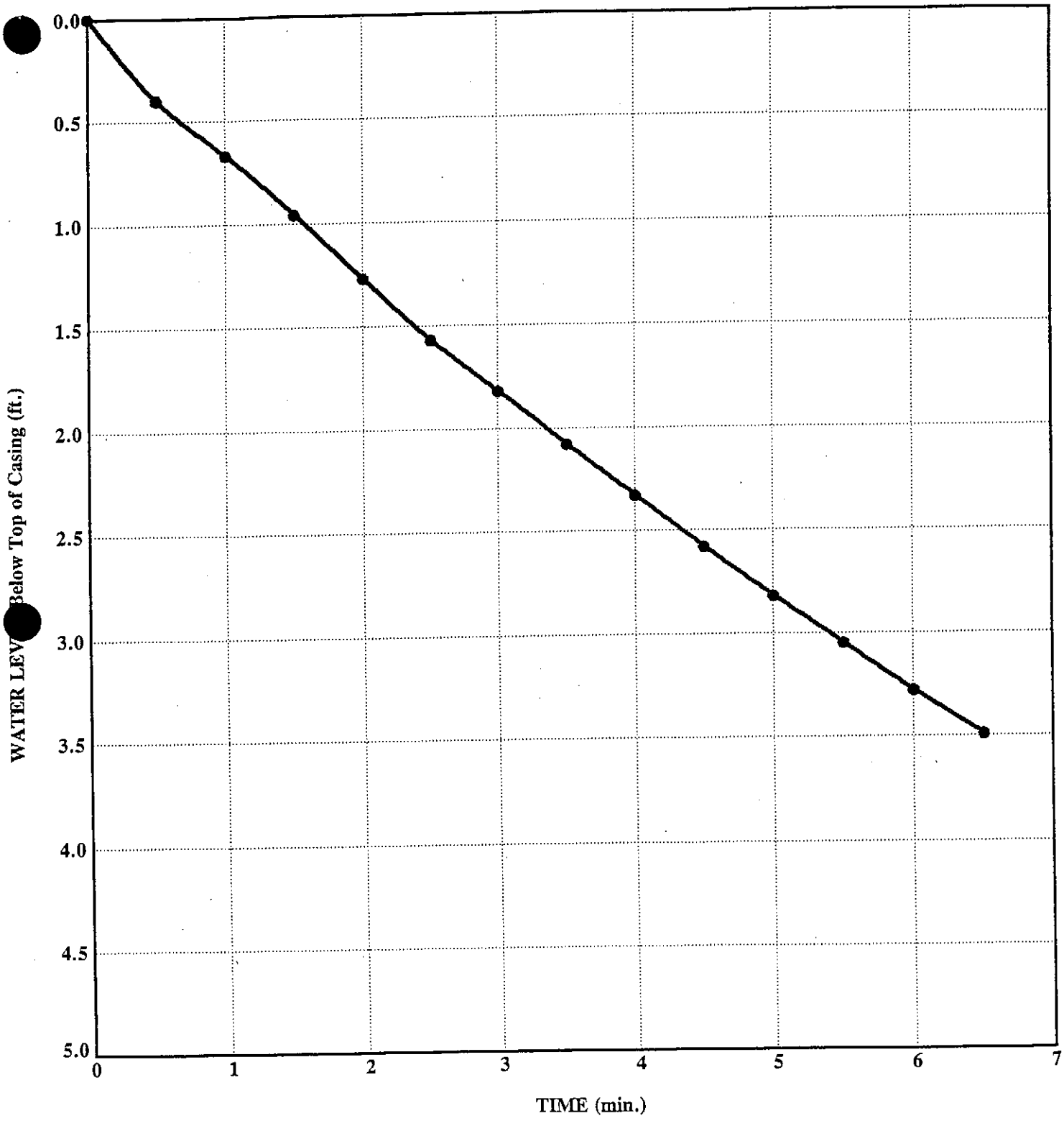
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

FIELD INFILTRATION TEST RESULTS

PLATE
B-13

BORING No. B- 5



Starting time and date: Nov. 9, 1993, 3:13 pm

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SOILS AND MATERIALS TESTING

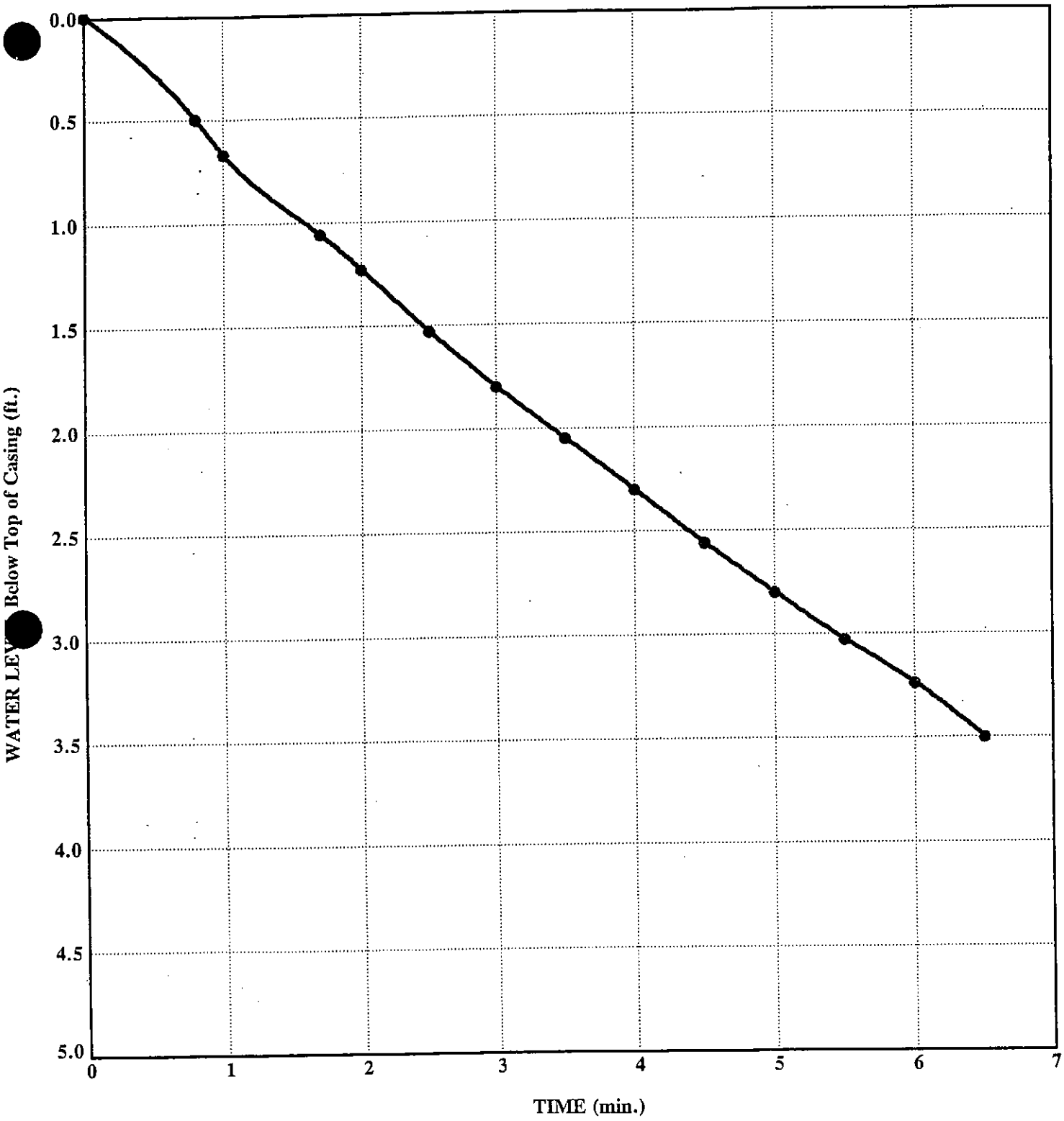
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

FIELD INFILTRATION TEST RESULTS

PLATE
B-14

BORING No. B- 5



Starting time and date: Nov. 9, 1993, 3:21 pm

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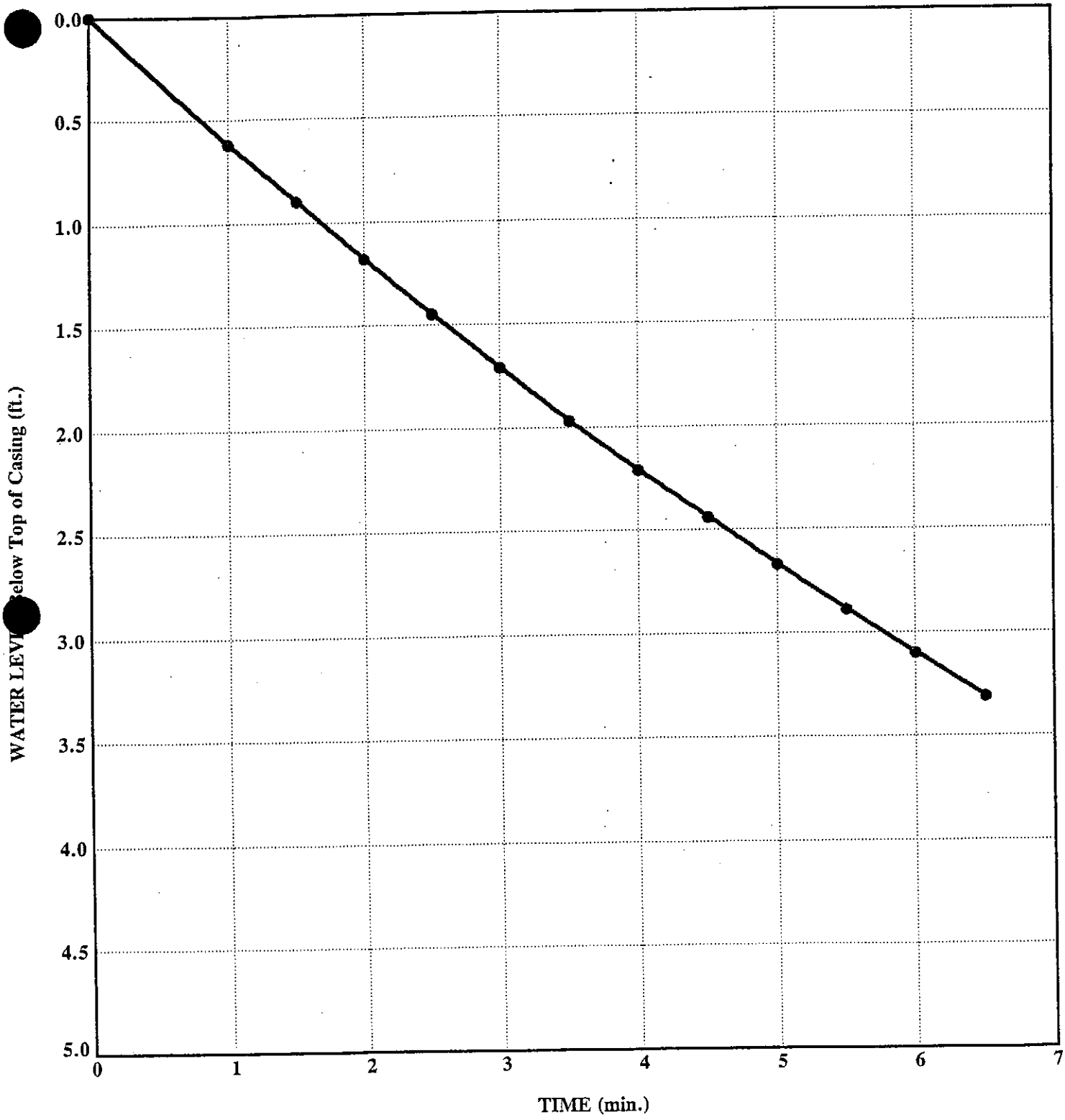
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

FIELD INFILTRATION TEST RESULTS

PLATE
B-15

BORING No. B- 5



Starting time and date: Nov. 9, 1993, 4:03 pm

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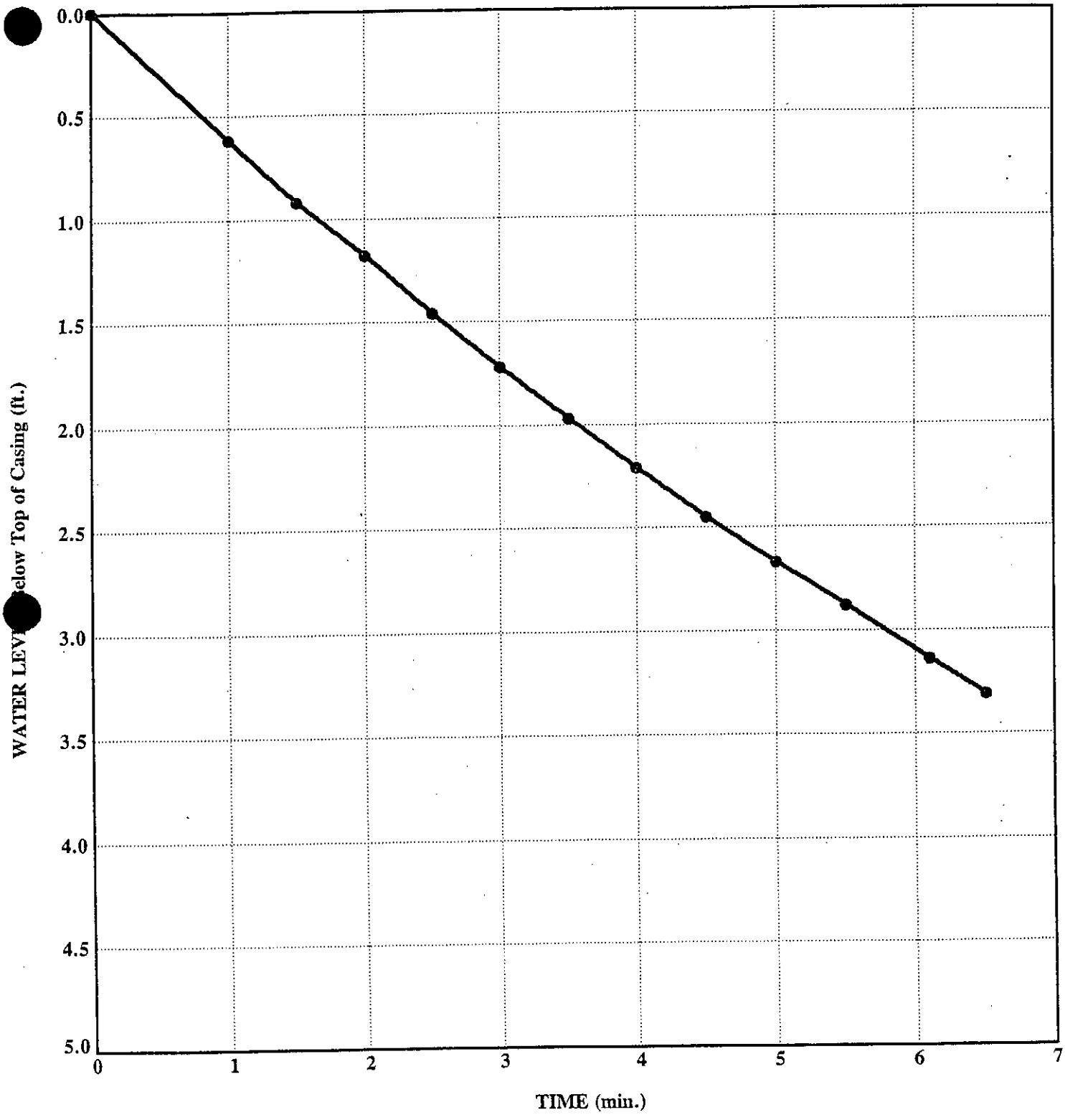
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

FIELD INFILTRATION TEST RESULTS

PLATE
B-16

BORING No. B- 5



Starting time and date: Nov. 9, 1993, 4:10 pm

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

FIELD INFILTRATION TEST RESULTS

PLATE
B-17

Atlas Chemical Testing Laboratories

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(702) 383-1199 • Fax (702) 383-4983

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TESTING MATERIALS

LABORATORY NO: 5810(b) DATE: November 10, 1993

SAMPLE: Soil

MARKED: 31-128834

DATE RECEIVED: 11/9/93

SUBMITTED BY: Kleinfelder, Inc.
6850 South Paradise Rd.
Las Vegas, NV 89119

REPORT OF DETERMINATION

BORING NUMBER	T-1	T-4	T-7	T-10	T-16	T-20
DEPTH (feet)	2	4	4	2	4	4
pH VALUE	8.64	9.20	9.32	9.23	9.59	9.16
RED-OX (MV)	+454	+440	+442	+446	+431	+442
SULFATE (ppm)	75	25	10	25	100	25
SULFIDE (ppm)	Nil	Nil	Nil	Nil	Nil	Nil
TOTAL SALTS (ppm)	447	66	80	50	168	60
CHLORIDE (ppm)	80	10	10	5	15	10

Respectfully submitted,
ATLAS CHEMICAL TESTING LABORATORIES

Robert L. Summers
Analytical Chemist

NOTES: 1. The soil water extract ratio was 5:1, therefore, to convert a solution ppm (or mg/l) to a soil ppm (or mg/kg) for this extract ratio multiply by five(5). To convert soil ppm to a weight percent divide by ten thousand(10,000).

2. The standard methods used for the determination above are the glass electrode/silver-silver chloride, ASTM D 1498, Turbidimetric/Std. Meth. 426C, Methylene Blue/Std. Meth. 427C, Electrical Conductivity, factor empirically determined/Std. Meth. 205 and Argentometric/Std. Meth. 407A respectively.

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LABORATORY NO: 5810(b) - Continued DATE: November 10, 1993

SAMPLE: Soil

MARKED: 31-128834

DATE RECEIVED: 11/9/93

SUBMITTED BY: Kleinfelder, Inc.
6850 South Paradise Rd.
Las Vegas, NV 89119

REPORT OF DETERMINATION

BORING NUMBER	T-22	T-25				
DEPTH (feet)	4	6				
pH VALUE	8.72	8.74				
RED-OX (MV)	+457	+456				
SULFATE (ppm)	160	100				
SULFIDE (ppm)	Nil	Nil				
TOTAL SALTS (ppm)	248	186				
CHLORIDE (ppm)	15	15				

Respectfully submitted,
ATLAS CHEMICAL TESTING LABORATORIES

Robert L. Summers

Robert L. Summers
Analytical Chemist

NOTES: 1. The soil water extract ratio was 5:1, therefore, to convert a solution ppm (or mg/l) to a soil ppm (or mg/kg) for this extract ratio multiply by five(5). To convert soil ppm to a weight percent divide by ten thousand(10,000).

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TESTING MATERIALS

LABORATORY NO: 5810(b) **DATE:** November 10, 1993

SAMPLE: Soil

MARKED: 31-128834

DATE RECEIVED: 11/9/93

SUBMITTED BY: Kleinfelder, Inc.
6850 South Paradise Rd.
Las Vegas, NV 89119

REPORT OF DETERMINATION

BORING NUMBER	T-1	T-4	T-7	T-10	T-16	T-20
DEPTH (feet)	2	4	4	2	4	4
pH VALUE	8.64	9.20	9.32	9.23	9.59	9.16
RED-OX (MV)	+454	+440	+442	+446	+431	+442
SULFATE (ppm)	75	25	10	25	100	25
SULFIDE (ppm)	Nil	Nil	Nil	Nil	Nil	Nil
TOTAL SALTS (ppm)	447	66	80	50	168	60
CHLORIDE (ppm)	80	10	10	5	15	10

Respectfully submitted,
ATLAS CHEMICAL TESTING LABORATORIES

Robert L. Summers
Analytical Chemist

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LABORATORY NO: 5810(b) - Continued DATE: November 10, 1993

SAMPLE: Soil

MARKED: 31-128834

DATE RECEIVED: 11/9/93

SUBMITTED BY: Kleinfelder, Inc.
6850 South Paradise Rd.
Las Vegas, NV 89119

REPORT OF DETERMINATION

BORING NUMBER	T-22	T-25				
DEPTH (feet)	4	6				
pH VALUE	8.72	8.74				
RED-OX (MV)	+457	+456				
SULFATE (ppm)	160	100				
SULFIDE (ppm)	Nil	Nil				
TOTAL SALTS (ppm)	248	186				
CHLORIDE (ppm)	15	15				

Respectfully submitted,
ATLAS CHEMICAL TESTING LABORATORIES

Robert L. Summers
Analytical Chemist

NOTES: 1. The soil water extract ratio was 5:1, therefore, to convert a solution ppm (or mg/l) to a soil ppm (or mg/kg) for this extract ratio multiply by five(5). To convert soil ppm to a weight percent divide by ten thousand(10,000).

2. The standard methods used for the determination above are the glass electrode/silver-silver chloride, ASTM D 1498, Turbidimetric/Std. Meth. 426C, Methylene Blue/Std. Meth. 427C, Electrical Conductivity, factor empirically determined/Std. Meth. 205 and Argentometric/Std. Meth. 407A respectively.

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities; and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

Published by

ASFE THE ASSOCIATION OF ENGINEERING FIRMS PRACTICING IN THE GEOSCIENCES

8811 Colesville Road/Suite G106/Silver Spring, Maryland 20910/(301) 565-2733

0788/3M

APPENDIX L

LEVEE CONSTRUCTION

SPECIFICATIONS

SECTION 203

EXCAVATION AND EMBANKMENT

DESCRIPTION

203.01.01 GENERAL

Add the following paragraph:

All mineral resources (including all soil) that are within Bureau of Land Management (BLM) parcels are owned by the BLM and shall be disposed of in accordance with BLM requirements and shall not become the property of the contractor unless the contractor acquires them in accordance with BLM procedures.

This work shall consist of grading and excavating within the slope lines of the berm embankment. Exceptions are structure excavation, or other separately designated pay items of work which are made a part of the contract. All work shall be in conformity with the alignment, grades, and cross sections shown on the plans or established by the ENGINEER.

203.01.02 GRADE TOLERANCE

(1) The actual grade shall not vary more than zero (0) inches below or two (2) inches above the grade shown on the plans or established by the ENGINEER for all completed berm.

(2) The actual thickness of the berm lining shall not vary more than 0.15 feet from the specified thickness. The actual thickness of the drain blanket shall not vary more than the specified thickness of the drain blanket minus zero (0) inches to plus two (2) inches.

MATERIALS

203.02.01 FILL FOR THE BERM EMBANKMENTS

A. Material

The fill for the berm core at the Basin and Foothill Channel Embankment shall consist of selected on-site soil from the excavation or approved imported soils that shall include poorly graded or well graded sand or silty sand with gravel or well graded sand with silt and gravel or properly sized fragments of partially cemented sand and gravel. The percent passing No. 4 sieve, i.e., the sand and silt size fraction, shall be between 45 and 90. The percent passing No. 200 Sieve, i.e., the silt size fraction, shall be between 0 and 30 percent.

All materials placed in fills shall be free from particles larger than 8 inches in size, vegetation, debris, and other delirious materials.

The soils shall be low plasticity and free of leaves, grass, roots, logs, stumps, brush or other

organic materials and shall conform to the following requirements: 1) soils with less than 2% solubility, 2) soils which have a clay swell less than 8%, and 3) soils which have less than 1% sulfates.

The berm lining shall consist of a two (2) foot thick blanket on the upstream slope as noted on the drawings. The materials used for the berm lining shall meet the following gradation requirements:

Sieve Sizes	Percent of Weight Passing
4"	100
3"	75-100
1"	50-80
No. 4	20-50
No. 200	0-20

The soils shall be low plasticity and free of leaves, grass, roots, logs, stumps, brush or other organic materials and shall conform to the following requirements: 1) soils with less than 2% solubility, 2) soils which have a clay swell less than 8%, and 3) soils which have less than 1% sulfates.

B. Placement and Compaction: The fill for the berm core shall be constructed in layers. The placement of the fill for the berm core shall begin at the lowest point of fill, unless otherwise approved by the ENGINEER. Individual layers shall be spread evenly to uniform thickness throughout and approximately horizontal. If the soil is placed against slopes that are steeper than 5:1 (5 horizontal to 1 vertical) the fill shall be benched into component material. The height of the benches shall not exceed 2 feet. The thickness of the layer shall be as necessary to secure the required compaction with an 8 inch maximum thickness before compaction, unless otherwise approved by the ENGINEER. All fill for the berm core shall be compacted to 90% relative density per ASTM D1557.

The fill shall be moisture-conditioned to obtain a soil moisture content at or above optimum moisture content and within 3 percent of optimum moisture content. The specified compaction shall be accomplished by mechanical means that has been approved by the ENGINEER. Each layer shall be compacted to the required density before placing the succeeding layer. If any portion of the compacted fill does not meet or exceed the required density during the construction of the dam, the contractor shall immediately make all necessary adjustments to insure that all of the berm core material will comply with the specified density. This shall include any compacted material that has become saturated and swelled or for any other reason does meet or exceed the required density at or before the time of completion of the berm.

Hauling and leveling equipment shall be routed and distributed over the full width of each layer in such a manner as to uniformly distribute the compaction afforded thereby. The approved compaction equipment shall work continuously with the hauling and grading equipment so that the major compacting effort on all portions of the berm is done by the approved compaction equipment.

The berm lining shall be compacted to 95% relative density per ASTM D1557. The berm lining and does not need to be benched into the berm core.

C. Drainage

The CONTRACTOR shall protect the fill materials from saturation and erosion during all phases of the construction.

D. Testing

Testing of the material in the berm shall be done in accordance with Subsection 111.03, "Field Density".

CONSTRUCTION

203.03.02 UNSUITABLE MATERIAL

Add the following paragraph:

Excavated materials which do not conform to the following requirements shall also be considered to be unsuitable materials: 1) soils with greater than 3% solubility, 2) soils which have a clay swell greater than 4%, and 3) soils which have greater than 0.2% sulfates.

203.03.03 ADDITIONAL EXCAVATION AND BACKFILL

Add the following subsection:

Where excavation to the required depth, as shown on the plans or as required by the specifications, encounters unsuitable material, or uncompacted fill (fill material that is not compacted to 90% relative density for fine grain material and 95% relative density for coarse grain material as determined by the engineer will be considered uncompacted fill) the CONTRACTOR shall remove the unsuitable materials or uncompacted fill and backfill to the finished graded section with material approved by the ENGINEER. The CONTRACTOR shall conduct operations in such a way that the necessary cross sectional measurements can be taken before the backfill is placed. This item is applicable to all excavation.

203.03.04 HAUL (EXCESS MATERIAL)

Insert the following section for an additive-deductive item:

Excess material not incorporporated into the project as surplus material and as directed by the ENGINEER, shall be removed from the project to a site designated by the City of Henderson.

METHOD OF MEASUREMENT

203.04.01 MEASUREMENT

Measurement for payment of the various items of excavation and embankment, will be measured by the cubic yard in the original space occupied and the volume of material removed and placed will be computed in cubic yards by the average end area method. final volumes are derived from the lines, grades, slopes and thicknesses shown on the plans. The CONTRACTOR may submit revisions to the contract quantities. The revised quantities must be accompanied by surveying notes and calculation sheets showing how the revised quantities were determined. The calculations shall be made using the average end area method or other acceptable methods as determined by the ENGINEER. If upon verification by the ENGINEER, it is determined that the actual in place quantities do not exceed the contract quantities, the CONTRACTOR shall be liable for the expense incurred by the ENGINEER in verifying the quantities and the cost will be deducted from the subsequent payment to the CONTRACTOR. No allowance will be made in measurement for payment of settlement, shrinkage, or consolidation of the foundation or embankment material. No allowance will be made for scarified and recompacted material in this item.

When changes are made during construction such as widening cuts, changing grades, disposing of unsuitable material, and other changes resulting in increases or decreases in quantities, then additional measurements for payment will be made by the ENGINEER as hereinafter outlined:

a. Unsuitable Material - When the removal and disposal of unsuitable material is shown in the contract documents, such material will be measured for payment as excavation for the related item.

   Removal and disposal of unsuitable material, not shown on the plans, will be measured and paid for using the applicable bid item. However, if removal and disposal of unsuitable material not shown on the plans required special equipment or unusual operations, it may be paid for as extra work according to the provisions of Subsection 104.03, "Extra Work".

   No measurement will be made of suitable material temporarily removed and replaced to facilitate compaction of material.

b. Over break - All side slope Over break as defined in Subsection 203.03.05, "Over break", shall not be paid for.

   Rock removed to a maximum depth of six (6) inches (15 centimeters) below subgrade will be measured for payment provided the rock has been removed sufficiently to permit accurate cross sectioning. Replacement to this depth shall be with material designated on the plans approved by the ENGINEER and will be measured and paid for at the contract unit price for the material used.

   Rock loosened or removed in excess of six (6) inches (15 centimeters) below subgrade will not be measured nor paid for. When ordered by the ENGINEER, the loosened material will be removed and the resultant space refilled with approved material at the expense of the CONTRACTOR.

c. Widening Cuts - If the ENGINEER directs the CONTRACTOR to excavate beyond the limits described in the plans and specifications and before the excavation is substantially completed, the material shall be classified and shall be paid for at the contract bid price. However, widening cuts requires special equipment, or unusual and extra expense may be paid for as extra work according to the provisions of Subsection 104.03, "Extra Work".

d. Surplus Material - Surplus excavated material will be measured for payment as excavation and no further compensation will be allowed by virtue of the method of disposing, placing, or widening embankments caused from such surplus material.

e. Slides and Slipouts - In the event of slides and slipouts, the ENGINEER and CONTRACTOR shall negotiate in each case and decide the relative difficulty of performing the work. The cost of pioneering work necessary to make slide or slipout areas accessible to normal excavation equipment and the cost of necessary clearing and grubbing will be paid for as extra work as provided in Subsection 104.03, "Extra Work".

Only those quantities of slide or slipout material which are authorized and actually removed will be measured for payment.

Excavation in excess of the staked or authorized cross section will not be measured for payment, except as outlined above.

Earthwork quantities within the limits of "Slope Rounding" will not be measured for payment.

V-type ditches will be measured parallel to the ground and each one hundred (100) linear feet (30 meters) shall constitute a unit of measure. The cross section of the ditches shall be approximately 2 ft. deep by 4 ft. wide. The volume of excavation for such ditches will not be measured for payment.

f. Additive-deductive excess material shall be measured for payment as excavation.

BASIS OF PAYMENT

203.05.01 PAYMENT

Delete this subsection and insert the following:

203.05.01 Payment: The accepted quantities of excavation measured as specified in Subsection 203.04.01, "Measurement", will be paid for at the contract unit price bid for each of the pay items listed in the bid schedule. Such price shall include excavating and loading.

Only original excavation will be considered for payment. Temporary stockpiling, screening, hauling, watering, compacting, testing, mixing, benching, and all other activities required to excavate and place the excavate material shall be considered to be a part of the unit price per cubic yard for excavation. No allowance will be made for scarified and recompacted material for this item. Changes to the bid amount due to revision of the quantities will be based on the unit bid price.

The accepted quantities of embankment measured as specified in Subsection 203.04.01, "Measurement" will be paid for at the contract unit price bid for each of the pay items listed in the bid schedule. Such price shall include temporary stockpiling; re-excavation, hauling, depositing spreading, compacting screening, watering and all other work necessary to place, compact, test and maintain the material complete and in place. All payments will be made in accordance with Subsection 109.02, "Scope of Payment".

Payment will be made under:

PAY ITEM	**PAY UNIT**
Channel Excavation	Cubic Yard
Basin Excavation	Cubic Yard
General Fill Embankment	Cubic Yard
Channel Embankment	Cubic Yard
Additive-deductive Item:	
Haul (Excess Material)	Cubic Yard/Mile

END OF SECTION

APPENDIX II

FEMA PAL Agreement

CITY OF HENDERSON
240 Water Street
P.O. Box 95050
Henderson, NV 89009-5050

Public Works
Robert A. Murnane Director
702-267-3030
fax 702-267-3002

Memorandum

TO: Mary-Kay Peck

FROM: Robert A. Murnane, P.E.

DATE: December 4, 2008

SUBJECT: Provisionally Accepted Levee Agreement Form

The Federal Emergency Management Agency (FEMA) has selected several levees in Clark County and incorporated areas which they believe warrant reaccreditation as adequate to protect areas from a 1 % annual chance flood (100-year flood). The Equestrian Diversion Levee C1EQ0297 in the City of Henderson was selected as requiring accreditation. FEMA has requested information to verify that the selected levees comply with the criteria of the Code of Federal Regulations, Title 44, Section 65.10, titled "Mapping of Areas Protected by Levee Systems." The CCRFCD has solicited proposals from qualified engineering firms to prepare the levee accreditation documentation for the selected levees that FEMA believes warrant accreditation. The work to accredit the levees must be completed and the necessary documentation submitted to FEMA before the deadline date of December 16, 2010. Submittal of the attached provisionally accepted levee agreement, a copy of the operation and maintenance plan, and copies of the inspection and maintenance records will allow FEMA to provisionally accredit the levee until that deadline date. As the Chief Executive Officer of the City, FEMA requires your signature on this agreement. The Levee in question has been regularly inspected and maintained and is in excellent condition.

U.S. Department of Homeland Security
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

September 17, 2008

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable James B. Gibson, Mayor
City of Henderson
Henderson City Hall
240 Water Street,
PO Box 95050, Mail Stop 142
Henderson, NV 89009-5050

Dear Mayor Gibson:

This letter is in regard to levee with ID # 2100, known as the Equestrian Diversion C1EQ0297 levee, that is accredited on the effective Flood Insurance Rate Map (FIRM) and in the effective Flood Insurance Study (FIS) report for Clark County and incorporated areas. This levee is identified on an enclosure to this letter. The U.S. Department of Homeland Security's, Federal Emergency Management Agency (FEMA), is in the process of producing a revision to the countywide FIS report and Digital Flood Insurance Rate Map (DFIRM) for Clark County and incorporated areas. This map revision will also address levees shown on the currently effective FIRM as providing flood protection to assure that they meet FEMA levee criteria.

Flood hazard information presented on the effective FIRM and in the FIS report is based, in some areas, on flood protection provided by the levees identified on the enclosure. Based on the information available and on the mapping standards of the National Flood Insurance Program (NFIP) at the time that the FIS was performed, FEMA accredited the levees with providing protection from the flood that has a 1-percent-chance of being equaled or exceeded in any given year. The 1-percent-annual-chance flood also is referred to as the base flood.

For FEMA to continue to accredit this levee as providing protection from the base flood, the levee must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems" (copy enclosed). In accordance with 44 CFR 65.10(a), it is the responsibility of the community or other party seeking recognition of a levee system, to provide the data defined and outlined within the regulation. Specifically, the design and construction data provided must be certified by a registered professional engineer or by a Federal agency with responsibility for levee design.

FEMA understands that it may take time to acquire and/or assemble the documentation necessary to fully comply with 44 CFR 65.10. Therefore, FEMA has incorporated a process into the map production life cycle that, if needed, will provide the City of Henderson with additional time to submit all the necessary documentation. Initiation of this process can take place only if the levee owner and a representative of each impacted community sign and return the enclosed agreement to the FEMA Region IX office within 90 days of the date of this letter (before December 16, 2008).

In addition, the following must be provided:

- A copy of the adopted operation and maintenance plan for the levee; and
- Records of levee maintenance and operation, as well as tests of the mechanized interior drainage systems, if applicable.

Completion and submittal of the agreement, as well as the operation and maintenance plan and records, will serve as an official request that FEMA label the levee as a Provisionally Accredited Levee (PAL) on the DFIRM and will serve as agreement that, to the best of your knowledge, the levee meets the criteria of 44 CFR 65.10. It is the responsibility of the levee owner to submit the data required by 44 CFR 65.10 before FEMA can accredit the levee as providing protection from the base flood. The completed package must be submitted to the FEMA Region IX office before December 16, 2008 for the levee to receive the PAL designation. Please note that a levee that has maintenance deficiencies is not eligible for PAL consideration.

By endorsing the enclosed agreement, you state that all the necessary documentation will be provided within 2-years to comply with 44 CFR 65.10; that is before December 16, 2010. If you are unable to submit all the documentation necessary to meet the criteria of 44 CFR 65.10 before this date, FEMA will initiate a map revision to redesignate certain areas on the landward side of the levee as floodprone.

Levees will be labeled as PALs during the 24-month period to convey to map users that levee certification verification is underway. FEMA recommends that the levee owner and the impacted communities implement outreach efforts to inform affected property owners that an assessment of the levee is underway. FEMA also encourages the purchase of flood insurance, even though coverage is not federally required for the areas landward of the accredited levee.

If the documentation necessary to fully comply with 44 CFR 65.10, including an existing operation and maintenance plan and record of on-site inspection, is readily available, please submit the data to this office. Upon receipt of your submittal, FEMA will review the data and determine whether the levee will continue to be accredited with providing protection from the base flood.

If the only grounds for the levee in question not currently meeting the 44 CFR 65.10 criteria or PAL requirements are **maintenance issues**, then the FEMA Region IX office must be contacted by letter to bring attention to the matter before the end of this 90-day period to submit the enclosed PAL agreement. If you notify FEMA that the levee has known maintenance deficiencies, then a 1-year correction period can be provided to remedy these deficiencies. This 1-year correction period would begin on December 16, 2008, if you notify FEMA within 90 days of the date of this letter. During the 1-year correction period, FEMA will move forward with the current flood hazard mapping project as if the areas landward of the levee is to be located in a Special Flood Hazard Area (SFHA); the mapped area subject to inundation by the base flood. However, FEMA will delay issuance of the Letter of Final Determination (LFD) and effective DFIRM until the 1-year correction period has elapsed.

For FEMA to remove the SFHA landward of the levee, the following requirements must be met within the 1-year correction period:

- All the criteria contained in 44 CFR 65.10 submitted to FEMA, <u>or</u>
- Submittal of the entire PAL application, including the following documentation:

- An agreement signed by the community and/or levee owner stating that the PAL designation is warranted because the levee meets the requirements of 44 CFR 65.10;
- A copy of the adopted operation and maintenance plan for the levee; and
- Records of levee maintenance and operation, as well as tests of the mechanized interior drainage systems, if applicable.

Once the 1-year correction period has expired, FEMA will assess any submitted data and determine whether any mapping revisions are necessary. If no data have been submitted within the 1-year correction period, or if the submitted data are determined inadequate, FEMA will issue the LFD and effective DFIRM to show the areas landward of a maintenance deficient levee as located in a SFHA. However, if all of the criteria of 44 CFR 65.10 or the entire PAL application is submitted before the 1-year correction period has elapsed, then FEMA will show the levee on the newly effective DFIRM as accredited or provisionally accredited, as applicable.

If you have additional questions regarding the specific submittal requirements, please contact, Eric Simmons of my staff, either by telephone at (510) 627-7029 or by facsimile at (510) 627-7147. We look forward to working with you and community officials to address this important matter. If there is anything we can do to facilitate the submittal process, please let us know.

Sincerely,

Sally Ziolkowski

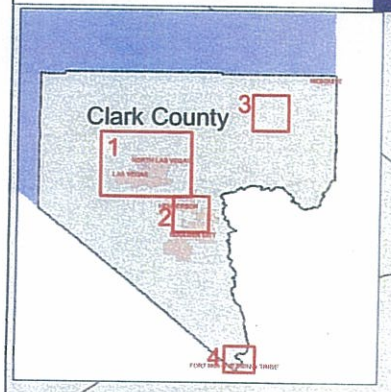
Sally Ziolkowski, Director
Mitigation Division

Enclosures:
- Requirements of 44 CFR Section 65.10: Mapping of Areas Protected by Levee Systems
- Letter of Agreement and Request for Provisionally Accredited Levee (PAL) Designation and Agreement to Provide Adequate Compliance With the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10)
- Levee Status Map
- Levee Status Table

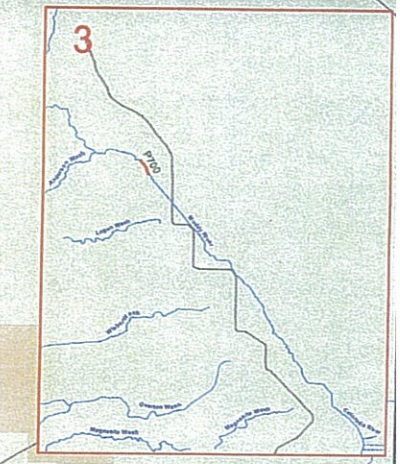
cc: Mary Kay Peck, City Manager, City of Henderson
Curt Chandler, Land Development Manager & Floodplain Administrator, City of Henderson
Rory Reid, Chairperson, Clark County Board of Commissioners
Virginia Valentine, County Manager, Clark County
Layne Weber, Principal Engineer & Floodplain Administrator, Clark County
Kevin Eubanks, Assistant General Manager, Clark County Regional Flood Control District
Kim Groenewold, Nevada Division of Water Resources, NFIP State Coordinator
Senator Reid State Office
Senator Ensign State Office
Representative Heller District Office

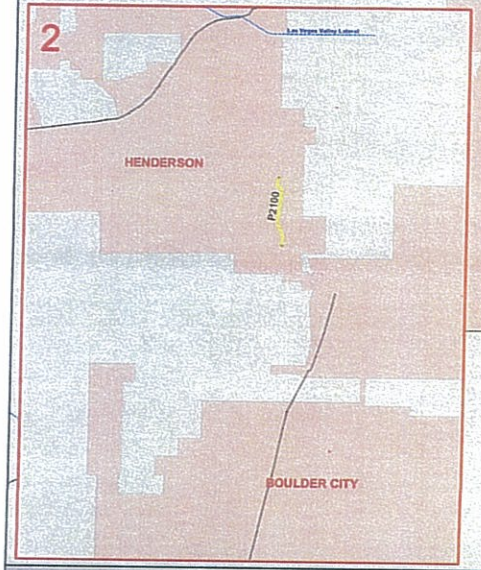
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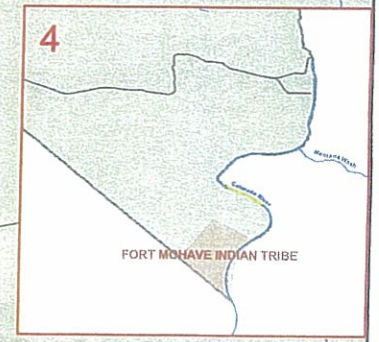
Clark County Levee Status



1







P800
P1400
P1200
P1300
NORTH LAS VEGAS
P1100
P1500
LAS VEGAS
P1800

Legend

Levees

- Levee is certified and full accreditation planned
- Certification pending resolution of O&M deficiencies
- May be PAL eligible
- May be PAL eligible pending resolution of O&M deficiencies
- Not certifiable against 1% annual chance flood

NOTE: This map only depicts the location of levees currently shown as providing protection against the 1% annual chance (100 year) flood on an effective Flood Insurance Rate Map (FIRM) or Letter Of Map Revision (LOMR)

FLOOD MAP MODERNIZATION

0 1.25 2.5 5 Miles

N

Created by: Michael Baker Jr, Inc.
Contact: Mike Skowronek (510) 879-5958
Date: Aug 29, 2008

Clark County Levee Status

August 27, 2008

Levee ID	Type	USACE Program Levee	Community	Flooding Source	Levee Status *	Location	Organization	Comment
P1100	Embankment Acting as Levee	No	City of Las Vegas	Unnamed Wash Along North Rancho Drive	Not PAL Eligible	US 95 along unnamed wash from Painted Mirage Road to Thomas Street	Nevada Department of Transportation	This structure requires new study and certification
P1600	Embankment Acting as Levee	No	City of Las Vegas	Urban	Not PAL Eligible	Rancho Drive along unnamed wash from Harvest Time Drive to Riverside Drive	Nevada Department of Transportation	Road embankment, channel, and culvert
P800	Levee	No	City of Las Vegas	Las Vegas Wash Moccasin Diversion	May be PAL A Eligible	Along Las Vegas Wash 2000 ft upstream of Homestead Road and 1000 ft upstream of Rainblow Boulevard	City of Las Vegas	May be eligible for PAL agreement
P1400	Levee	No	City of North Las Vegas	Range Wash Fan	May be PAL A Eligible	West Range Wash Diversion Dike from Nellis Airforce Base to North Las Vegas Wash Detention Basin	City of North Las Vegas	This structure requires new study and certification
P1650	Levee	No	City of Las Vegas	Las Vegas Wash	May be PAL A Eligible	Along Las Vegas Wash from Vegas Valley Drive to 3300 ft downstreams	City of Las Vegas	This structure is incorporated in the new study
P700	Levee	No	Clark County Unincorporated Area	Muddy R. Wells Siding	Not PAL Eligible	Along Muddy River from Wells Avenue to Waite Avenue	Private	CCRFD has indicated they do not wish to pursue a PAL for this structure. The levee may be below the 100-year flood elevations. This may not be an accredited levee.
P2100	Levee	No	City of Henderson	Unnamed Washes	May be PAL A Eligible	Along Foothills Drive from Equestrian Drive to South Boulder Highway	City of Henderson	Need certification information; *Watershed map from Case No. 03-09-0270P is on file. Designed as a diversion levee and is operated and maintained as such by City of Henderson with CCRFCD funds.*
P2200	Levee	No	Clark County Unincorporated Area	Colorado River	May be PAL A Eligible	Along Colorado River between Needles Highway and Camel Trail Road	Bureau of Reclamation	Letter from BOR that addresses their objective in construction of the levee is on file

*** May be PAL A Eligible:** Levees not in USACE program that are shown as providing base flood protection on an effective FIRM or LOMR, and may be eligible for PAL

*** May be PAL B Eligible:** Levees in USACE program that are shown as providing base flood protection on an effective FIRM or LOMR, and may be eligible for PAL

*** May be PAL C-2 Eligible:** Levees in USACE program that are shown as providing base flood protection on an effective FIRM or LOMR, and that have known deficiencies where USACE offered a 1-year "maintenance deficiency correction period"

CITY OF HENDERSON
240 Water Street
P. O. Box 95050
Henderson, NV 89009

December 9, 2008

Mr. Eric Simmons
FEMA Region IX – Mitigation Division
1111 Broadway, Suite 1200
Oakland, California 94607-4052

Dear Mr. Simmons;

In the wake of catastrophic levee failures in the Midwest and the Gulf Coast and knowing that many densely populated areas of our country exist behind aging levee systems the Federal Emergency Management Agency (FEMA) has undertaken a levee certification program nationwide. The Clark County Regional Flood Control District (CCRFCD) provided FEMA a list of flood control facilities and major roadway embankments which have an effect on flood hazard map delineations. FEMA has weighed this list with their policies and criteria and selected several levees in Clark County and incorporated areas which they believe warrant recertification as adequate to protect areas from a 1 % annual chance flood (100-year flood).

This letter is being sent with the Provisionally Accredited Levee Agreement form to provide additional information regarding the Equestrian Diversion Levee C1EQ0297, Levee ID#2100, located in the City of Henderson (City). The levee is an integral part of the Equestrian Detention Basin system that was designed and constructed to provide 100-year base flood protection for citizens and property in the C-1 watershed. The riprap-lined levee is a passive facility that is approximately 10-feet in height and 9000-feet in length that requires no mechanized interior drainage system. The Equestrian Detention Basin system is part of the CCRFCD Las Vegas Valley Master Plan (LVVMP), which makes it eligible for funding under the CCRCFD Maintenance Work Program (MWP). The MWP was created to assure that flood control projects included in the LVVMP are maintained at a level that maximizes their useful life and allows them to function at design capacity. The CCRFCD Operations and Maintenance Manual is the document that establishes overall policies and levels of service, develops operating procedures, and requires ongoing inspection and reporting procedures for all regional flood control facilities.

The City operates, inspects, and maintains the levee through the MWP with in-house support staff. The facility is inspected once per year at a minimum, and after every major storm event in the C-1 watershed. Maintenance is performed as identified by the facility inspections and has typically consisted of trash and debris removal and vegetation control. The levee embankment has not required structural maintenance or repairs to date due to deposition, erosion, embankment or foundation stability issues, or settlement. Included with this letter are copies of the inspection reports for the last three years and the executed Inter-local Agreements between the City and CCRFCD showing that the levee is included in the MWP and that funding was allocated for the inspection, operation, and maintenance of the facility.

Based upon the information sent regarding the certification process, the City understands that additional information must be submitted to verify that the Equestrian Diversion Levee C1EQ0297, Levee ID#2100, complies with the criteria of the Code of Federal Regulations, Title 44, Section 65.10, titled "Mapping of Areas Protected by Levee Systems." The CCRFCD has solicited proposals from qualified engineering firms with an interest in preparing the levee certification documentation for facilities within Clark County and Incorporated Areas, Nevada that FEMA believes warrant recertification as adequate to protect areas from a 1 % annual chance flood. Once the consultant is selected and the work to certify the levee is complete it is expected that the necessary documentation will be submitted by CCRFCD before December 16, 2010. Please do not hesitate to contact the City if there are any questions.

Sincerely,

Robert A. Murnane, P.E.
Public Works Director

Letter of Agreement and Request for Provisionally Accredited Levee (PAL) Designation and Agreement to Provide Adequate Compliance with the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10)

PAL Agreement Form for Clark County

We, the undersigned, have received a letter from FEMA dated September 17, 2008 with an enclosed *"Levee Status Map"* and *"Levee Status Table"* and enclosed document titled "*Requirements of 44 CFR Section 65.10: Mapping of Areas Protected by Levee Systems.*" We understand that FEMA is in the process of providing an updated Flood Insurance Rate Map for Clark County, NV and that the flood hazards around levee(s) identified on the *Levee Status Map* and *Levee Status Table* with unique levee ID number(s) ____, ____, ____, ____, ____ will be remapped to reflect that these levees have been designated a PAL. This/these levee(s) or levee system(s) is/are also known as _____.

To the best of our knowledge, the levee(s) identified above meet the criteria of 44 CFR 65.10 and has/have been maintained in accordance with an adopted operation and maintenance plan. For Scenario A (non-USACE Program) levees, this must be evidenced by an attached Operation and Maintenance Plan and records of levee maintenance and operation, as well as Test Records of Mechanized Interior Drainage System. We hereby submit to FEMA within 90 days (before December 16, 2008) our agreement to provide FEMA with all the necessary information to show that the levee(s) identified above comply with 44 CFR 65.10. We understand that this documentation will be provided before December 16, 2010. Providing the information described in 44 CFR 65.10 will allow FEMA to move forward with the flood mapping for Clark County. We fully understand that if complete documentation of compliance with 44 CFR 65.10 is not provided within the designated timeframe of 24 months, FEMA will initiate a revision to the Flood Insurance Rate Map for Clark County to redesignate the area as floodprone.

Levee Owner Representative (signature): _____ Date: 12/9/08

Levee Owner Representative (print name): ROBERT MURNANE

Levee Owner Title/Organization (print): CITY OF HENDERSON, NEVADA DIRECTOR OF PUBLIC WORKS.

Community CEO (signature): _____ Date: 12-9-08

Community CEO (print name): MARY-KAY PECK

Community Name (print): CITY OF HENDERSON, NEVADA

Other, if applicable (signature): _____ Date: _____

Other, if applicable (print name): _____

Required Attachments for Scenario A (non-USACE Program) Levees only:

- Operation and Maintenance Plan and Records
- Test Records of Mechanized Interior Drainage System

Instructions for Completing this Form:

- On this PAL Agreement Form, fill-in the levee ID numbers and levee(s) name/description for which the Provisionally Accredited Levee (PAL) designation is requested. A separate PAL Agreement Form is recommended for each unique levee owner/levee system. Make copies of this blank form to request PAL designation for multiple levee systems, as necessary.
- This document is available on-line (in a PDF format that can be filled-in electronically) via the link named "Generic PAL Agreement Form for Region IX" at http://rmc.mapmodteam.com/rmc9/Fact_Sheets.htm

FEMA

Provisionally Accredited Levee (PAL) Progress Report

Template Updated 7/3/08 for FEMA Region IX Use

Guidance on Completing this PAL Progress Report: FEMA's intent is for levee owners to submit this PAL Progress Report for each hydraulically independent levee system. If separate PAL Agreement forms were submitted by a levee owner for each levee segment within the same levee system, only 1 PAL Progress Report is required for this levee system. If a PAL Agreement form was submitted by a levee owner for multiple levee segments within different levee systems, only 1 PAL Progress Report is required for this PAL Agreement form, but it should document the status of all levee segments on the PAL Agreement form and identify those levee segments that have exceptions to meeting the criteria below.

I. Levee Identification

PAL Scenario: A1

PAL Period: Start Date: December 16, 2008 End Date: December 16, 2010

Progress Report due date 12 months after 91st day of PAL Period.

Progress Report Due Date: December 16, 2009 **FEMA Received Date:**

FEMA Region: IX

State/Territory: NV

County: Clark

Community: City of Henderson

Levee Name(s) and/or ID(s): Equestrian Diversion (ID# 2100) **Flooding Source(s)** Unnamed Washes

Levee Owner Name: City of Henderson **Levee Owner Agency:** City of Henderson

Contact information: Albert Jankowiak **Phone #:** (702) 267-3024

Project Officer (FEMA): Eric Simmons **Phone #:** (510) 627-7029

II. Status Report: Report By Certification Requirement (44 CFR 65.10)

Requirement #: 1 **Description:** Demonstrate that all levees provide the minimum required freeboard [44 CFR 65.10(b)(1)].

Completion Dates and Status: **N/A due to USACE Certification?**

March 31, 2010	:Planned	: Actual	90%	: Estimated % Work Complete

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

A new hydraulic model of the existing condition geometry of the Equestrian Levee (EL) was created using HEC-RAS and new survey information obtained in September 2009. The new hydraulic model was created because no electronic model was available and there were some minor differences in the surveyed cross sections when compared to the hydraulic model submitted in the "Equestrian Detention Basin LOMR" prepared by Poggemeyer Design Group dated December 21, 1998. The new hydraulic model shows that the EL will meet the FEMA freeboard requirements, except for the 3.5 feet of freeboard required at the most upstream end of the levee (approximately 180 ft). At this section, the calculated freeboard ranges from 1.9-2.9 ft and total flow collected is 189 cfs with velocities ranging from 4-6 ft/s. The freeboard at the upstream end of the levee is being reviewed in more detail, but it is anticipated that the freeboard condition will be satisfactory.

Requirement #: 2 **Description:** Demonstrate that all openings have been provided with appropriate closure devices that are a structural part of the system [44 CFR 65.10(b)(2)].

Completion Dates and Status: **N/A due to USACE Certification?**

N/A	**:Planned**	N/A	**: Actual**	N/A	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

No Activity - This requirement is not applicable for this levee system.

Requirement #: 3 **Description:** Demonstrate through engineering analyses that no appreciable erosion of the levee embankment can be expected during the base flood [44 CFR 65.10(b)(3)].

Completion Dates and Status: **N/A due to USACE Certification?**

March 31, 2010	**:Planned**		**: Actual**	70%	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

The erosion analysis submitted with the "Equestrian Detention Basin LOMR" will be reviewed to determine if the analysis reflects the existing condition of the levee system. If the review does not adequately support the lack of protection along the levee embankment, additional embankment protection analysis will be performed.

Requirement #: 4 **Description:** Evaluate through engineering analyses the levee embankment stability [44 CFR 65.10(b)(4)].

Completion Dates and Status: **N/A due to USACE Certification?**

March 31, 2010	**:Planned**		**: Actual**	20%	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

Based on the data submitted in the "Geotechnical Investigation - Equestrian Detention Basin" prepared by Kleinfelder dated January 19, 1994, the test pits did not extend to a depth below the levee foundation based on criteria outlined in EM 1110-2-1913. Therefore, an additional 7 borings will be drilled to a depth of 30 ft below the levee crest at intervals of approximately 2000 ft along the length of the levee alignment. The purpose of these borings is to document as-built conditions of the existing structure and to gather data to support that the subsurface conditions along the alignment are consistent to a minimum depth equal to the levee height.

A seepage analysis will be performed which considers depth of water and duration of loading for the design flood at critical locations along the levee alignment where the embankment geometry indicates the seepage path to be shortest. An estimate of the time required for steady-state seepage to occur will be included in the analysis to aid in assessing the applicability of the transient seepage analysis. A total of four sections will be analyzed.

A slope stability analysis will be performed and include the seismic loading for the end of construction case and incorporate the results of the seepage analysis.

Encroachments and a waterline penetration along the levee were documented during the initial geotechnical inspection. Additional assessment, including a review of construction documents, exploration, sampling, and testing will be performed at the site of the waterline crossing locations to evaluate potential impacts to embankment and foundation stability, such as reductions in seepage path.

Requirement #: 5 **Description:** Assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained [44 CFR 65.10(b)(5)].

Completion Dates and Status: **N/A due to USACE Certification?**

March 31, 2010	**:Planned**		**: Actual**	20%	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

A settlement analysis, including a discussion of methods or procedures used in the analysis, is not provided in the geotechnical report for the EL. Any anticipated settlement is expected to have occurred due to the age of the structure and the expected low compressibility of the granular embankment and foundation soils. A settlement analysis will be performed for documentation purposes which considers the results of the additional borings (mentioned in Requirement #4 Summary), survey data and engineering judgment.

Requirement #: 6 **Description:** Analyze the interior drainage; identify the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood [44 CFR 65.10(b)(6)].

Completion Dates and Status: **N/A due to USACE Certification?**

N/A	**:Planned**	N/A	**: Actual**	N/A	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

No Activity - This requirement is not applicable for this levee system.

Requirement #: 7 **Description:** Adopt and submit an official operation manual [44 CFR 65.10(c)].

Completion Dates and Status:

N/A	**:Planned**	N/A	**: Actual**	N/A	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

No Activity - This requirement is not applicable for this levee system.

Requirement #: 8 **Description:** Adopt and submit an official maintenance plan [44 CFR 65.10(d)].

Completion Dates and Status:

March 31, 2010	**:Planned**		**: Actual**	90%	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

The City of Henderson (COH) has adopted the Clark County Regional Flood Control District's (CCRFCD) Operation and Maintenance Manual (O&M Manual, amended January 11, 2007). The annual Maintenance Contract between the COH and CCRFCD lists facilities to be maintained and the responsible party for maintenance activities. A copy of the O&M Manual was submitted with the PAL Agreement Form.

The maintenance manual is being reviewed to ensure that the manual meets the minimum FEMA criteria for levee maintenance. Maintenance activities and field visits/inspections are being performed.

Requirement #: 9 **Description:** Submit as-built plans of the levee certified by a Professional Engineer [44 CFR 65.10(e)].

Completion Dates and Status:

March 31, 2010	**:Planned**		**: Actual**	100%	**: Estimated % Work Complete**

Summary: (Significant milestones, problem identification, etc; Reason for slippage of schedule if objectives are not met; If no activity during period, just state "No Activity".)

The "Equestrian Detention Basin" as-built plans including the EL have been obtained and will be submitted to FEMA.

III. Overall Levee Certification Progress:

Estimated Total Progress Completed: 60%

Levee Certification Proceeding on Schedule:

Schedule: On Schedule **How Much?**

If certification progress is not proceeding as scheduled, please describe problems or issues with the potential to impact completion date or overall ability to certify levee.

(Attach documentation as required)

IV. Progress Code:

Green	***(On track for complete 65.10 submission as planned)***
Yellow	***(Problems/issues potential to impact 65.10 submission schedule)***
Red*	***(Complete 65.10 package submission will likely not meet deadline)***

Green

*** FEMA may require a meeting to discuss inadequate process and determine the next course of action (continue with collection of 65.10 requirements, proceed to de-accredit the levee, or other)**

V. Additional Comments:

APPENDIX III

As-Built Drawings

DEPARTMENT OF PUBLIC WORKS

Mayor:
ROBERT GROESBECK

Councilmen:
JACK CLARK
ANDY HAFEN
AMANDA CYPHERS
DAVID WOOD

City Manager:
PHILIP SPEIGHT

Director of Public Works:
MARK T. CALHOUN, P.E.

EQUESTRIAN DETENTION BASIN

CONTRACT NO. 95 - 96 * 02

APPROVALS

Mark T. Calhoun — 12-11-95
Mark T. Calhoun, P.E. No. 6585 — **Date**
Director of Public Works
City of Henderson

Kurt R. Segler — 12-11-95
Kurt R. Segler — **Date**
Utility Services Manager
City of Henderson

Gale W. Fraser, II — 12/4/95
Clark County Regional Flood Control District — **Date**
Gale W. Fraser II, P.E. – General Manager/Chief Engineer

Nyla Smith — 10.20.95
Sprint Central Telephone Company — **Date**

10/23/95
Nevada Power Company — **Date**

10-23-95
Southwest Gas Company — **Date**

Prime Cable Company — **Date**

ENGINEERS PLANNERS SURVEYORS
POGGEMEYER DESIGN GROUP
2601 NORTH TENAYA WAY, LAS VEGAS, NEVADA 89128 (702) 255-8100

FUNDED BY:
CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT

STAMP

OCT. 12, 1995

RECORD DRAWINGS

FILENAME: 184C-CA2.DWG

GENERAL NOTES

1. ALL CONSTRUCTION SHALL CONFORM TO THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, OFFSITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, LATEST EDITION AND THE UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, OFFSITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, LATEST EDITION.
2. APPLICATION FOR INSPECTION BY THE CITY OF HENDERSON PUBLIC WORKS SHALL BE MADE BY THE CONTRACTOR AT LEAST 24 HOURS BEFORE THE INSPECTION SERVICES WILL BE REQUIRED, 565-2136 OR 565-2140.
3. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE PROSECUTED TO COMPLETION WITHOUT DELAY SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.
4. THE CONTRACTOR SHALL TAKE ALL NECESSARY AND PROPER PRECAUTIONS TO PROTECT ADJACENT PROPERTIES FROM ANY AND ALL DAMAGE THAT MAY OCCUR FROM STORM WATER RUNOFF AND/OR DEPOSITION OF DEBRIS RESULTING FROM ANY AND ALL WORK IN CONNECTION WITH CONTRUCTION OF THIS PROJECT.
5. PRIOR TO FINAL ACCEPTANCE, A CERTIFIED LEGIBLE AS-BUILT DRAWING MUST BE SUBMITTED TO THE CITY OF HENDERSON. AS-BUILT MUST SHOW ALL CHANGES AND FIELD LOCATIONS. IN THE ABSENCE OF CHANGES, A COPY OF APPROVED DRAWINGS WILL BE REQUIRED STATING "INSTALLED AS PER DRAWINGS" AND CERTIFIED AS SUCH BY THE CONTRACTOR.
6. EXISTING UTILITIES ARE LOCATED ON PLANS FOR THE CONVENIENCE OF THE CONTRACTOR ONLY. THE CONTRACTOR SHALL BEAR FULL RESPONSIBILITY FOR THE PROTECTION OF UTILITIES NOT SHOWN ON THE PLANS OR NOT IN THE LOCATION SHOWN ON THE PLANS. THIS INCLUDES ALL SERVICE LATERALS OF ANY KIND.
7. THE CONTRACTOR IS ADVISED TO BECOME FAMILIAR WITH THE SUBSURFACE NATURE OF THE SOILS LOCATED WITHIN THE PROJECT LIMITS. A GEOTECHNICAL STUDY, PREPARED BY:

   ENGINEER KLEINFELDER, INC., LAS VEGAS, NV
   DATE: JANUARY 19, 1995
   JOB NUMBER 31-128834-001

   WHICH IS ON FILE AT THE OFFICE OF KLIENFELDER, INC., WHERE IT CAN BE REVIEWED. BIDDERS SHALL MAKE THEIR OWN INTERPRETATIONS OF THE DATA CONTAINED IN SAID REPORT UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS OR SPECIFICATIONS. THE CONTRACTOR SHALL NOT BE RELIEVED OF LIABILITY UNDER THE CONTRACT FOR ANY LOSS SUSTAINED AS A RESULT OF VARIANCES BETWEEN CONDITIONS INDICATED AND THE ACTUAL CONDITIONS ENCOUNTERED DURING THE PROGRESS OF THE WORK.
8. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING PUBLIC STREETS IMMEDIATELY AFTER THE FIRST GRADING WORK IS ACCOMPLISHED AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "NEVADA TRAFFIC CONTROL MANUAL"- CURRENT EDITION AND TO THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES"- CURRENT EDITION AND BE APPROVED BY THE CITY OF HENDERSON BEFORE CONSTRUCTION BEGINS.
9. PROTECTION AND REPLACEMENT OF SURVEY MONUMENTS OR PROPERTY STAKES NOT DELINEATED ON THE CONTRACT DRAWINGS SHALL BE THE CONTRACTOR'S RESPONSIBILITY. REPLACEMENT OF SURVEY MONUMENTS OR PROPERTY STAKES SHALL BE DONE TO THE CITY OF HENDERSON SURVEY SECTIONS SATISFACTION.
10. AFFECTED UTILITY COMPANIES SHALL BE NOTIFIED AT LEAST (2) WORKING DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION.
11. CALL BEFORE YOU DIG, 1-800-227-2600.
12. MODIFICATIONS TO EXISTING UTILITIES SHALL CONFORM TO THE OWNER'S UTILITY STANDARDS AND SPECIFICATIONS.
13. THE CONTRACTOR SHALL TAKE REASONABLE MEASURES TO PROTECT EXISTING IMPROVEMENTS FROM DAMAGE AND ALL SUCH IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATION SHALL BE REPAIRED OR RECONSTRUCTED TO THE ENGINEERS SATISFACTION AT THE EXPENSE OF THE CONTRACTOR.

A. GENERAL REQUIREMENTS

1. THE CONTRACTOR SHALL EXAMINE THE DRAWINGS AND SHALL NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DISCREPANCIES HE MAY FIND BEFORE PROCEEDING WITH THE WORK.
2. ALL OMISSIONS OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER BEFORE PROCEEDING WITH ANY WORK SO INVOLVED.
3. THE CONTRACTOR SHALL VERIFY AND BE RESPONSIBLE FOR ALL SITE CONDITIONS AND DIMENSIONS. HE SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES BETWEEN ACTUAL CONDITIONS AND INFORMATION SHOWN ON THE DRAWINGS BEFORE PROCEEDING WITH THE WORK.
4. THE CONTRACTOR SHALL SUPERVISE AND DIRECT HIS WORK AND HE SHALL BE SOLELY RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES.
5. SPECIFIC NOTES AND DETAILS SHALL TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS. WHERE THE NOTES, DRAWINGS, AND/OR SPECIFICATIONS DIFFER, THE MORE STRINGENT REQUIREMENT SHALL APPLY.
6. CONTRACTOR SHALL OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND FEES REQUIRED FOR CONSTRUCTION.

B. CONCRETE

1. CONCRETE USED IN THE WORK SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 3000 PSI AT AGE 28 DAYS.
2. ALL CONCRETE SHALL BE STONE CONCRETE UTILIZING AGGREGATE CONFORMING TO ASTM C33.
3. CEMENT SHALL BE TYPE V CONFORMING TO ASTM C150
4. ALL CONCRETE MIXES SHALL BE DESIGNED BY AN ASTM CERTIFIED INDEPENDENT TESTING LABORATORY WHO SHALL SUBMIT COPIES OF THE DESIGN FOR APPROVAL AND SHALL IN ADDITION SUBMIT COPIES OF 7 AND 28 DAY CYLINDER TEST RESULTS TO THE ENGINEER AND THE PUBLIC WORKS DEPARTMENT, AND OBTAIN APPROVAL PRIOR TO USE.
5. BEFORE CONCRETE IS PLACED THE CONTRACTOR SHALL COORDINATE AND VERIFY WITH ALL TRADES TO INSURE THE PROPER PLACEMENT OF ALL OPENINGS, SLEEVES, INSERTS, DEPRESSIONS, ETC RELATING TO THE WORK.
6. MINIMUM CONCRETE COVER OVER REINFORCING STEEL SHALL BE AS FOLLOWS : (UNLESS OTHERWISE NOTED)

   A. CONCRETE AGAINST EARTH (UNFORMED) 3"
   B. CONCRETE AGAINST EARTH (FORMED) 2"

7. CONCRETE SHALL NOT BE FREELY DROPPED MORE THAN 3 FEET.
8. CONSTRUCTION OR COLD JOINTS OTHER THAN THOSE SHOWN ON THE PLANS SHALL NOT BE MADE WITHOUT PRIOR APPROVAL BY THE ENGINEER. REINFORCEMENT MAY BE SPLICED TO FACILITATE HANDLING AND PLACEMENT SUBJECT TO THE APPROVAL OF THE ENGINEER.
9. ALL CONCRETE SHALL BE PLACED WITH A SLUMP NOT TO EXCEED 4".
10. AN INITIAL CURING OF CONCRETE SHALL IMMEDIATELY FOLLOW THE FINISHING OPERATION. THE CONCRETE SHALL BE KEPT CONTINUOUSLY MOIST OVERNIGHT BY USE OF ANY OF THE FOLLOWING :

    A. PONDING OR CONTINUOUS SPRINKLING
    B. ABSORPTIVE MAT OR FABRIC KEPT CONTINUOUSLY WET
    C. CURING COMPOUNDS APPLIED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE CURING COMPOUND MANUFACTURER

11. IMMEDIATELY FOLLOWING THE INITIAL CURING AND BEFORE THE CONCRETE HAS DRIED, ADDITIONAL CURING SHALL BE ACCOMPLISHED FOR 7 CUMULATIVE DAYS BY:

    A. CONTINUING THE METHOD USED FOR THE INITIAL CURING
    B. WATERPROOF PAPER
    C. OTHER MOISTURE-RETAINING COVERINGS AS APPROVED

12. ALL CORNERS OF FORMED SURFACES SHALL BE CHAMFERED 3/4" UNLESS SHOWN OTHERWISE.

C. REINFORCING STEEL

1. REINFORCING STEEL SHALL BE NEW STOCK, DEFORMED BARS CONFORMING TO ASTM A615, GRADE 40 (MINIMUM) UNLESS NOTED OTHERWISE. GRADE 60 BARS ARE ALLOWED.
2. ALL BARS SHALL BE FREE OF RUST, GREASE, MILL SCALE, OR ANY MATERIAL WHICH MIGHT AFFECT ITS BOND TO CONCRETE.
3. BENDING, PLACING, SPACING, CONCRETE PROTECTIVE COVER, SPLICING, AND ALL OTHER DETAILS OF REINFORCEMENT SHALL CONFORM TO THE "BUILDING CODE REQUIREMENT FOR REINFORCED CONCRETE" A.C.I.318-LATEST EDITION,CHAPTER 7 AND THE "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES" A.C.I. 315-LATEST EDITION.
4. ALL TESTING OF REINFORCING STEEL SHALL BE AS REQUIRED BY LOCAL BUILDING CODE.

D. SITE GRADING

1. ALL GRADING SHALL BE COMPLETED IN FULL CONFORMANCE WITH THE RECOMMENDATIONS OF THE SOILS ENGINEERING REPORT PREPARED BY KLIENFELDER INC., 6850 S. PARADISE ROAD, LAS VEGAS, NEVADA, 89119-3735, (702) 736-2936 FOR POGGEMEYER DESIGN GROUP DATED JAN 19, 1995, PROJECT NUMBER 31-128834-001
2. THE CONTRACTOR SHALL TAKE ALL REASONABLE PRECAUTIONS TO ABATE FUGITIVE DUST FROM BECOMING AIRBORNE, INCLUDING ANY VISIBLE PLUME OF DUST EXTENDING 200 YARDS FROM POINT OF ORIGIN OR BEYOND THE NEAREST PROPERTY LINE WHICHEVER IS LESS, AS A RESULT OF CONSTRUCTION ACTIVITIES. REASONABLE PRECAUTIONS INCLUDE, BUT ARE NOT LIMITED TO, SPRINKLING, COMPACTING, SEALING AND SWEEPING.

E. DEWATERING

1. THE CONTRACTOR SHALL BE COMPLETELY RESPONSIBLE FOR REMOVING EXCESSIVE GROUNDWATER, SURFACE WATER AND MISCELLANEOUS WATER WHICH IMPEDES THE EXECUTION OF THE CONTRACT.

LEGEND

- DETAIL/SECTION IDENTIFICATION LETTER OR NUMBER
- SHEET DETAIL IS SHOWN
- M.H. — EXISTING MANHOLE
- F.H. — EXISTING FIRE HYDRANT
- EXISTING SIGN
- P.P. — EXISTING POWER POLE
- W — EXISTING WATER LINE
- G — EXISTING GAS LINE
- E — EXISTING ELECTRICAL LINE
- SS — EXISTING SANITARY SEWER LINE
- SD — EXISTING STORM DRAIN LINE
- XX — EXISTING CONTOUR
- EXISTING CHAIN-LINK FENCE
- XX.XX — EXISTING ELEVATION
- EDGE OF EXISTING PAVEMENT
- M.H. — PROPOSED MANHOLE
- XXXX — PROPOSED CONTOUR
- PROPOSED SIGN
- W — PROPOSED WATER LINE
- SD — PROPOSED STORM DRAIN LINE
- X-X — PROPOSED CHAIN LINK FENCE
- XX.XX — NEW ELEVATION
- R/W — RIGHT OF WAY LINE
- CENTERLINE
- PROPERTY LINE

SHEET INDEX

CA-1 COVER SHEET
CA-2 NOTES
CA-3 PROJECT KEYMAP (ESTIMATED QUANTITIES)
CA-4 CONTROL PLAN
CA-5 DRAINAGE BASIN MAP
CA-6 BASIN CHARACTERISTICS
CA-7 BASIN CHARACTERISTICS

CG-1 DETENTION BASIN GRADING PLAN
CG-2 DETENTION BASIN GRADING PLAN
CG-3 DETENTION BASIN GRADING PLAN
CG-4 DETENTION BASIN GRADING PLAN
CG-5 DETENTION BASIN GRADING PLAN
CG-6 DETENTION BASIN GRADING PLAN
CG-7 DETENTION BASIN GRADING PLAN
CG-8 DETENTION BASIN GRADING PLAN
CG-9 OUTFALL STRUCTURE P & P (1"=40')

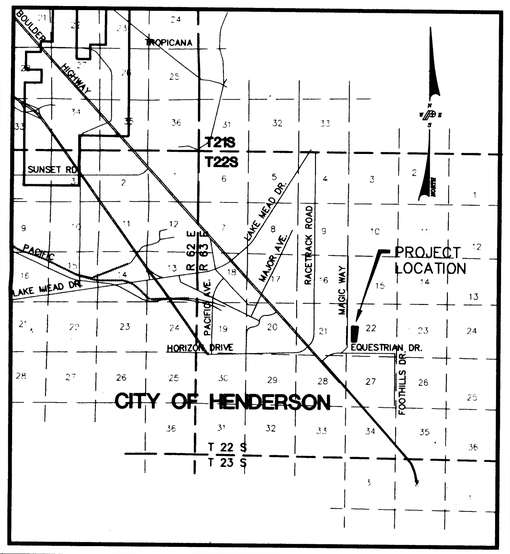
CH-1 EQUESTRIAN DRIVE CHANNEL P & P (1"=40')
CH-2 EQUESTRIAN DRIVE CHANNEL P & P (1"=40')
CH-3 EQUESTRIAN DRIVE CHANNEL P & P (1"=40')
CH-4 EQUESTRIAN DRIVE CHANNEL P & P (1"=40')
CH-5 EQUESTRIAN DRIVE CHANNEL P & P (1"=40')

CI-1 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-2 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-3 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-4 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-5 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-6 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-7 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-8 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-9 FOOTHILLS DRIVE CHANNEL P & P (1"=40')
CI-10 FOOTHILLS DRIVE CHANNEL P & P (1"=40')

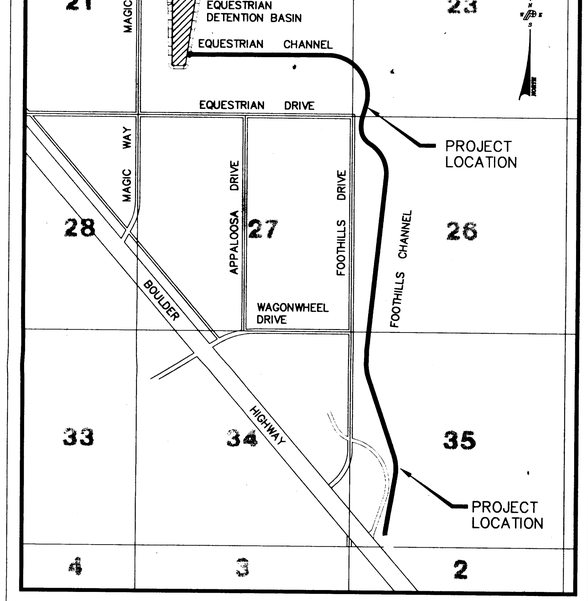
CN-1 EQUESTRIAN DRIVE CHANNEL CROSS SECTIONS AND DETAILS
CN-2 FOOTHILLS DRIVE CHANNEL CROSS SECTIONS AND DETAILS
CN-3 BASIN BERM CROSS SECTIONS/SCHEDULE
CN-4 BASIN SPILLWAY CROSS SECTIONS/SCHEDULE

CO-1 OUTLET STRUCTURE PLAN AND SECTIONS
CO-2 OUTLET STRUCTURE DETAILS
CO-3 STILLING WELL AND DETAILS
CO-4 MAGIC WAY INLET SECTION & DETAIL
CO-5 STILLING WELL INLET DETAILS
CO-6 PARTIAL SPILLWAY PLANS & DETAILS
CO-7 SPILLWAY DETAILS
CO-8 MAGIC WAY INLET PROFILE AND DETAILS
CO-9 SAINT ANTHONY FALLS STILLING BASIN DETAILS
CO-10 MISCELLANEOUS DETAILS
CO-11 MISCELLANEOUS DETAILS
CG-1 HYDROSEED AND WATER FOR 6 MOS. PER C.O. (SEE SHTS. CG-2 THRU CG-4, CG-7 & 8, CH-1 THRU 5, CI-1 THRU CI-10)

LOCATION MAP



VICINITY MAP



WATER NOTES

1. CONTRACTOR TO PROVIDE THRUST BLOCKS AS REQUIRED.
2. ALL LINES TO BE PRESSURE TESTED ACCORDING TO AWWA STANDARDS AND CHLORINATED TO STANDARD DWG. #518 PRIOR TO USE AND FINAL ACCEPTANCE.
3. ALL FLANGED FITTINGS TO BE COATED WITH EC-224 AND WRAPPED WITH 10 MIL THICK POLYETHYLENE.
4. NO OTHER UTILITY LINES MAY BE PLACED IN THE SAME TRENCH WITH WATERLINES.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL MATERIAL SPILLED ON EXISTING ROADWAYS ON DAILY BASIS.
6. ANY CONFLICT WITH EXISTING UTILITIES SHALL BE IMMEDIATELY CALLED TO THE ATTENTION OF THE ENGINEER.
7. CONTRACTOR SHALL PROVIDE APPURTENANCES TO PERFORM PRESSURE TESTS AND DISINFECTION AS REQUIRED BY THE CITY ENGINEER.

REVISION | DATE

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POGGEMEYER DESIGN GROUP
ENGINEERS - PLANNERS - SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STATE OF NEVADA — REGISTERED PROFESSIONAL ENGINEER — No. 9525 — TIMOTHY E. HARTER — CIVIL

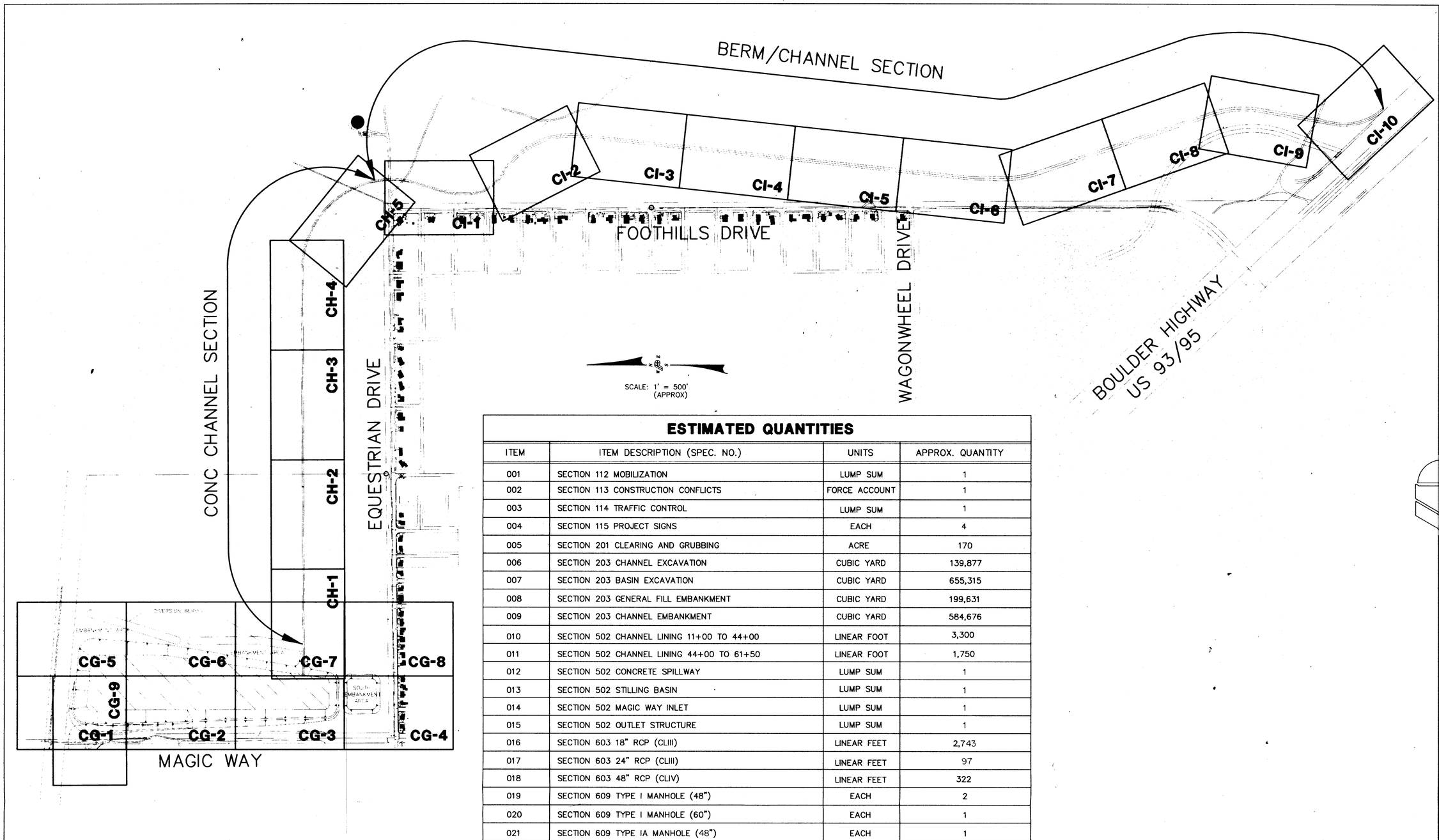
EQUESTRIAN DETENTION BASIN

NOTES

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	JGH/DRF
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CA-2 OF

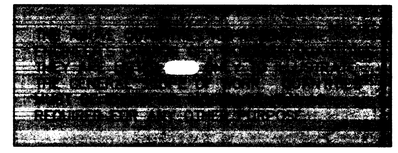
Call before you Dig. 1-800-227-2600

RECORD DRAWINGS



ESTIMATED QUANTITIES

ITEM	ITEM DESCRIPTION (SPEC. NO.)	UNITS	APPROX. QUANTITY
001	SECTION 112 MOBILIZATION	LUMP SUM	1
002	SECTION 113 CONSTRUCTION CONFLICTS	FORCE ACCOUNT	1
003	SECTION 114 TRAFFIC CONTROL	LUMP SUM	1
004	SECTION 115 PROJECT SIGNS	EACH	4
005	SECTION 201 CLEARING AND GRUBBING	ACRE	170
006	SECTION 203 CHANNEL EXCAVATION	CUBIC YARD	139,877
007	SECTION 203 BASIN EXCAVATION	CUBIC YARD	655,315
008	SECTION 203 GENERAL FILL EMBANKMENT	CUBIC YARD	199,631
009	SECTION 203 CHANNEL EMBANKMENT	CUBIC YARD	584,676
010	SECTION 502 CHANNEL LINING 11+00 TO 44+00	LINEAR FOOT	3,300
011	SECTION 502 CHANNEL LINING 44+00 TO 61+50	LINEAR FOOT	1,750
012	SECTION 502 CONCRETE SPILLWAY	LUMP SUM	1
013	SECTION 502 STILLING BASIN	LUMP SUM	1
014	SECTION 502 MAGIC WAY INLET	LUMP SUM	1
015	SECTION 502 OUTLET STRUCTURE	LUMP SUM	1
016	SECTION 603 18" RCP (CLIII)	LINEAR FEET	2,743
017	SECTION 603 24" RCP (CLIII)	LINEAR FEET	97
018	SECTION 603 48" RCP (CLIV)	LINEAR FEET	322
019	SECTION 609 TYPE I MANHOLE (48")	EACH	2
020	SECTION 609 TYPE I MANHOLE (60")	EACH	1
021	SECTION 609 TYPE IA MANHOLE (48")	EACH	1
022	SECTION 609 TYPE II MANHOLE	EACH	4
023	SECTION 610 RIP RAP	CUBIC YARD	5,908
024	SECTION 610 GROUTED RIP RAP	CUBIC YARD	267
025	SECTION 616 VEHICLE BARRICADE FENCE (ROCK)	LINEAR FOOT	3,730
026	SECTION 616 CHAIN LINK FENCE	LINEAR FOOT	12,015
027	SECTION 627 PERMANENT SIGNS	LUMP SUM	1
028	SECTION 629 RELOCATE 20" STEEL WATER LINE	LINEAR FEET	60
029	SECTION 670 USGS STILLING WELL	LUMP SUM	1
030	POST CONSTRUCTION DUST PALLIATIVE	LUMP SUM	1
031	HAUL (EXCESS MATERIAL)	YD. PER MILE	10,885



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POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STATE OF NEVADA REGISTERED PROFESSIONAL ENGINEER No. 5986 CIVIL

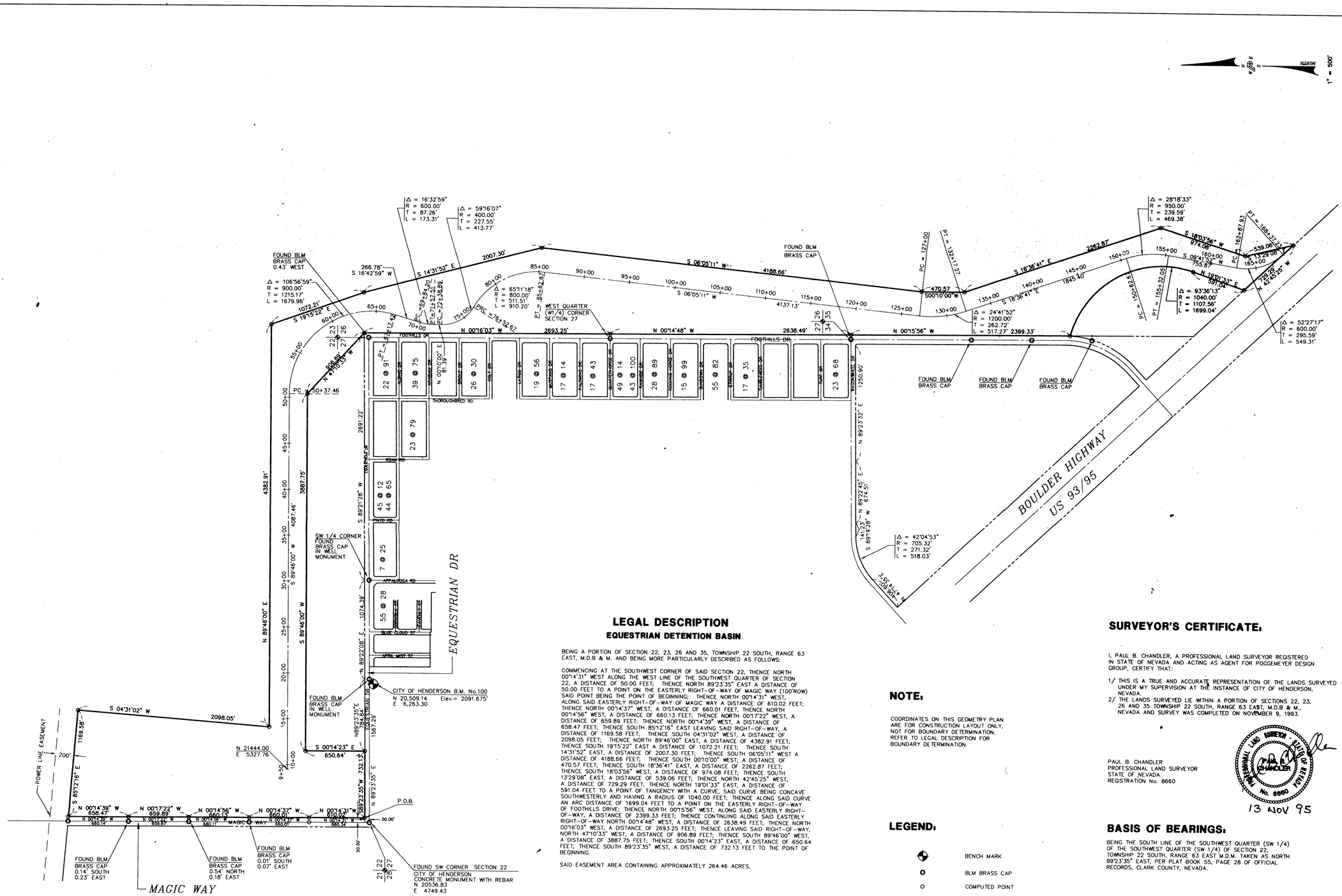
EQUESTRIAN DETENTION BASIN

PROJECT KEYMAP (ESTIMATED QUANTITIES)

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	RP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CA-3
OF	

RECORD DRAWINGS

FILENAME: 184C-CA4.DWG



LEGAL DESCRIPTION

EQUESTRIAN DETENTION BASIN

BEING A PORTION OF SECTION 22, 23, 26 AND 35, TOWNSHIP 22 SOUTH, RANGE 63 EAST, M.D.B & M. AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST CORNER OF SAID SECTION 22, THENCE NORTH 00°14'31" WEST ALONG THE WEST LINE OF THE SOUTHWEST QUARTER OF SECTION 22, A DISTANCE OF 50.00 FEET; THENCE NORTH 89°23'35" EAST A DISTANCE OF 50.00 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY OF MAGIC WAY (100'ROW) SAID POINT BEING THE POINT OF BEGINNING; THENCE NORTH 00°14'31" WEST, ALONG SAID EASTERLY RIGHT-OF-WAY OF MAGIC WAY A DISTANCE OF 610.02 FEET; THENCE NORTH 00°14'37" WEST, A DISTANCE OF 660.01 FEET, THENCE NORTH 00°14'56" WEST, A DISTANCE OF 660.13 FEET; THENCE NORTH 00°17'22" WEST, A DISTANCE OF 659.89 FEET; THENCE NORTH 00°14'39" WEST, A DISTANCE OF 658.47 FEET; THENCE SOUTH 85°12'16" EAST LEAVING SAID RIGHT-OF-WAY, A DISTANCE OF 1169.58 FEET; THENCE SOUTH 04°31'02" WEST, A DISTANCE OF 2098.05 FEET; THENCE NORTH 89°46'00" EAST, A DISTANCE OF 4382.91 FEET; THENCE SOUTH 19°15'22" EAST A DISTANCE OF 1072.21 FEET; THENCE SOUTH 14°31'52" EAST, A DISTANCE OF 2007.30 FEET; THENCE SOUTH 06°05'11" WEST A DISTANCE OF 4188.66 FEET; THENCE SOUTH 00°10'00" WEST, A DISTANCE OF 470.57 FEET; THENCE SOUTH 18°36'41" EAST, A DISTANCE OF 2262.87 FEET; THENCE SOUTH 18°03'56" WEST, A DISTANCE OF 974.08 FEET; THENCE SOUTH 13°29'08" EAST, A DISTANCE OF 539.06 FEET; THENCE NORTH 42°45'25" WEST, A DISTANCE OF 729.29 FEET; THENCE NORTH 19°01'33" EAST, A DISTANCE OF 591.04 FEET TO A POINT OF TANGENCY WITH A CURVE, SAID CURVE BEING CONCAVE SOUTHWESTERLY AND HAVING A RADIUS OF 1040.00 FEET; THENCE ALONG SAID CURVE AN ARC DISTANCE OF 1699.04 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY OF FOOTHILLS DRIVE; THENCE NORTH 00°15'56" WEST, ALONG SAID EASTERLY RIGHT-OF-WAY, A DISTANCE OF 2399.33 FEET; THENCE CONTINUING ALONG SAID EASTERLY RIGHT-OF-WAY NORTH 00°14'48" WEST, A DISTANCE OF 2638.49 FEET; THENCE NORTH 00°16'03" WEST, A DISTANCE OF 2693.25 FEET; THENCE LEAVING SAID RIGHT-OF-WAY, NORTH 47°10'33" WEST, A DISTANCE OF 906.89 FEET; THENCE SOUTH 89°46'00" WEST, A DISTANCE OF 3887.75 FEET; THENCE SOUTH 00°14'23" EAST, A DISTANCE OF 650.64 FEET; THENCE SOUTH 89°23'35" WEST, A DISTANCE OF 732.13 FEET TO THE POINT OF BEGINNING.

SAID EASEMENT AREA CONTAINING APPROXIMATELY 264.46 ACRES.

GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)
1 inch = 500 ft.

NOTE:

COORDINATES ON THIS GEOMETRY PLAN ARE FOR CONSTRUCTION LAYOUT ONLY, NOT FOR BOUNDARY DETERMINATION. REFER TO LEGAL DESCRIPTION FOR BOUNDARY DETERMINATION.

LEGEND:

- BENCH MARK
- BLM BRASS CAP
- COMPUTED POINT
- 17 @ 35 — PLAT NUMBER (BOOK No. @ PAGE No.)
- CENTERLINE
- PROPERTY LINE
- EASEMENT LIMIT LINE

SURVEYOR'S CERTIFICATE:

I, PAUL B. CHANDLER, A PROFESSIONAL LAND SURVEYOR REGISTERED IN STATE OF NEVADA AND ACTING AS AGENT FOR POGGEMEYER DESIGN GROUP, CERTIFY THAT:

1/ THIS IS A TRUE AND ACCURATE REPRESENTATION OF THE LANDS SURVEYED UNDER MY SUPERVISION AT THE INSTANCE OF CITY OF HENDERSON, NEVADA.
2/ THE LANDS SURVEYED LIE WITHIN A PORTION OF SECTIONS 22, 23, 26 AND 35 TOWNSHIP 22 SOUTH, RANGE 63 EAST, M.D.B & M., NEVADA AND SURVEY WAS COMPLETED ON NOVEMBER 9, 1993.

PAUL B. CHANDLER
PROFESSIONAL LAND SURVEYOR
STATE OF NEVADA
REGISTRATION No. 8660

PROFESSIONAL LAND SURVEYOR - STATE OF NEVADA - PAUL B. CHANDLER - No. 8660

13 NOV 95

BASIS OF BEARINGS:

BEING THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST M.D.M. TAKEN AS NORTH 89°23'35" EAST, PER PLAT BOOK 55, PAGE 28 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

BENCH MARK:

CITY OF HENDERSON BENCH MARK NO. 100 BEING DESCRIBED AS A BRASS CAP IN THE TOP OF THE CURB ON THE SOUTHWEST CORNER OF EQUESTRIAN DRIVE AND LONGMEADOW STREET. ELEVATION = 2,091.675' (637.544 METERS)

DATE	REVISION

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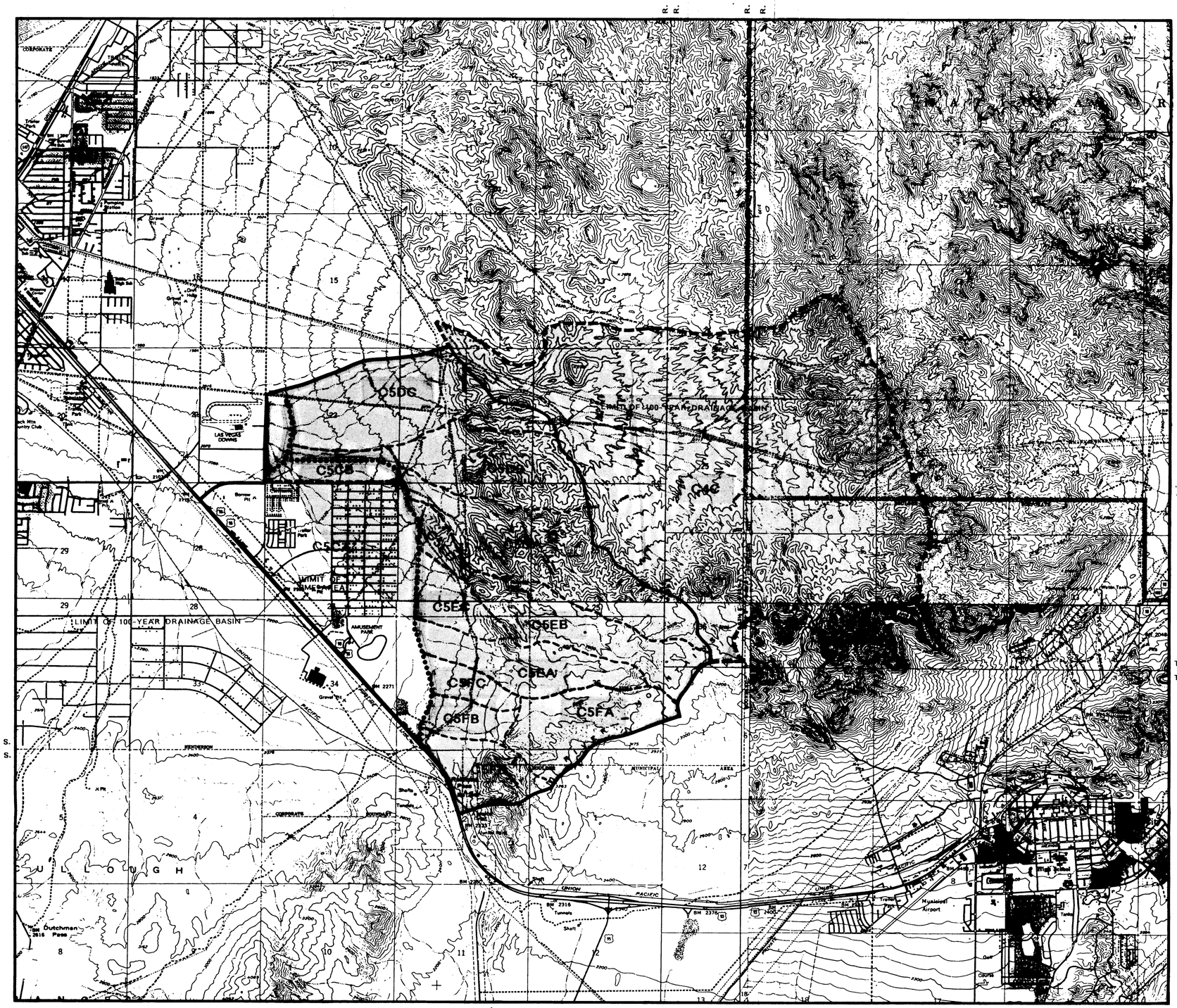
STAMP: PROFESSIONAL ENGINEER - STATE OF NEVADA - TIMOTHY B. CARTER - CIVIL - No. 5269 - RECEIVED MONITORING WELL

EQUESTRIAN DETENTION BASIN
CONTROL PLAN

JOB NUMBER	95184C
DESIGNED BY	PBC
DRAWN BY	LDA/DRF
CHECKED BY	PBC
DATE	11-13-95
SHEET NUMBER	CA-4 OF

RECORD DRAWINGS

FILENAME: 184-CA5.DWG



SCALE: 1"=2000'

GRAPHIC SCALE

2000 0 1000 2000 4000 8000

(IN FEET)
1 inch = 2000ft.

LEGEND

- 100 YEAR DRAINAGE BASIN BOUNDARY
- EQUESTRIAN FLOOD CONTROL FACILITIES
- SUB-BASIN BOUNDARY
- C4C — SUB-BASIN AREA DESIGNATION
- PROBABLE MAXIMUM FLOOD (PMF) AREA

HYDROLOGIC BASIN SUB-AREA	SIZE (SQ. MILE)	LAG TIME (HOURS)
C5FA	0.52	0.20
C5FB	0.20	0.35
C5FC	0.19	0.30
C5FD	0.32	0.29
C5EA	0.48	0.62
C5EB	0.60	0.64
C5EC	0.22	0.25
C5ED	0.10	0.17
C5DA	1.00	0.40
C5DB	0.66	0.52
C5DC	0.98	0.69
C5CB	0.21	0.49
C5CA	1.67	0.28
C4C	5.53	0.89

DATE	REVISION

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ENGINEERS PLANNERS SURVEYORS
2501 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-6100

STAMP: REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA TIMOTHY E. POGGEMEYER No. 5208 CIVIL

EQUESTRIAN DETENTION BASIN

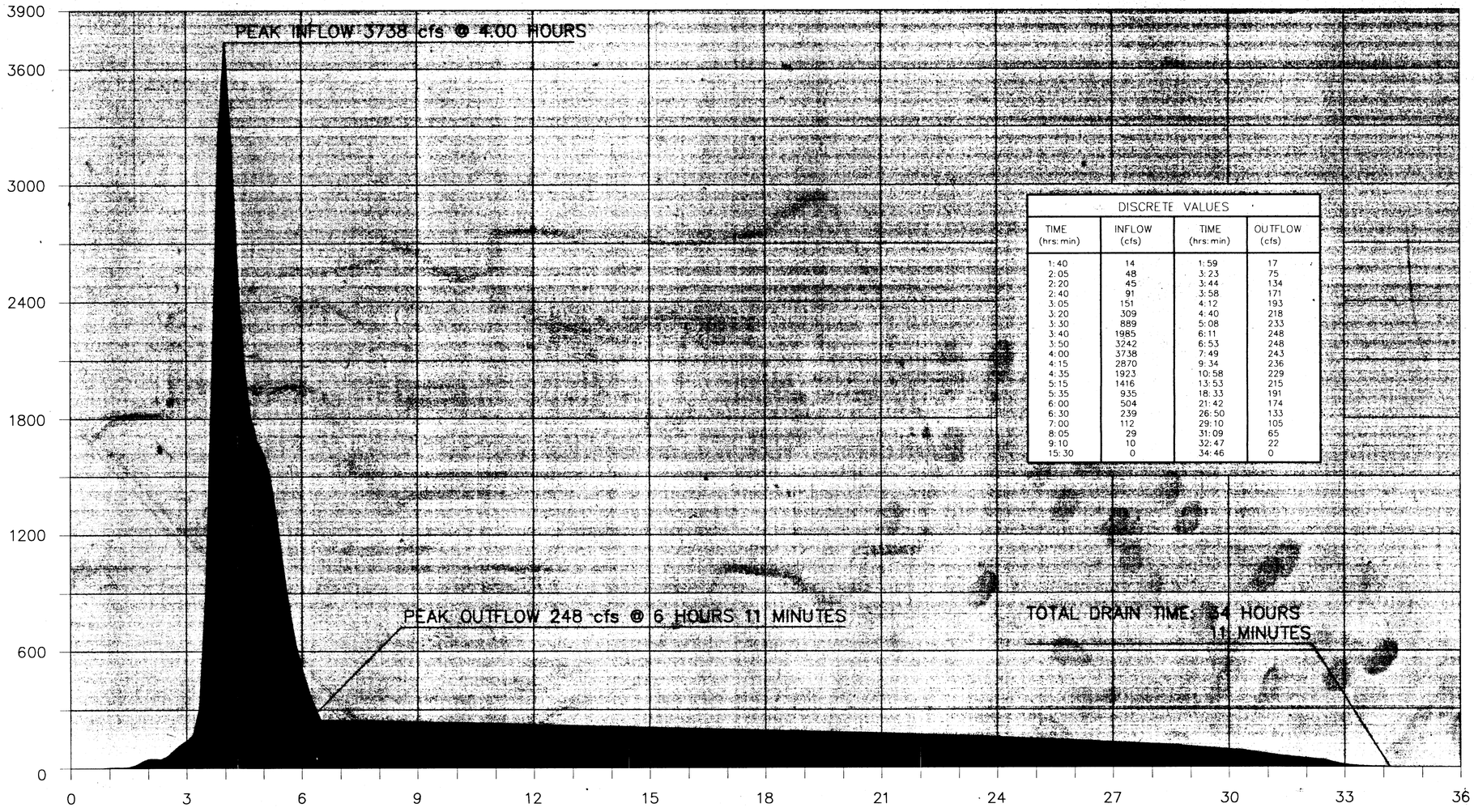
DRAINAGE BASIN MAP

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	RCP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CA-5

RECORD DRAWINGS

FILENAME: 184C-CA-2.DWG

INFLOW–OUTFLOW HYDROGRAPHS



DISCRETE VALUES

TIME (hrs:min)	INFLOW (cfs)	TIME (hrs:min)	OUTFLOW (cfs)
1:40	14	1:59	17
2:05	48	3:23	75
2:20	45	3:44	134
2:40	91	3:58	171
3:05	151	4:12	193
3:20	309	4:40	218
3:30	889	5:08	233
3:40	1985	6:11	248
3:50	3242	6:53	248
4:00	3738	7:49	243
4:15	2870	9:34	236
4:35	1923	10:58	229
5:15	1416	13:53	215
5:35	935	18:33	191
6:00	504	21:42	174
6:30	239	26:50	133
7:00	112	29:10	105
8:05	29	31:09	65
9:10	10	32:47	22
15:30	0	34:46	0

SCALE:
HORIZONTAL: 1" = 1.5 HOURS
VERTICAL: 1" = 300 CFS

NOTES:

1. INFLOW HYDROGRAPH COMPILED FROM 5 MINUTE COMPUTATIONAL INTERVALS
2. OUTFLOW HYDROGRAPH COMPILED FROM 7 MINUTE COMPUTATIONAL INTERVAL
3. OUTFLOW CURVE IS BASED UPON CLEARWATER FLOW FROM BASIN VOLUMES MODIFIED BY PROPORTIONAL DISTRIBUTION OF 42 ACRE–FEET OF SEDIMENT STORAGE

DATE	REVISION

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EQUESTRIAN DETENTION BASIN

BASIN CHARACTERISTICS INFLOW - OUTFLOW HYDROGRAPHS

JOB NUMBER	95184C
DESIGNED BY	JJD
DRAWN BY	DRF
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CA-6
OF	

RECORD DRAWING

RECORD DRAWINGS

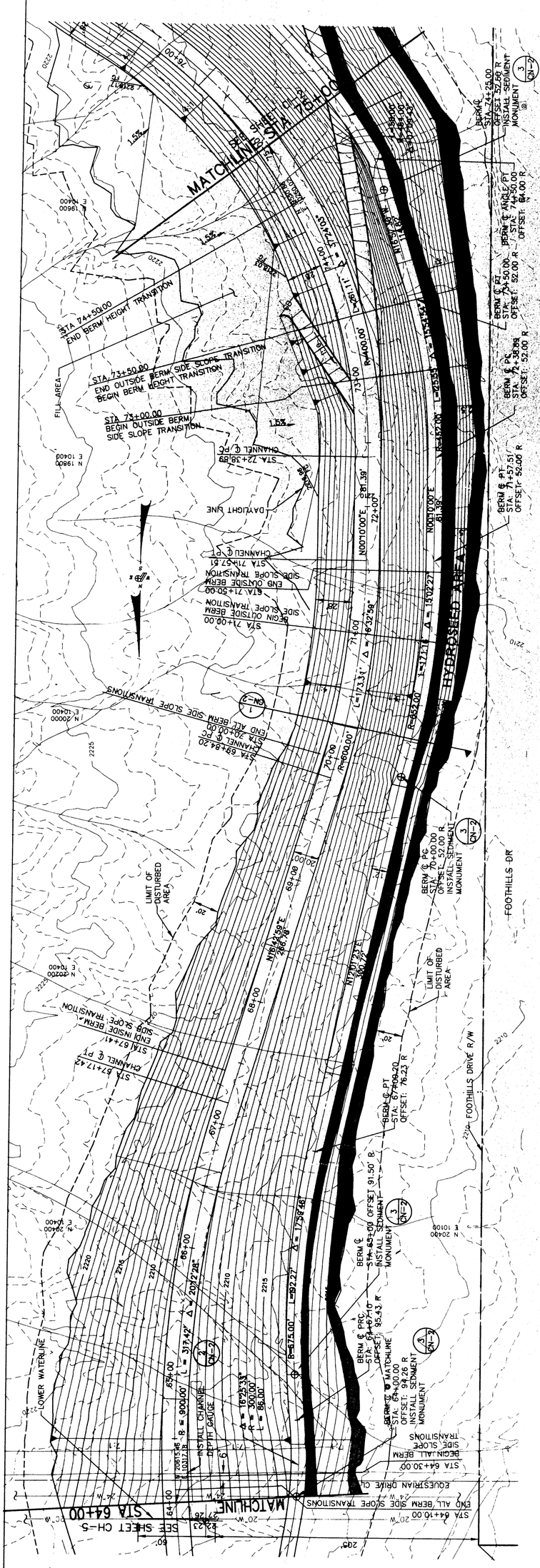
EQUESTRIAN DETENSION BASIN
FOOTHILLS DRIVE CHANNEL
PLAN & PROFILE
STA 64+00 TO STA 75+00

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CI-1 of

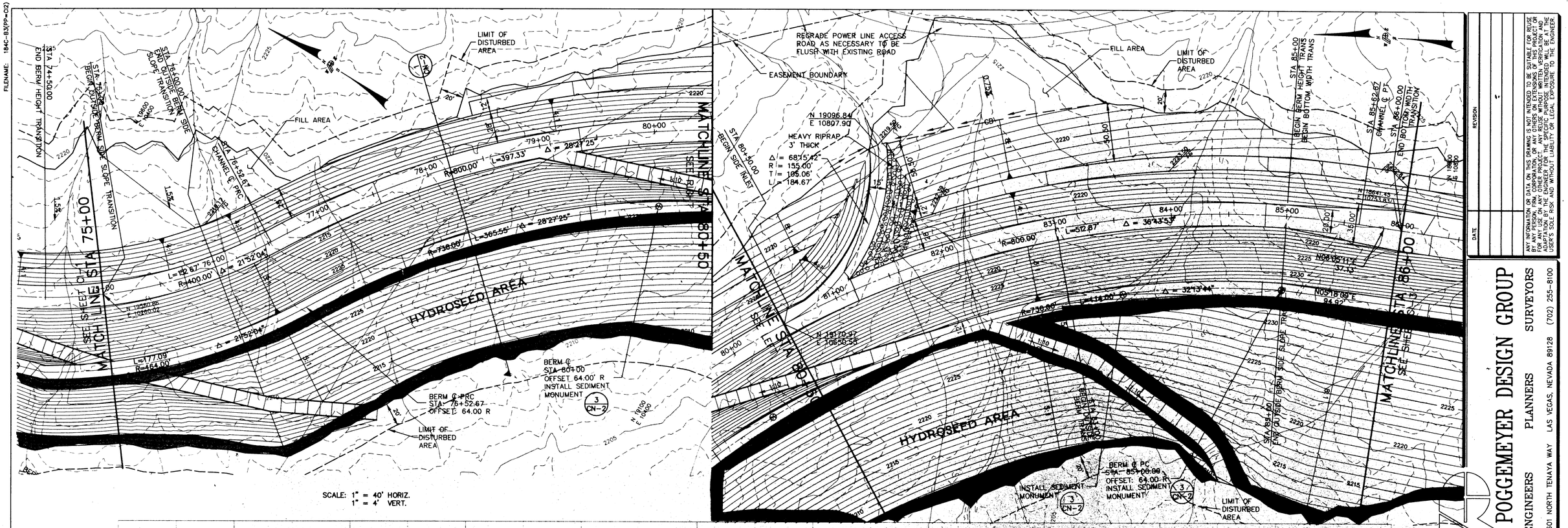
POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

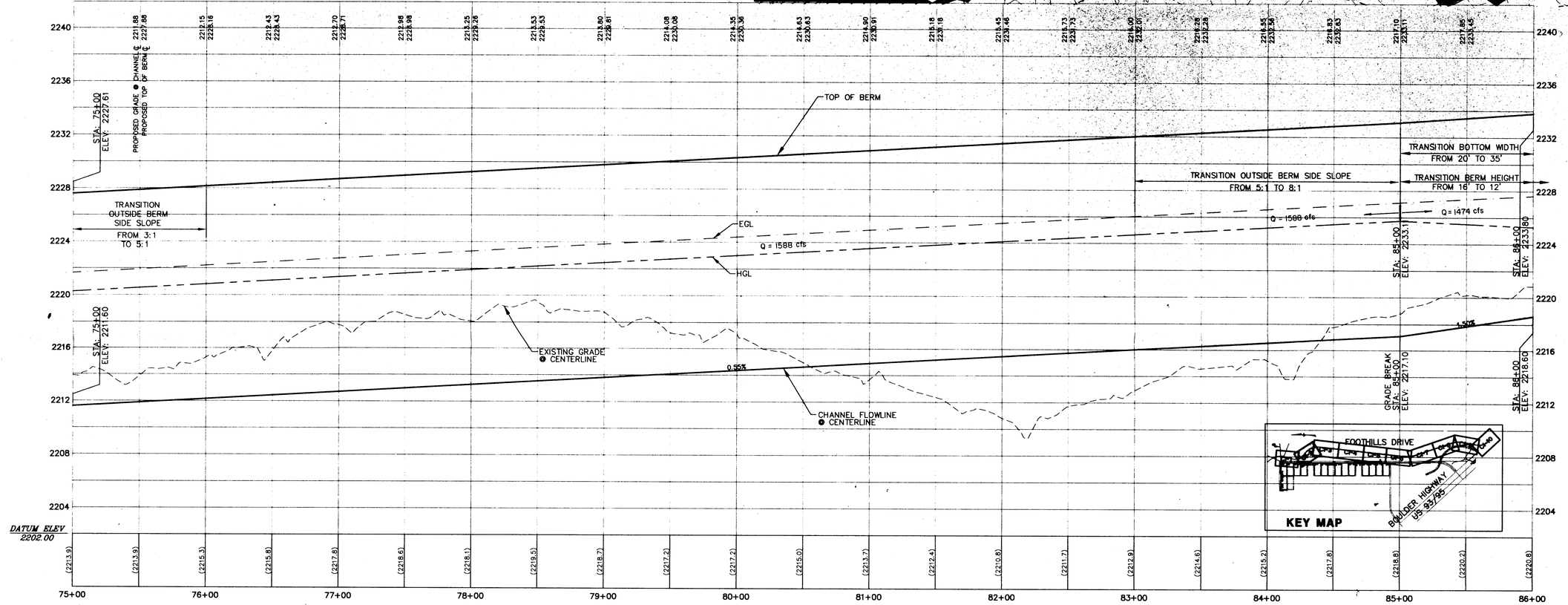
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MATCHLINE STA 75+00
SEE SHEET CI-2
MATCHLINE STA 64+00
SEE SHEET CH-5
STA 74+50.00 END BERM HEIGHT TRANSITION
STA 73+50.00 END OUTSIDE BERM SIDE SLOPE TRANSITION BEGIN BERM HEIGHT TRANSITION
STA 73+00.00 BEGIN OUTSIDE BERM SIDE SLOPE TRANSITION
FILL AREA
CHANNEL ℄ PC STA 72+38.89
DAYLIGHT LINE
CHANNEL ℄ PT STA 71+57.51
STA 71+50.00 END OUTSIDE BERM SIDE SLOPE TRANSITION
STA 71+00.00 BEGIN OUTSIDE BERM SIDE SLOPE TRANSITION
STA 68+84.20 CHANNEL ℄ PC END ALL BERM SIDE SLOPE TRANSITIONS
STA 67+41 END INSIDE BERM SIDE SLOPE TRANSITION
CHANNEL ℄ PT STA 67+17.42
STA 64+30.00 BEGIN ALL BERM SIDE SLOPE TRANSITIONS
STA 64+10.00 END ALL BERM SIDE SLOPE TRANSITIONS
HYDROSEED AREA
LIMIT OF DISTURBED AREA
FOOTHILLS DR
FOOTHILLS DRIVE R/W
EQUESTRIAN DRIVE CL
LOWER WATERLINE
INSTALL CHANNEL DEPTH GAUGE
BERM ℄ PC STA: 74+25.00 OFFSET: 52.00 R INSTALL SEDIMENT MONUMENT
BERM ℄ PT STA: 74+50.00 OFFSET: 52.00 R
BERM ℄ PC STA: 72+38.89 OFFSET: 52.00 R
BERM ℄ PT STA: 71+57.51 OFFSET: 52.00 R
BERM ℄ PC STA: 69+06.20 OFFSET: 76.23 R
BERM ℄ PT STA: 67+66.10 OFFSET: 91.50' R
BERM ℄ PRC STA: 67+67.10 OFFSET: 95.43 R
BERM ℄ ● MATCHLINE STA: 64+00.00 OFFSET: 94.26 R INSTALL SEDIMENT MONUMENT
N 19800 E 10400
N 20000 E 10400
N 20200 E 10400
N 20400 E 10400
N 20600 E 10400
N 20800 E 10400
N 21000 E 10400
N 21200 E 10400
N 21400 E 10400
N 21600 E 10400
N

FILENAME: 184C-B3(PP=02)



SCALE: 1" = 40' HORIZ.
1" = 4' VERT.



REVISION	DATE

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POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

EQUESTRIAN DETENTION BASIN

FOOTHILLS DRIVE CHANNEL PLAN & PROFILE STA 75+00 TO STA 86+00

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CI-2
OF	

RECORD DRAWINGS

RECORD DRAWINGS

FOOTHILLS DRIVE
PLAN & PROFILE
STA 86+00 TO STA 97+00

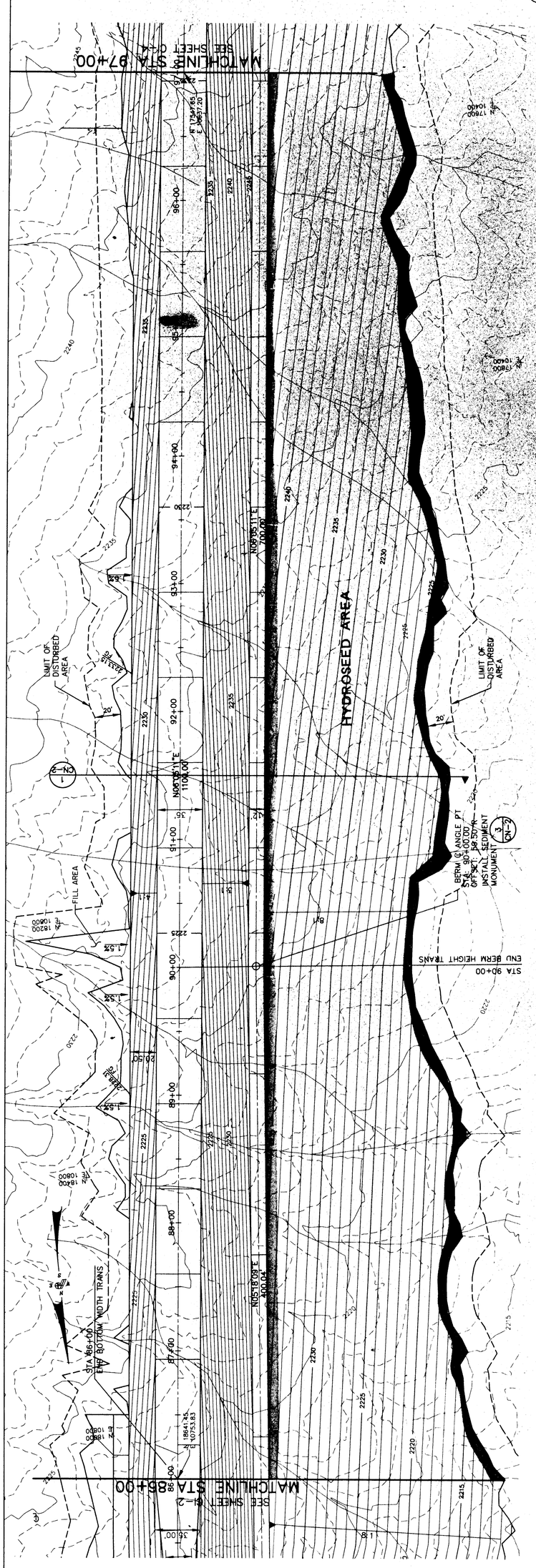
EQUESTRIAN DETENTION BASIN

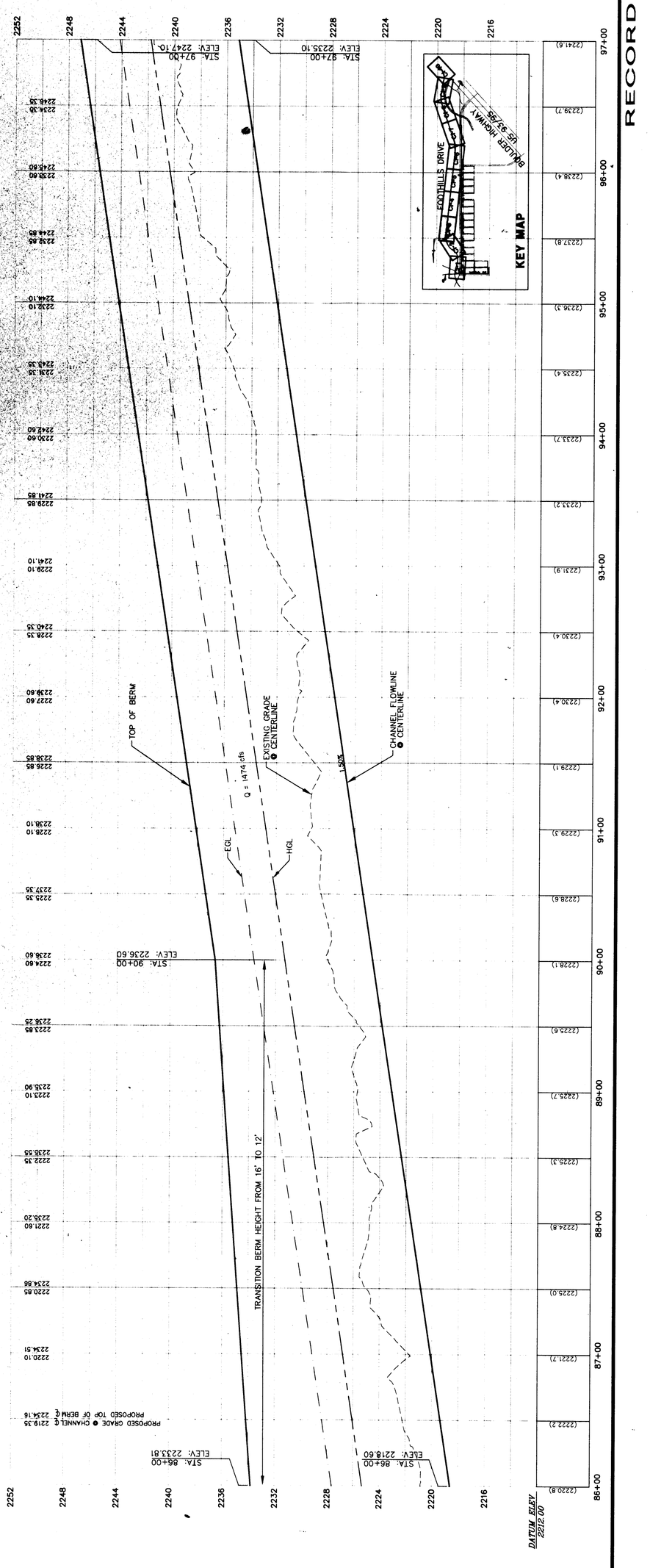
JOB NUMBER	95184C
DESIGNED BY	SJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CI-3

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

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FILENAME: , 1840-B3(PP=01)

FILENAME: 184C-83(PP=04)

MATCHLINE STA 97+00
SEE SHEET C1-3

MATCHLINE STA 108+00
SEE SHEET C1-5

LIMIT OF DISTURBED AREA

HYDROSEED AREA

BERM ℄
STA 100+00.00
OFFSET 59.50' R
INSTALL SEDIMENT MONUMENT

3 CN-2

SCALE: 1" = 40' HORIZ.
1" = 4' VERT.

PROPOSED GRADE ● CHANNEL ℄
PROPOSED TOP OF BERM ℄

TOP OF BERM

EGL

Q = 1474 cfs

HGL

EXISTING GRADE ● CENTERLINE

CHANNEL FLOWLINE ● CENTERLINE

STA: 97+00
ELEV: 2247.10

STA: 97+00
ELEV: 2235.10

STA: 108+00
ELEV: 2263.60

STA: 108+00
ELEV: 2251.60

DATUM ELEV
2230.00

KEY MAP
FOOTHILLS DRIVE
BOULDER HIGHWAY
US-93/95

RECORD DRAWINGS

REVISION

DATE

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2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

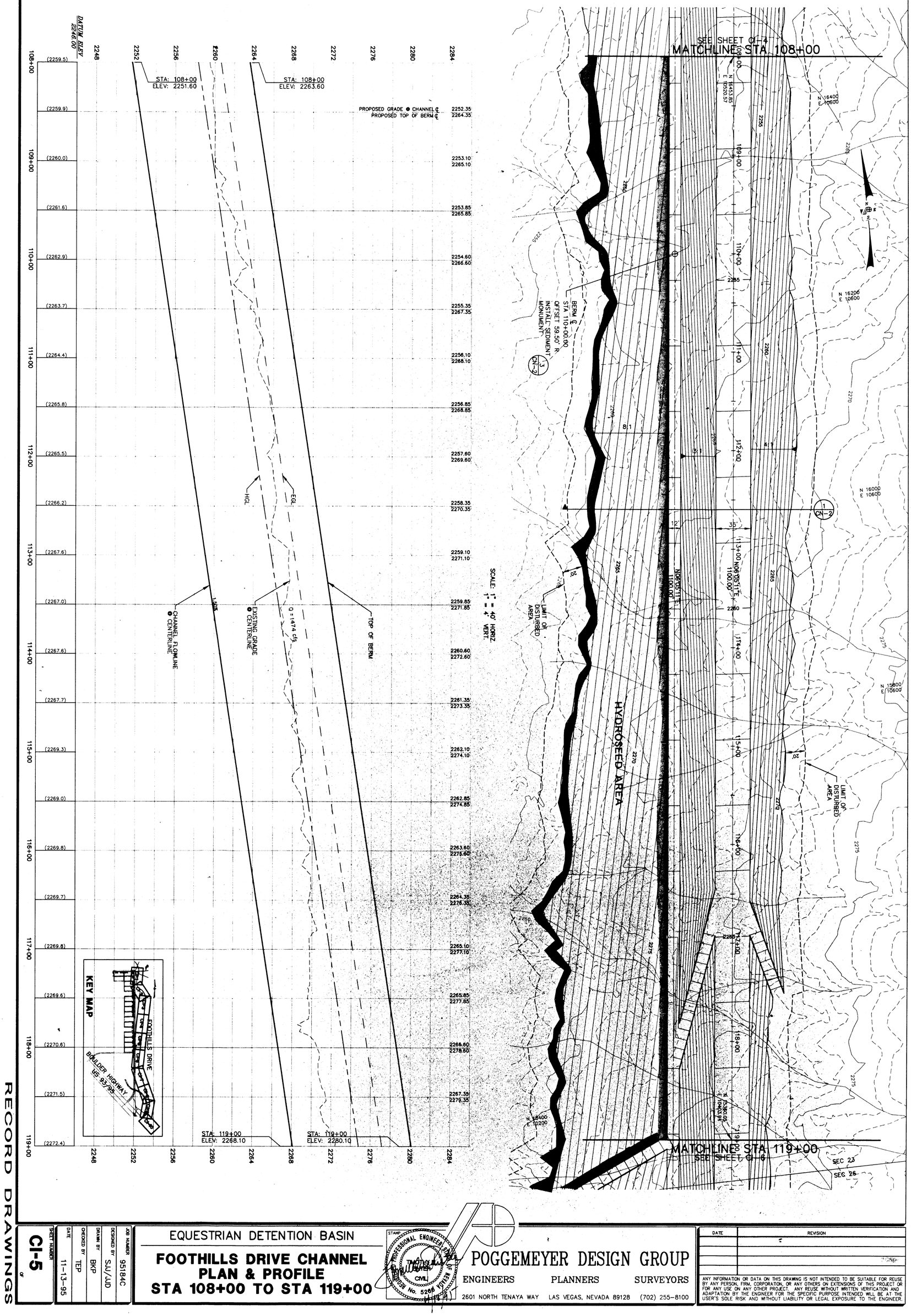
STATE OF NEVADA REGISTERED PROFESSIONAL ENGINEER
JOHN J. DRAGE
CIVIL
No. 9236

EQUESTRIAN DETENTION BASIN

FOOTHILLS DRIVE CHANNEL PLAN & PROFILE STA 97+00 TO STA 108+00

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	C1-4
OF	

FILENAME: 184C-B3(PP=CI5)



RECORD DRAWINGS

SHEET NUMBER CI-5 OF

DATE 11-13-95
CHECKED BY TEP
DRAWN BY BKP
DESIGNED BY SJJ/JJD
JOB NUMBER 95184C

EQUESTRIAN DETENTION BASIN

FOOTHILLS DRIVE CHANNEL PLAN & PROFILE STA 108+00 TO STA 119+00

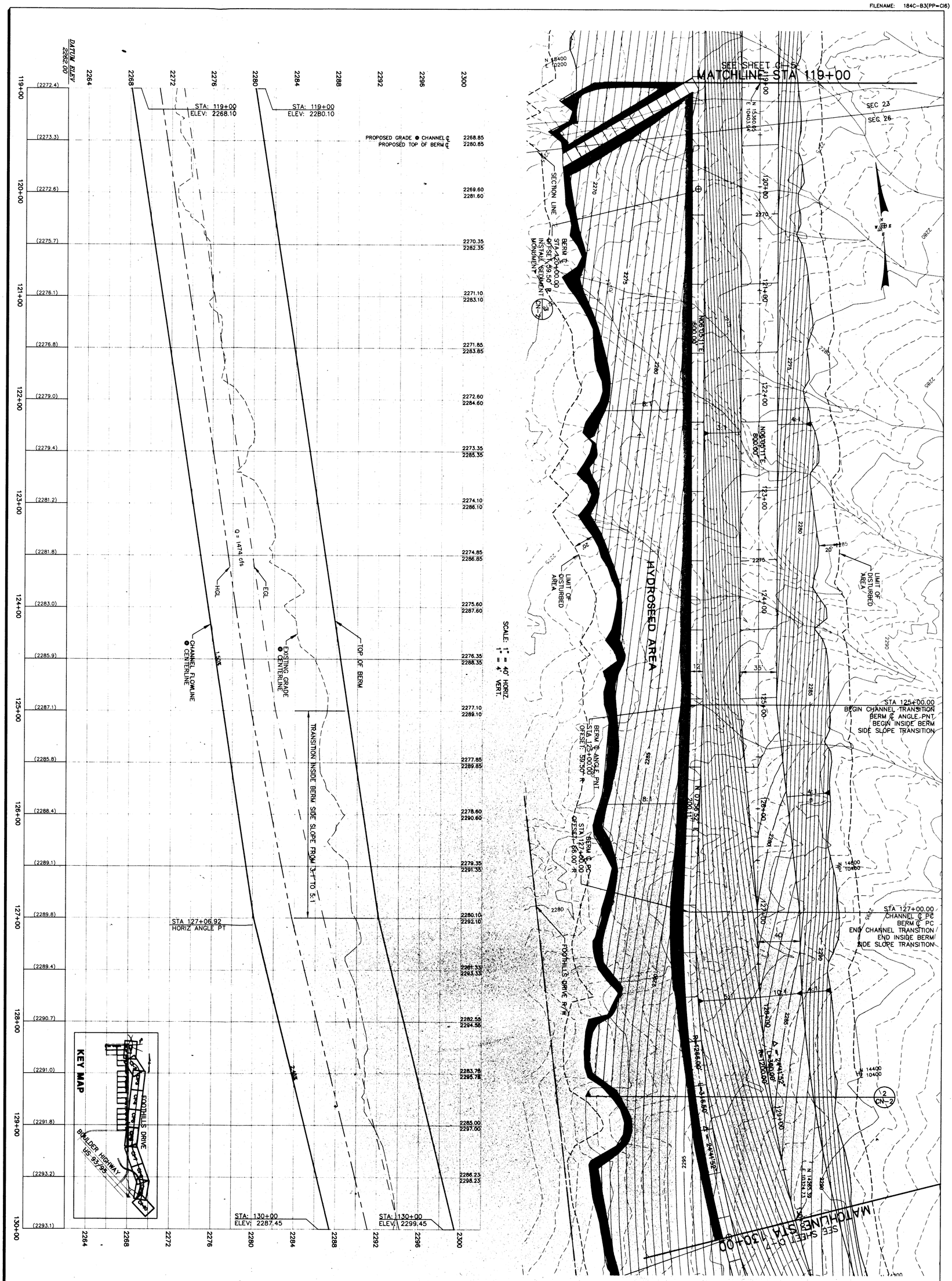
STANDARD PROFESSIONAL ENGINEER SEAL — TIMOTHY J. HUNTER — CIVIL — No. 5266 — STATE OF NEVADA

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

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FILENAME: 184C-B3(PP=CI6)



RECORD DRAWINGS

EQUESTRIAN DETENTION BASIN

FOOTHILLS DRIVE CHANNEL PLAN & PROFILE STA 119+00 TO STA 130+00

STAMP: PROFESSIONAL ENGINEER STATE OF NEVADA TIMOTHY E. LUCHETTI CIVIL EXPIRES 12/31/96 No. 5286

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

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SHEET NUMBER	CI-6 OF
DATE	11-13-95
CHECKED BY	TEP
DRAWN BY	BKP
DESIGNED BY	SJJ/JJD
JOB NUMBER	95184C

RECORD DRAWINGS

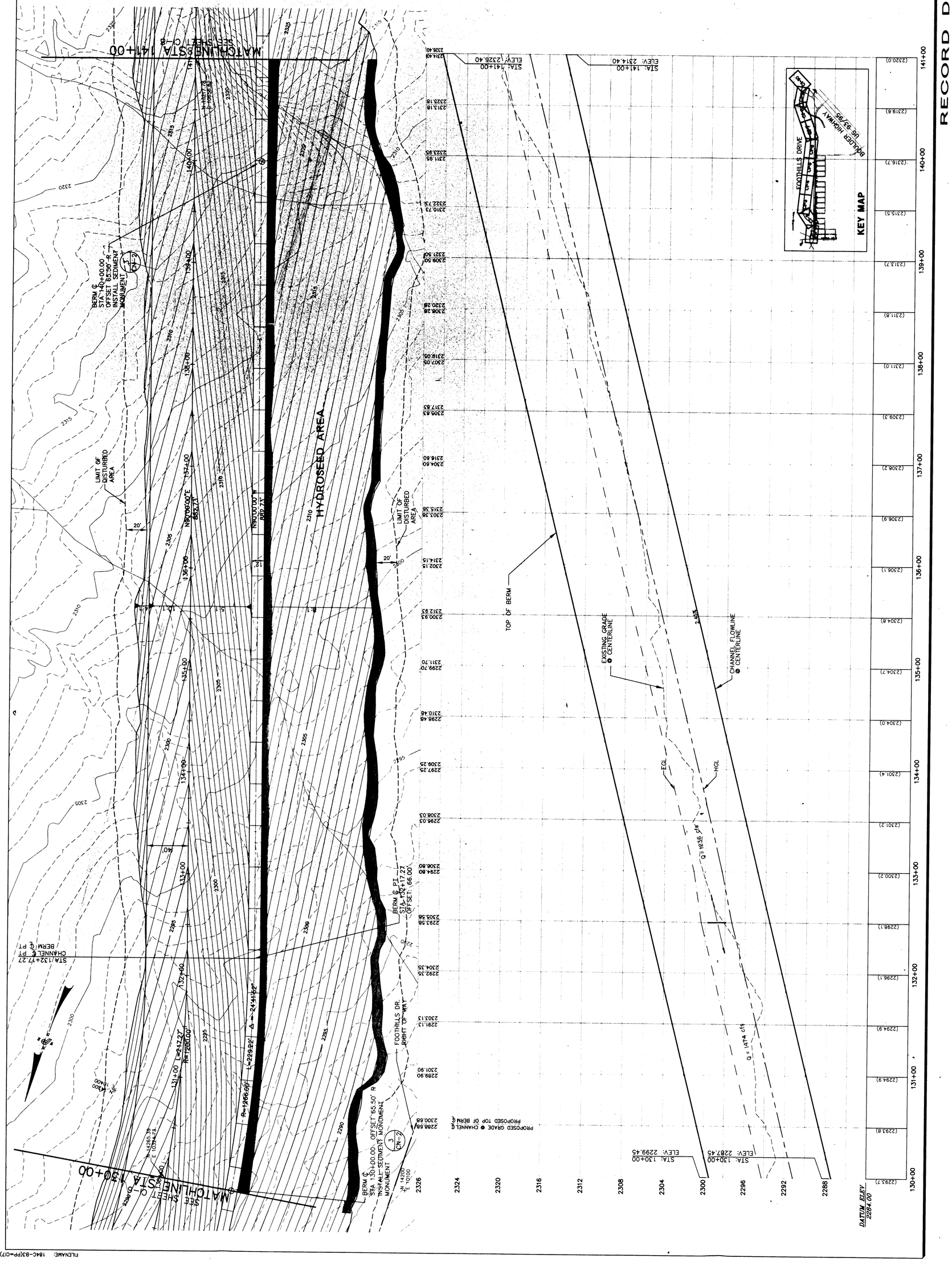
EQUESTRIAN DETENTION BASIN
FOOTHILLS DRIVE CHANNEL
PLAN & PROFILE
STA 130+00 TO STA 141+00

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CI-7 OF

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

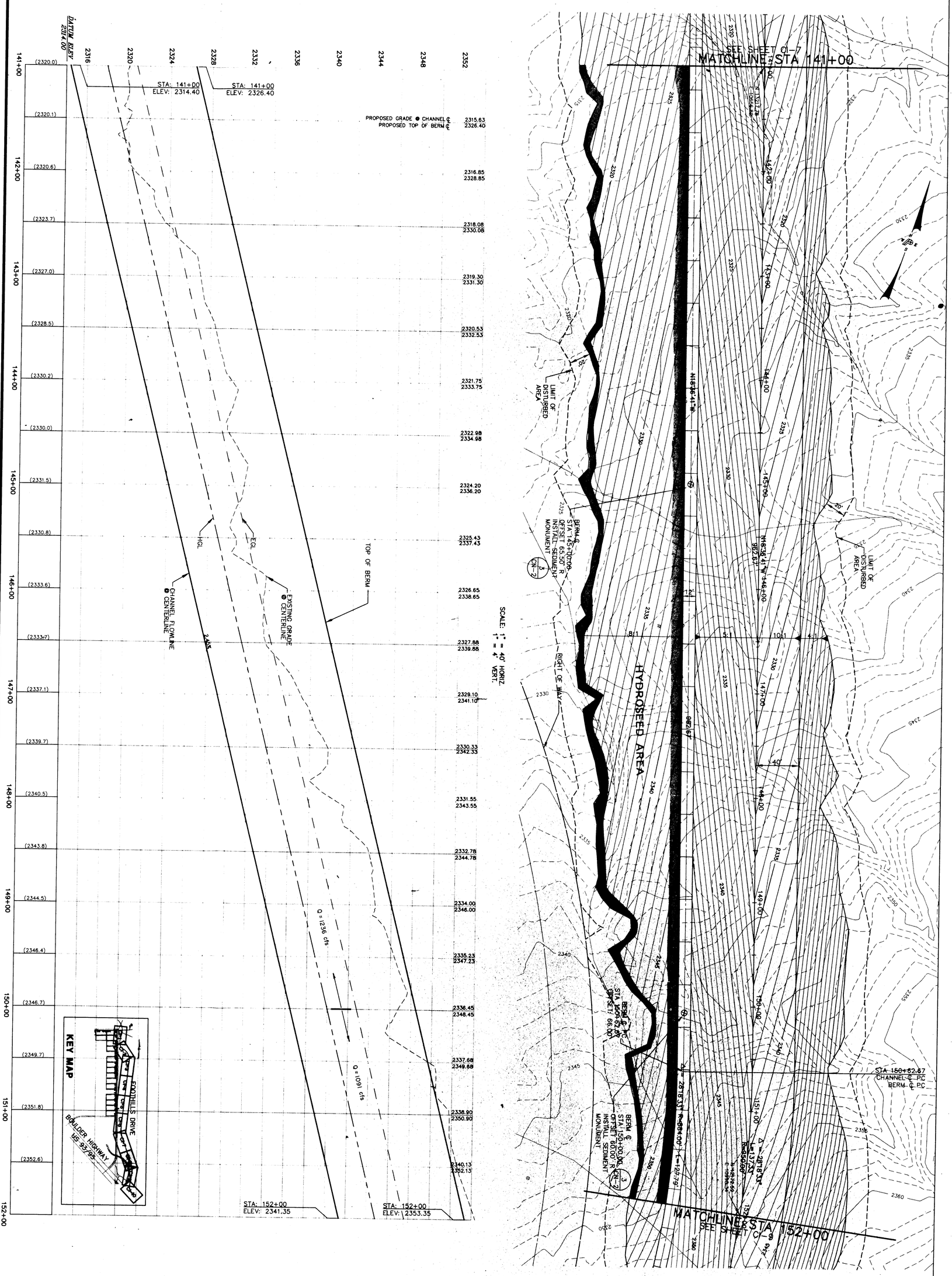
DATE	REVISION

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FILENAME: 184C-83(PP=CI7)

FILENAME: 184C-B3(PP-C18)



RECORD DRAWINGS

EQUESTRIAN DETENTION BASIN

FOOTHILLS DRIVE CHANNEL PLAN & PROFILE STA 141+00 TO STA 152+00

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	C1-8

STAMP: PROFESSIONAL ENGINEER STATE OF NEVADA — TIMOTHY E. PAHL — CIVIL — No. 5289 — 11/13/95

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

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RECORD DRAWINGS

EQUESTRIAN DETENTION BASIN

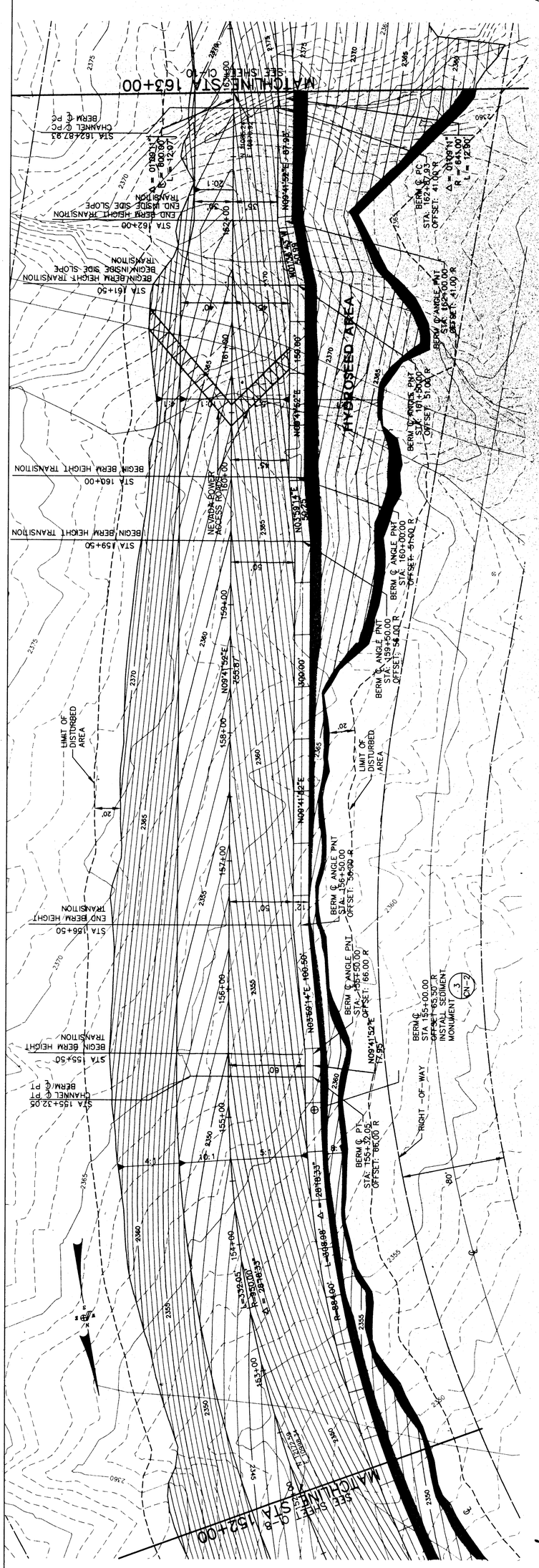
FOOTHILLS DRIVE CHANNEL
PLAN & PROFILE
STA 152+00 TO STA 161+00

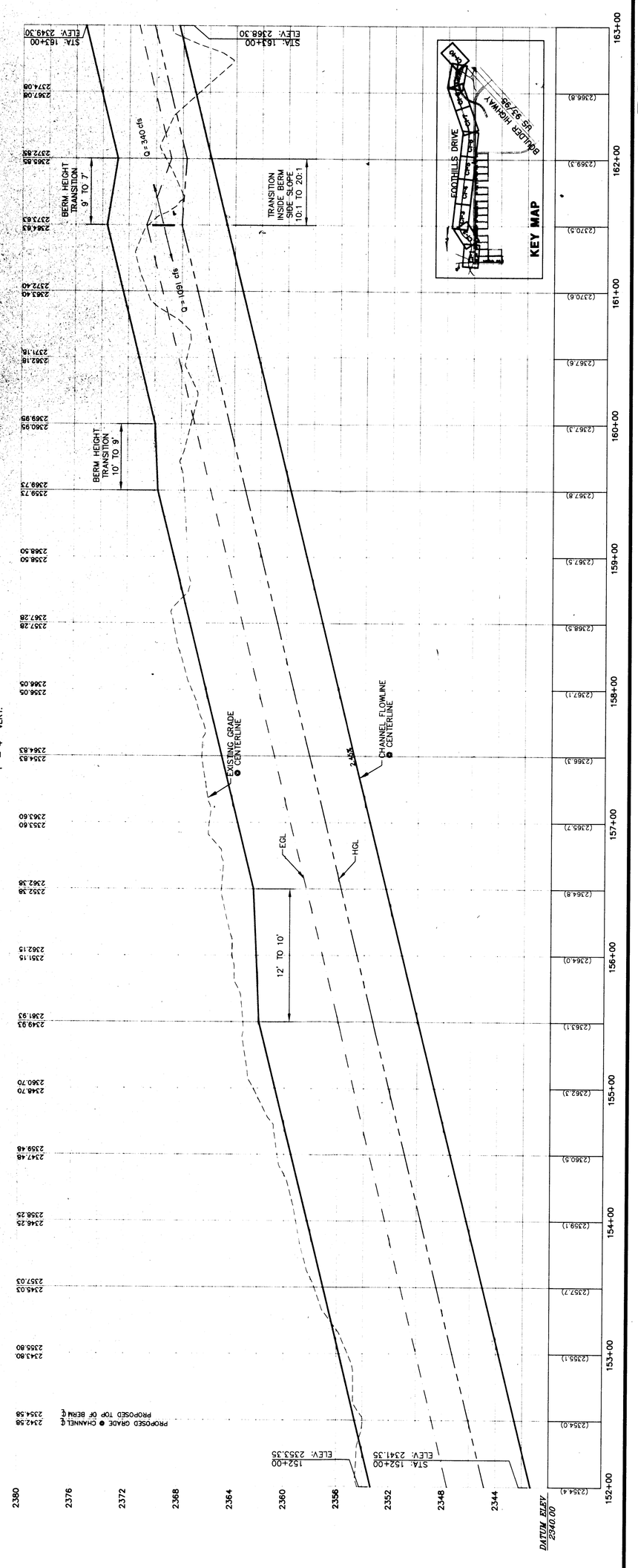
JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CI-9 of

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

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FILENAME: 184C-B3(PP=CI9)

RECORD DRAWINGS

EQUESTRIAN DETENTION BASIN

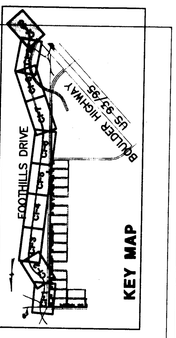
FOOTHILLS DRIVE CHANNEL
PLAN & PROFILE
STA 161+00 TO END

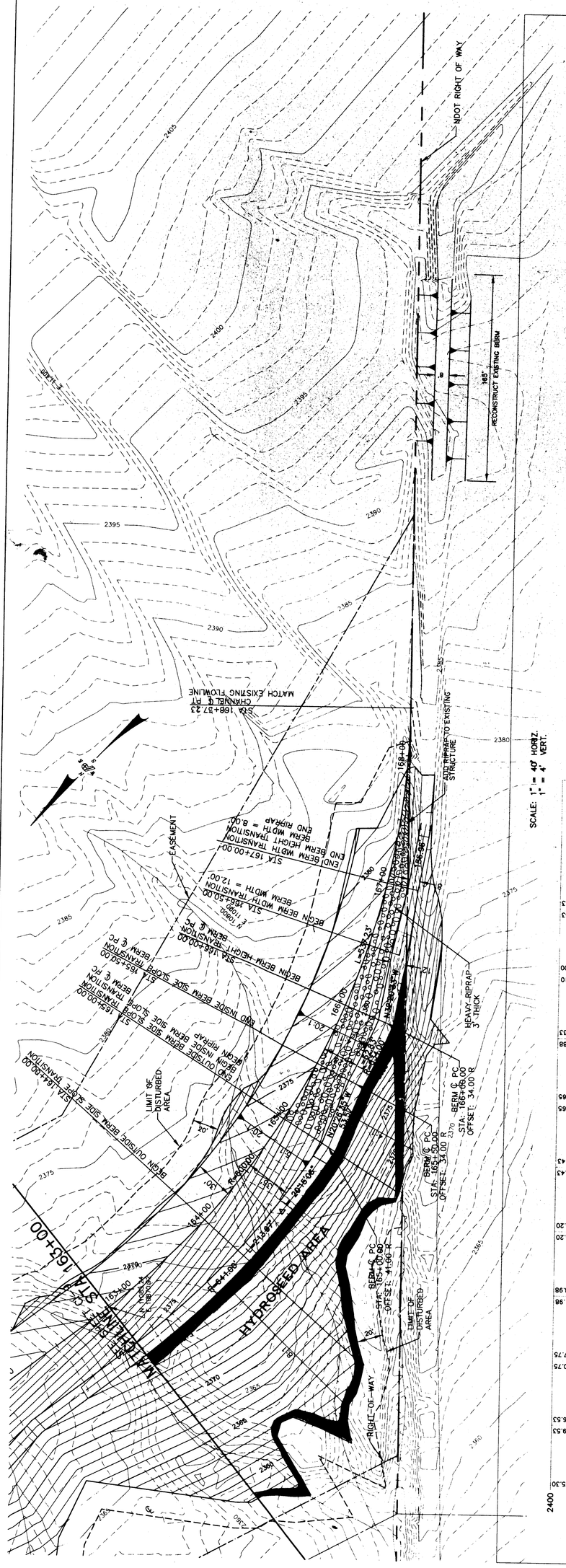
JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	BKP
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CI-10

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

DATE	REVISION

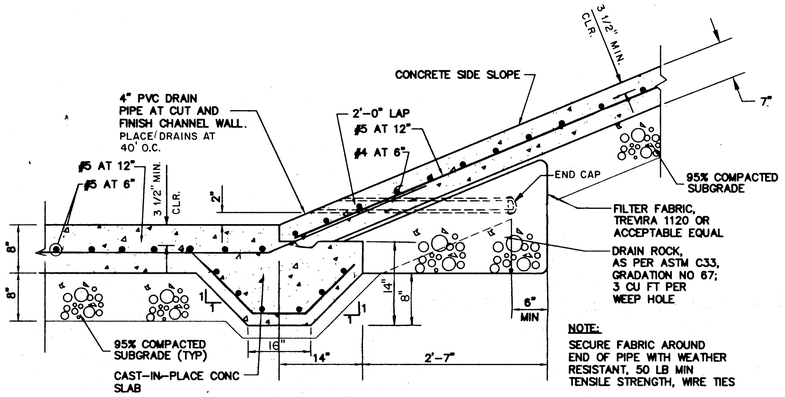
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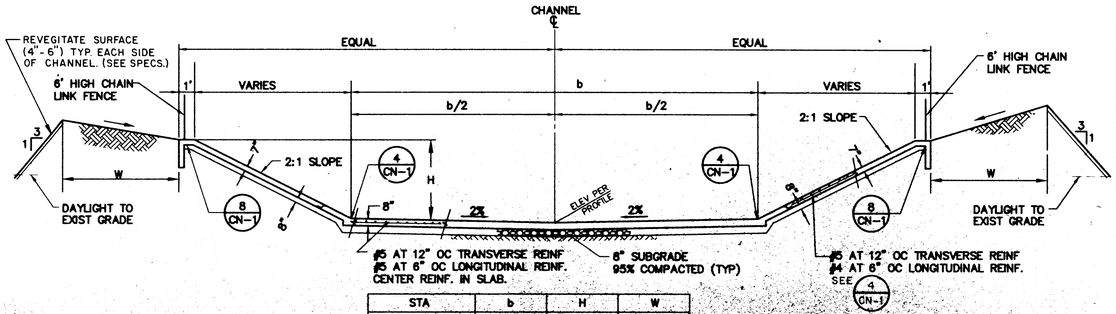
FILENAME: 184C-B3(PP=CI10)

FILENAME: 184C-CN1.DWG



DETAIL 4

SCALE: 1" = 1'-0"

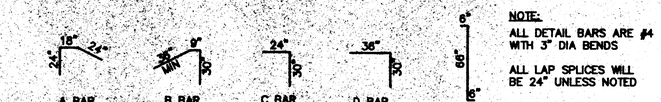


NOTE:
LONGITUDINAL STEEL SHALL BE PLACED ON TOP OF TRANSVERSE STEEL. SEE 4 CN-1

STA	b	H	W
11+00	40.0'	6.0'	SEE PLAN
11+00 TO 12+00	TRANSITION	6.0'	SEE PLAN
12+00 TO 16+00	20.0'	6.0'	SEE PLAN
16+00 TO 45+00	20.0'	6.0'	140.0'
45+00 TO 49+00	20.0'	TRANSITION	TRANSITION
49+00 TO 50+00	20.0'	8.0'	TRANSITION
50+00 TO 61+50	20.0'	8.0'	12.0'

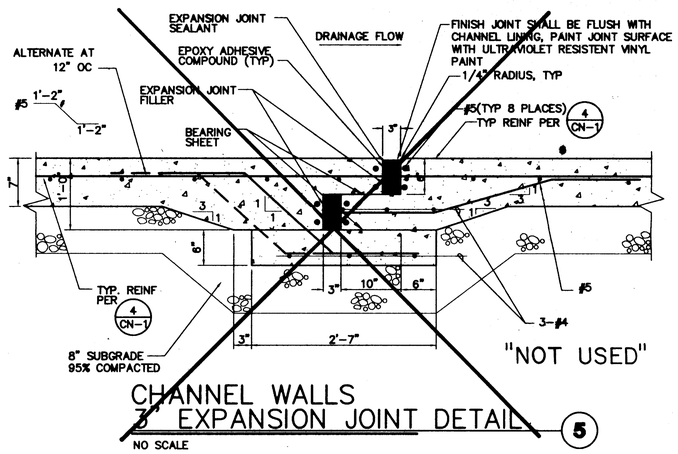
CHANNEL CROSS SECTION 1

NO SCALE



NOTE:
ALL DETAIL BARS ARE #4 WITH 3" DIA BENDS

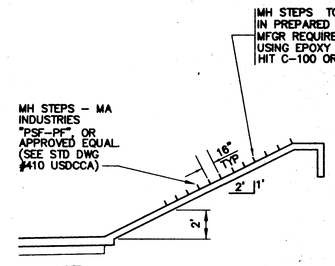
ALL LAP SPLICES WILL BE 24" UNLESS NOTED



"NOT USED"

CHANNEL WALLS EXPANSION JOINT DETAIL 5

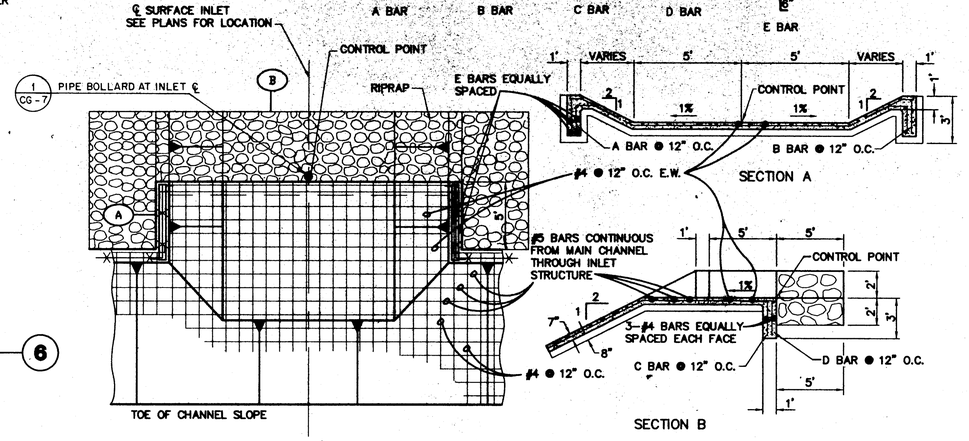
NO SCALE



NOTE:
PROVIDE 3'-0" WIDE YELLOW REFLECTIVE PAINT STRIPE CENTERED ON STEPS FROM CHANNEL BOTTOM TO CHANNEL TOP

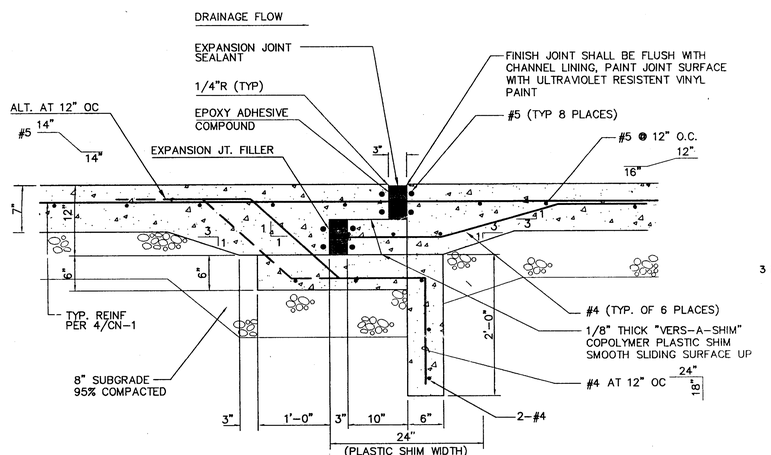
STEP DETAIL 6

NO SCALE



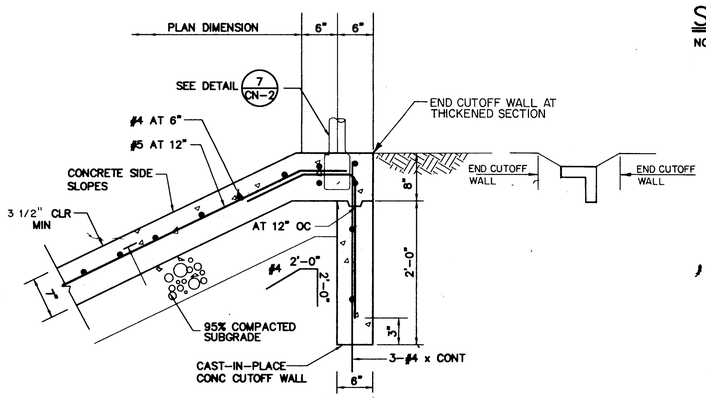
SURFACE INLET DETAIL 2

NO SCALE



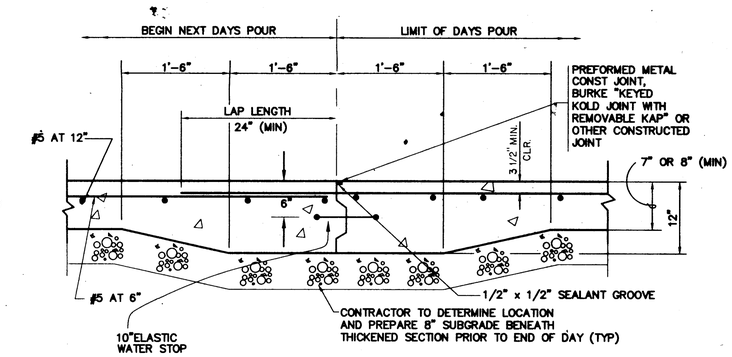
CUT OFF WALL/ EXPANSION JOINT DETAIL 7

NO SCALE



TYP TURN DOWN WALL DETAIL 8

SCALE: 1" = 1'-0"



TYP. CONSTRUCTION JOINT 3

NO SCALE

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DATE	REVISION

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

EQUESTRIAN DETENTION BASIN

EQUESTRIAN DRIVE CHANNEL CROSS SECTIONS AND DETAILS

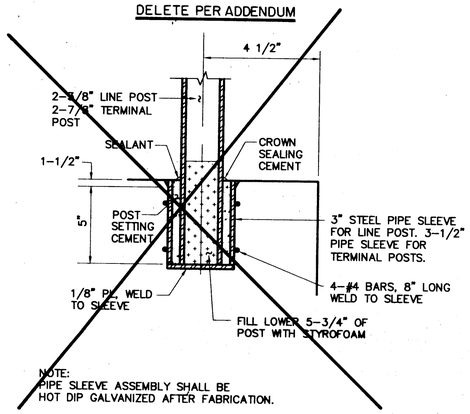
JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	JGH
CHECKED BY	TEP
DATE	11-13-95

SHEET NUMBER **CN-1** OF

RECORD DRAWINGS

FILENAME 184C-CN2.DWG

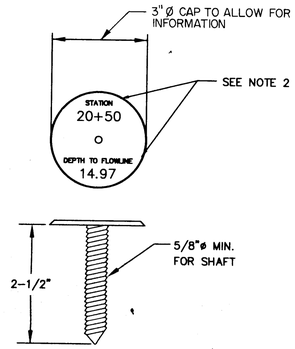
DELETE PER ADDENDUM



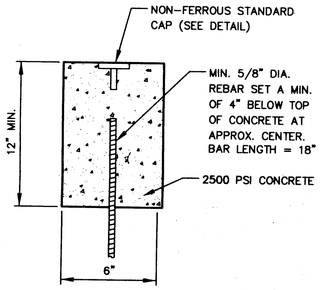
NOTE:
PIPE SLEEVE ASSEMBLY SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.

FENCE BASE DETAIL (5)

NO SCALE



STANDARD CAP



MONUMENT

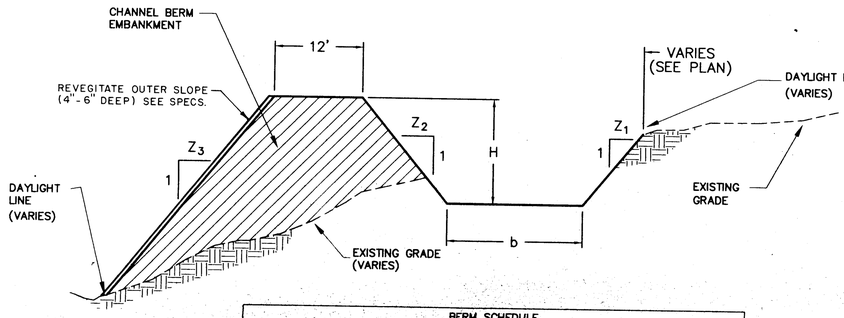
NOTES:

1. NON-FERROUS CAP TO BE MADE FROM CAST VIRGIN METAL IN ONE PIECE, FREE FROM CASTING IMPERFECTIONS, WITH CORRUGATED SHAFT.
2. THE WORDS "STATION" AND "DEPTH TO FLOWLINE" SHALL BE STAMPED ON EACH SEDIMENTATION MONUMENT AS SHOWN.
3. THE STATION OF EACH MONUMENT SHALL BE STAMPED ON THE CAP. STATION TO THE NEAREST ONE FOOT WITH A "+" SYMBOL BETWEEN THE HUNDREDS AND TENS OF FEET.
4. DEPTH TO FLOWLINE SHALL BE STAMPED ON THE CAP TO THE NEAREST HUNDREDTH FOOT.
5. CAP SHALL BE LOCATED ON TOP OF BERM AT THE BERM'S CENTERLINE

CHANNEL STATION	DEPTH TO FLOWLINE	OFFSET TO CHANNEL℄	CHANNEL STATION	DEPTH TO FLOWLINE	OFFSET TO CHANNEL℄
64+00	12.00'	94.00'	100+00	12.00'	59.50'
65+00	12.00'	91.50'	110+00	12.00'	59.50'
70+00	12.00'	52.00'	120+00	12.00'	59.50'
74+25	16.00'	58.50'	130+00	12.00'	65.50'
80+00	16.00'	64.00'	140+00	12.00'	65.50'
83+50	16.00'	64.00'	145+00	12.00'	65.50'
85+00	16.00'	64.00'	150+00	12.00'	65.50'
90+00	12.00'	59.50'	155+00	12.00'	65.50'

SEDIMENT MONUMENT (3)

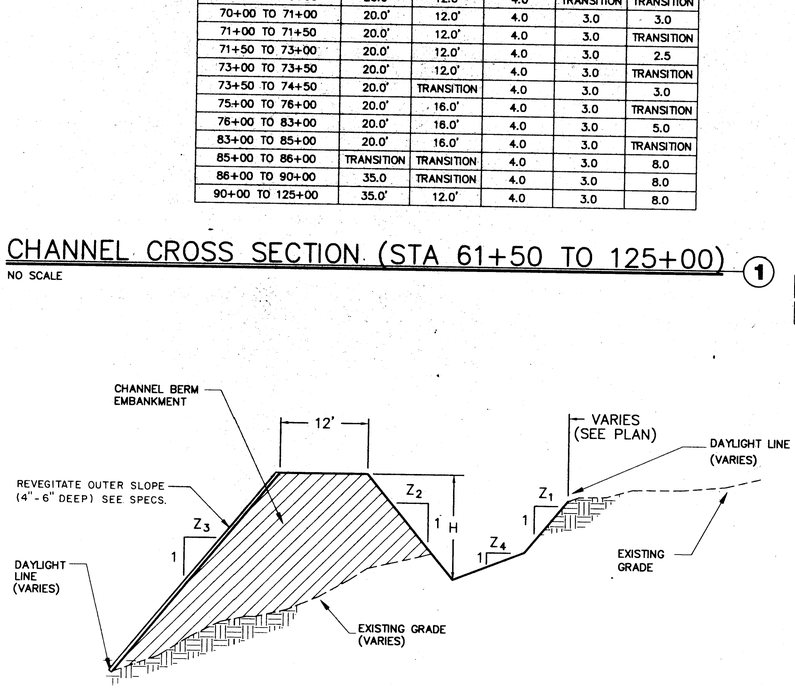
NO SCALE



BERM SCHEDULE					
STA	b	H	Z_1	Z_2	Z_3
61+50	20.0'	8.0'	2.0	2.0	3.0
61+50 TO 64+10	20.0'	TRANSITION	TRANSITION	TRANSITION	TRANSITION
64+10 TO 64+30	20.0'	12.0'	7.0	7.0	7.0
64+30 TO 67+41	20.0'	12.0'	TRANSITION	TRANSITION	TRANSITION
67+41 TO 70+00	20.0'	12.0'	4.0	TRANSITION	TRANSITION
70+00 TO 71+00	20.0'	12.0'	4.0	3.0	3.0
71+00 TO 71+50	20.0'	12.0'	4.0	3.0	TRANSITION
71+50 TO 73+00	20.0'	12.0'	4.0	3.0	2.5
73+00 TO 73+50	20.0'	12.0'	4.0	3.0	TRANSITION
73+50 TO 74+50	20.0'	TRANSITION	4.0	3.0	3.0
75+00 TO 76+00	20.0'	16.0'	4.0	3.0	TRANSITION
76+00 TO 83+00	20.0'	16.0'	4.0	3.0	5.0
83+00 TO 85+00	20.0'	16.0'	4.0	3.0	TRANSITION
85+00 TO 86+00	TRANSITION	TRANSITION	4.0	3.0	8.0
86+00 TO 90+00	35.0	TRANSITION	4.0	3.0	8.0
90+00 TO 125+00	35.0'	12.0'	4.0	3.0	8.0

CHANNEL CROSS SECTION (STA 61+50 TO 125+00) (1)

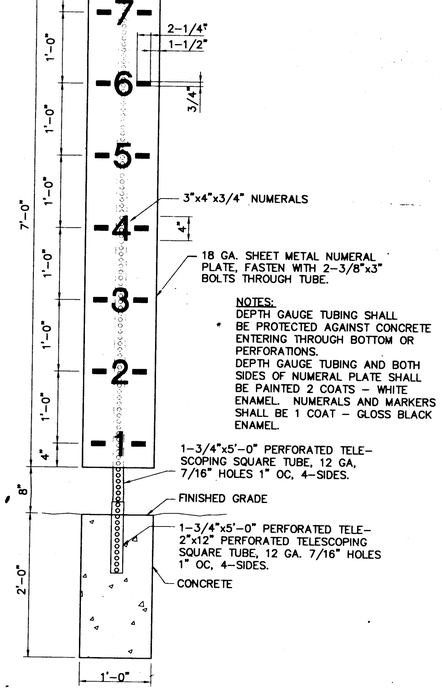
NO SCALE



BERM SCHEDULE					
STA	H	Z_1	Z_2	Z_3	Z_4
125+00 TO 127+00	12.0'	4.0	TRANSITION	8.0	TRANSITION
127+00 TO 155+50	12.0'	4.0	5.0	8.0	10.0
155+50 TO 156+50	TRANSITION	4.0	5.0	8.0	10.0
156+50 TO 159+50	10.0'	4.0	5.0	8.0	10.0
159+50 TO 160+00	TRANSITION	4.0	5.0	8.0	10.0
160+00 TO 161+50	9.0'	4.0	5.0	8.0	10.0
161+50 TO 162+00	TRANSITION	4.0	5.0	8.0	TRANSITION
162+00 TO 164+00	7.0'	4.0	5.0	8.0	20.0
164+00 TO 165+00	7.0'	4.0	5.0	TRANSITION	20.0
165+00 TO 165+50	7.0'	4.0	TRANSITION	4.0	20.0
165+50 TO 166+00	7.0'	4.0	4.0	4.0	20.0
166+00 TO 167+00	TRANSITION	4.0	4.0	4.0	20.0
167+00	4.0'				
167+00 TO END	MATCH INTO EXISTING				

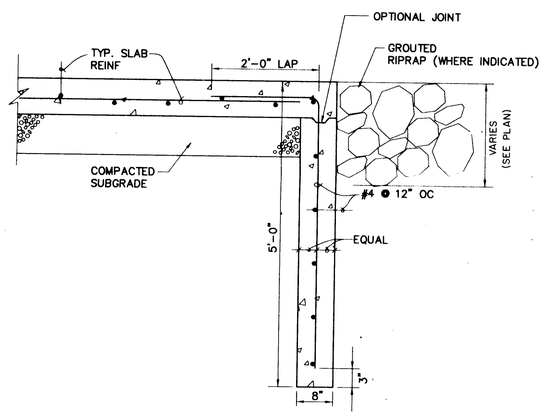
CHANNEL CROSS SECTION (STA 125+00 TO END) (2)

NO SCALE



DEPTH GAUGE (6)

NO SCALE



ENDWALL DETAIL (4)

NO SCALE

ANY INFORMATION OR DATA ON THIS DRAWING IS NOT INTENDED TO BE SUITABLE FOR REUSE BY ANY PERSON, FIRM, CORPORATION, OR ANY OTHERS ON EXTENSIONS OF THIS PROJECT OR FOR ANY OTHER PROJECT. ANY REUSE WITHOUT WRITTEN VERIFICATION AND ADAPTATION BY POGGEMEYER DESIGN GROUP FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT USER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO THE ENGINEER.

DATE	REVISION

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

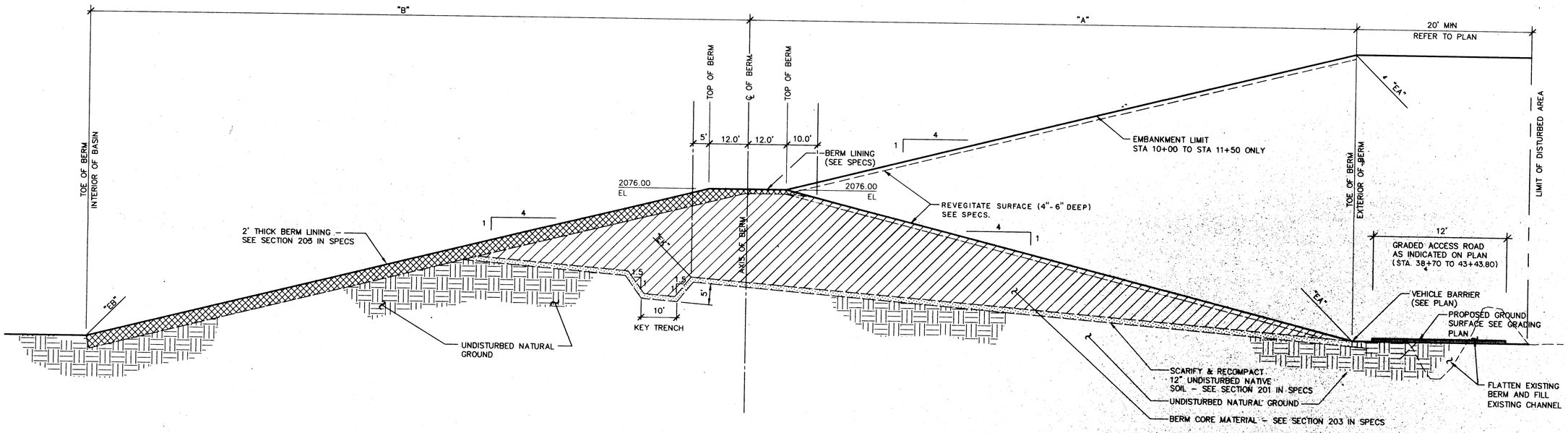
EQUESTRIAN DETENTION BASIN

FOOTHILLS DRIVE CHANNEL CROSS SECTIONS AND DETAILS

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	JGH
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CN-2
OF	

RECORD DRAWINGS

FILENAME: 184C-CN3.DWG

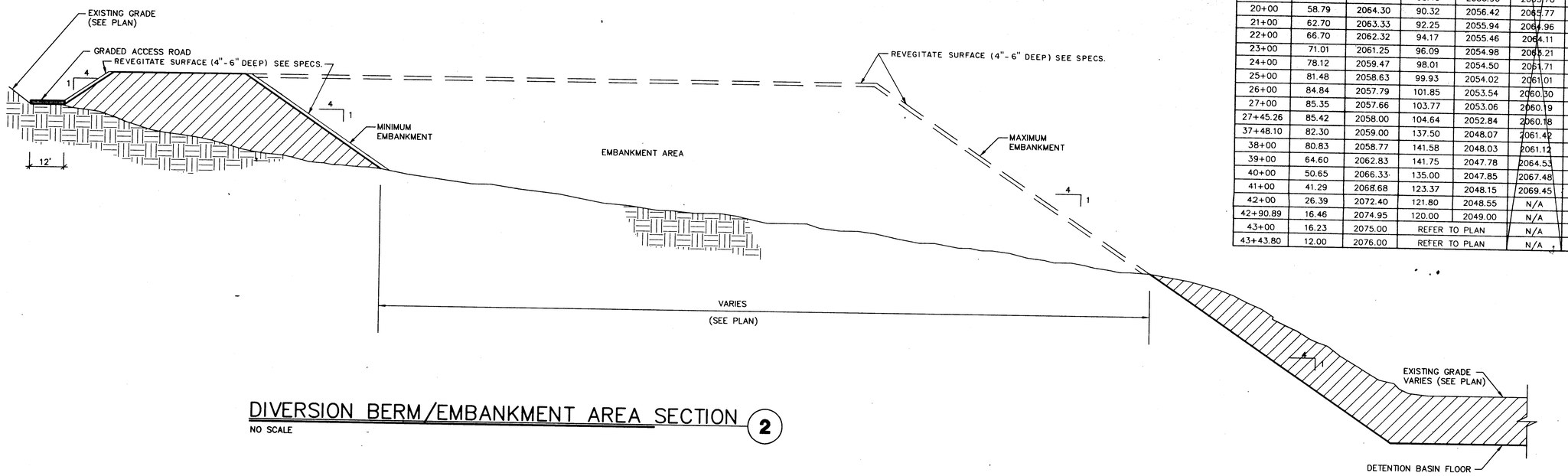


BERM CROSS SECTION

NO SCALE

1

DETENTION BASIN - BERM SCHEDULE						
STATION	"A"	"EA"	"B"	"EB"	"E1"	"EK"
10+00	72.16	2090.69	78.00	2059.50	N/A	N/A
10+18.18	73.88	2090.64	77.84	2059.54	N/A	N/A
11+00	68.88	2090.22	77.48	2059.63	N/A	N/A
12+00	N/A	N/A	76.00	2060.00	N/A	N/A
12+99.20	N/A	N/A	76.80	2059.80	N/A	N/A
13+00	N/A	N/A	76.80	2059.80	N/A	N/A
14+00	21.18	2073.70	78.80	2059.30	N/A	N/A
15+00	32.40	2070.90	80.72	2059.82	2069.22	2070.78
16+00	39.20	2069.20	82.64	2058.34	2067.97	2069.53
17+00	45.20	2067.70	84.56	2057.86	2067.18	2067.74
18+00	51.20	2066.20	86.48	2057.38	2066.29	2067.85
19+00	56.58	2064.85	88.40	2056.90	2065.70	2067.26
20+00	58.79	2064.30	90.32	2056.42	2065.77	2067.33
21+00	62.70	2063.33	92.25	2055.94	2064.96	2066.52
22+00	66.70	2062.32	94.17	2055.46	2064.11	2065.67
23+00	71.01	2061.25	96.09	2054.98	2063.21	2064.77
24+00	78.12	2059.47	98.01	2054.50	2061.71	2063.27
25+00	81.48	2058.63	99.93	2054.02	2061.01	2062.57
26+00	84.84	2057.79	101.85	2053.54	2060.30	2061.86
27+00	85.35	2057.66	103.77	2053.06	2060.19	2061.75
27+45.26	85.42	2058.00	104.64	2052.84	2060.18	2061.74
37+48.10	82.30	2059.00	137.50	2048.07	2061.42	2062.97
38+00	80.83	2058.77	141.58	2048.03	2061.12	2062.68
39+00	64.60	2062.83	141.75	2047.78	2064.53	2066.09
40+00	50.65	2066.33	135.00	2047.85	2067.48	2069.04
41+00	41.29	2068.68	123.37	2048.15	2069.45	2071.01
42+00	26.39	2072.40	121.80	2048.55	N/A	N/A
42+90.89	16.46	2074.95	120.00	2049.00	N/A	N/A
43+00	16.23	2075.00	REFER TO PLAN		N/A	N/A
43+43.80	12.00	2076.00	REFER TO PLAN		N/A	N/A



DIVERSION BERM/EMBANKMENT AREA SECTION

NO SCALE

2

REVISION	DATE

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POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STATE OF NEVADA PROFESSIONAL ENGINEER TIMOTHY E. POGGEMEYER No. 5201 CIVIL

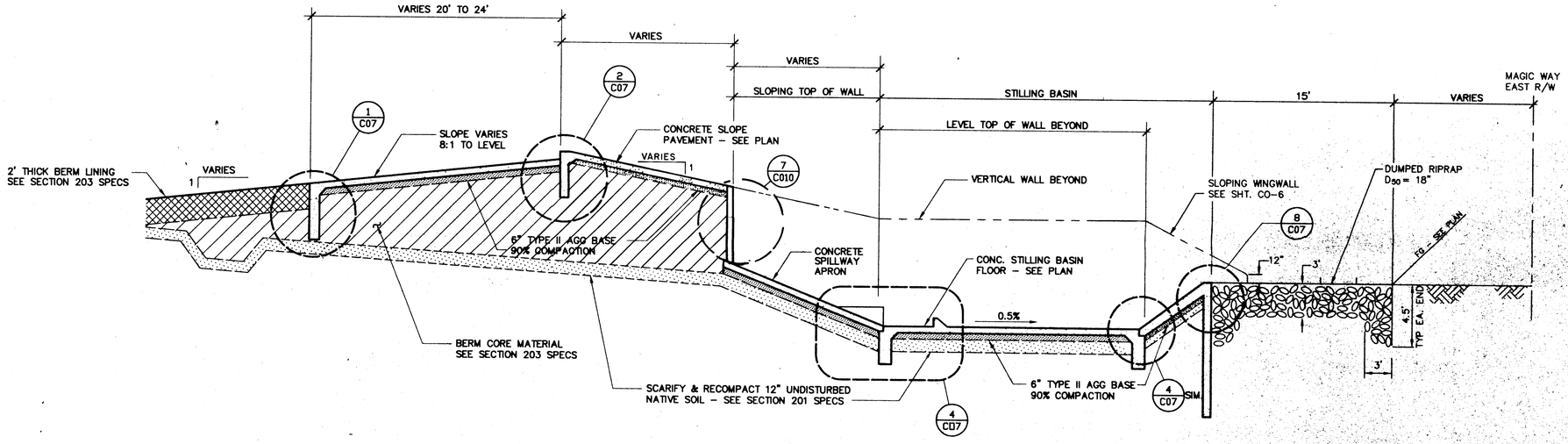
EQUESTRIAN DETENTION BASIN

BASIN BERM CROSS SECTIONS / SCHEDULE

JOB NUMBER	95184C
DESIGNED BY	SJJ/JDD
DRAWN BY	JGH
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CN-3
OF	

RECORD DRAWINGS

FILENAME: 1170N-4.DWG

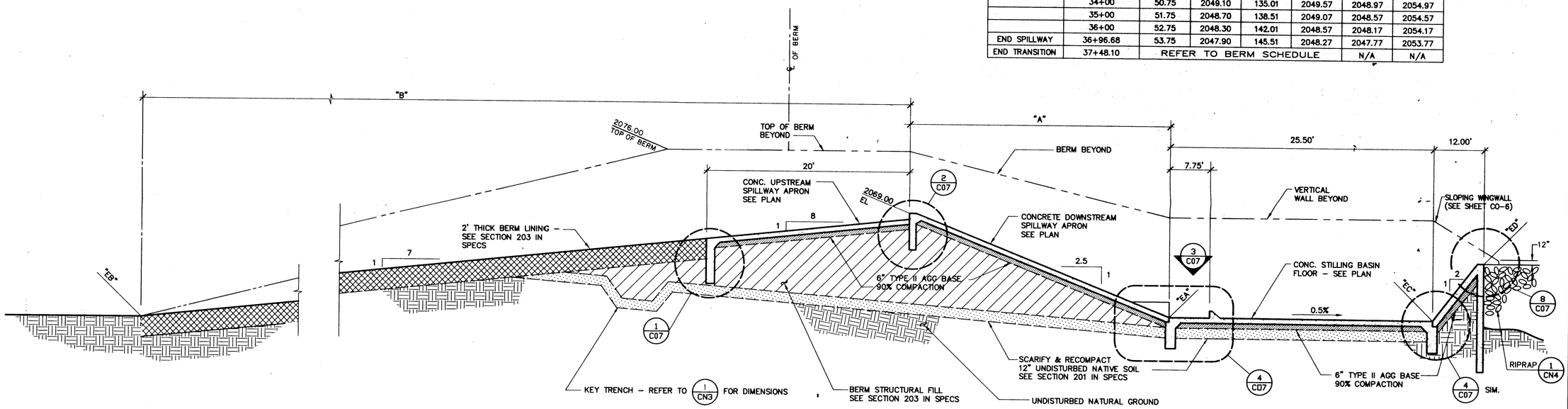


SPILLWAY TRANSITION CROSS SECTION

NO SCALE

1

DETENTION BASIN SPILLWAY SCHEDULE							
	STATION	"A"	"EA"	"B"	"EB"	"EC"	"ED"
BEGIN TRANSITION	27+45.26	REFER TO BERM SCHEDULE				N/A	N/A
BEGIN SPILLWAY	27+96.68	44.75	2051.50	113.87	2052.59	2051.37	2057.37
	28+00	44.78	2051.49	114.01	2052.57	2051.36	2057.36
	29+00	45.75	2051.10	117.51	2052.07	2050.97	2056.97
	30+00	46.75	2050.70	121.01	2051.57	2050.57	2056.57
	31+00	47.75	2050.30	124.51	2051.07	2050.17	2056.17
	32+00	48.75	2049.90	128.01	2050.57	2049.77	2055.77
	33+00	49.75	2049.50	131.51	2050.07	2049.37	2055.37
	34+00	50.75	2049.10	135.01	2049.57	2048.97	2054.97
	35+00	51.75	2048.70	138.51	2049.07	2048.57	2054.57
	36+00	52.75	2048.30	142.01	2048.57	2048.17	2054.17
END SPILLWAY	36+96.68	53.75	2047.90	145.51	2048.27	2047.77	2053.77
END TRANSITION	37+48.10	REFER TO BERM SCHEDULE				N/A	N/A



SPILLWAY CROSS SECTION

NO SCALE

2

REVISION | DATE

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POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

STAMP: ENGINEER IN RESPONSIBLE CHARGE, STATE OF NEVADA, REGISTERED PROFESSIONAL, CIVIL, No. 5718, DATE 9/30/96

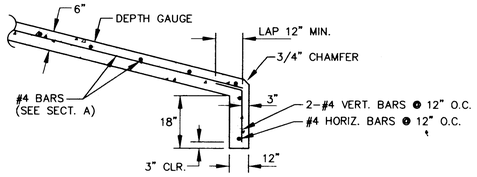
EQUESTRIAN DETENTION BASIN

BASIN SPILLWAY CROSS SECTIONS / SCHEDULE

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	JGH
CHECKED BY	TEP
DATE	11-13-95
SHEET NUMBER	CN-4
OF	

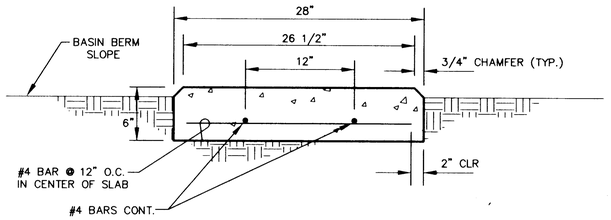
RECORD DRAWINGS

FILENAME: 184-C011.DWG



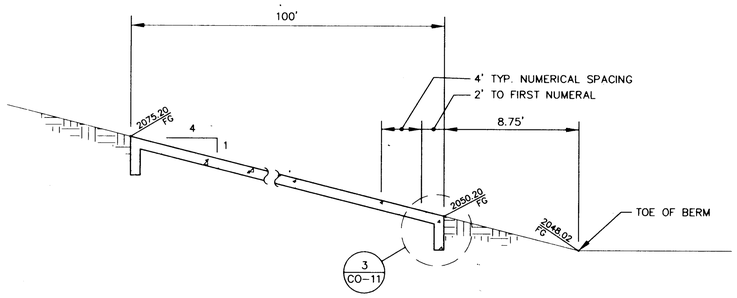
DETAIL – DEPTH GAUGE ANCHOR WALL (3)

NO SCALE



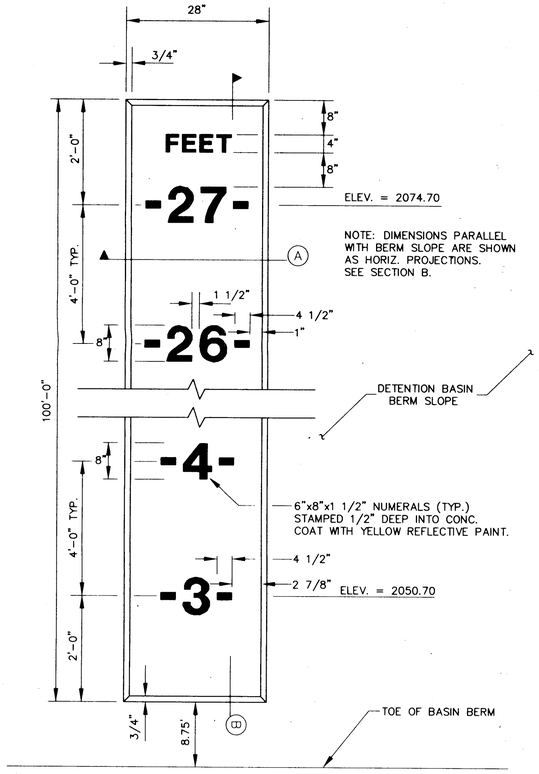
SECTION – BASIN DEPTH GAUGE (A)

NO SCALE



SECTION – BASIN DEPTH GAUGE (B)

NO SCALE

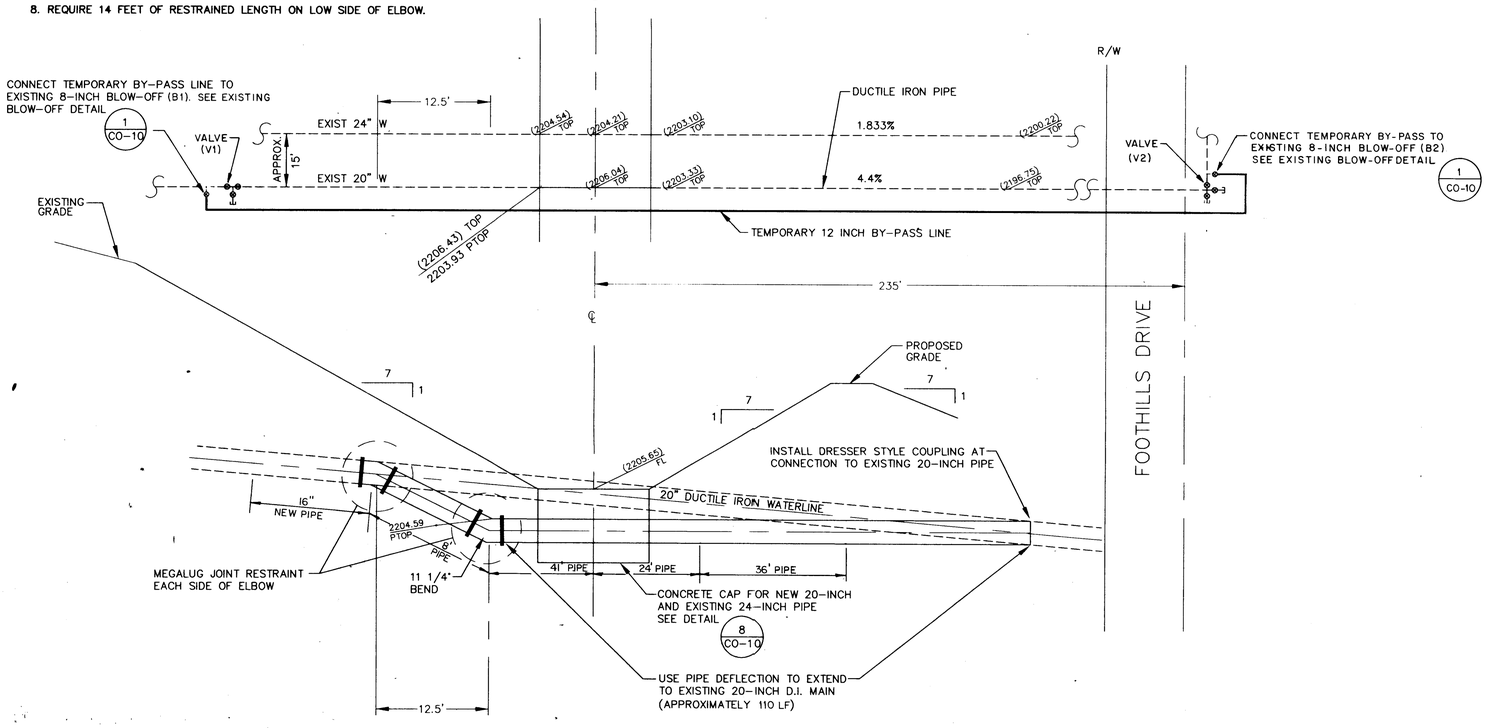


DETENTION BASIN DEPTH GAUGE (1)

NO SCALE

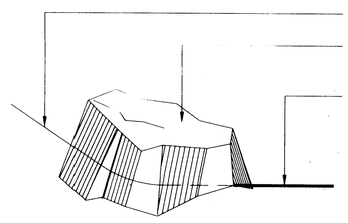
NOTES

1. THE WATERLINE RELOCATION WORK SHALL NOT BE PERFORMED DURING THE TIME PERIOD OF MAY 1 THRU SEPTEMBER 30.
2. CONTRACTOR SHALL FIELD VERIFY PIPE LOCATION, DEPTH, MATERIAL AND O.D..
3. CONTRACTOR SHALL NOTIFY THE CITY OF HENDERSON UTILITY SERVICES DIVISION AT LEAST FOUR (4) WORKING DAYS PRIOR TO RELOCATION WORK.
4. CONTRACTOR TO PROVIDE APPROXIMATELY 800 LF OF 12-INCH TEMPORARY LINE FROM EXISTING 8-INCH BLOW-OFF ASSEMBLY (B2) IN FOOTHILLS DRIVE EAST TO EXISTING 8-INCH BLOW-OFF ASSEMBLY (B1). TEMPORARY LINE CAN BE PLACED ABOVE GROUND WHERE PRACTICAL.
5. CONTRACTOR TO PRESSURE TEST EXISTING LINE (BETWEEN CONNECTION POINTS OF TEMPORARY LINE) BEFORE AND AFTER CONSTRUCTION TO VERIFY THAT ANY FINAL LEAKS ARE THE RESULT OF THE CONSTRUCTION.
6. TEMPORARY LINE TO BE DISINFECTED PER SPECIFICATIONS PRIOR TO ITS USE.
7. REQUIRE 14 FEET OF RESTRAINED LENGTH ON HIGH SIDE OF CUT. IF EXISTING PIPE LENGTH ON HIGH SIDE FROM CUT IS LESS THAN 14 FEET WITHOUT JOINTS, THEN TWO OPTIONS AVAILABLE TO CONTRACTOR:
   - OPTION 1: RESTRAIN EXISTING JOINT WITHIN 14 FOOT LENGTH WITH MEGALUG JOINT RESTRAINT.
   - OPTION 2: REPLACE PIPE LENGTH WITH SINGLE NON-JOINTED SEGMENT WITH MINIMUM LENGTH OF 14 FEET.
8. REQUIRE 14 FEET OF RESTRAINED LENGTH ON LOW SIDE OF ELBOW.

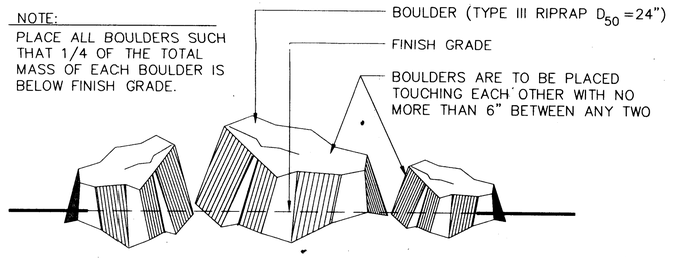


WATERLINE RELOCATION DETAIL (4)

NO SCALE



NOTE:
PLACE ALL BOULDERS SUCH THAT 1/4 OF THE TOTAL MASS OF EACH BOULDER IS BELOW FINISH GRADE.



VEHICLE BARRIER FENCE (2)

NIO SCALE

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REVISION	DATE

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA TIMOTHY E. POGGEMEYER No. 5295 CIVIL

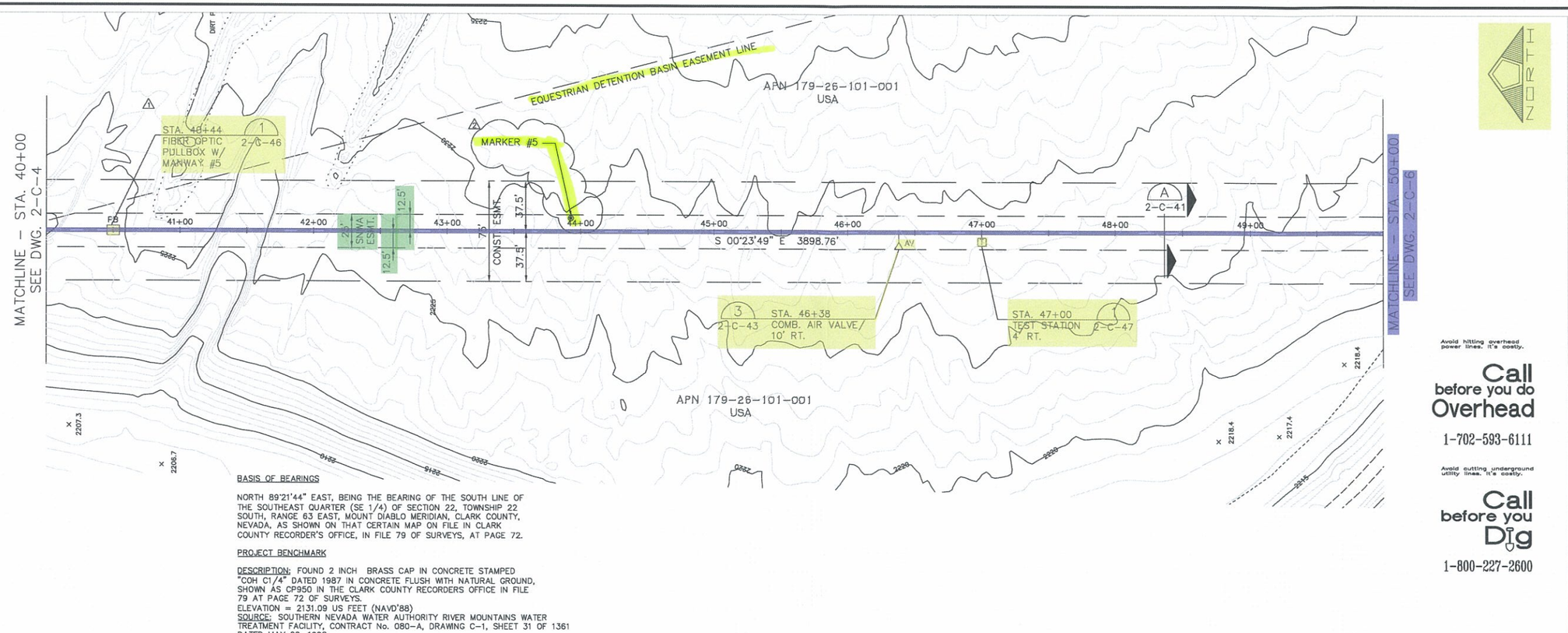
EQUESTRIAN DETENTION BASIN

MISCELLANEOUS DETAILS

JOB NUMBER	95184C
DESIGNED BY	SJJ/JJD
DRAWN BY	
CHECKED BY	TEP
DATE	12-13-95
SHEET NUMBER	CO-11
OF	

RECORD DRAWINGS

Equestrian DR.



BASIS OF BEARINGS

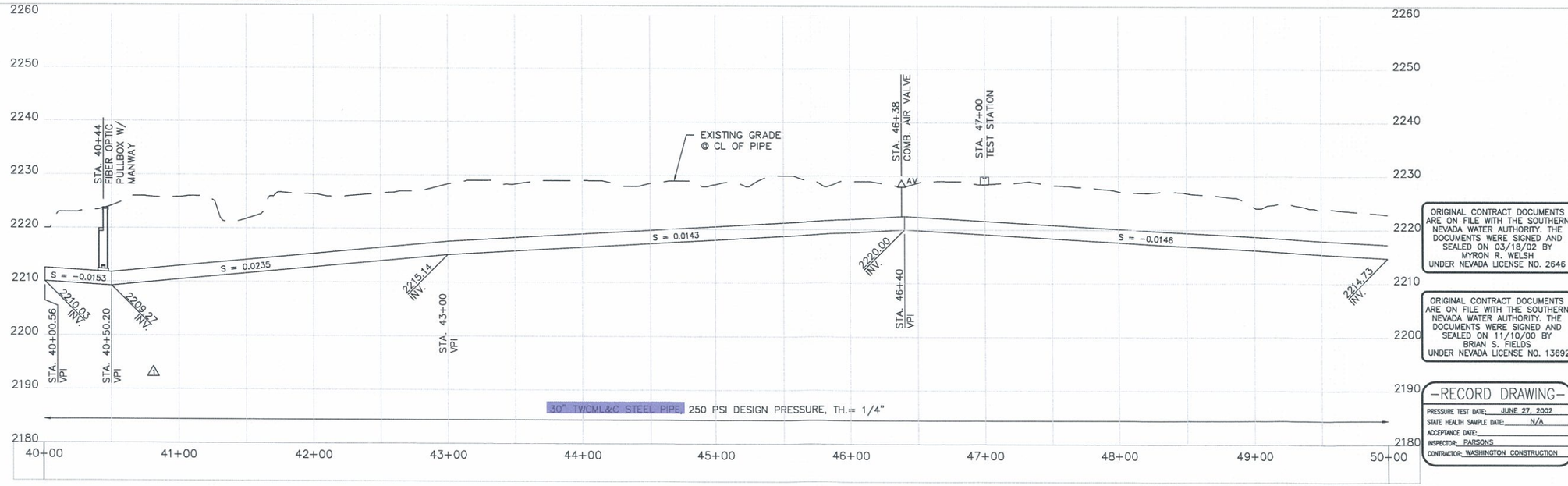
NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

DESCRIPTION: FOUND 2 INCH BRASS CAP IN CONCRETE STAMPED "COH C1/4" DATED 1987 IN CONCRETE FLUSH WITH NATURAL GROUND, SHOWN AS CP950 IN THE CLARK COUNTY RECORDERS OFFICE IN FILE 79 AT PAGE 72 OF SURVEYS.
ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.

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Avoid cutting underground utility lines. It's costly.
Call before you Dig
1-800-227-2600



ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 03/18/02 BY MYRON R. WELSH UNDER NEVADA LICENSE NO. 2646

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

Disclaimer: The data contained herein is provided for informational purposes only. The Southern Nevada Water Authority makes no warranties and does not guarantee its correctness, completeness, or usefulness for any purpose, and hereby disclaims any liability for any loss or damage, however arising from the use of or reliance on the data provided. The SNWA easement, location and depth of all SNWA facilities shall be field verified.

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE-HALF INCHES ON ORIGINAL

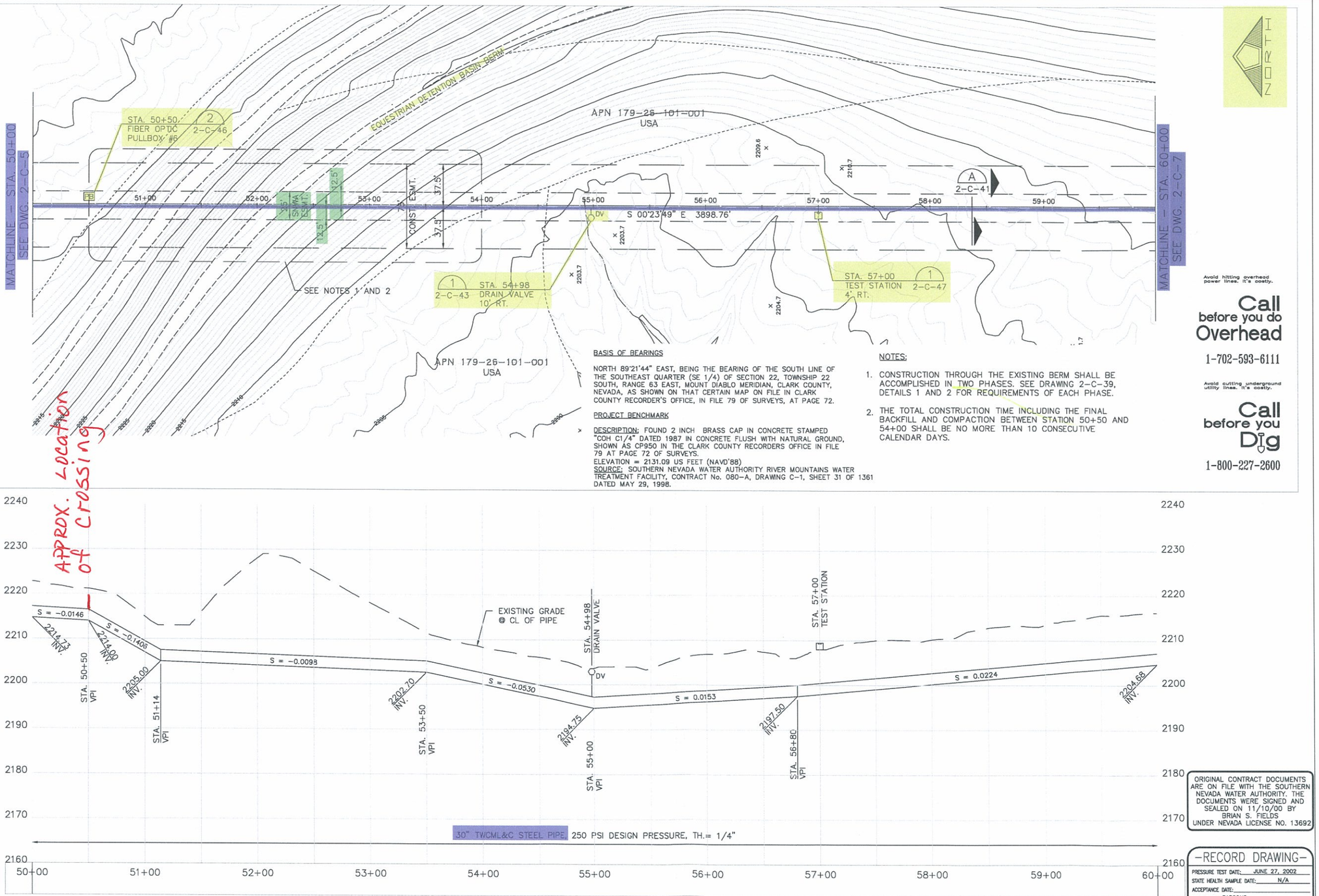
BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 40+00 TO STA. 50+00

REV.	PIPELINE VERT. ALIGNMENT THRU COH WATERLINES	DD	08/01	MW	MARKER #
1	RECORD DRAWING	SL	03/03	MW	SCALE: HORZ. 1"=40' VERT. 1"=10'
	PipF-005.dwg 08/08/01 4:47:19 pm	SL	03/03	MW	

PENTACORE
CIVIL ENGINEERING · LAND SURVEYING · PLANNING
CORPORATE OFFICE: 2300 W. SAHARA AVENUE, SUITE 800
LAS VEGAS, NEVADA 89102 TELEPHONE

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH
DR: D. DAVIDSE

CONTRACT NO.
135-A
DRAWING NO.
2-C-5
SHEET 22 OF 121



BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

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ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.

NOTES:

1. CONSTRUCTION THROUGH THE EXISTING BERM SHALL BE ACCOMPLISHED IN TWO PHASES. SEE DRAWING 2-C-39, DETAILS 1 AND 2 FOR REQUIREMENTS OF EACH PHASE.
2. THE TOTAL CONSTRUCTION TIME INCLUDING THE FINAL BACKFILL AND COMPACTION BETWEEN STATION 50+50 AND 54+00 SHALL BE NO MORE THAN 10 CONSECUTIVE CALENDAR DAYS.

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Avoid cutting underground utility lines. It's costly.

Call before you Dig

1-800-227-2600

APPROX. Location of Crossing

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

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SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 50+00 TO STA. 60+00

RECORD DRAWING	SL	03/03	MW

PlpF-006.DWG 11/10/00 9:48:23 am

SCALE: HORZ. 1"=40' VERT. 1"=10'

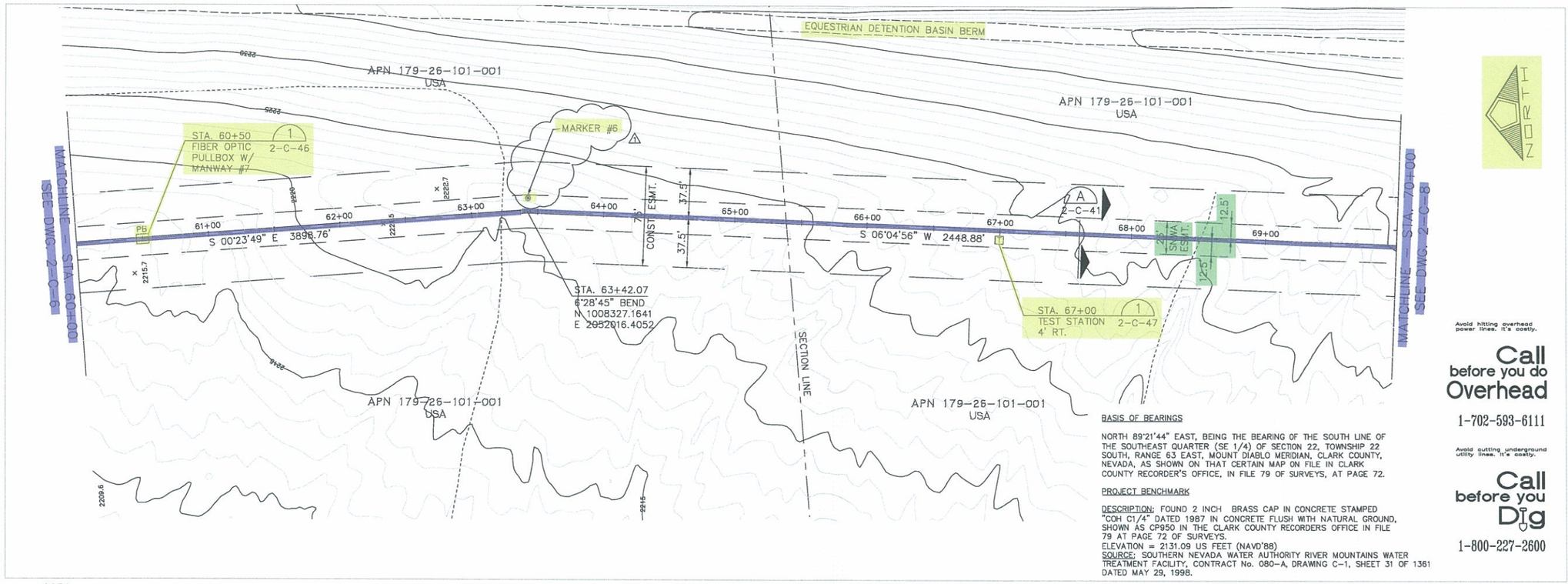
PENTACORE
CIVIL ENGINEERING · LAND SURVEYING · PLANNING
3762 SOUTH MARYLAND PARKWAY, LAS VEGAS, NEVADA 89109
(702) 735-6040 · FAX (702) 735-0049

DSGN: B. FIELDS/D. DAVIDSE
DR: D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH

CONTRACT NO.
135-A

DRAWING NO.
2-C-6

SHEET 23 OF 121



BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

DESCRIPTION: FOUND 2 INCH BRASS CAP IN CONCRETE STAMPED "COH C1/4" DATED 1987 IN CONCRETE FLUSH WITH NATURAL GROUND, SHOWN AS CP950 IN THE CLARK COUNTY RECORDERS OFFICE IN FILE 79 AT PAGE 72 OF SURVEYS.
ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.

Avoid hitting overhead power lines. It's costly.

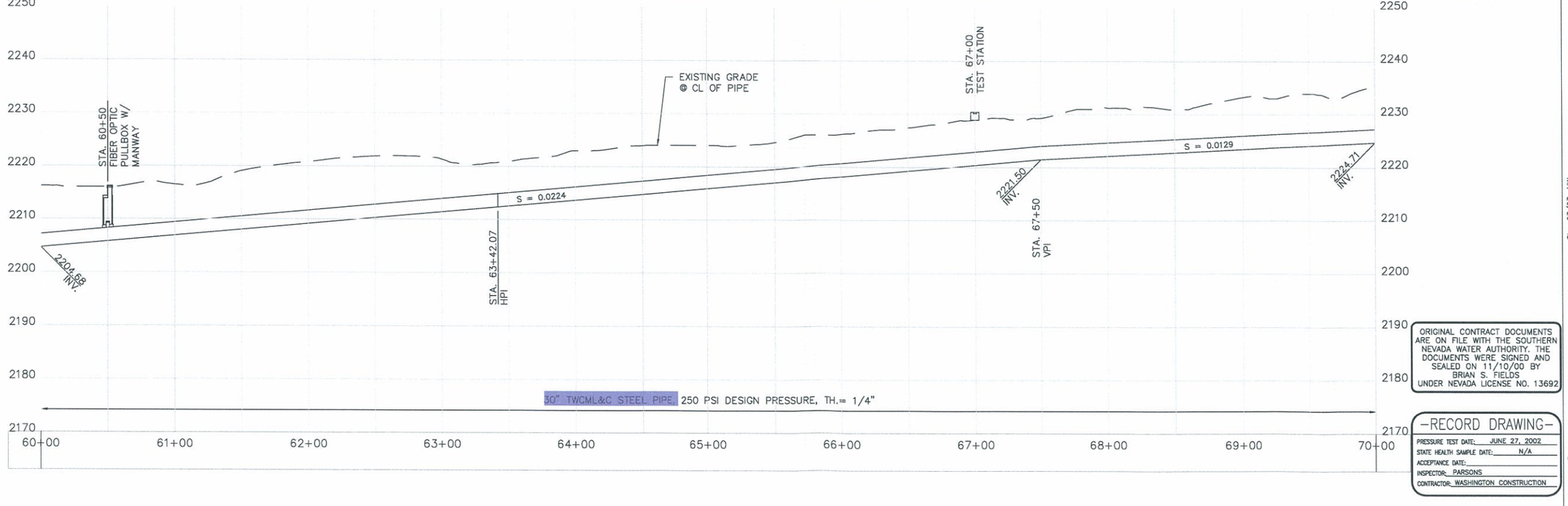
Call before you do Overhead

1-702-593-6111

Avoid cutting underground utility lines. It's costly.

Call before you Dig

1-800-227-2600



ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

MARKER #

SL 03/03 MW

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 60+00 TO STA. 70+00

SL	03/03	MW	SCALE: HORZ. 1"=40' VERT. 1"=10'

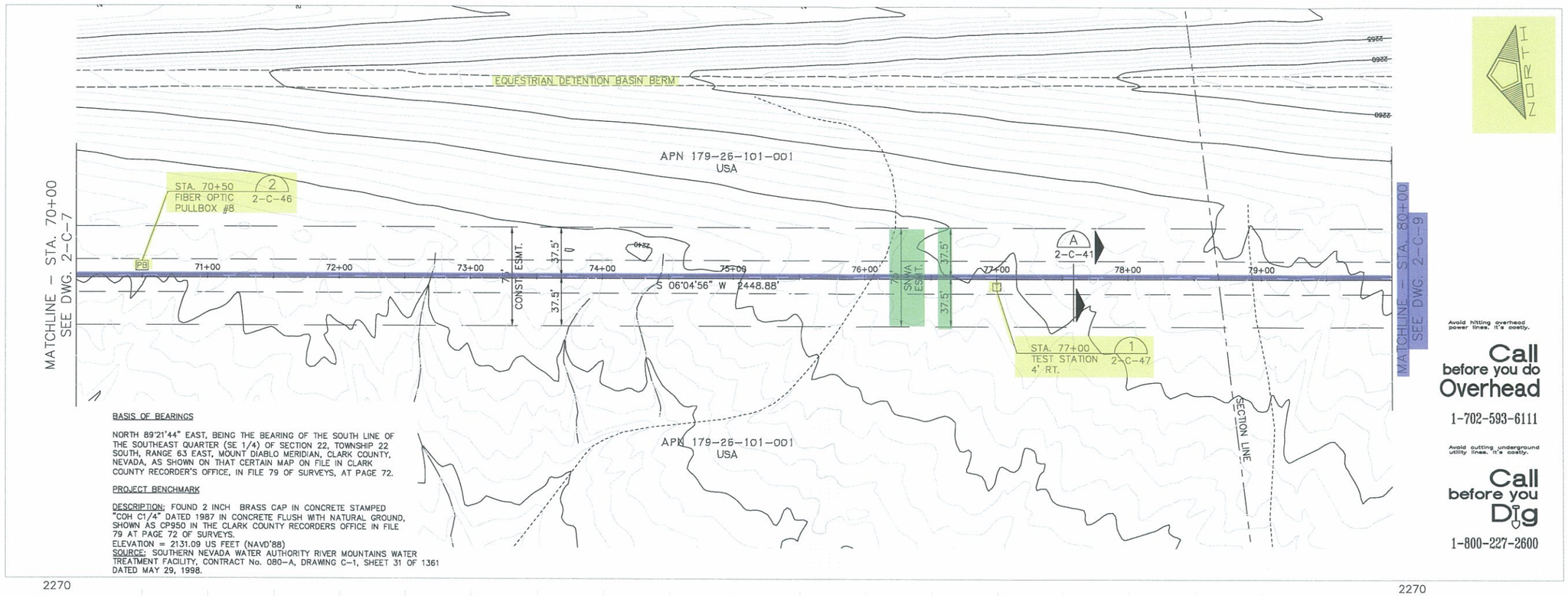
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PlpF-007.dwg

PENTACORE
CIVIL ENGINEERING, LAND & WATER PLANNING
CORPORATE OFFICE: 1000 SOUTH RAINBOW BOULEVARD, SUITE 100, LAS VEGAS, NEVADA 89145 (702)259-3100

DSGN: B. FIELDS/D. DAVIDSE
DR: D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH

CONTRACT NO.
135-A
DRAWING NO.
2-C-7
SHEET 24 OF 121

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ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

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SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

DELIVERY IMPROVEMENTS

BOULDER CITY WATER

PIPELINE PLAN & PROFILE
STA. 70+00 TO STA. 80+00

		SL.	03/03
RECORD DRAWING		MW	
1	11/10/00		
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SCALE HORIZ. 1"=40' VERT. SCALE 1"=10'

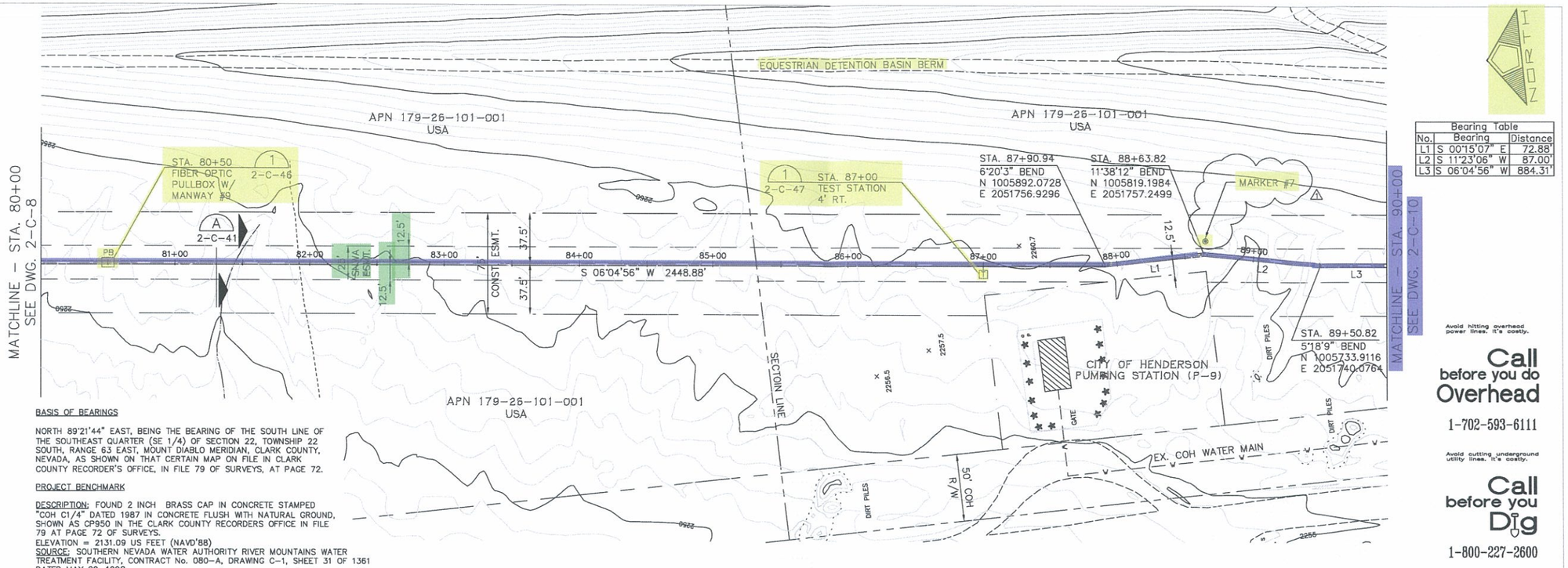
PENTACORE
ENGINEERING | SURVEYING | PLANNING
CONSTRUCTION MANAGEMENT AND OWNER REPRESENTATION SERVICES
LAS VEGAS, NEVADA 89118 (702)228-3115

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
APV'D: M. WELSH
DR: D. DAVIDSE

CONTRACT NO.
135-A

DRAWING NO.
2-C-8

SHEET 25 OF 121

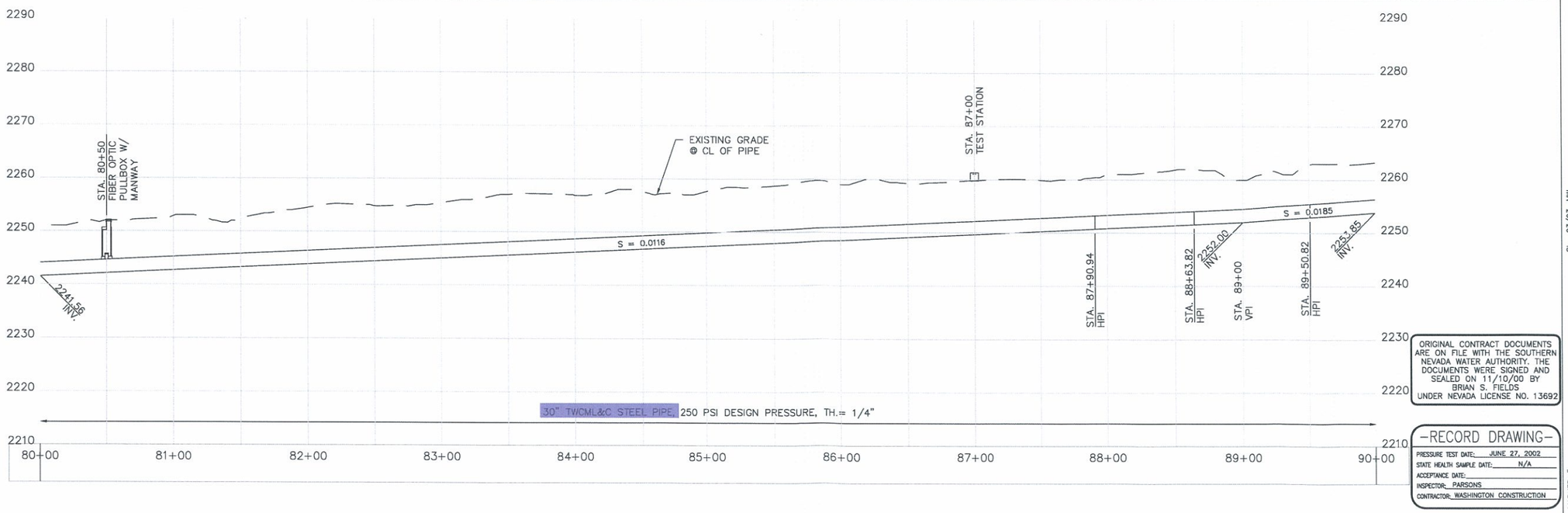


BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

DESCRIPTION: FOUND 2 INCH BRASS CAP IN CONCRETE STAMPED "COH C1/4" DATED 1987 IN CONCRETE FLUSH WITH NATURAL GROUND, SHOWN AS CP950 IN THE CLARK COUNTY RECORDERS OFFICE IN FILE 79 AT PAGE 72 OF SURVEYS.
ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.



ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

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SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

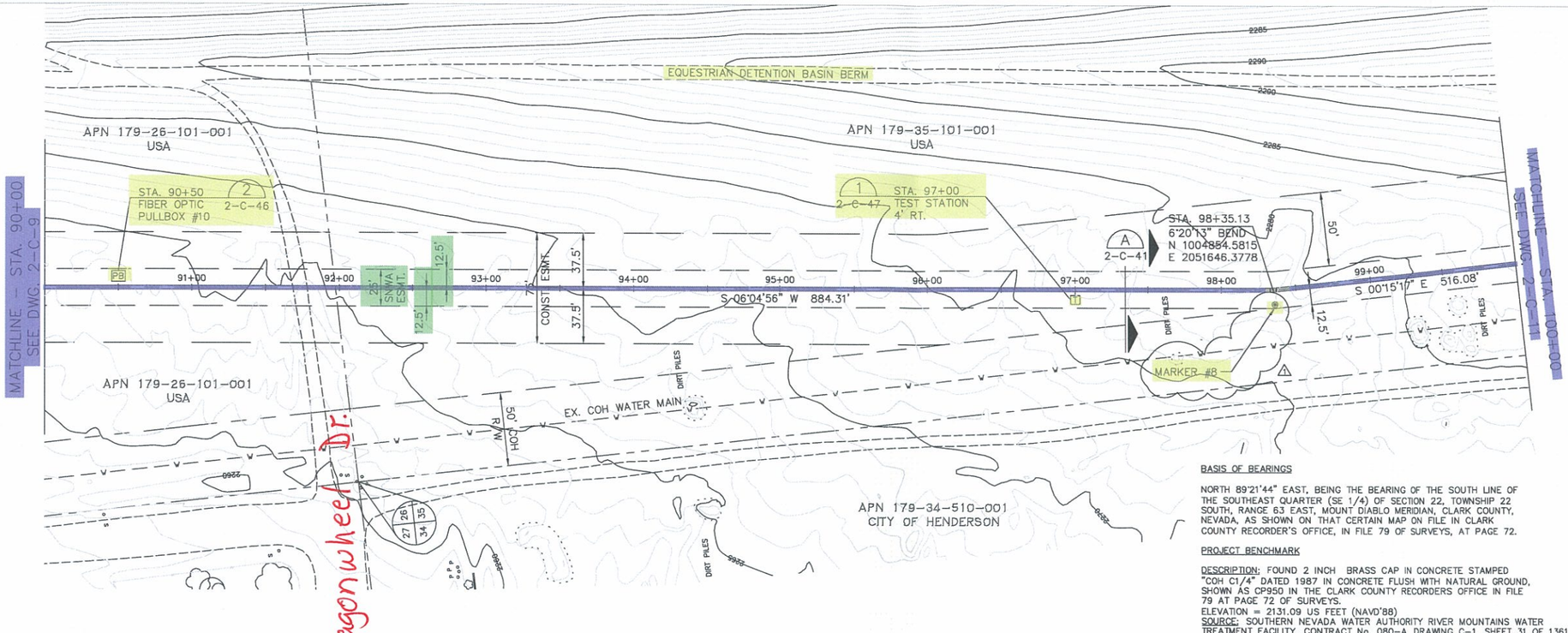
BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 80+00 TO STA. 90+00

SL 03/03 MW
HORZ. SCALE 1"=40'
VERT. SCALE 1"=10'
RECORD DRAWING 11/10/00 9:50:52 am
PlpF-009.dwg

PENTACORE
PIPELINE CONSTRUCTION & MATERIAL SUPPLIERS
CONSTRUCTION MANAGEMENT, ALASKA, NEVADA
LAS VEGAS, NEVADA 89118 (702)558-1919

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
DR: D. DAVIDSE
APVD: M. WELSH

CONTRACT NO.
135-A
DRAWING NO.
2-C-9
SHEET 26 OF 121



BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

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ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.

Avoid hitting overhead power lines. It's costly.

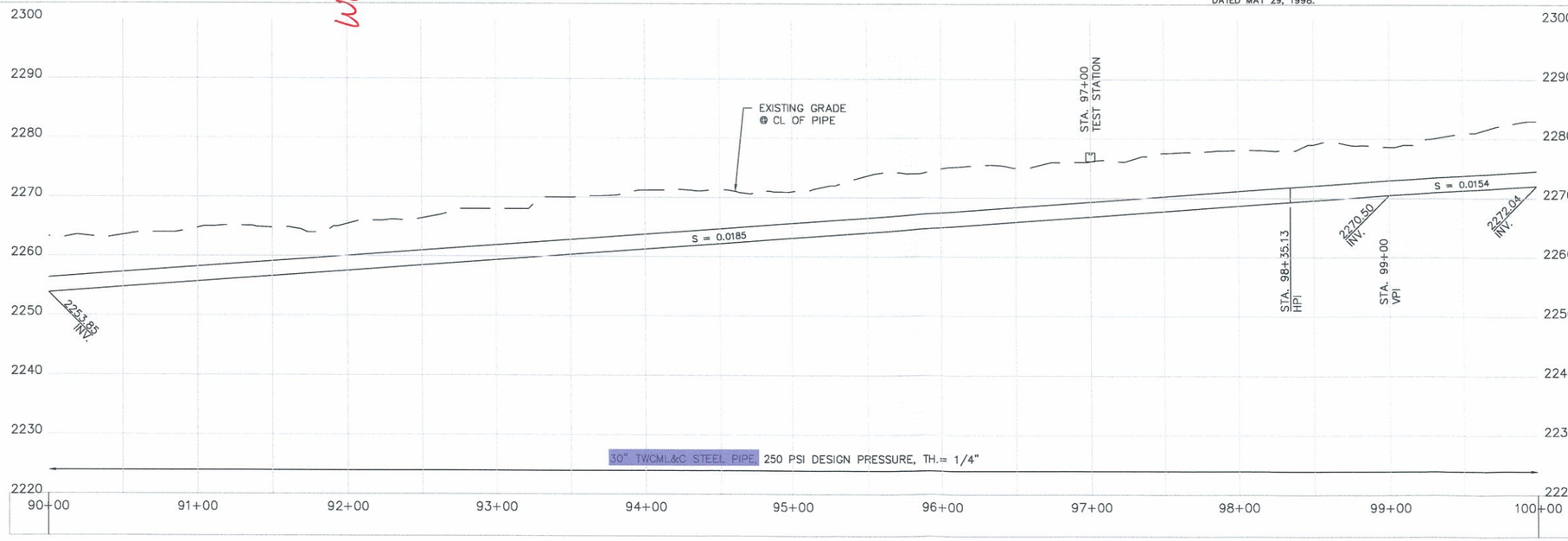
Call before you do Overhead

1-702-593-6111

Avoid cutting underground utility lines. It's costly.

Call before you Dig

1-800-227-2600



ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

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SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE-HALF INCH ON ORIGINAL

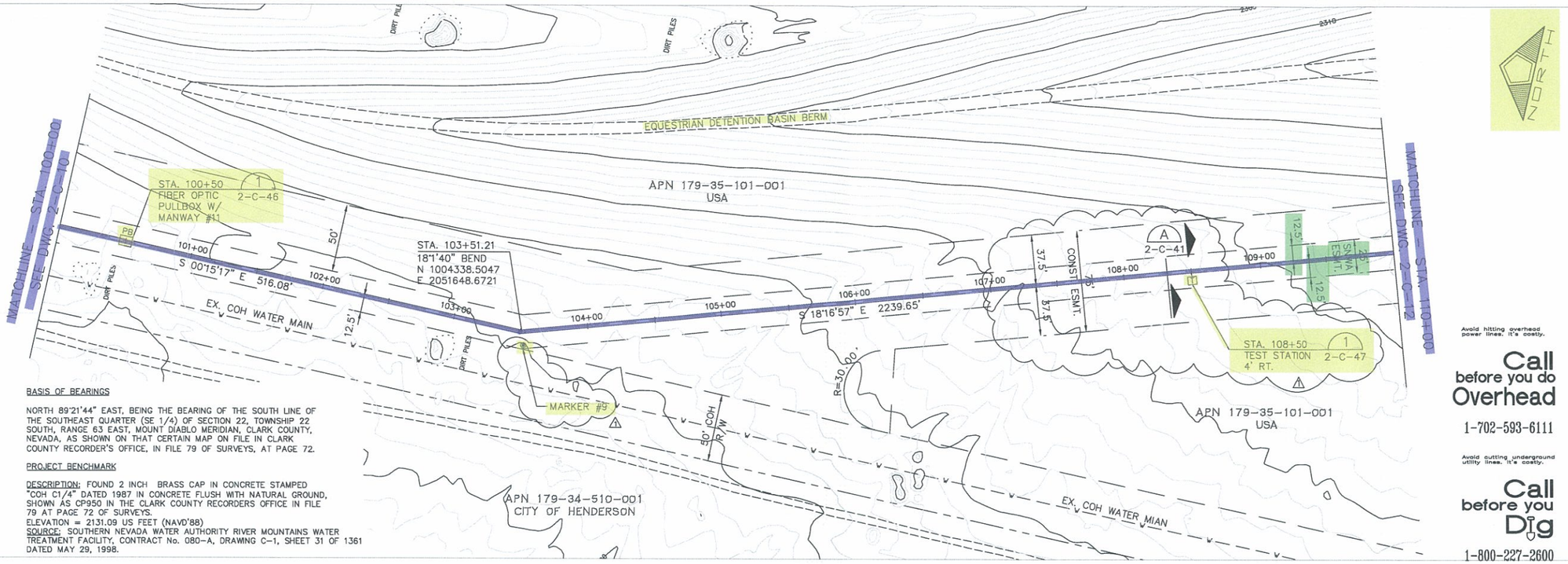
BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 90+00 TO STA. 100+00

SL	03/03	MW	SCALE: HORZ. 1"=40' VERT. 1"=10'
RECORD DRAWING			
PipF-010.dwg 11/10/00 9:51:35 am			

PENTACORE
CIVIL ENGINEERING, LAND SURVEYING, PLANNING
2300 WEST SAHARA AVENUE, SUITE 800
LAS VEGAS, NEVADA 89102 (702)258-3115

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH
DR: D. DAVIDSE

CONTRACT NO. 135-A
DRAWING NO. 2-C-10
SHEET 27 OF 121



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SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 100+00 TO STA. 110+00

	SL	03/03	MW

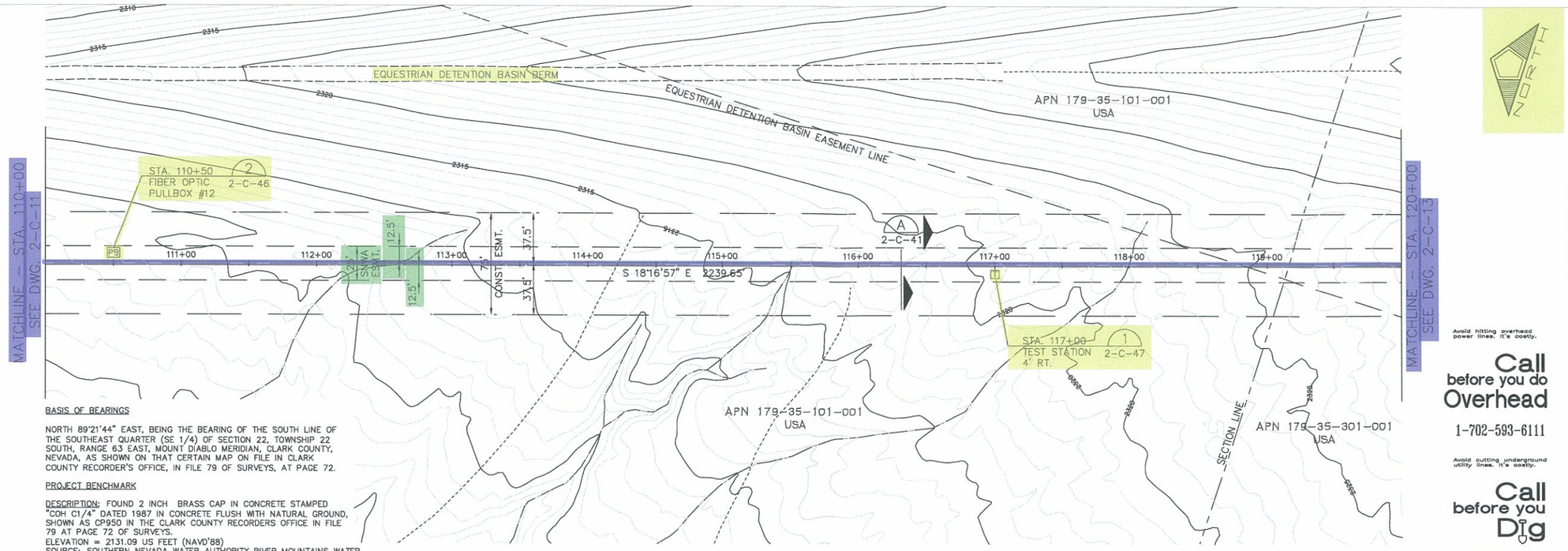
SCALE: HORZ. 1"=40' VERT. 1"=10'

RECORD DRAWING 11/10/00 9:52:15 am
PlpF-011.dwg

PENTACORE
CIVIL ENGINEERING • LAND SURVEYING • PLANNING
CONSTRUCTION MANAGEMENT
6671 SOUTHERN HIGHLANDS PKWY. SUITE 110
LAS VEGAS, NEVADA 89118 (702)228-4111

DSGN: B. FIELDS/D. DAVIDSE
DR: D. DAVIDSE
CHK: T. SHIELDS
APV'D: M. WELSH

CONTRACT NO.
135-A
DRAWING NO.
2-C-11
SHEET 28 OF 121



BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

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Avoid hitting overhead power lines. It's costly.

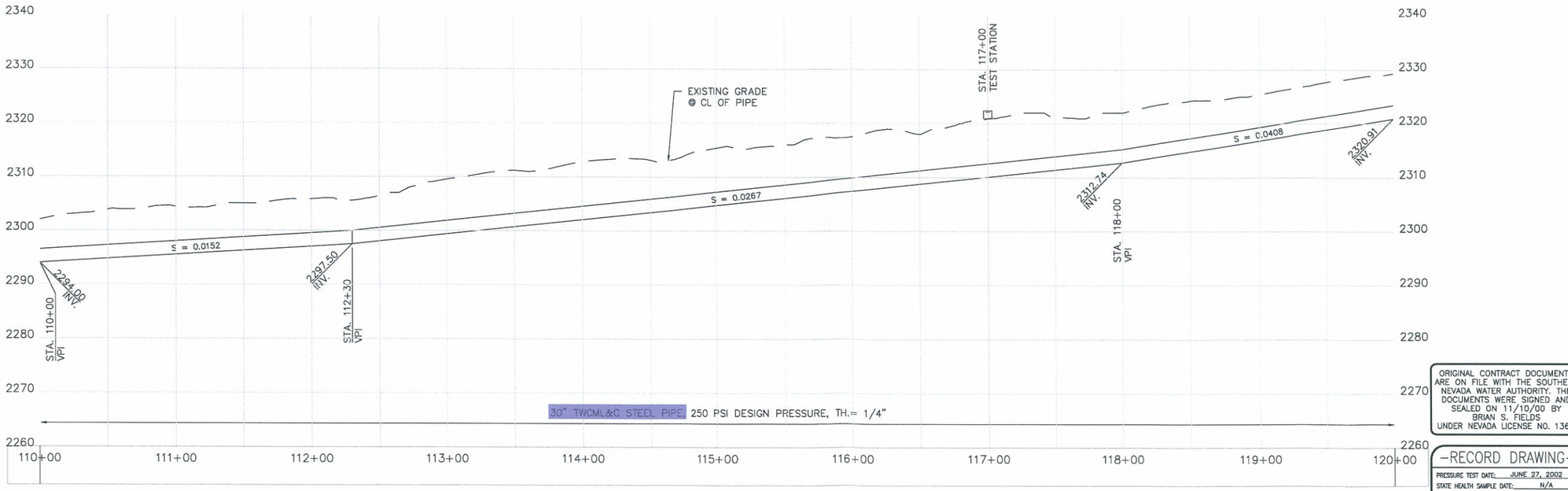
Call before you do Overhead

1-702-593-6111

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Call before you Dig

1-800-227-2600



ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

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SOUTHERN NEVADA
WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 110+00 TO STA. 120+00

		SL	03/03
RECORD DRAWING			
PlpF-012.dwg	11/10/00	9525/57	am

SCALE: HORZ. 1"=40' VERT. 1"=10'

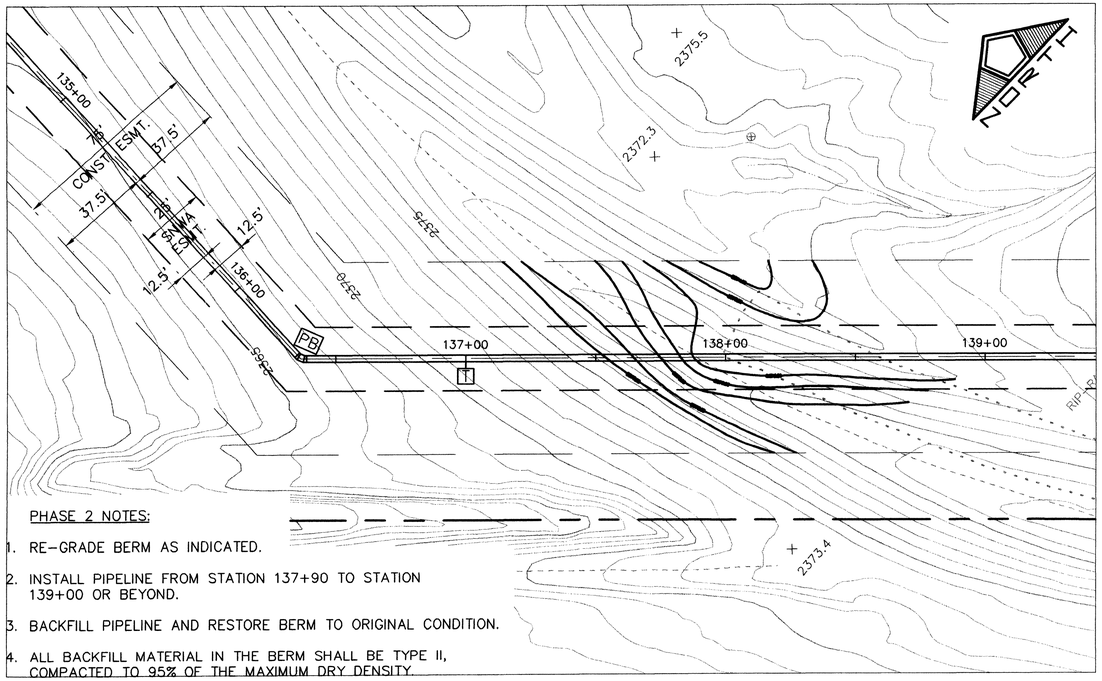
PENTACORE
CIVIL ENGINEERING • LAND SURVEYING • PLANNING
CONSTRUCTION MANAGEMENT • ENVIRONMENTAL
LAS VEGAS, NEVADA 89118 (702)228-7015

DSGN: B. FIELDS/D. DAVIDSE
DR: D. DAVIDSE
CHK: T. SHIELDS
APV'D: M. WELSH

CONTRACT NO.
135-A

DRAWING NO.
2-C-12

SHEET 29 OF 121



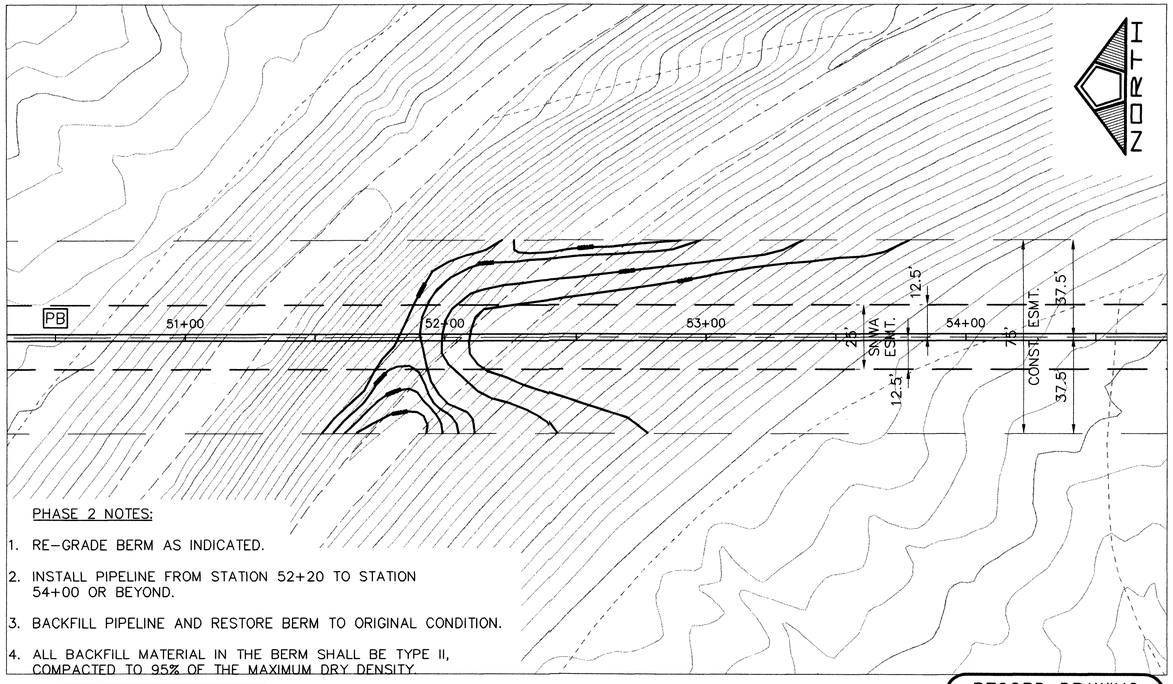
PHASE 2 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE FROM STATION 137+90 TO STATION 139+00 OR BEYOND.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

BERM BREACH PLAN – PHASE 2
STA. 136+50 TO STA. 139+00

SCALE: 1" = 30'

4 / 2-C-39



PHASE 2 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE FROM STATION 52+20 TO STATION 54+00 OR BEYOND.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

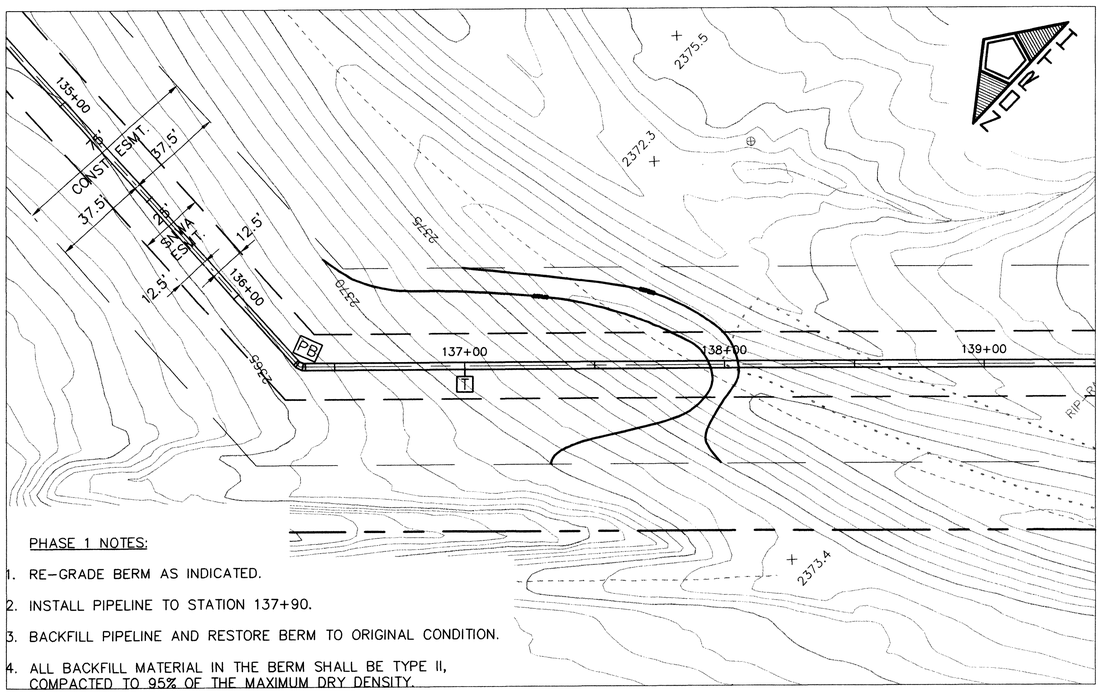
BERM BREACH PLAN – PHASE 2
STA. 50+50 TO STA. 54+00

SCALE: 1" = 30'

2 / 2-C-39

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION



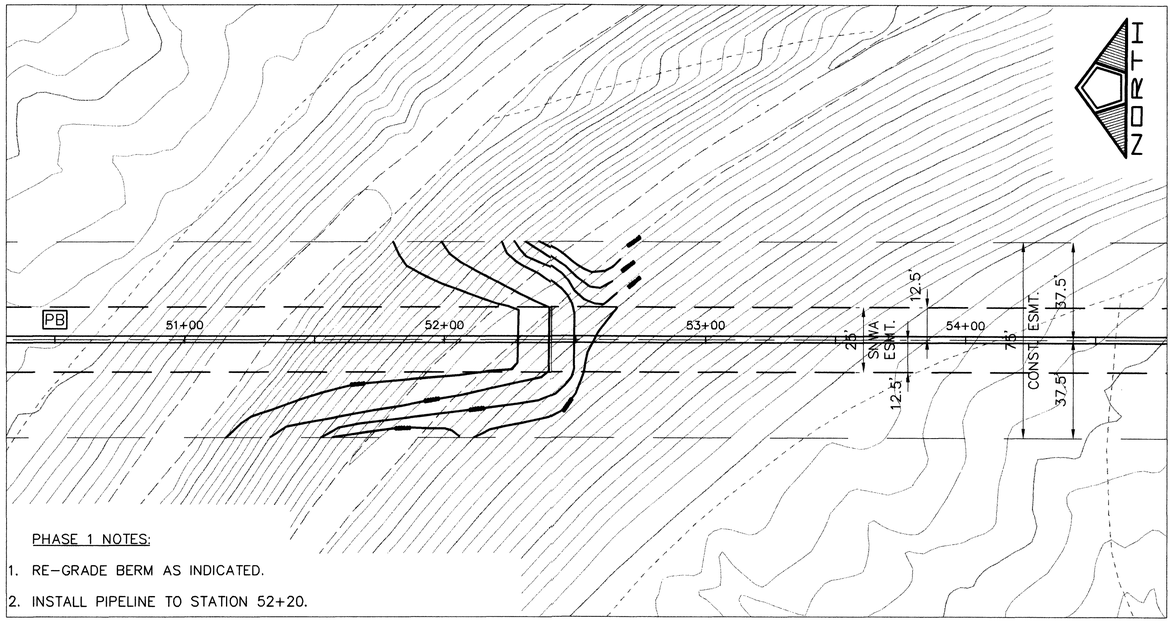
PHASE 1 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE TO STATION 137+90.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

BERM BREACH PLAN – PHASE 1
STA. 136+50 TO STA. 139+00

SCALE: 1" = 30'

3 / 2-C-39



PHASE 1 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE TO STATION 52+20.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

BERM BREACH PLAN – PHASE 1
STA. 50+50 TO STA. 54+00

SCALE: 1" = 30'

1 / 2-C-39

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1-702-593-6111

Avoid cutting underground utility lines. It's costly.
Call before you Dig
1-800-227-2600

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS

PLAN

BERM BREACH PLAN

1	RECORD DRAWING	11/09/00	357:34 pm
	BERMGRAD.dwg		

SCALE: AS SHOWN

DSGN: B. FIELDS/D. DAVIDSE	CHK: T. SHIELDS	APVD: M. WELSH
DR: D. DAVIDSE	SL	03/03 MW

PENTACORE
CIVIL ENGINEERING • LAND SURVEYING • PLANNING
CONSTRUCTION MANAGEMENT • PROJECT MANAGEMENT
6763 W. WEST CHARLESTON BOULEVARD
LAS VEGAS, NEVADA 89146 (702)228-0115

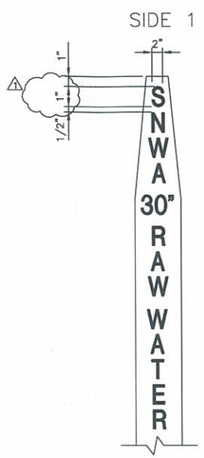
CONTRACT NO. 135-A

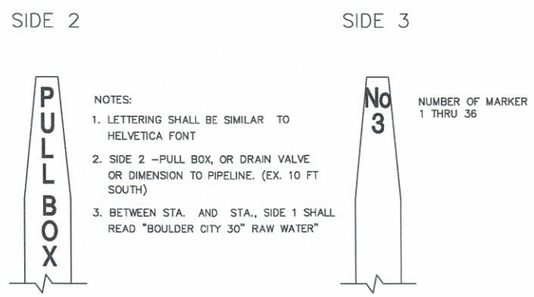
DRAWING NO. 2-C-39

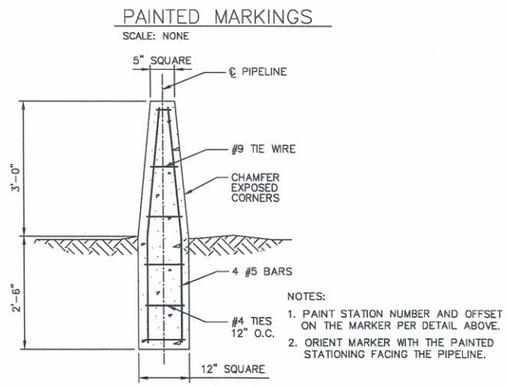
SHEET 56 OF 121

SNWA Contract 135-A
Boulder City Water Improvements
Pipeline Marker Schedule

	Point	Northing	Easting	Station	Offset	Direction
Southern Nevada Water Authority	1	1013901.1191	2051083.2807	3+35.64	-10.00	West
	2	1013561.9879	2051142.9711	6+67.11	10.00	North
	3	1013543.2195	2051534.3596	10+49.58	-10.00	West
	4	1012229.1696	2051998.8254	24+43.30	-10.00	West
	5	1010276.5732	2052012.9012	43+92.68	-10.00	West
	6	1008326.1012	2052026.3485	63+42.07	-10.00	West
	7	1005817.2229	2051767.0528	88+63.82	-10.00	West
	8	1004854.5323	2051636.3779	98+35.13	10.00	East
	9	1004335.3650	2051639.1777	103+51.21	10.00	East
	10	1002211.0000	2052361.2103	125+90.86	-10.00	West
	11	1001171.4424	2052246.6465	136+36.52	10.00	East
	12	1000568.9698	2052828.4001	144+65.00	-10.00	West
	13	1000298.5568	2052991.3701	147+78.69	10.00	East
	14	999812.1302	2053468.5282	154+58.00	-10.00	West
	15	997950.2011	2054476.0809	175+65.88	10.00	North
	16	998016.8275	2054590.6491	176+88.04	-10.00	West
	17	997754.4492	2054717.3321	179+76.54	-10.00	West
	18	997522.2365	2054734.8228	182+08.55	10.00	East
	19	996677.8368	2055098.8012	191+41.21	-10.00	West
	20	996586.0699	2054992.6023	192+71.21	10.00	East
	21	994868.2655	2056612.7230	216+65.35	-10.00	South
	22	994614.1528	2058982.9199	240+59.50	10.00	South
	23	994713.1807	2058979.8778	241+48.07	-10.00	South
	24	994901.4002	2059196.6529	245+34.07	-10.00	East
	25	994847.7304	2059673.5292	250+13.54	10.00	North
	26	995354.8094	2060240.9829	18+08.14	-10.00	South
	27	995257.1713	2060433.9136	20+24.37	-10.00	South
	28	994768.9733	2060832.3040	26+50.42	10.00	North
	29	994659.6513	2062625.6817	279+71.61	-10.00	South
	30	994513.9816	2064407.5091	297+59.27	10.00	North
Boulder City	31	994631.0080	2065381.0206	307+37.93	10.00	North
	32	995104.9471	2065367.0747	312+02.06	-10.00	South
	33	995297.5748	2066887.0410	327+29.75	-10.00	South
	34	996385.3934	2068947.9460	355+28.64	-10.00	East
	35	997615.2041	2069960.6479	371+21.75	-10.00	East
	36	998838.1853	2070991.0559	387+14.86	10.00	West







STANDARD PIPELINE MARKERS
SCALE: NONE

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE MARKER DETAIL

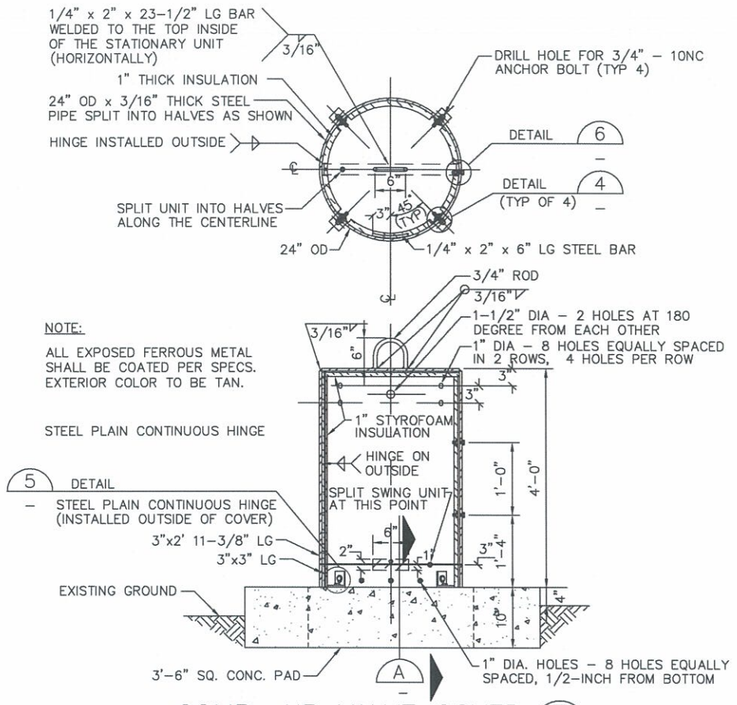
C.O. NO 32.	SL	03/03	MW
CHANGED DIM.			
RECORD DRAWING			

SCALE: AS SHOWN

PENTACORE
CONSTRUCTION MANAGEMENT AND CONSULTING
DSGN:
DR: K. SCHREPFER
CHK:
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-40
SHEET 57 OF 121

Disclaimer: The data contained herein is provided for informational purposes only. The Southern Nevada Water Authority makes no warranties and does not guarantee its correctness, completeness, or usefulness for any purpose, and hereby disclaims any liability for any loss or damage, however arising from the use of or reliance on the data provided. The SNWA easement, location and depth of all SNWA facilities shall be field verified.

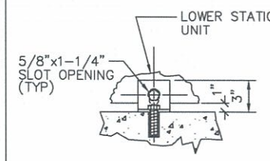


COMB. AIR VALVE COVER 7

NOT TO SCALE

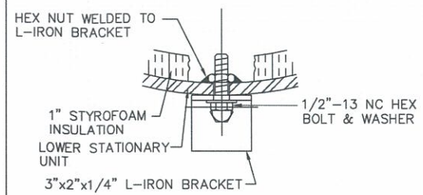
USE DRAIN ROCK BACKFILL TO A MAXIMUM DEPTH

3-C-43



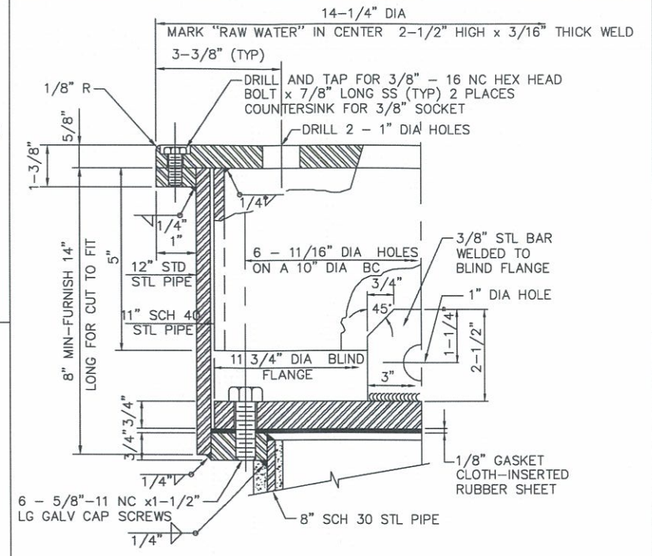
DETAIL 5

NOT TO SCALE 2-C-43



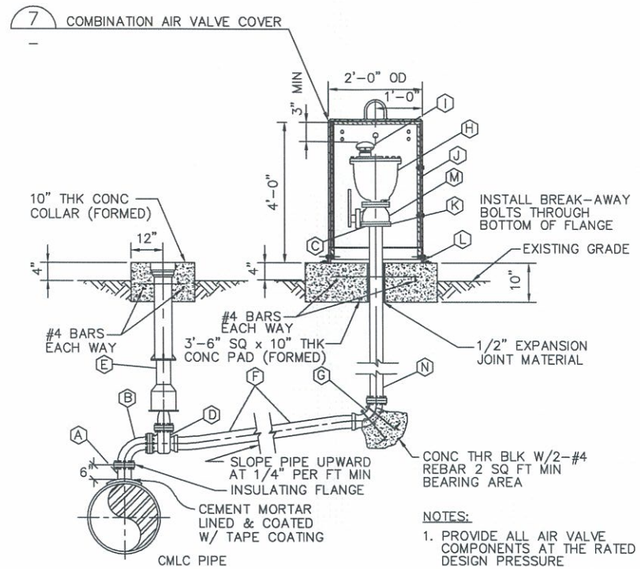
DETAIL 4

NOT TO SCALE 2-C-43



DRAIN VALVE COVER 2

NOT TO SCALE 2-C-43

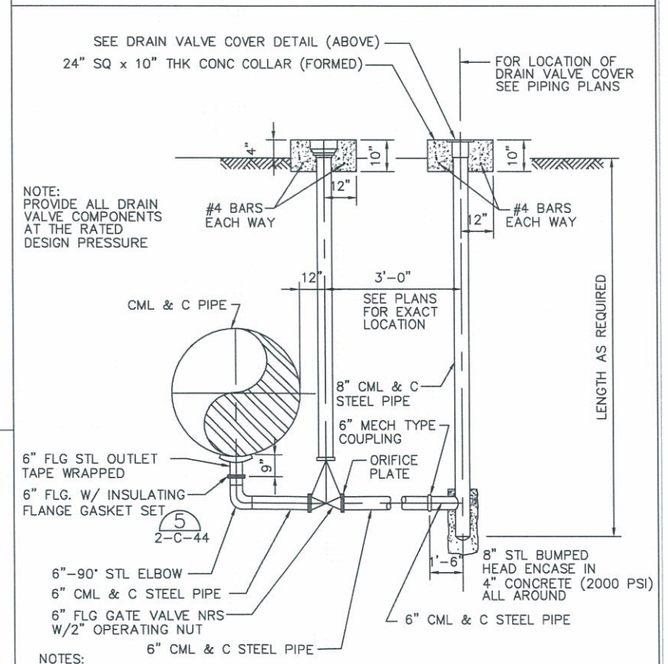


NOTES:

1. PROVIDE ALL AIR VALVE COMPONENTS AT THE RATED DESIGN PRESSURE
2. SEE LEGEND THIS SHEET.

4" COMB. AIR VALVE ASSEMBLY 3

NOT TO SCALE 2-C-43

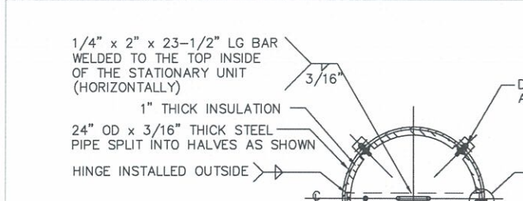


NOTES:

1. ALL 6" & 8" STL PIPE & FITTINGS TO HAVE CEMENT MORTAR LINING & COATING
2. CONCRETE TO BE 1/8" TO 1/4" BELOW FINAL STREET GRADE
3. FOR ORIFICE PLATE SIZE SEE SCHEDULE THIS SHEET.

DRAIN VALVE ASSEMBLY 1

NOT TO SCALE 2-C-43



DETAIL 6

NOT TO SCALE 2-C-43

DETAIL A

NOT TO SCALE 2-C-43

LEGEND

- (A) 4" FLG STL OUTLET FOR CMLC STL. PIPE, WITH CML&C OR TAPE WRAPPED
- (B) 4"- 90° FLG DUCTILE IRON BEND
- (C) 4" DUCTILE IRON FLANGE
- (D) 4" FLG x PO OR FLG x MJ GATE VALVE W/2" OPERATING NUT
- (E) VALVE BOX & COVER - SEE DETAIL 1 / 2-C-45
- (F) 4" DUCTILE IRON PIPE
- (G) 4" - 90° FLG x PO OR FLG x MJ CI BEND
- (H) 4" COMBINATION AIR VALVE, FLANGED INLET
- (I) 4" MUSHROOM FOR 4" COMBINATION AIR VALVE ASSY
- (J) 2'-0" OD x 3'-6" HIGH STEEL COVER
- (K) 5/8"-11NC BREAK-AWAY ZINC PLATED HEX HD BOLT, HEX NUT AND LOCKWASHER
- (L) 1/2"-13NC x 2-1/2" LG "RED HEAD" ANCHOR BOLT INSTALLED OUTSIDE
- (M) 4" BALL VALVE - QUARTER TURN - FOR 4" COMB AIR VALVE ASSY
- (N) 4" DUCTILE IRON PIPE

ORIFICE PLATE SCHEDULE

DRAIN VALVE STATION	ORIFICE DIAMETER	DRAIN VALVE STATION	ORIFICE DIAMETER
2+42.92	2"	209+88	4"
6+48	2"	214+93	4"
25+73	2"	218+62.97	4"
38+93	2"	222+43	4"
54+98	2"	225+68	4"

NOTE:

ALL OTHER DRAIN VALVES HAVE NO ORIFICE PLATE.

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

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SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS

COMBINATION AIR VALVE & DRAIN VALVE DETAILS

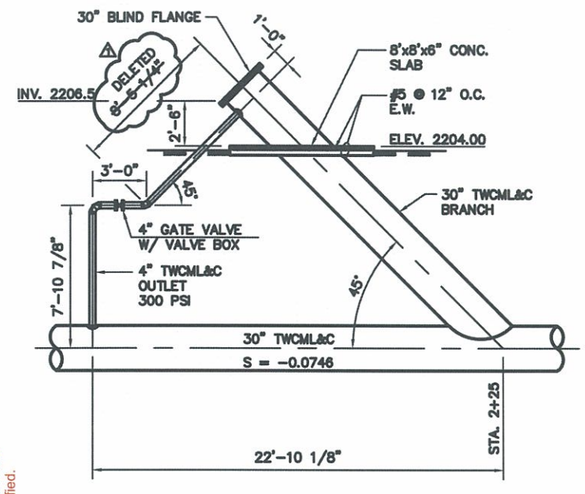
SCALE: AS SHOWN			
SL	03/03	MW	
RECORD DRAWING			

PENTACORE
CIVIL ENGINEERING - LAND SURVEYING - PLANNING
6725 W. RUSSELL ROAD, SUITE 320, LAS VEGAS, NEVADA 89118
LAS VEGAS (702) 562-3900 FAX (702) 562-3901

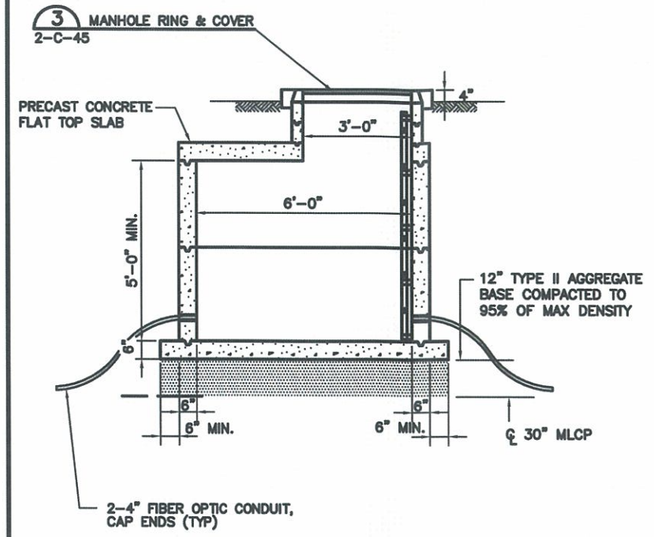
DSGN: B.FIELDS/D. DAVIDSE
CHK:
APV'D:
DR: K. ALEXANDER

CONTRACT NO. 135-A
DRAWING NO. 2-C-43
SHEET 60 OF 121

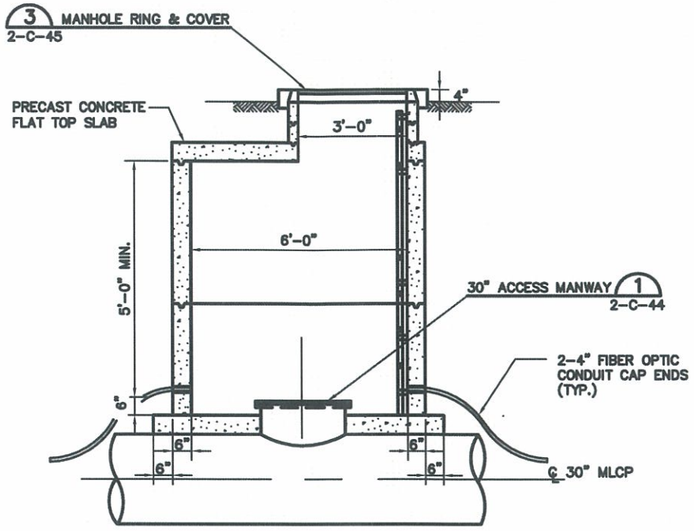
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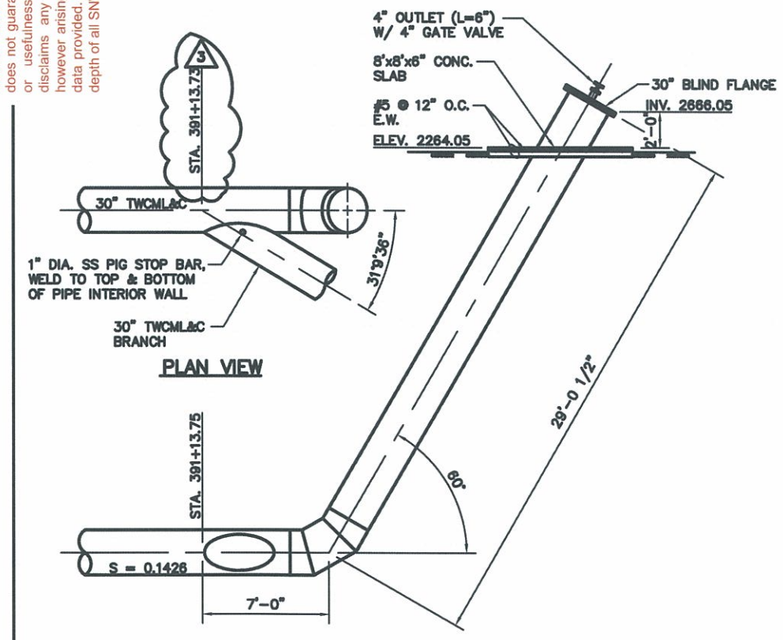
PIPE PIG ENTRY PROFILE 4
SCALE: 1/4"=1'-0" 2-C-46



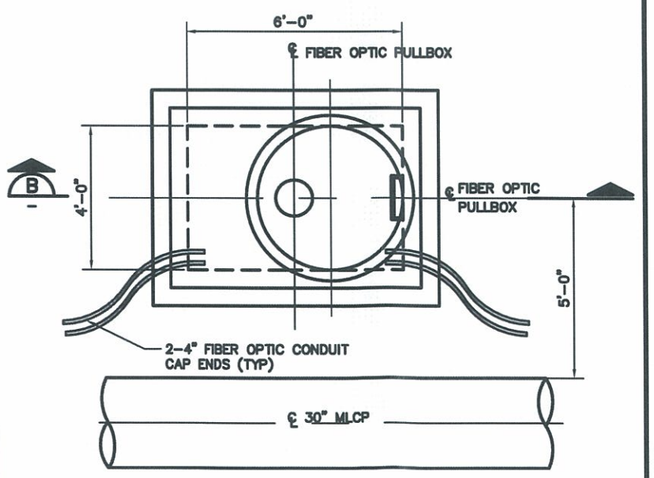
SECTION B
SCALE: 1/2"=1'-0" 2-C-46



SECTION A
SCALE: 1/2"=1'-0" 2-C-46

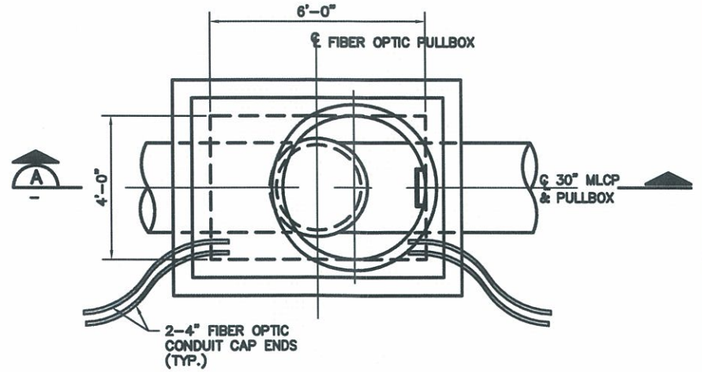


PIPE PIG EXIT PROFILE 3
SCALE: 1/4"=1'-0" 2-C-46



FIBER OPTIC PULLBOX 2
SCALE: 1/2"=1'-0" 2-C-46

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692



-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

FIBER OPTIC PULLBOX W/ MANWAY 1
SCALE: 1/2"=1'-0" 2-C-46

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE 1/2 0 1/2
BAR MEASURES ONE INCH ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS

MISCELLANEOUS PIPE DETAILS - III

4	EQUATION STATION REMOVAL AND STATION NUMBERS UPDATED	HF	11/00
3	DELETED DWG.	SL	03/03
2		MW	
1			

pipedet-t3.dwg 11/09/00 3:56:58 pm

SCALE: AS SHOWN

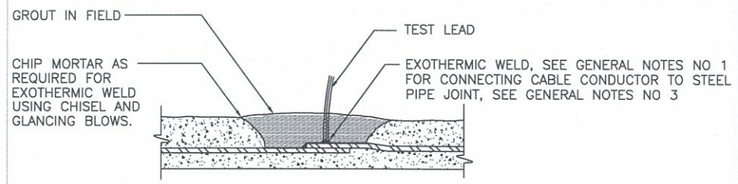
DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH
DR: K. ALEXANDER

PENTACORE

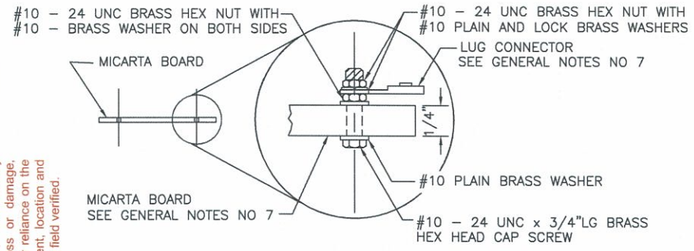
CONTRACT NO. 135-A
DRAWING NO. 2-C-46
SHEET 63 OF 121

RECORD DRAWING

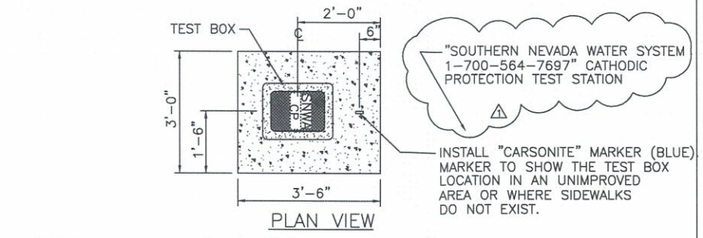
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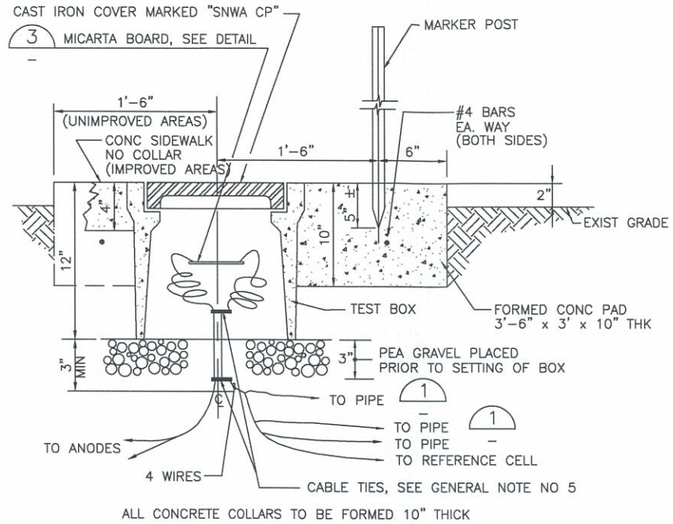
TEST LEAD CONNECTION 5
NOT TO SCALE 2-C-47



TEST BOARD DETAIL 4
NOT TO SCALE 2-C-47

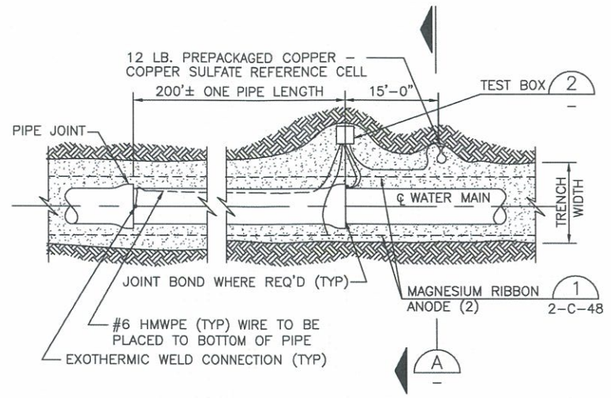


PLAN VIEW



TEST BOX DETAIL 2
NOT TO SCALE 2-C-47

M.J. SCHIFF & ASSOCIATES
1308 MONTE VISTA AVE., SUITE 6
UPLAND, CA 91786
(909) 931-1360

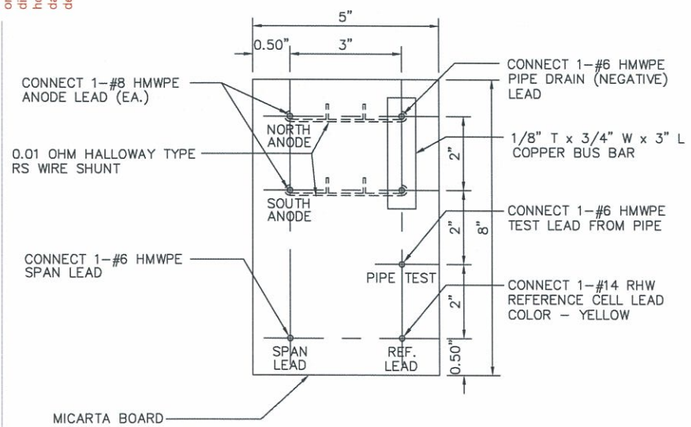


PLAN VIEW

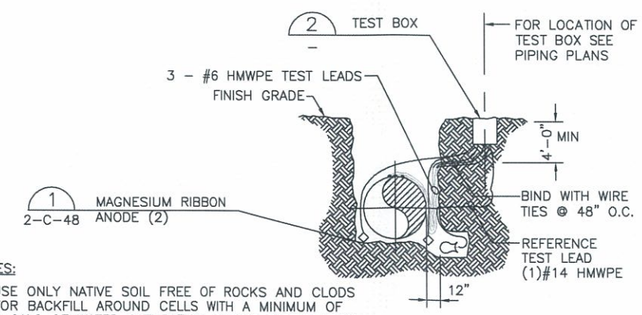
ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY GRAHAM E. C. BELL UNDER NEVADA LICENSE NO. 11869

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

TEST STATION 1
NOT TO SCALE 2-C-47



TYPICAL TEST BOARD 3
NOT TO SCALE 2-C-47



NOTES:
1. USE ONLY NATIVE SOIL FREE OF ROCKS AND CLODS FOR BACKFILL AROUND CELLS WITH A MINIMUM OF 5 GALS OF WATER SATURATION DURING INSTALLATION. DO NOT USE SAND AS BACKFILL.
2. SUPPLY ENOUGH WIRE FROM EACH LEAD TO REACH FULL R/W WIDTH PLUS FIVE (5) ADDITIONAL FEET. COIL WIRE IN BOTTOM OF BOX.

SECTION A

SECTION A
NOT TO SCALE 2-C-47

GENERAL CATHODIC PROTECTION NOTES:

1 ALL TEST LEADS SHALL BE ATTACHED TO THE STEEL CYLINDER OF THE PIPE BY MEANS OF A "CADWELD" EXOTHERMIC WELD.

2 ALL TEST LEADS SHALL BE ATTACHED TO EITHER THE PIPELINE'S BELL END, SPIGOT END OR PLAIN END AS SHOWN ON THE DRAWING.

3 ALL EXPOSED PORTIONS OF THE EXOTHERMIC WELD AND COPPER CABLE CONDUCTORS SHALL BE COATED WITH A SCOTCHCOAT 4 INSULATING RESIN PRIOR TO PLACING GROUT AROUND THE PIPELINE JOINT.

4 ALL TEST LEADS AND ANODE LEADS SHALL BE RUN WITHOUT SPLICES FROM THE CONNECTION AT THE PIPE OR ANODE TO THE CONNECTION AT THE TEST STATION BOX.

5 ALL TEST LEADS OR ANODE LEADS INSIDE THE TEST BOX SHALL BE BUNDLED TOGETHER AT 48 INCH INTERVALS WITH NYLON CABLE TIES. ALL TEST STATION LEADS SHALL BE PROVIDED WITH SUFFICIENT SLACK SO THAT THE TEST BOARD MAY BE EXTENDED A MINIMUM OF 4 FEET ABOVE THE TEST BOX.

6 ALL TEST LEADS AND ANODE LEADS SHALL BE COLOR CODED WITH COLORED TAPE AT EACH END AND AT 4 FOOT INTERVALS. COLOR CODE SHALL BE AS FOLLOWS:

TEST STATION LEADS FROM PIPE	– WHITE
REFERENCE CELL TEST LEADS	– RED
ANODE LEADS	– GREEN
200' TEST LEAD	– BLUE
FOREIGN PIPE LEAD	– YELLOW

7 ALL TEST LEADS AND ANODE LEADS SHALL BE CONNECTED TO THE BRASS BOLTS ON THE TEST BOARD WITH SOLDERLESS SCREW TIGHT COPPER LUG CONNECTORS OR PRESSURE TERMINAL CONNECTORS.

8 ALL TEST LEADS AND ANODE LEADS SHALL HAVE A MINIMUM OF 4' OF SLACK NEAR THE PIPE JOINT TO PREVENT DAMAGE DURING THE BACKFILL OPERATION.

9 ALL TEST LEADS AND ANODE LEADS SHALL BE PLACED ALONG THE SIDE AND BELOW THE SPRINGLINE OF THE PIPE.

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE 1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
CATHODIC PROTECTION
TEST STATION DETAILS

SCALE: AS SHOWN
MW 03/03 SL
RECORD DRAWING
cathprot.dwg 11/07/00 1:51:27 pm

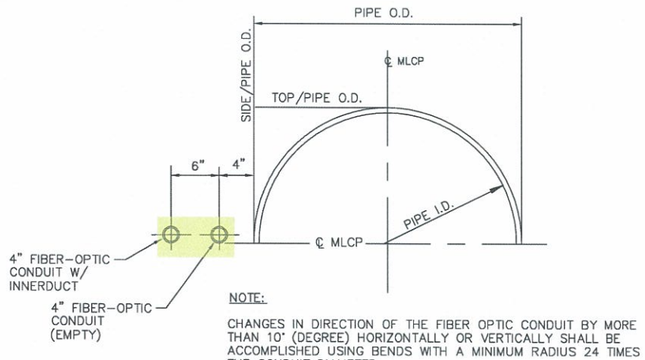
PENTACORE
CIVIL ENGINEERING LAND SURVEYING PLANNING
LAS VEGAS, NEVADA (702)228-7015
LAS VEGAS, NEVADA (702)228-7015

DSGN: G. BARTON
DR: K. ALEXANDER
CHK: B. FIELDS
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-47
SHEET 64 OF 121

ADD NOTE SL 03/03 MW

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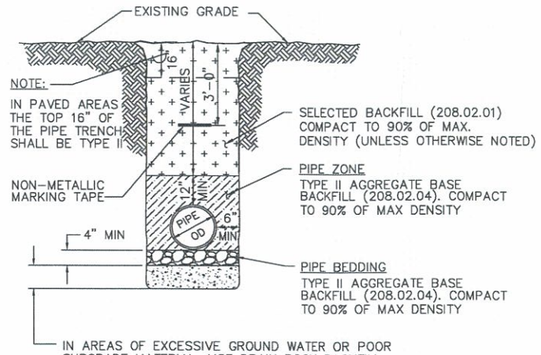


NOTE:

CHANGES IN DIRECTION OF THE FIBER OPTIC CONDUIT BY MORE THAN 10° (DEGREE) HORIZONTALLY OR VERTICALLY SHALL BE ACCOMPLISHED USING BENDS WITH A MINIMUM RADIUS 24 TIMES THE CONDUIT DIAMETER.

FIBER OPTIC CONDUIT DETAIL (1)

NOT TO SCALE — 2-C-41



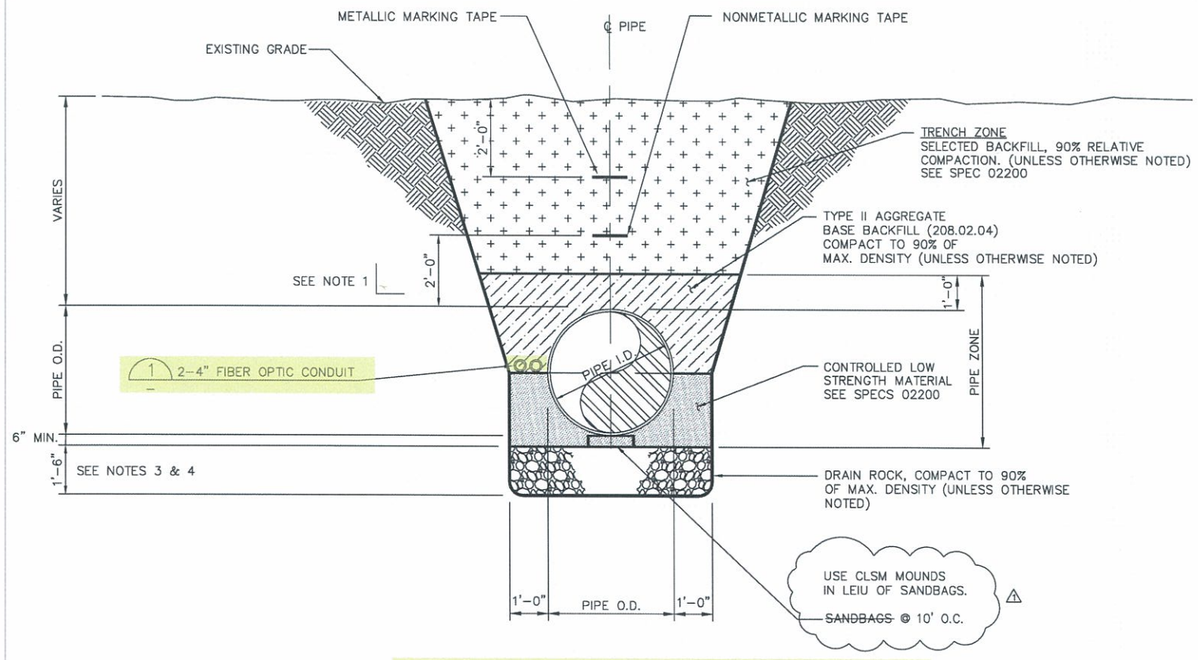
IN AREAS OF EXCESSIVE GROUND WATER OR POOR SUBGRADE MATERIAL, USE DRAIN ROCK BACKFILL SECTION (208.02.05) TO A MAXIMUM DEPTH OF 18" FOR STABILIZATION. DEPTHS GREATER THAN 18" SHALL BE AS DIRECTED BY THE CONSTRUCTION MANAGER. DRAIN ROCK UP TO 18" DEEP SHALL BE AT NO ADDITIONAL COST TO THE AUTHORITY

NOTE:

SEE PIPELINE TRENCH NOTES BELOW

PIPE TRENCH SECTION (B)

NOT TO SCALE — 2-C-41



TYPICAL PIPE TRENCH SECTION (A)

NOT TO SCALE — 2-C-41

PIPELINE TRENCH NOTES:

1. TRENCH EXCAVATION SHALL COMPLY WITH THE CURRENT REGULATIONS AS DETERMINED BY NEVADA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION.
2. FIBER OPTIC CONDUIT TO BE PLACED ON THE NORTH AND EAST SIDE(S) OF THE PIPE AS INDICATED ON THE PLAN & PROFILE DRAWINGS.
3. IN AREAS OF EXCESSIVE GROUND WATER OR POOR SUBGRADE MATERIAL, AS DETERMINED BY THE CONSTRUCTION MANAGER, USE DRAIN ROCK BACKFILL TO A DEPTH OF 18" FOR STABILIZATION. DEPTHS GREATER THAN 18" SHALL BE AS DIRECTED BY THE CONSTRUCTION MANAGER. DRAIN ROCK UP TO 18" DEEP SHALL BE AT NO ADDITIONAL COST TO THE AUTHORITY.
4. IF THE EXPOSED NATIVE SOILS ARE SOFT OR LOOSE, OR ARE DISTURBED BY TRENCHING OPERATIONS, THE EXPOSED SOILS SHALL BE RE-COMPACTED TO 90% MAX. DENSITY.
5. TWO 4" FIBER OPTIC CONDUITS SHALL BE INSTALLED, ONE OF WHICH SHALL HAVE THREE SMOOTH WALL 1-1/4" HIGH DENSITY POLYETHYLENE (HDPE) INNERDUCTS, SEE SPEC 16810.
6. THIS TRENCH SECTION SHALL BE USED FOR ALL STEEL PIPELINES HAVING A DIAMETER OF 24-INCHES OR GREATER. ALL OTHER PIPELINES SHALL USE SECTION B ABOVE.
7. WITHIN THE NDOT RIGHT-OF-WAY, ALL COMPACTION SHALL BE 95% OF MAX. DENSITY
8. WITHIN THE RMWTF, ALL COMPACTION SHALL BE 95% OF MAX. DENSITY.

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPE TRENCH DETAILS

RECORD DRAWING	11/09/00	3:55:55 pm	Trench.dwg
SL	03/03	MW	SCALE: AS SHOWN

SL 03/03 MW CLSM MOUNDS INSTEAD OF SANDBAGS

PENTACORE
DESIGN | CONSTRUCTION MANAGEMENT | PROJECT MANAGEMENT
CONSTRUCTION MANAGEMENT AND CONSULTING
Las Vegas, Nevada 89146 (702)260-3113

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
DR: K. ALEXANDER
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-41
SHEET 58 OF 121

APPENDIX IV

FEMA Effective HEC-RAS Model

APPENDIX F

HEC-RAS CALCULATIONS

Sub-Critical Evaluation

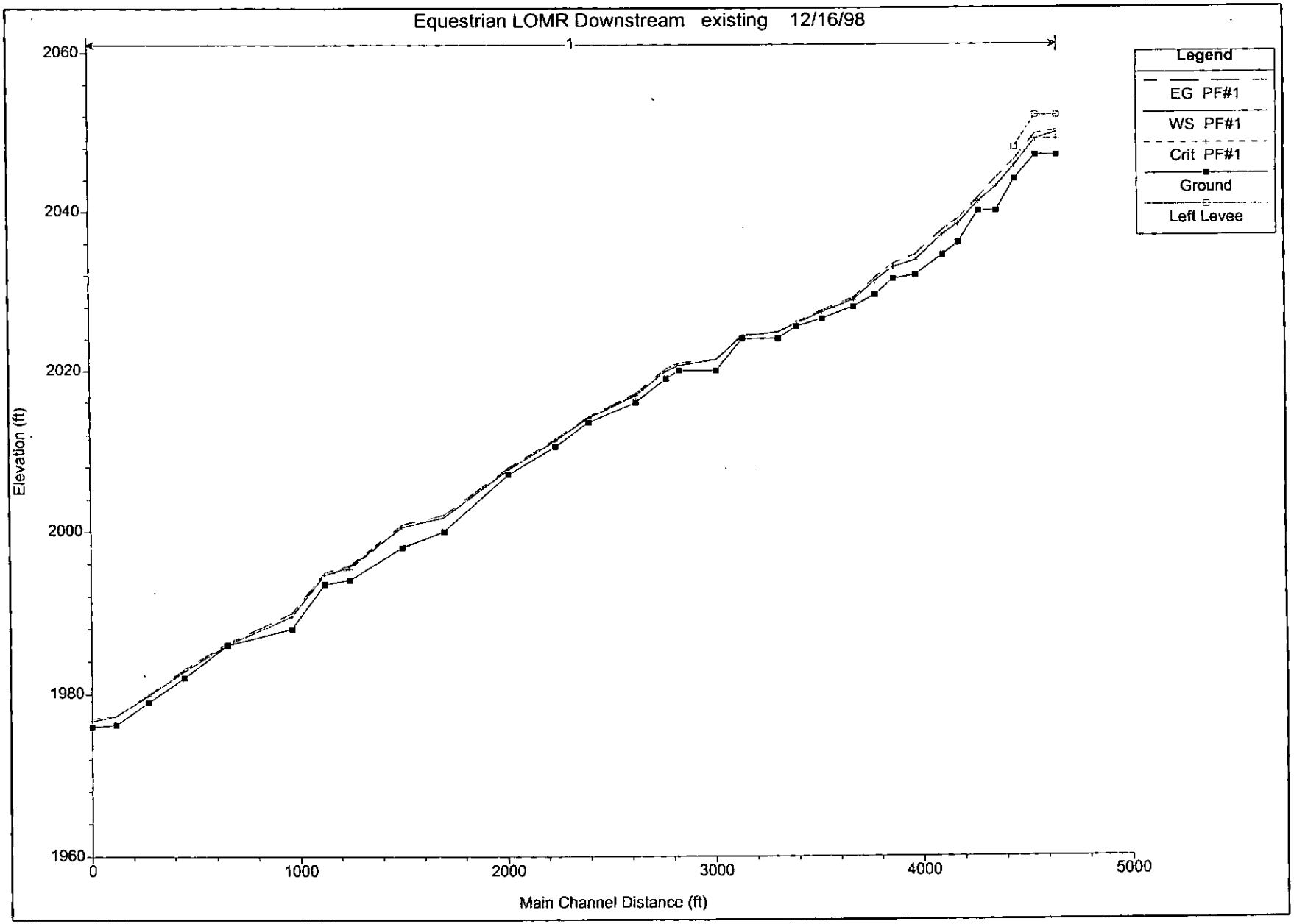
Of Discharge Channel

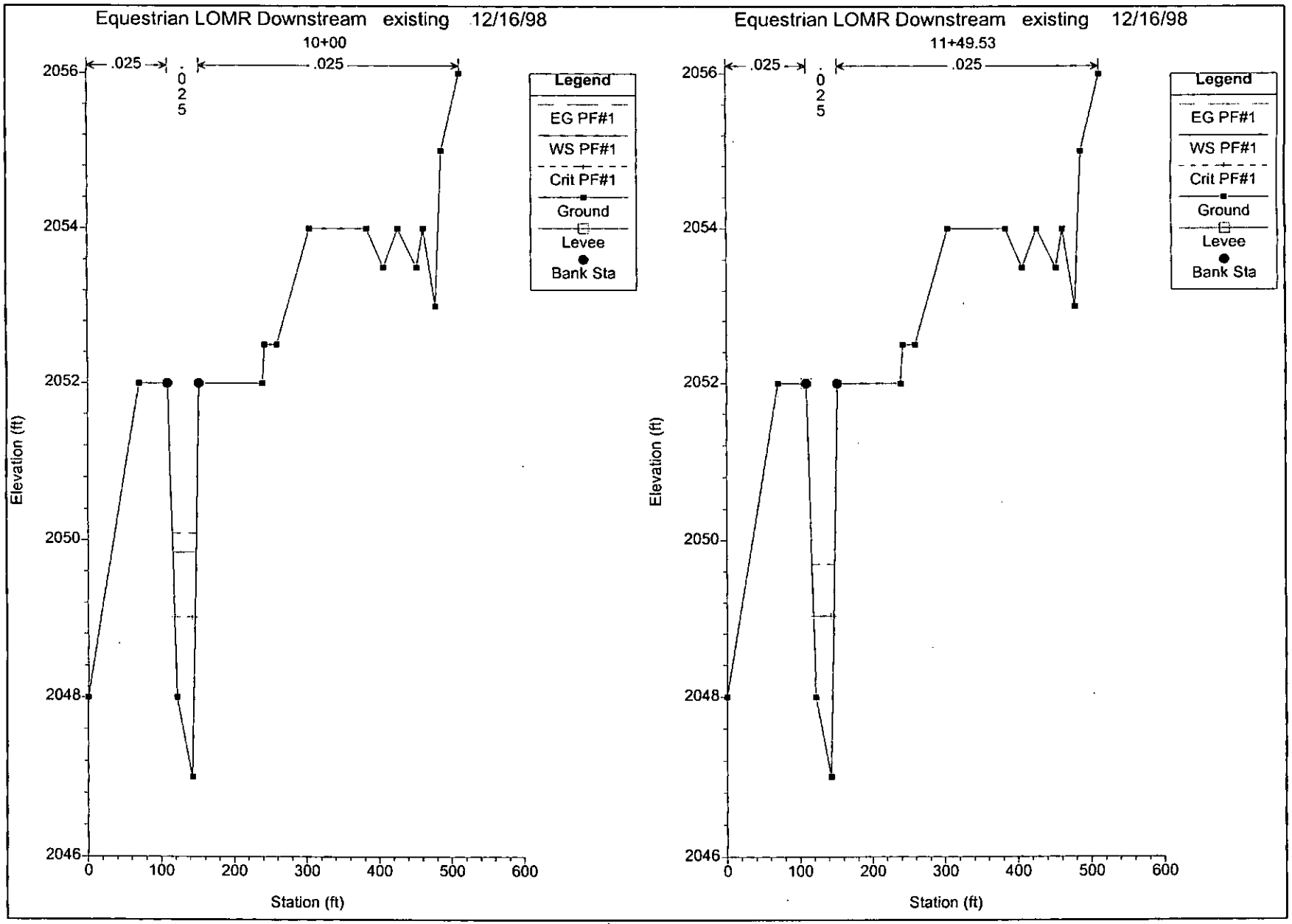
HEC-RAS Plan: BASINOTS River: Equestrian Outfa Reach: 1

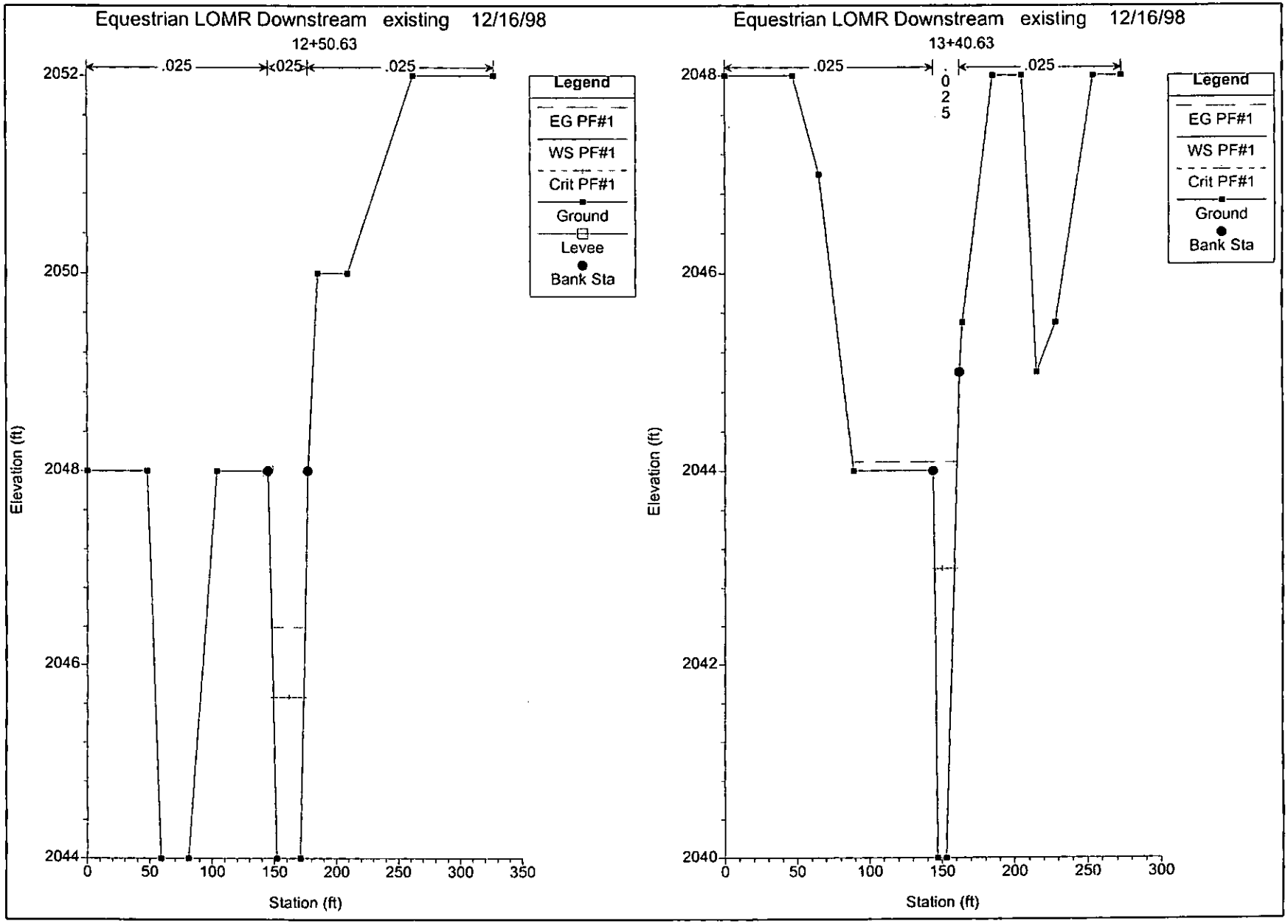
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Max Chl Dpth	Top Width	Sta W.S. Lft	Sta W.S. Rgt	LOB Elev	ROB Elev
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
1	33.2	247.00	2047.00	2049.85	2049.01	2050.09	0.001908	3.95	2.85	32.23	116.46	148.69	2052.00	2052.00
1	32.1	247.00	2047.00	2049.03	2049.03	2049.69	0.008446	6.54	2.03	28.13	118.92	147.05	2052.00	2052.00
1	31.1	247.00	2044.00	2045.66	2045.66	2046.39	0.008276	6.84	1.66	24.41	149.09	173.49	2048.00	2048.00
1	30.1	247.00	2040.00	2043.00	2043.00	2044.09	0.008784	8.39	3.00	13.64	144.75	158.39	2044.00	2045.00
1	29.1	247.00	2040.00	2041.14	2041.14	2041.60	0.009454	5.44	1.14	49.59	126.83	176.42	2044.00	2044.00
1	28.1	247.00	2036.00	2038.35	2038.35	2038.96	0.009408	6.25	2.35	33.88	227.77	261.65	2040.00	2040.00
1	27.1	247.00	2034.50	2037.06	2037.06	2037.59	0.009769	5.84	2.56	40.81	285.94	326.75	2040.00	2040.00
1	26.1	247.00	2032.00	2033.79	2033.79	2034.48	0.008667	6.65	1.79	27.45	316.76	344.21	2036.00	2036.00
1	25.1	247.00	2031.50	2032.97	2032.97	2033.40	0.010056	5.26	1.47	56.36	220.70	277.06	2035.00	2035.00
1	24.1	247.00	2029.50	2031.25	2031.25	2031.61	0.010720	4.80	1.75	74.47	289.59	364.06	2032.00	2032.00
1	23.1	247.00	2028.00	2028.87	2028.85	2029.16	0.009956	4.30	0.87	93.15	195.43	288.58	2030.00	2032.00
1	22.1	247.00	2026.50	2027.35	2027.33	2027.54	0.010782	3.50	0.85	165.18	245.40	410.58	2028.00	2028.00
1	21.1	247.00	2025.50	2025.90	2025.90	2026.07	0.012990	3.33	0.40	214.73	172.90	387.63	2026.00	2026.50
1	20.1	247.00	2024.00	2024.78		2024.81	0.000813	1.35	0.78	259.13	158.01	417.14	2028.00	2026.50
1	19.1	247.00	2024.00	2024.29	2024.29	2024.44	0.013826	3.04	0.29	282.55	111.91	394.46	2027.00	2025.50
1	17.1	247.00	2020.00	2021.37		2021.43	0.001088	2.02	1.37	117.02	183.36	300.38	2024.00	2024.00
1	16.1	247.00	2020.00	2020.67	2020.67	2020.96	0.011049	4.33	0.67	98.72	179.08	277.80	2021.82	2021.50
1	15.1	247.00	2019.00	2019.98	2019.98	2020.25	0.011443	4.18	0.98	110.79	74.13	184.92	2020.00	2020.00
1	14.1	247.00	2016.00	2016.88	2016.88	2017.13	0.011813	4.03	0.88	124.59	197.74	322.32	2017.00	2018.50
1	13.1	247.00	2013.50	2014.03	2014.03	2014.21	0.012960	3.49	0.53	191.20	325.90	523.75	2014.00	2016.00
1	12.1	247.00	2010.50	2011.21	2011.21	2011.42	0.012103	3.73	0.71	163.23	394.90	558.13	2012.00	2011.00
1	11.1	247.00	2007.00	2007.62	2007.62	2007.86	0.011756	3.95	0.62	130.05	352.89	482.94	2008.00	2008.00
1	10.1	247.00	2000.00	2001.73		2002.01	0.004573	4.20	1.73	54.76	364.56	419.32	2004.00	2003.00
1	9.1	247.00	1998.00	2000.56	2000.56	2000.85	0.007363	5.28	2.56	100.69	194.20	325.00	2000.00	2000.00
1	8.1	247.00	1994.00	1995.59	1995.36	1995.78	0.004784	3.48	1.59	91.11	188.70	279.81	1996.00	1996.00
1	7.1	247.00	1993.50	1994.65	1994.65	1994.93	0.011603	4.24	1.15	107.91	210.77	318.69	1995.50	1996.00
1	6.1	247.00	1988.00	1989.51	1989.51	1989.90	0.010023	5.04	1.51	62.67	197.17	259.83	1991.00	1991.50
1	5.1	247.00	1986.00	1986.10	1986.10	1986.31	0.012057	0.87	0.60	165.06	176.81	508.44	1987.00	1988.00
1	4.1	247.00	1982.00	1982.77	1982.77	1983.03	0.011403	4.09	0.77	116.79	350.29	467.08	1983.50	1984.00
1	3.1	247.00	1979.00	1979.81	1979.81	1979.95	0.015324	2.84	1.31	306.42	388.58	695.00	1980.00	1979.75
1	2.1	247.00	1976.25	1977.31		1977.36	0.001269	1.72	1.06	208.63	268.37	477.00	1976.50	1977.00
1	1.1	247.00	1976.00	1976.70	1976.70	1977.01	0.010009	4.68	0.70	88.00	0.00	88.00	1976.00	1976.00

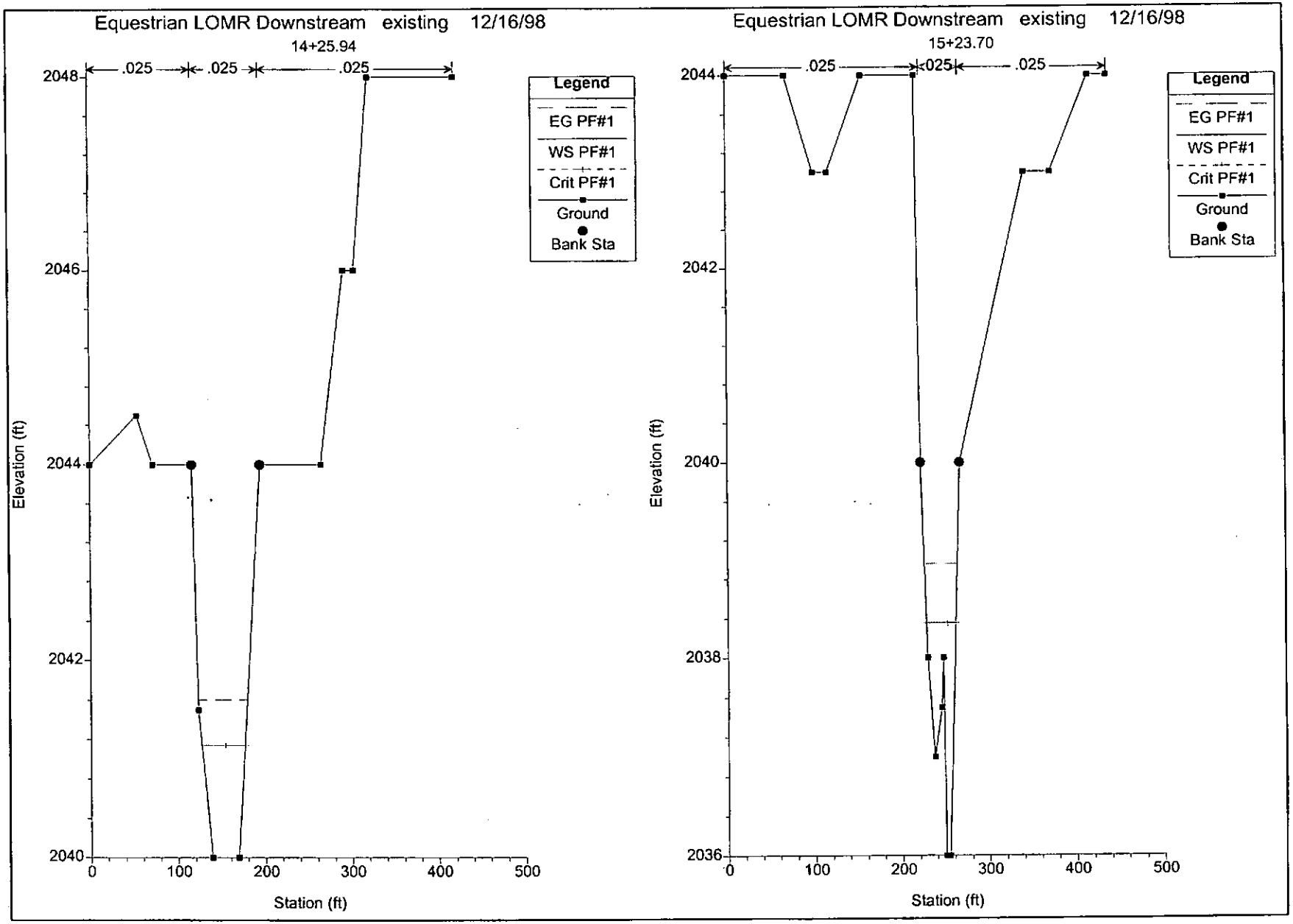
HEC-RAS Plan: BASINOTS River: Equestrian Outfa Reach: 1

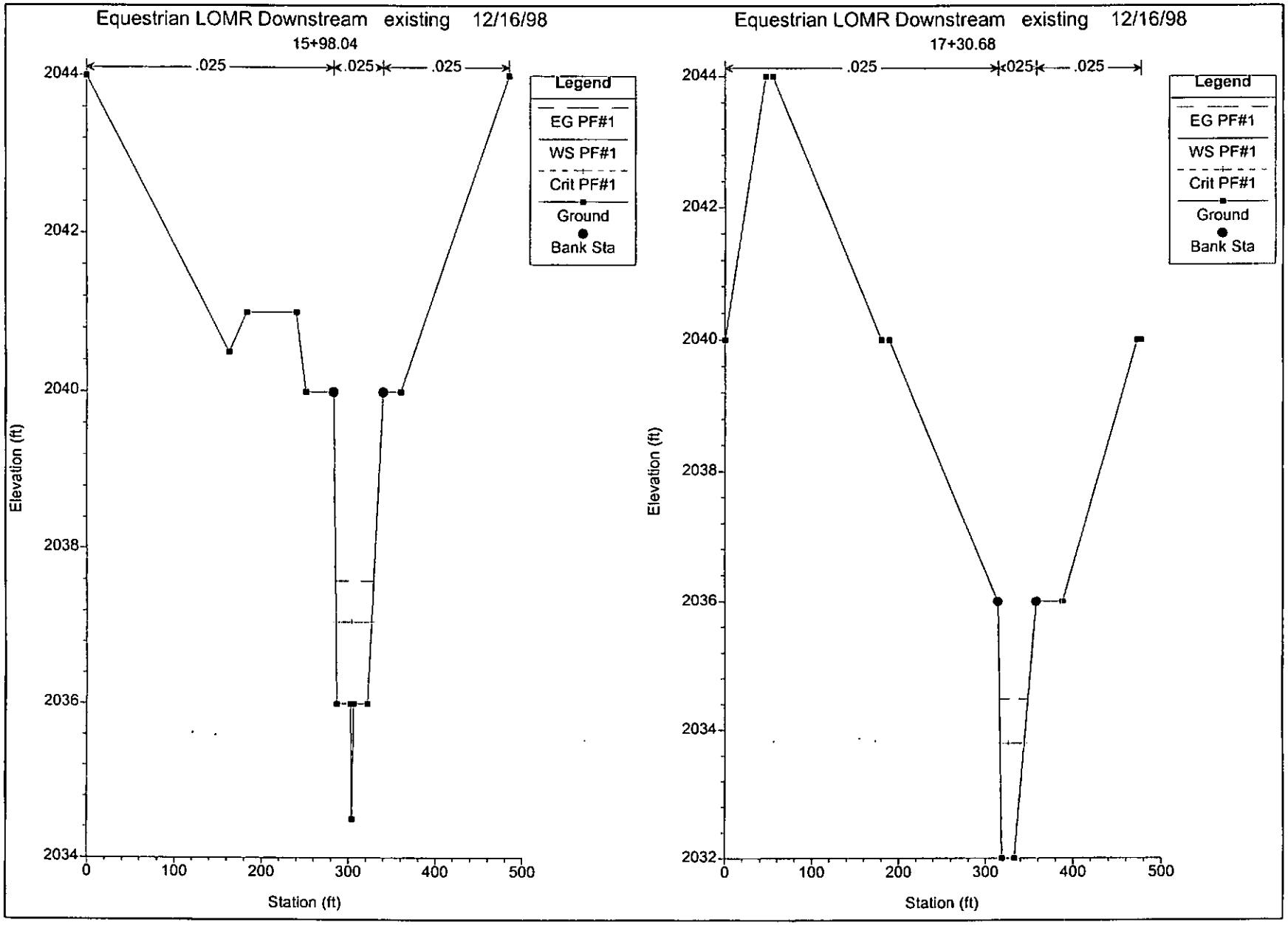
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	33.2	247.00	2047.00	2049.85	2049.01	2050.09	0.001908	3.95	62.46	32.23	0.50
1	32.1	247.00	2047.00	2049.03	2049.03	2049.69	0.008446	6.54	37.75	28.13	1.00
1	31.1	247.00	2044.00	2045.66	2045.66	2046.39	0.008276	6.84	36.09	24.41	0.99
1	30.1	247.00	2040.00	2043.00	2043.00	2044.09	0.008784	8.39	29.43	13.64	1.01
1	29.1	247.00	2040.00	2041.14	2041.14	2041.60	0.009454	5.44	45.41	49.59	1.00
1	28.1	247.00	2036.00	2038.35	2038.35	2038.96	0.009408	6.25	39.53	33.88	1.02
1	27.1	247.00	2034.50	2037.06	2037.06	2037.59	0.009769	5.84	42.29	40.81	1.01
1	26.1	247.00	2032.00	2033.79	2033.79	2034.48	0.008667	6.65	37.16	27.45	1.01
1	25.1	247.00	2031.50	2032.97	2032.97	2033.40	0.010056	5.26	46.99	56.36	1.01
1	24.1	247.00	2029.50	2031.25	2031.25	2031.61	0.010720	4.80	51.43	74.47	1.02
1	23.1	247.00	2028.00	2028.87	2028.85	2029.16	0.009956	4.30	57.48	93.15	0.96
1	22.1	247.00	2026.50	2027.35	2027.33	2027.54	0.010782	3.50	70.56	165.18	0.94
1	21.1	247.00	2025.50	2025.90	2025.90	2026.07	0.012990	3.33	74.11	214.73	1.00
1	20.1	247.00	2024.00	2024.78		2024.81	0.000813	1.35	183.51	259.13	0.28
1	19.1	247.00	2024.00	2024.29	2024.29	2024.44	0.013826	3.04	81.18	282.55	1.00
1	17.1	247.00	2020.00	2021.37		2021.43	0.001088	2.02	122.37	117.02	0.35
1	16.1	247.00	2020.00	2020.67	2020.67	2020.96	0.011049	4.33	57.02	98.72	1.00
1	15.1	247.00	2019.00	2019.98	2019.98	2020.25	0.011443	4.18	59.10	110.79	1.01
1	14.1	247.00	2016.00	2016.88	2016.88	2017.13	0.011813	4.03	61.33	124.59	1.01
1	13.1	247.00	2013.50	2014.03	2014.03	2014.21	0.012960	3.49	70.73	191.20	1.01
1	12.1	247.00	2010.50	2011.21	2011.21	2011.42	0.012103	3.73	66.92	163.23	1.00
1	11.1	247.00	2007.00	2007.62	2007.62	2007.86	0.011756	3.95	62.48	130.05	1.00
1	10.1	247.00	2000.00	2001.73		2002.01	0.004573	4.20	58.76	54.76	0.72
1	9.1	247.00	1998.00	2000.56	2000.56	2000.85	0.007363	5.28	62.34	100.69	0.89
1	8.1	247.00	1994.00	1995.59	1995.36	1995.78	0.004784	3.48	71.01	91.11	0.69
1	7.1	247.00	1993.50	1994.65	1994.65	1994.93	0.011603	4.24	58.22	107.91	1.02
1	6.1	247.00	1988.00	1989.51	1989.51	1989.90	0.010023	5.04	48.97	62.67	1.01
1	5.1	247.00	1986.00	1986.10	1986.10	1986.31	0.012057	0.87	67.61	165.06	0.70
1	4.1	247.00	1982.00	1982.77	1982.77	1983.03	0.011403	4.09	60.41	116.79	1.00
1	3.1	247.00	1979.00	1979.81	1979.81	1979.95	0.015324	2.84	81.41	306.42	1.02
1	2.1	247.00	1976.25	1977.31		1977.36	0.001269	1.72	146.93	208.63	0.35
1	1.1	247.00	1976.00	1976.70	1976.70	1977.01	0.010009	4.68	55.75	88.00	0.99

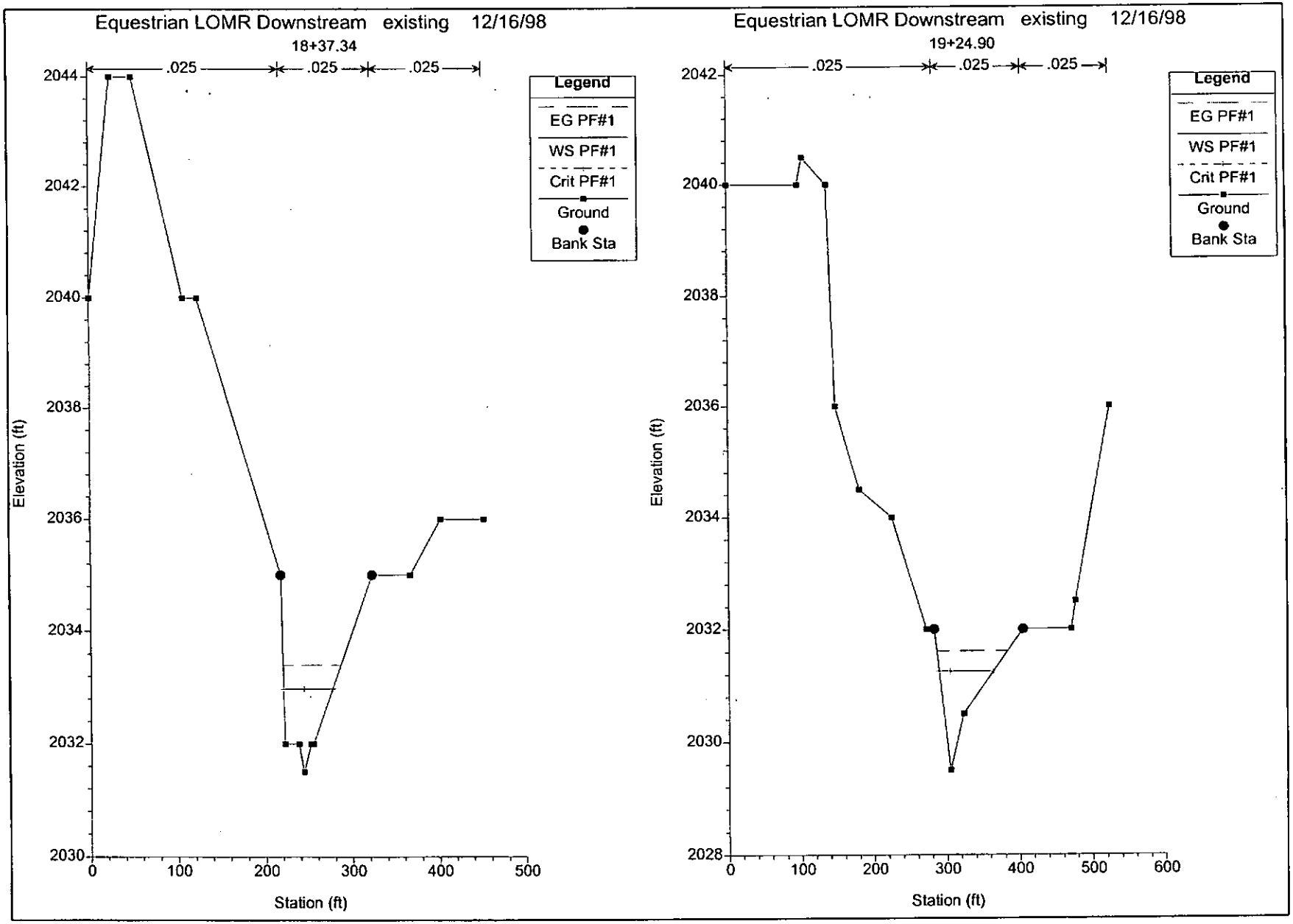

Equestrian LOMR Downstream existing 12/16/98
1
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Left Levee
2060
2040
2020
2000
1980
1960
Elevation (ft)
0
1000
2000
3000
4000
5000
Main Channel Distance (ft)

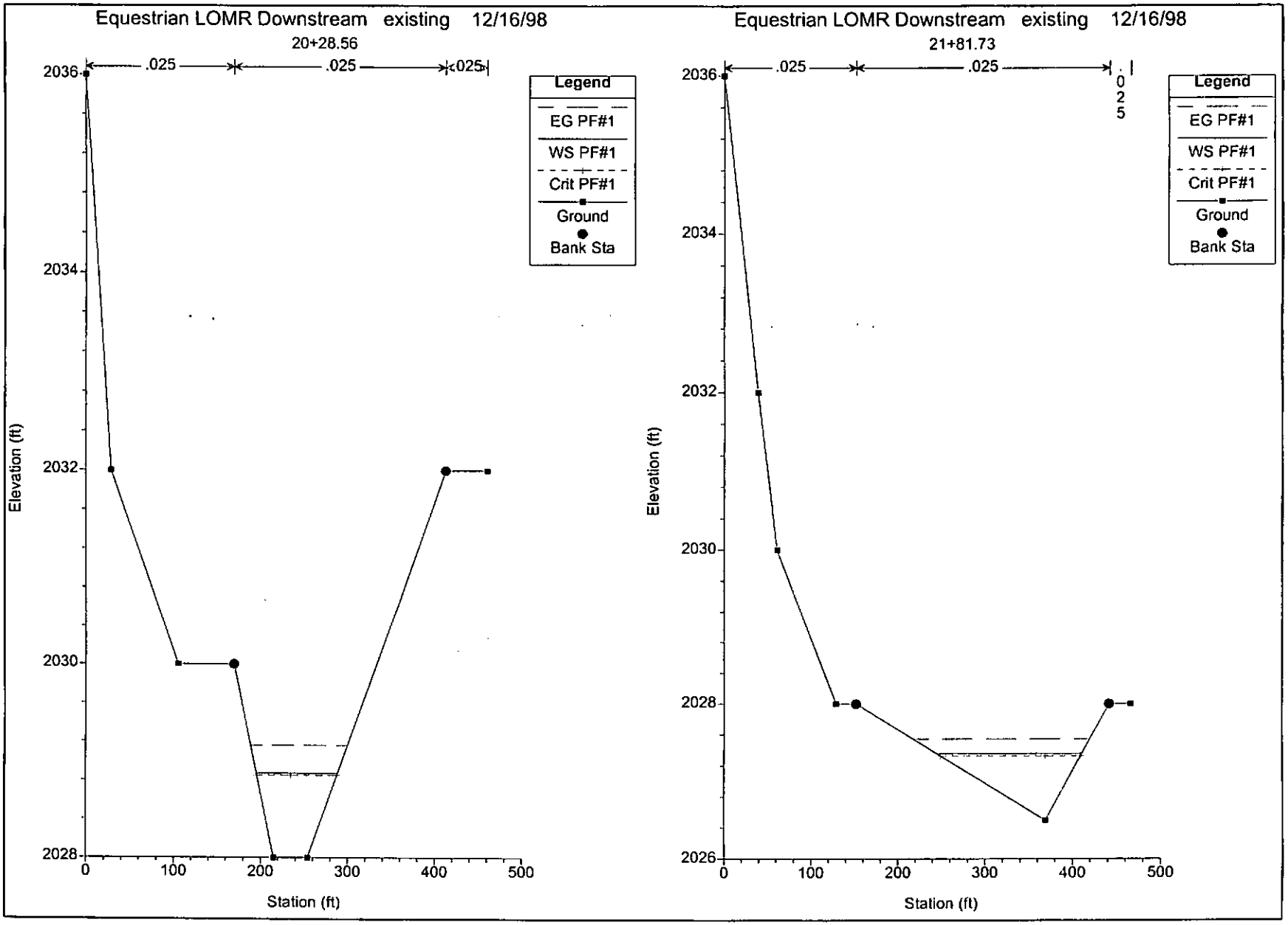

Equestrian LOMR Downstream existing 12/16/98
10+00
.025
.025
.025
2056
2054
2052
2050
2048
2046
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Levee
Bank Sta
Equestrian LOMR Downstream existing 12/16/98
11+49.53
.025
.025
.025
2056
2054
2052
2050
2048
2046
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Levee
Bank Sta

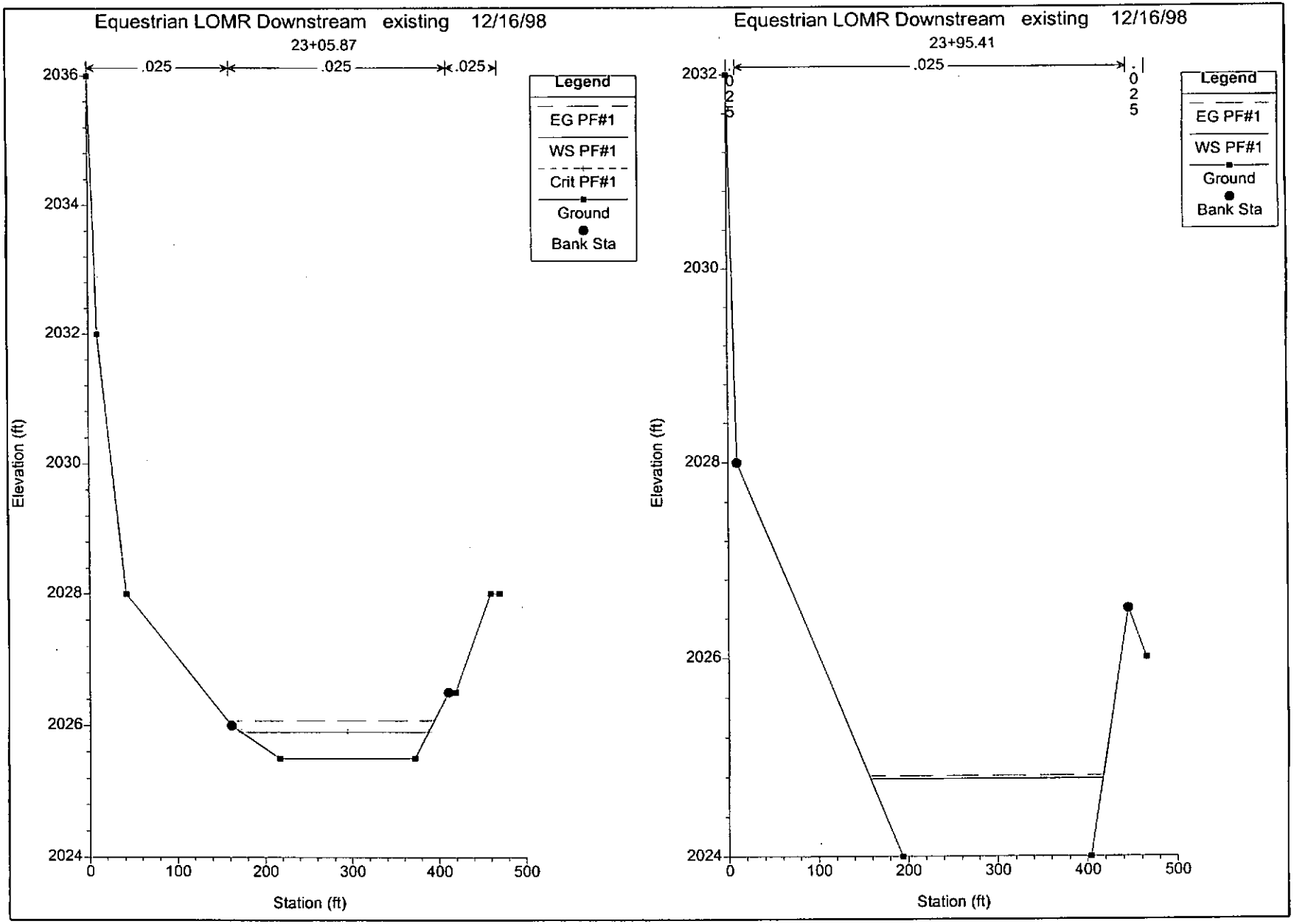

Equestrian LOMR Downstream existing 12/16/98
12+50.63
.025
.025
.025
2052
2050
2048
2046
2044
Elevation (ft)
0
50
100
150
200
250
300
350
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Levee
Bank Sta
Equestrian LOMR Downstream existing 12/16/98
13+40.63
.025
.025
2048
2046
2044
2042
2040
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta

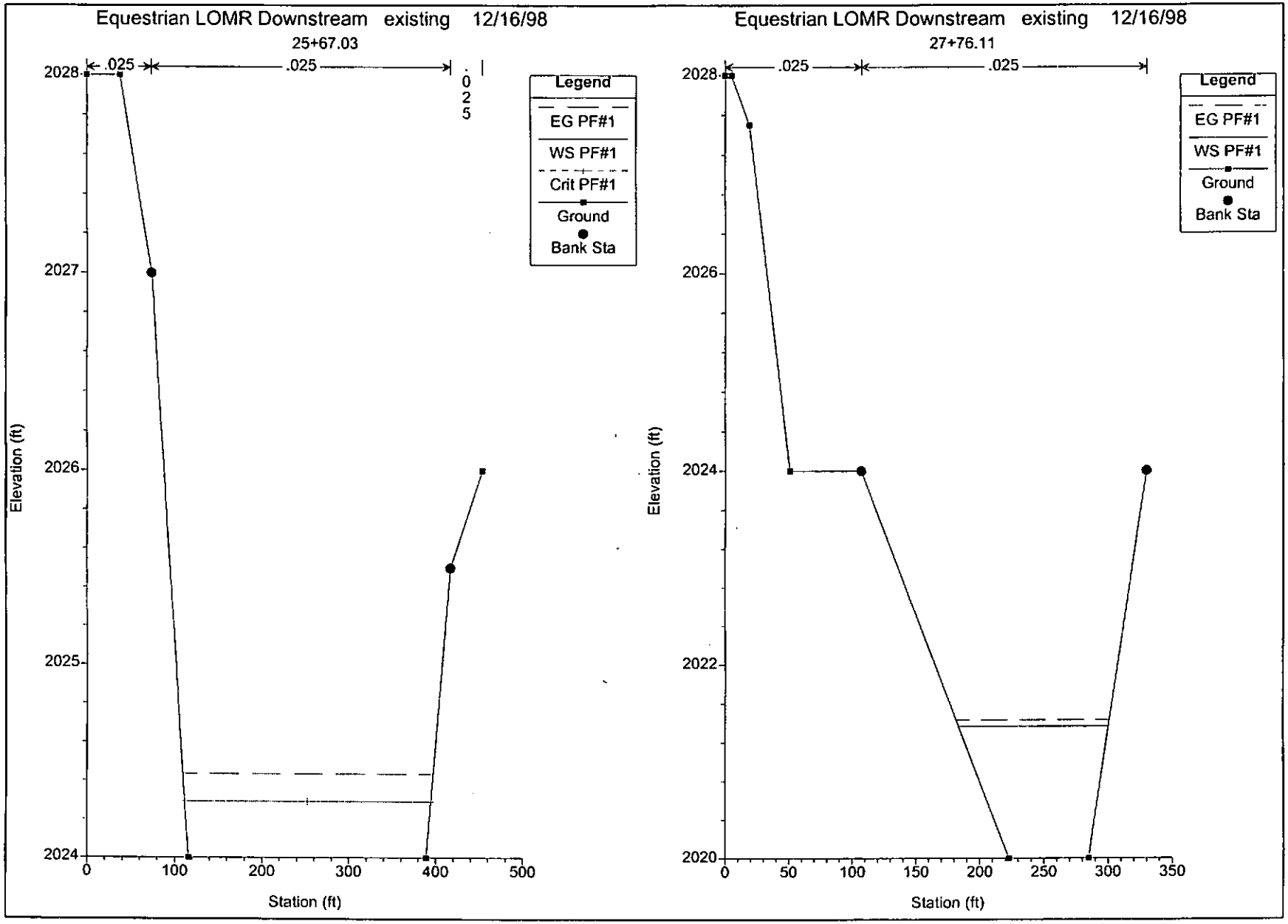

Equestrian LOMR Downstream existing 12/16/98
14+25.94
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2048
2046
2044
2042
2040
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
15+23.70
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2044
2042
2040
2038
2036
0
100
200
300
400
500
Station (ft)

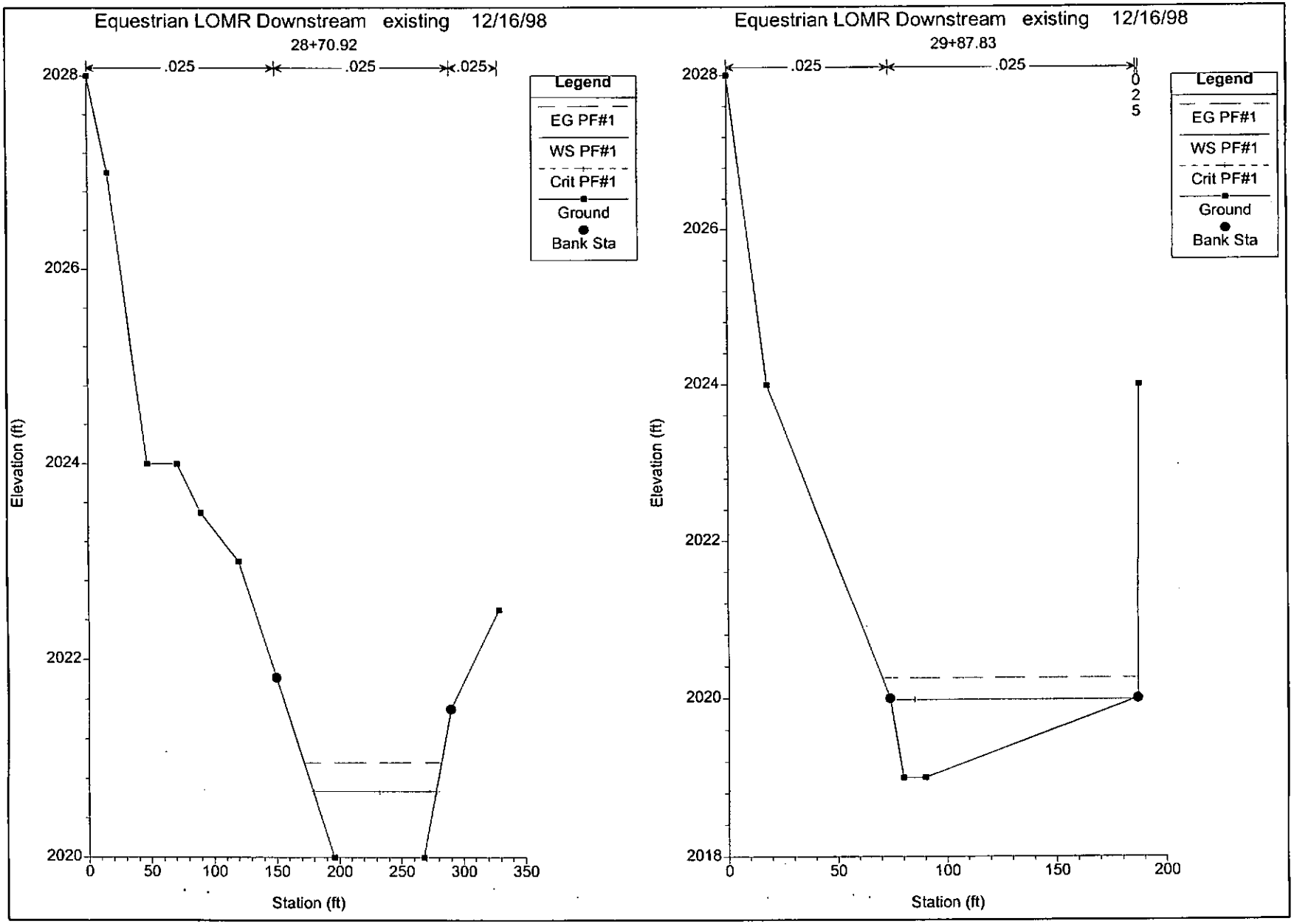

Equestrian LOMR Downstream existing 12/16/98
15+98.04
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2044
2042
2040
2038
2036
2034
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
17+30.68
.025
025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2044
2042
2040
2038
2036
2034
2032
0
100
200
300
400
500

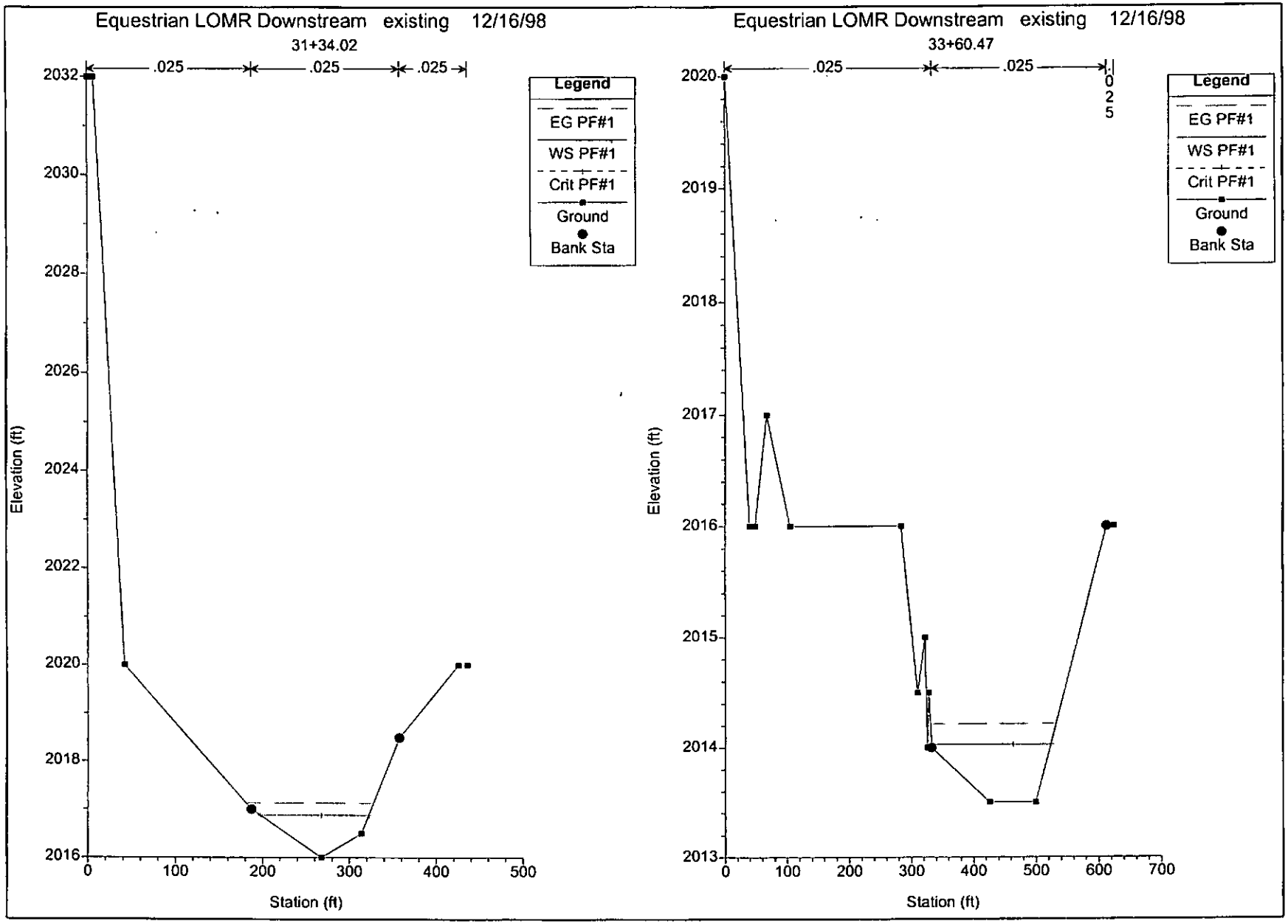

Equestrian LOMR Downstream existing 12/16/98
18+37.34
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2044
2042
2040
2038
2036
2034
2032
2030
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
19+24.90
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2042
2040
2038
2036
2034
2032
2030
2028
0
100
200
300
400
500
600

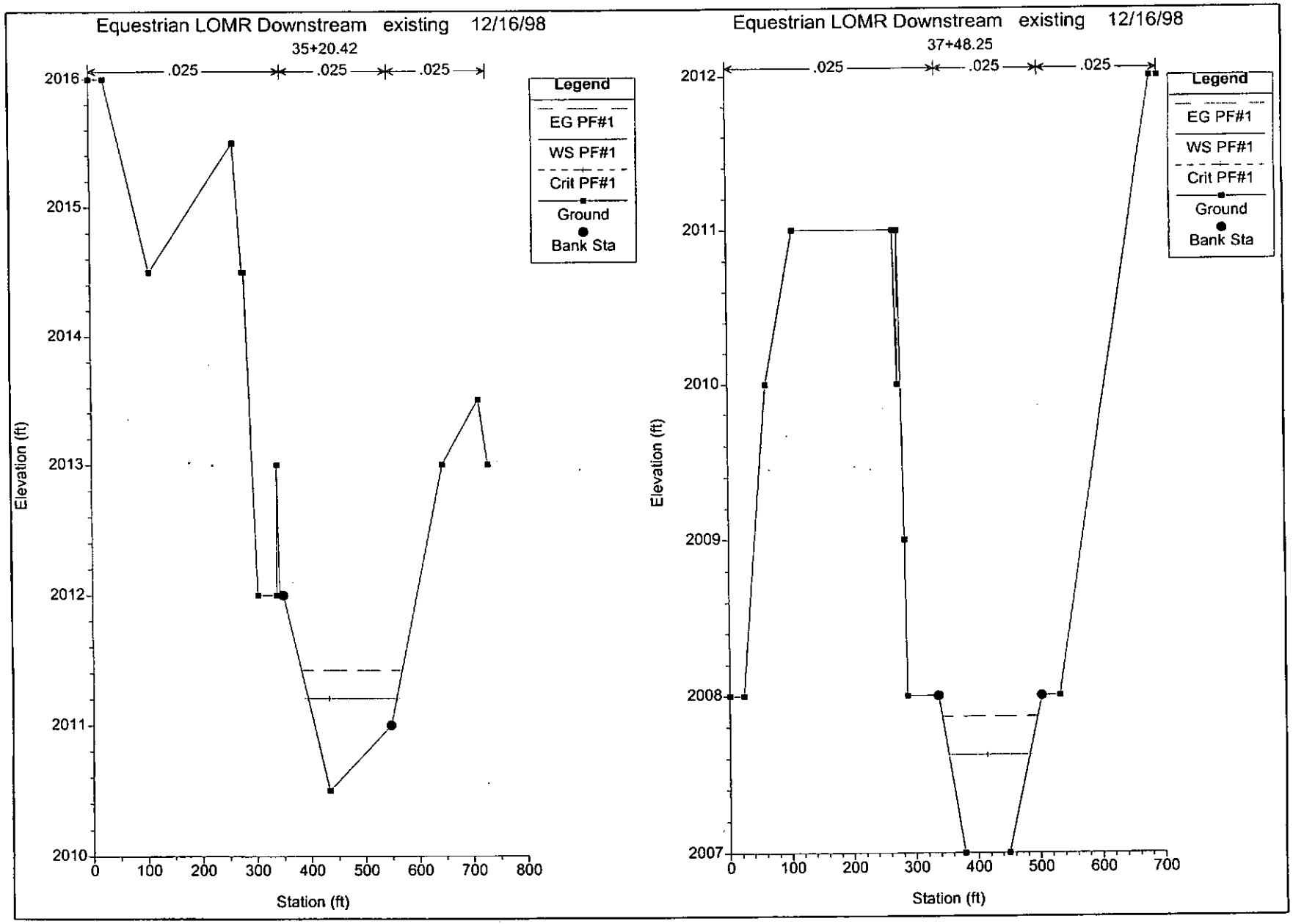

Equestrian LOMR Downstream existing 12/16/98
20+28.56
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2036
2034
2032
2030
2028
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
21+81.73
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2036
2034
2032
2030
2028
2026
0
100
200
300
400
500

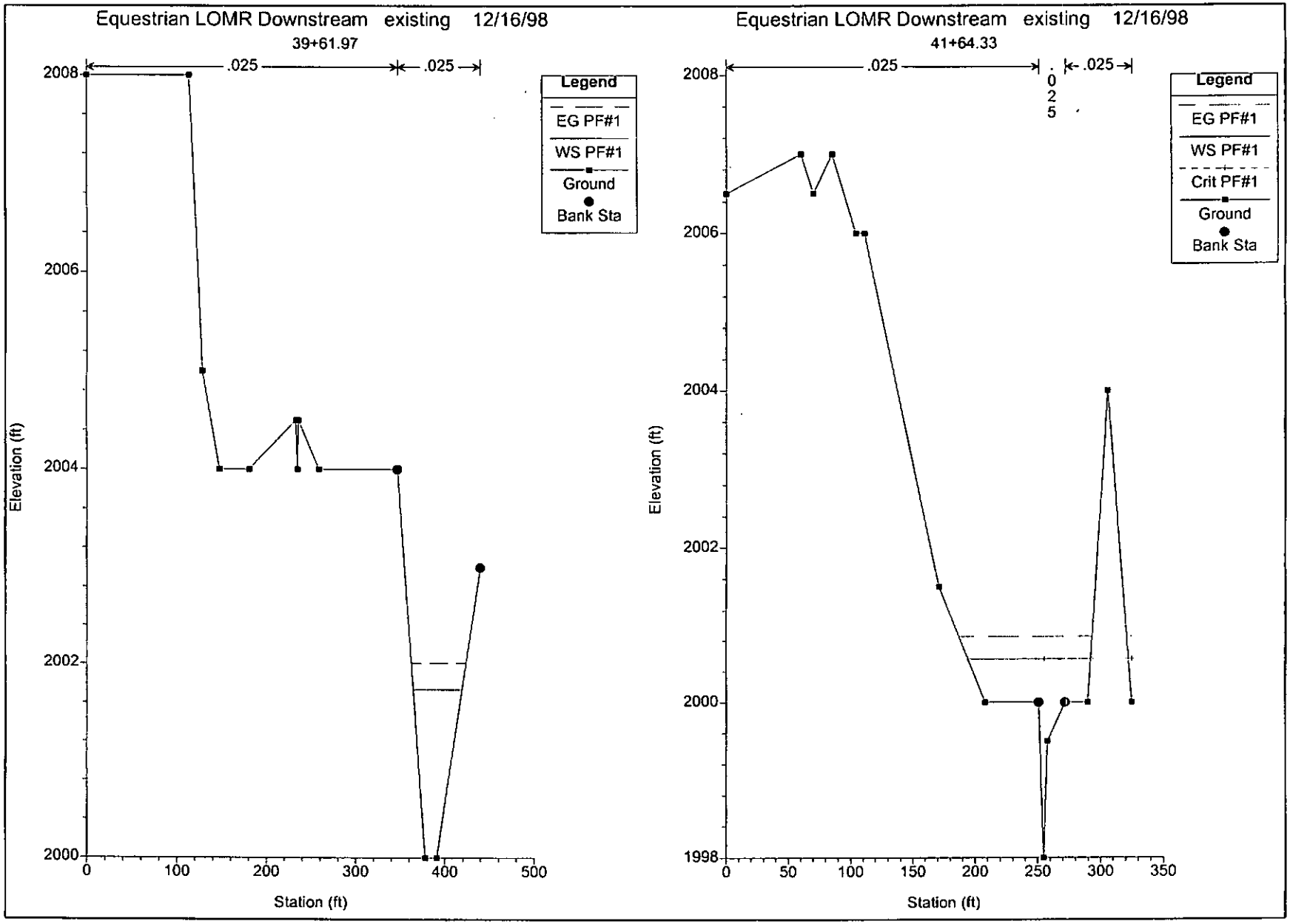

Equestrian LOMR Downstream existing 12/16/98
23+05.87
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2036
2034
2032
2030
2028
2026
2024
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
23+95.41
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
2032
2030
2028
2026
2024
0
100
200
300
400
500
Station (ft)

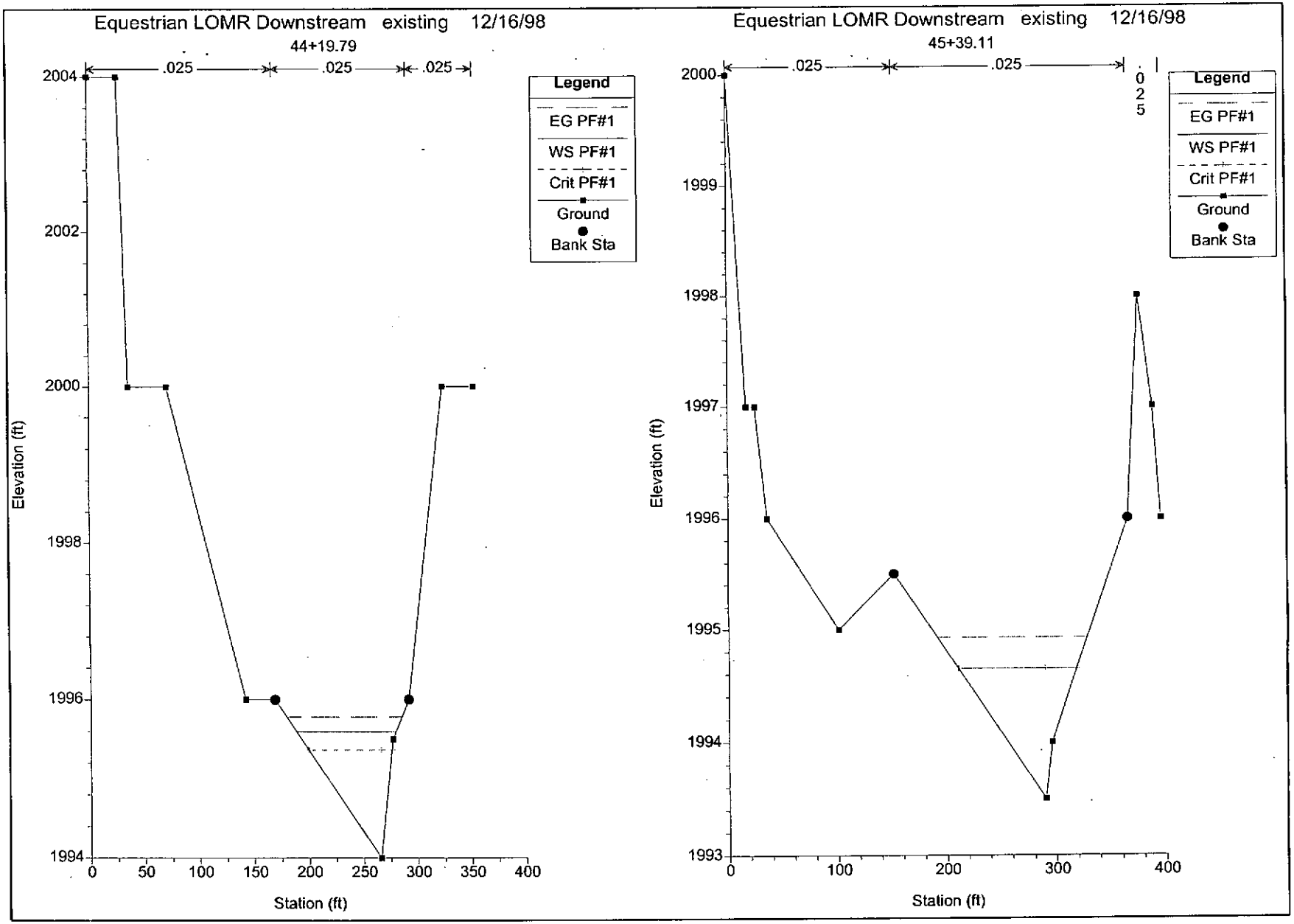

Equestrian LOMR Downstream existing 12/16/98
25+67.03
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2028
2027
2026
2025
2024
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
27+76.11
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2028
2026
2024
2022
2020
0
50
100
150
200
250
300
350

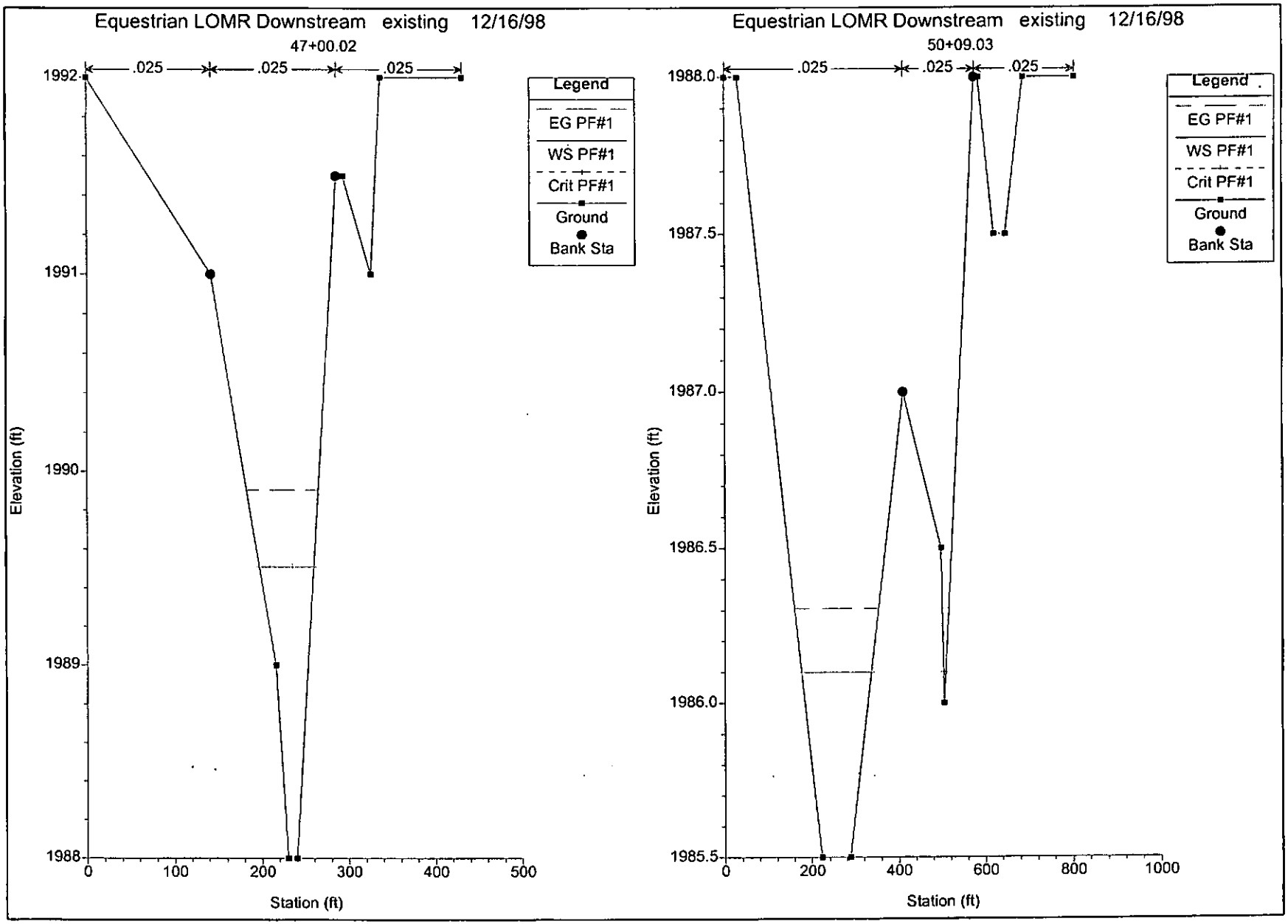

Equestrian LOMR Downstream existing 12/16/98
28+70.92
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2028
2026
2024
2022
2020
0
50
100
150
200
250
300
350
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
29+87.83
.025
.025
0
2
5
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2028
2026
2024
2022
2020
2018
0
50
100
150
200
Station (ft)

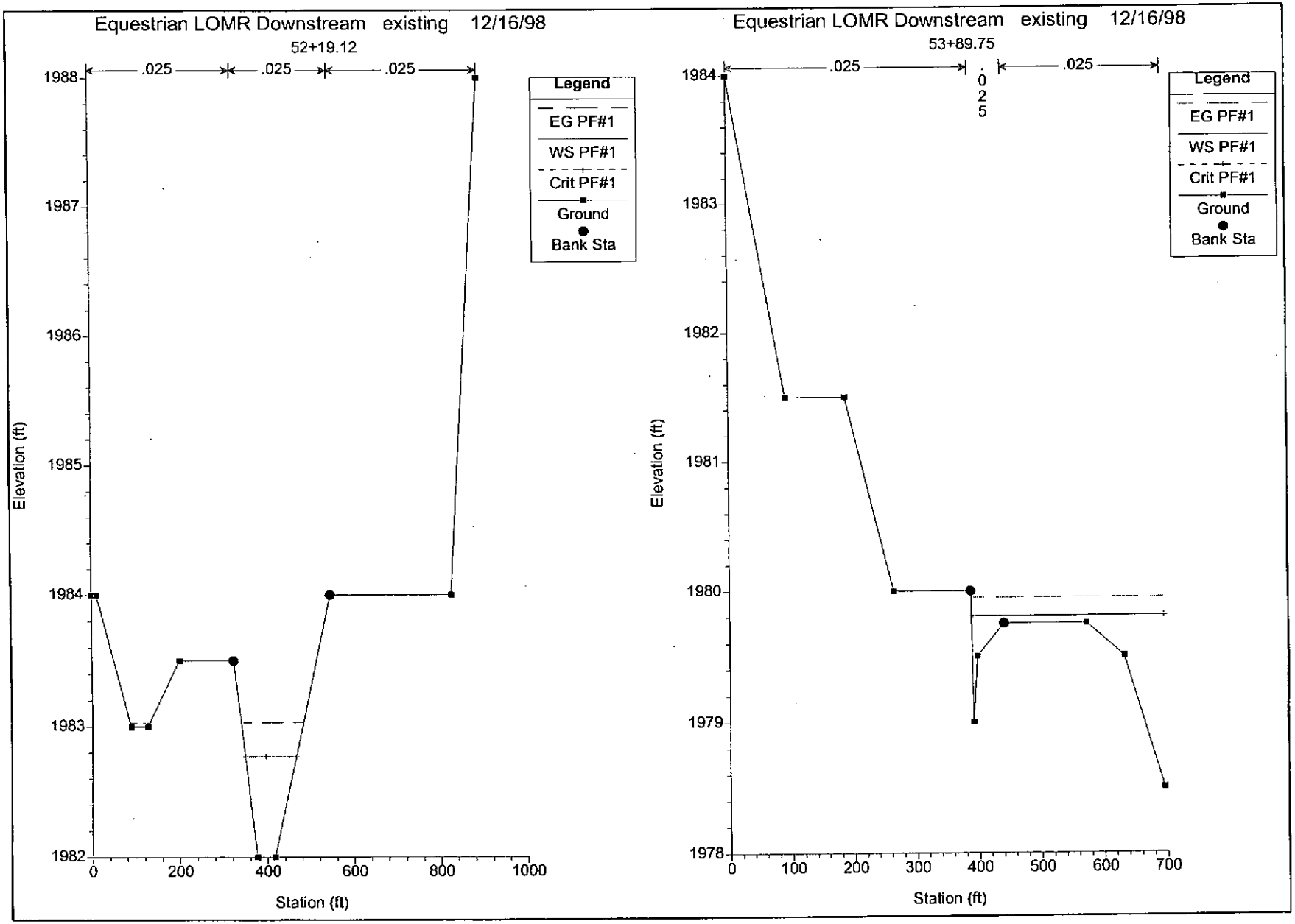

Equestrian LOMR Downstream existing 12/16/98
31+34.02
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2032
2030
2028
2026
2024
2022
2020
2018
2016
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
33+60.47
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2020
2019
2018
2017
2016
2015
2014
2013
0
100
200
300
400
500
600
700

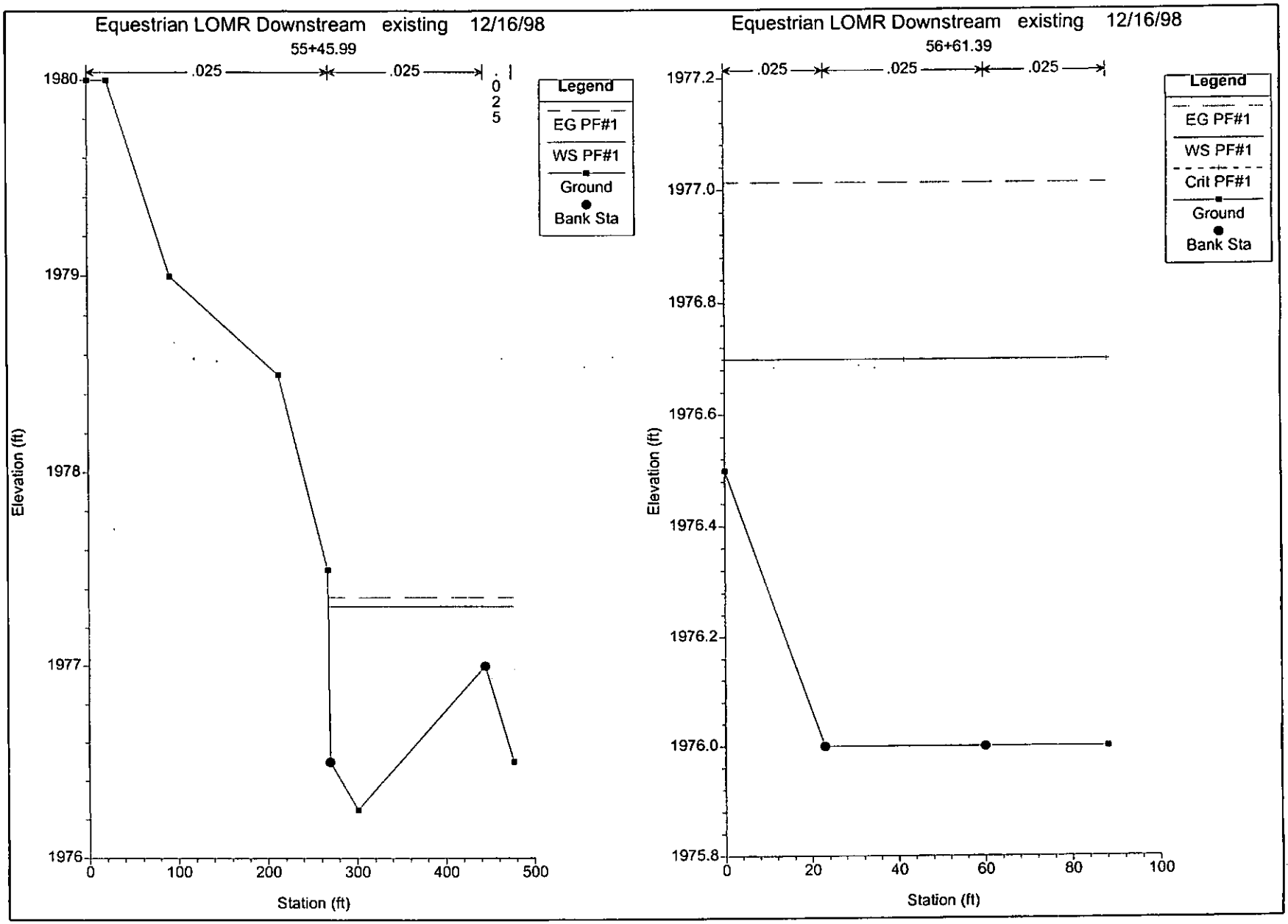

Equestrian LOMR Downstream existing 12/16/98
35+20.42
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2016
2015
2014
2013
2012
2011
2010
0
100
200
300
400
500
600
700
800
Equestrian LOMR Downstream existing 12/16/98
37+48.25
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2012
2011
2010
2009
2008
2007
0
100
200
300
400
500
600
700


Equestrian LOMR Downstream existing 12/16/98
39+61.97
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
2008
2006
2004
2002
2000
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
41+64.33
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
2008
2006
2004
2002
2000
1998
0
50
100
150
200
250
300
350
Station (ft)


Equestrian LOMR Downstream existing 12/16/98
44+19.79
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2004
2002
2000
1998
1996
1994
0
50
100
150
200
250
300
350
400
Equestrian LOMR Downstream existing 12/16/98
45+39.11
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2000
1999
1998
1997
1996
1995
1994
1993
0
100
200
300
400


Equestrian LOMR Downstream existing 12/16/98
47+00.02
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1992
1991
1990
1989
1988
0
100
200
300
400
500
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
50+09.03
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1988.0
1987.5
1987.0
1986.5
1986.0
1985.5
0
200
400
600
800
1000
Station (ft)


Equestrian LOMR Downstream existing 12/16/98
52+19.12
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1988
1987
1986
1985
1984
1983
1982
0
200
400
600
800
1000
Station (ft)
Equestrian LOMR Downstream existing 12/16/98
53+89.75
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
1984
1983
1982
1981
1980
1979
1978
0
100
200
300
400
500
600
700
Station (ft)


Equestrian LOMR Downstream existing 12/16/98
55+45.99
.025
.025
.025
Legend
EG PF#1
WS PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1980
1979
1978
1977
1976
0
100
200
300
400
500
Equestrian LOMR Downstream existing 12/16/98
56+61.39
.025
.025
.025
Legend
EG PF#1
WS PF#1
Crit PF#1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1977.2
1977.0
1976.8
1976.6
1976.4
1976.2
1976.0
1975.8
0
20
40
60
80
100

HEC-RAS Version 2.1 October 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X     X    X   X
XXXXXXX  XXXX     X       XXX XXXX      XXXXXX   XXXX
X     X  X        X           X  X      X    X       X
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X     X  XXXXXX    XXXX       X    X    X    X   XXXXX
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PROJECT DATA
Project Title: Equestrian LOMR Downstream
Project File : equstds.prj
Run Date and Time: 12/16/98 11:45:20 AM

Project in English units

Project Description:
Equestrian LOMR Basin Discharge ******* Softdesk, Inc. HEC-2 Input Data file
****

 ************   Minimum
Data Input   **************

****

PLAN DATA

Plan Title: existing
Plan File : j:\1002005\HECRAS\equstds.p02

Geometry Title: EXISTING CONDITIONS
Geometry File : j:\1002005\HECRAS\equstds.g02

Flow Title : Imported Flow 01
Flow File : j:\1002005\HECRAS\equstds.f01

Plan Summary Information:
Number of: Cross Sections = 32 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

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

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Imported Flow 01
Flow File : j:\1002005\HECRAS\equstds.f01

Flow Data (cfs)

River	Reach	RS	PF#1
Equestrian Outfal		33.2	247
Equestrian Outfal		1.1	247

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Equestrian Outfa1		PF#1	Critical	Critical

GEOMETRY DATA

Geometry Title: EXISTING CONDITIONS
Geometry File : j:\1002005\HECRAS\equstds.g02

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 33.2

INPUT
Description: 10+00
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	71	2052	110	2052	122	2048	143	2047
153	2052	240	2052	243	2052.5	260	2052.5	305	2054
384	2054	407	2053.5	427	2054	453	2053.5	462	2054
479	2053	487	2055	512	2056				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	110	.025	153	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	153	75 101.1	125	.1	.3

Left Levee Station= 110 Elevation= 2052

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2049.85	Element			
Vel Head (ft)	0.24	Wt. n-Val.		0.025	
E.G. Elev (ft)	2050.09	Reach Len. (ft)	75.00	101.10	125.00
Crit W.S. (ft)	2049.01	Flow Area (sq ft)		62.46	
E.G. Slope (ft/ft)	0.001908	Area (sq ft)		62.46	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	32.23	Top Width (ft)		32.23	
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)		3.95	

Max Chl Dpth (ft)	2.85	Hydr. Depth (ft)		1.94	
Conv. Total (cfs)	5655.1	Conv. (cfs)		5655.1	
Length Wtd. (ft)	101.10	Wetted Per. (ft)		33.22	
Min Ch El (ft)	2047.00	Shear (lb/sq ft)		0.22	
Alpha	1.00	Stream Power (lb/ft s)		0.89	
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	0.61	6.25	0.35
C & E Loss (ft)	0.04	Cum SA (acres)	1.41	10.54	1.06

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 32.1

INPUT
Description: 11+49.53
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	71	2052	110	2052	122	2048	143	2047
153	2052	240	2052	243	2052.5	260	2052.5	305	2054
384	2054	407	2053.5	427	2054	453	2053.5	462	2054
479	2053	487	2055	512	2056				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	110	.025	153	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
110	153	75 101.1	125	.1	.3

Left Levee Station= 110 Elevation= 2052

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2049.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.		0.025	
E.G. Elev (ft)	2049.69	Reach Len. (ft)	75.00	101.10	125.00
Crit W.S. (ft)	2049.03	Flow Area (sq ft)		37.75	
E.G. Slope (ft/ft)	0.008446	Area (sq ft)		37.75	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	28.13	Top Width (ft)		28.13	
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)		6.54	
Max Chl Dpth (ft)	2.03	Hydr. Depth (ft)		1.34	

Conv. Total (cfs)	2687.6	Conv. (cfs)		2687.6	
Length Wtd. (ft)	101.10	Wetted Per. (ft)		28.80	
Min Ch El (ft)	2047.00	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		4.52	
Frctn Loss (ft)	0.85	Cum Volume (acre-ft)	0.61	6.13	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	10.47	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 31.1

INPUT
Description: 12+50.63
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	48	2048	59	2044	81	2044	104	2048
145	2048	152	2044	171	2044	177	2048	185	2050
209	2050	262	2052	327	2052				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	145	.025	177	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
145	177	110	90	50	.1 .3

Left Levee Station= 145 Elevation= 2048

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2045.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.		0.025	

E.G. Elev (ft)	2046.39	Reach Len. (ft)	110.00	90.00	50.00
Crit W.S. (ft)	2045.66	Flow Area (sq ft)		36.09	
E.G. Slope (ft/ft)	0.008276	Area (sq ft)		36.09	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	24.41	Top Width (ft)		24.41	
Vel Total (ft/s)	6.84	Avg. Vel. (ft/s)		6.84	
Max Chl Dpth (ft)	1.66	Hydr. Depth (ft)		1.48	
Conv. Total (cfs)	2715.0	Conv. (cfs)		2715.0	
Length Wtd. (ft)	90.00	Wetted Per. (ft)		25.35	
Min Ch El (ft)	2044.00	Shear (lb/sq ft)		0.74	
Alpha	1.00	Stream Power (lb/ft s)		5.03	
Frctn Loss (ft)	0.77	Cum Volume (acre-ft)	0.61	6.05	0.35
C & E Loss (ft)	0.04	Cum SA (acres)	1.41	10.41	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 30.1

INPUT
Description: 13+40:63
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2048	47	2048	65	2047	89	2044	144	2044
147	2040	153	2040	162	2045	164	2045.5	185	2048
205	2048	215	2045	228	2045.5	254	2048	273	2048

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	144	.025	162	.025

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

144	162		85	85.31	85	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2043.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.09	Wt. n-Val.		0.025	
E.G. Elev (ft)	2044.09	Reach Len. (ft)	85.00	85.31	85.00
Crit W.S. (ft)	2043.00	Flow Area (sq ft)		29.43	
E.G. Slope (ft/ft)	0.008784	Area (sq ft)		29.43	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	13.64	Top Width (ft)		13.64	
Vel Total (ft/s)	8.39	Avg. Vel. (ft/s)		8.39	
Max Chl Dpth (ft)	3.00	Hydr. Depth (ft)		2.16	
Conv. Total (cfs)	2635.4	Conv. (cfs)		2635.4	
Length Wtd. (ft)	85.31	Wetted Per. (ft)		15.92	
Min Ch El (ft)	2040.00	Shear (lb/sq ft)		1.01	
Alpha	1.00	Stream Power (lb/ft s)		8.51	
Frctn Loss (ft)	0.78	Cum Volume (acre-ft)	0.61	5.98	0.35
C & E Loss (ft)	0.19	Cum SA (acres)	1.41	10.37	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 29.1

INPUT
Description: 14+25.94
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2044	54	2044.5	72	2044	117	2044	123	2041.5
139	2040	169	2040	195	2044	265	2044	292	2046
304	2046	321	2048	420	2048				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	117	.025	195	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
117	195	110 97.76	65	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2041.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.		0.025	
E.G. Elev (ft)	2041.60	Reach Len. (ft)	110.00	97.76	65.00
Crit W.S. (ft)	2041.14	Flow Area (sq ft)		45.41	
E.G. Slope (ft/ft)	0.009454	Area (sq ft)		45.41	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	49.59	Top Width (ft)		49.59	
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)		5.44	
Max Chl Dpth (ft)	1.14	Hydr. Depth (ft)		0.92	
Conv. Total (cfs)	2540.4	Conv. (cfs)		2540.4	
Length Wtd. (ft)	97.76	Wetted Per. (ft)		49.73	
Min Ch El (ft)	2040.00	Shear (lb/sq ft)		0.54	
Alpha	1.00	Stream Power (lb/ft s)		2.93	
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	0.61	5.91	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	10.31	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 28.1

INPUT
Description: 15+23.70
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2044	68	2044	100	2043	116	2043	156	2044

217	2044	222	2040	229	2038	237	2037	245	2037.5
247	2038	250	2036	254	2036	267	2040	342	2043
372	2043	416	2044	437	2044				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	222	.025	267	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
222	267	50 74.34	120	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2038.35	Element			
Vel Head (ft)	0.61	Wt. n-Val.		0.025	
E.G. Elev (ft)	2038.96	Reach Len. (ft)	50.00	74.34	120.00
Crit W.S. (ft)	2038.35	Flow Area (sq ft)		39.53	
E.G. Slope (ft/ft)	0.009408	Area (sq ft)		39.53	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	33.88	Top Width (ft)		33.88	
Vel Total (ft/s)	6.25	Avg. Vel. (ft/s)		6.25	
Max Chl Dpth (ft)	2.35	Hydr. Depth (ft)		1.17	
Conv. Total (cfs)	2546.6	Conv. (cfs)		2546.6	
Length Wtd. (ft)	74.34	Wetted Per. (ft)		35.03	
Min Ch El (ft)	2036.00	Shear (lb/sq ft)		0.66	
Alpha	1.00	Stream Power (lb/ft s)		4.14	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.61	5.81	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	10.22	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 27.1

INPUT
Description: 15+98.04
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2044	163	2040.5	183	2041	240	2041	251	2040
283	2040	287	2036	303	2036	304	2034.5	306	2036
322	2036	340	2040	360	2040	485	2044		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	283	.025	340	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	340	132 132.64	132	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2037.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.		0.025	
E.G. Elev (ft)	2037.59	Reach Len. (ft)	132.00	132.64	132.00
Crit W.S. (ft)	2037.06	Flow Area (sq ft)		42.29	
E.G. Slope (ft/ft)	0.009769	Area (sq ft)		42.29	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	40.81	Top Width (ft)		40.81	
Vel Total (ft/s)	5.84	Avg. Vel. (ft/s)		5.84	
Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)		1.04	
Conv. Total (cfs)	2499.0	Conv. (cfs)		2499.0	
Length Wtd. (ft)	132.64	Wetted Per. (ft)		42.67	
Min Ch El (ft)	2034.50	Shear (lb/sq ft)		0.60	
Alpha	1.00	Stream Power (lb/ft s)		3.53	
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)	0.61	5.74	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	10.15	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 26.1

INPUT
Description: 17+30.68
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2040	47	2044	55	2044	180	2040	189	2040
314	2036	319	2032	333	2032	358	2036	388	2036
473	2040	477	2040						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	314	.025	358	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
314	358	110 106.66	90	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2033.79	Element			
Vel Head (ft)	0.69	Wt. n-Val.		0.025	
E.G. Elev (ft)	2034.48	Reach Len. (ft)	110.00	106.66	90.00
Crit W.S. (ft)	2033.79	Flow Area (sq ft)		37.16	
E.G. Slope (ft/ft)	0.008667	Area (sq ft)		37.16	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	27.45	Top Width (ft)		27.45	
Vel Total (ft/s)	6.65	Avg. Vel. (ft/s)		6.65	
Max Chl Dpth (ft)	1.79	Hydr. Depth (ft)		1.35	
Conv. Total (cfs)	2653.1	Conv. (cfs)		2653.1	
Length Wtd. (ft)		Wetted Per. (ft)		28.22	
Min Ch El (ft)	2032.00	Shear (lb/sq ft)		0.71	
Alpha	1.00	Stream Power (lb/ft s)		4.74	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.61	5.62	0.35
C & E Loss (ft)		Cum SA (acres)	1.41	10.05	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa

REACH: 1 RS: 25.1

INPUT
Description: 18+37.34
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2040	25	2044	50	2044	107	2040	123	2040
218	2035	222	2032	238	2032	244	2031.5	252	2032
255	2032	323	2035	367	2035	402	2036	452	2036

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	218	.025	323	.025

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
218	323		87	87.56	87	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2032.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.025	
E.G. Elev (ft)	2033.40	Reach Len. (ft)	87.00	87.56	87.00
Crit W.S. (ft)	2032.97	Flow Area (sq ft)		46.99	
E.G. Slope (ft/ft)	0.010056	Area (sq ft)		46.99	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	56.36	Top Width (ft)		56.36	
Vel Total (ft/s)	5.26	Avg. Vel. (ft/s)		5.26	
Max Chl Dpth (ft)	1.47	Hydr. Depth (ft)		0.83	
Conv. Total (cfs)	2463.1	Conv. (cfs)		2463.1	
Length Wtd. (ft)	87.56	Wetted Per. (ft)		56.74	
Min Ch El (ft)	2031.50	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		2.73	
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.61	5.52	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	9.95	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that

there is
not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 24.1

INPUT
Description: 19+24.90
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2040	97	2040	104	2040.5	137	2040	148	2036
181	2034.5	226	2034	272	2032	283	2032	305	2029.5
323	2030.5	405	2032	471	2032	477	2032.5	525	2036

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	283	.025	405	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
283	405	85 103.66	115	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2031.25	Element			
Vel Head (ft)	0.36	Wt. n-Val.		0.025	
E.G. Elev (ft)	2031.61	Reach Len. (ft)	85.00	103.66	115.00
Crit W.S. (ft)	2031.25	Flow Area (sq ft)		51.43	
E.G. Slope (ft/ft)	0.010720	Area (sq ft)		51.43	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	74.47	Top Width (ft)		74.47	
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)		4.80	
Max Chl Dpth (ft)	1.75	Hydr. Depth (ft)		0.69	
Conv. Total (cfs)	2385.6	Conv. (cfs)		2385.6	
Length Wtd. (ft)	103.66	Wetted Per. (ft)		74.60	
Min Ch El (ft)	2029.50	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		2.22	
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.61	5.42	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	9.82	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 23.1

INPUT
Description: 20+28.56

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2036	29	2032	106	2030	170	2030	215	2028
254	2028	413	2032	461	2032				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	170	.025	413	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
170	413	80 153.17	190	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2028.87	Element			
Vel Head (ft)	0.29	Wt. n-Val.		0.025	
E.G. Elev (ft)	2029.16	Reach Len. (ft)	80.00	153.17	190.00
Crit W.S. (ft)	2028.85	Flow Area (sq ft)		57.48	
E.G. Slope (ft/ft)	0.009956	Area (sq ft)		57.48	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	93.15	Top Width (ft)		93.15	
Vel Total (ft/s)	4.30	Avg. Vel. (ft/s)		4.30	
Max Chl Dpth (ft)	0.87	Hydr. Depth (ft)		0.62	
Conv. Total (cfs)	2475.5	Conv. (cfs)		2475.5	
Length Wtd. (ft)	153.17	Wetted Per. (ft)		93.18	
Min Ch El (ft)	2028.00	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.65	
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	0.61	5.29	0.35
C & E Loss (ft)	0.03	Cum SA (acres)	1.41	9.62	1.06

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 22.1

INPUT
Description: 21+81.73
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2036	39	2032	61	2030	129	2028	152	2028
369	2026.5	442	2028	466	2028				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	152	.025	442	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152	442	60 124.14	130	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2027.35	Element			
Vel Head (ft)	0.19	Wt. n-Val.		0.025	
E.G. Elev (ft)	2027.54	Reach Len. (ft)	60.00	124.14	130.00
Crit W.S. (ft)	2027.33	Flow Area (sq ft)		70.56	
E.G. Slope (ft/ft)	0.010782	Area (sq ft)		70.56	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	165.18	Top Width (ft)		165.18	
Vel Total (ft/s)	3.50	Avg. Vel. (ft/s)		3.50	
Max Chl Dpth (ft)	0.85	Hydr. Depth (ft)		0.43	
Conv. Total (cfs)	2378.7	Conv. (cfs)		2378.7	
Length Wtd. (ft)	124.14	Wetted Per. (ft)		165.19	
Min Ch El (ft)	2026.50	Shear (lb/sq ft)		0.29	
Alpha	1.00	Stream Power (lb/ft s)		1.01	
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)	0.61	5.06	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	9.16	1.06

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 21.1

INPUT
Description: 23+05.87
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2036	10	2032	42	2028	162	2026	217	2025.5
372	2025.5	411	2026.5	419	2026.5	460	2028	470	2028

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	162	.025	411	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
162	411	89 89.54	89	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2025.90	Element		0.025	
Vel Head (ft)	0.17	Wt. n-Val.			
E.G. Elev (ft)	2026.07	Reach Len. (ft)	89.00	89.54	89.00
Crit W.S. (ft)	2025.90	Flow Area (sq ft)		74.11	
E.G. Slope (ft/ft)	0.012990	Area (sq ft)		74.11	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	214.73	Top Width (ft)		214.73	
Vel Total (ft/s)	3.33	Avg. Vel. (ft/s)		3.33	
Max Chl Dpth (ft)	0.40	Hydr. Depth (ft)		0.35	
Conv. Total (cfs)	2167.2	Conv. (cfs)		2167.2	
Length Wtd. (ft)	89.54	Wetted Per. (ft)		214.74	
Min Ch El (ft)	2025.50	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)		0.93	
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	0.61	4.86	0.35
C & E Loss (ft)	0.04	Cum SA (acres)	1.41	8.62	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is

not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 20.1

INPUT
Description: 23+95.41
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2032	10	2028	194	2024	404	2024	446	2026.5
466	2026								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	10	.025	446	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10	446	100 171.62	180	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2024.78	Element			
Vel Head (ft)	0.03	Wt. n-Val.		0.025	
E.G. Elev (ft)	2024.81	Reach Len. (ft)	100.00	171.62	180.00
Crit W.S. (ft)		Flow Area (sq ft)		183.51	
E.G. Slope (ft/ft)	0.000813	Area (sq ft)		183.51	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	259.13	Top Width (ft)		259.13	
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)		1.35	
Max Chl Dpth (ft)	0.78	Hydr. Depth (ft)		0.71	
Conv. Total (cfs)	8665.2	Conv. (cfs)		8665.2	
Length Wtd. (ft)	171.62	Wetted Per. (ft)		259.16	
Min Ch El (ft)	2024.00	Shear (lb/sq ft)		0.04	
Alpha	1.00	Stream Power (lb/ft s)		0.05	
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	0.61	4.59	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	8.13	1.06

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 19.1

INPUT
Description: 25+67.03
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	38	2028	74	2027	116	2024	389	2024
417	2025.5	454	2026						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	74	.025	417	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
74	417	50 127.18	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2024.29	Element			
Vel Head (ft)	0.14	Wt. n-Val.		0.025	
E.G. Elev (ft)	2024.44	Reach Len. (ft)	50.00	127.18	150.00
Crit W.S. (ft)	2024.29	Flow Area (sq ft)		81.18	
E.G. Slope (ft/ft)	0.013826	Area (sq ft)		81.18	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	282.55	Top Width (ft)		282.55	
Vel Total (ft/s)	3.04	Avg. Vel. (ft/s)		3.04	
Max Chl Dpth (ft)	0.29	Hydr. Depth (ft)		0.29	
Conv. Total (cfs)	2100.6	Conv. (cfs)		2100.6	
Length Wtd. (ft)	127.18	Wetted Per. (ft)		282.56	
Min Ch El (ft)	2024.00	Shear (lb/sq ft)		0.25	
Alpha	1.00	Stream Power (lb/ft s)		0.75	
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)	0.61	4.07	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	7.07	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is

not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 17.1

INPUT
Description: 27+76.11
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	5	2028	19	2027.5	51	2024	107	2024
223	2020	285	2020	330	2024				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	107	.025	330	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
107	330	190 176.7	90	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2021.37	Element			
Vel Head (ft)	0.06	Wt. n-Val.		0.025	
E.G. Elev (ft)	2021.43	Reach Len. (ft)	190.00	176.70	90.00
Crit W.S. (ft)		Flow Area (sq ft)		122.37	
E.G. Slope (ft/ft)	0.001088	Area (sq ft)		122.37	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	117.02	Top Width (ft)		117.02	
Vel Total (ft/s)	2.02	Avg. Vel. (ft/s)		2.02	
Max Chl Dpth (ft)	1.37	Hydr. Depth (ft)		1.05	
Conv. Total (cfs)	7489.4	Conv. (cfs)		7489.4	
Length Wtd. (ft)	176.70	Wetted Per. (ft)		117.11	
Min Ch El (ft)	2020.00	Shear (lb/sq ft)		0.07	
Alpha	1.00	Stream Power (lb/ft s)		0.14	
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	0.61	3.78	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	6.48	1.06

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 16.1

INPUT
Description: 28+70.92
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	16	2027	47	2024	71	2024	90	2023.5
120	2023	1502021.816		196	2020	268	2020	290	2021.5
329	2022.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	150	.025	290	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
150	290	70 62.62	40	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2020.67	Element			
Vel Head (ft)	0.29	Wt. n-Val.		0.025	
E.G. Elev (ft)	2020.96	Reach Len. (ft)	70.00	62.62	40.00
Crit W.S. (ft)	2020.67	Flow Area (sq ft)		57.02	
E.G. Slope (ft/ft)	0.011049	Area (sq ft)		57.02	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	98.72	Top Width (ft)		98.72	
Vel Total (ft/s)	4.33	Avg. Vel. (ft/s)		4.33	
Max Chl Dpth (ft)	0.67	Hydr. Depth (ft)		0.58	
Conv. Total (cfs)	2349.8	Conv. (cfs)		2349.8	
Length Wtd. (ft)	62.62	Wetted Per. (ft)		98.75	
Min Ch El (ft)	2020.00	Shear (lb/sq ft)		0.40	
Alpha	1.00	Stream Power (lb/ft s)		1.73	
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	0.61	3.41	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	6.05	1.06

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 15.1

INPUT
Description: 29+87.83
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2028	18	2024	74	2020	80	2019	90	2019

187	2020	188	2024

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	74	.025	187	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
74	187	130 146.19	170	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2019.98	Element			
Vel Head (ft)	0.27	Wt. n-Val.		0.025	
E.G. Elev (ft)	2020.25	Reach Len. (ft)	130.00	146.19	170.00
Crit W.S. (ft)	2019.98	Flow Area (sq ft)		59.10	
E.G. Slope (ft/ft)	0.011443	Area (sq ft)		59.10	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	110.79	Top Width (ft)		110.79	
Vel Total (ft/s)	4.18	Avg. Vel. (ft/s)		4.18	
Max Chl Dpth (ft)	0.98	Hydr. Depth (ft)		0.53	
Conv. Total (cfs)	2309.1	Conv. (cfs)		2309.1	
Length Wtd. (ft)	146.19	Wetted Per. (ft)		110.87	
Min Ch El (ft)	2019.00	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.59	
Frctn Loss (ft)	1.70	Cum Volume (acre-ft)	0.61	3.33	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	5.89	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 14.1

INPUT
Description: 31+34.02
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2032	7	2032	42	2020	188	2017	268	2016
314	2016.5	358	2018.5	426	2020	436	2020		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	188	.025	358	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
188	358	180 226.45	270	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2016.88	Element			
Vel Head (ft)	0.25	Wt. n-Val.		0.025	
E.G. Elev (ft)	2017.13	Reach Len. (ft)	180.00	226.45	270.00
Crit W.S. (ft)	2016.88	Flow Area (sq ft)		61.33	
E.G. Slope (ft/ft)	0.011813	Area (sq ft)		61.33	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	124.59	Top Width (ft)		124.59	
Vel Total (ft/s)	4.03	Avg. Vel. (ft/s)		4.03	
Max Chl Dpth (ft)	0.88	Hydr. Depth (ft)		0.49	
Conv. Total (cfs)	2272.6	Conv. (cfs)		2272.6	
Length Wtd. (ft)	226.45	Wetted Per. (ft)		124.60	
Min Ch El (ft)	2016.00	Shear (lb/sq ft)		0.36	
Alpha	1.00	Stream Power (lb/ft s)		1.46	
Frctn Loss (ft)	2.80	Cum Volume (acre-ft)	0.61	3.13	0.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.41	5.50	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 13.1

INPUT
Description: 33+60.47

Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2020	39	2016	48	2016	67	2017	104	2016
283	2016	310	2014.5	322	2015	326	2014	328	2014.5
333	2014	426	2013.5	500	2013.5	613	2016	625	2016

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	333	.025	613	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
333	613	159 159.95	159	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2014.03	Element			
Vel Head (ft)	0.19	Wt. n-Val.	0.025	0.025	
E.G. Elev (ft)	2014.21	Reach Len. (ft)	159.00	159.95	159.00
Crit W.S. (ft)	2014.03	Flow Area (sq ft)	0.01	70.73	
E.G. Slope (ft/ft)	0.012960	Area (sq ft)	0.01	70.73	
Q Total (cfs)	247.00	Flow (cfs)	0.00	247.00	
Top Width (ft)	191.20	Top Width (ft)	0.46	190.75	
Vel Total (ft/s)	3.49	Avg. Vel. (ft/s)	0.36	3.49	
Max Chl Dpth (ft)	0.53	Hydr. Depth (ft)	0.01	0.37	
Conv. Total (cfs)	2169.7	Conv. (cfs)	0.0	2169.7	
Length Wtd. (ft)	159.95	Wetted Per. (ft)	0.46	190.75	
Min Ch El (ft)	2013.50	Shear (lb/sq ft)	0.01	0.30	
Alpha	1.00	Stream Power (lb/ft s)	0.00	1.05	
Frctn Loss (ft)	2.00	Cum Volume (acre-ft)	0.61	2.78	0.35
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	4.68	1.06

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - Divided flow computed for this cross-section.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 12.1

INPUT
Description: 35+20.42
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2016	26	2016	108	2014.5	263	2015.5	279	2014.5
282	2014.5	304	2012	339	2012	340	2013	344	2012
351	2012	434	2010.5	548	2011	646	2013	713	2013.5
730	2013								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	351	.025	548	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
351	548	170 227.83	290	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2011.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.		0.025	0.025
E.G. Elev (ft)	2011.42	Reach Len. (ft)	170.00	227.83	290.00
Crit W.S. (ft)	2011.21	Flow Area (sq ft)		65.88	1.05
E.G. Slope (ft/ft)	0.012103	Area (sq ft)		65.88	1.05
Q Total (cfs)	247.00	Flow (cfs)		245.49	1.51
Top Width (ft)	163.23	Top Width (ft)		153.10	10.13
Vel Total (ft/s)	3.69	Avg. Vel. (ft/s)		3.73	1.44
Max Chl Dpth (ft)	0.71	Hydr. Depth (ft)		0.43	0.10
Conv. Total (cfs)	2245.2	Conv. (cfs)		2231.5	13.7
Length Wtd. (ft)	228.02	Wetted Per. (ft)		153.11	10.13
Min Ch El (ft)	2010.50	Shear (lb/sq ft)		0.33	0.08
Alpha	1.01	Stream Power (lb/ft s)		1.21	0.11
Frctn Loss (ft)	2.72	Cum Volume (acre-ft)	0.61	2.53	0.35
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	4.05	1.05

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 11.1

INPUT
Description: 37+48.25
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2008	23	2008	61	2010	106	2011	268	2011
274	2010	275	2011	284	2009	287	2008	337	2008
379	2007	450	2007	503	2008	532	2008	682	2012
694	2012								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	337	.025	503	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
337	503	270 312.72	170	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2007.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.025	
E.G. Elev (ft)	2007.86	Reach Len. (ft)	270.00	312.72	170.00
Crit W.S. (ft)	2007.62	Flow Area (sq ft)		62.48	
E.G. Slope (ft/ft)	0.011756	Area (sq ft)		62.48	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	130.05	Top Width (ft)		130.05	
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)		3.95	
Max Chl Dpth (ft)	0.62	Hydr. Depth (ft)		0.48	
Conv. Total (cfs)	2278.1	Conv. (cfs)		2278.1	
Length Wtd. (ft)	312.72	Wetted Per. (ft)		130.06	
Min Ch El (ft)	2007.00	Shear (lb/sq ft)		0.35	
Alpha	1.00	Stream Power (lb/ft s)		1.39	
Frctn Loss (ft)	2.17	Cum Volume (acre-ft)	0.61	2.20	0.34
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	3.31	1.01

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 10.1

INPUT
Description: 39+61.97
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2008	114	2008	129	2005	148	2004	181	2004
233	2004.5	235	2004	236	2004.5	259	2004	347	2004
378	2000	391	2000	440	2003				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	347	.025	440	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
347	440	230 202.36	150	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	2001.73	Element			
Vel Head (ft)	0.27	Wt. n-Val.		0.025	
E.G. Elev (ft)	2002.01	Reach Len. (ft)	230.00	202.36	150.00
Crit W.S. (ft)		Flow Area (sq ft)		58.76	
E.G. Slope (ft/ft)	0.004573	Area (sq ft)		58.76	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	54.76	Top Width (ft)		54.76	
Vel Total (ft/s)	4.20	Avg. Vel. (ft/s)		4.20	
Max Chl Dpth (ft)	1.73	Hydr. Depth (ft)		1.07	
Conv. Total (cfs)	3652.6	Conv. (cfs)		3652.6	
Length Wtd. (ft)	203.40	Wetted Per. (ft)		54.93	

Min Ch El (ft)	2000.00	Shear (lb/sq ft)		0.31	
Alpha	1.00	Stream Power (lb/ft s)		1.28	
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	0.61	1.76	0.34
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	2.65	1.01

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 9.1

INPUT
Description: 41+64.33
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2006.5	60	2007	70	2006.5	85	2007	104	2006
111	2006	171	2001.5	208	2000	251	2000	255	1998
258	1999.5	272	2000	290	2000	306	2004	325	2000

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	251	.025	272	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
251	272	260 255.46	230	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	2000.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.025	0.025	0.025
E.G. Elev (ft)	2000.85	Reach Len. (ft)	260.00	255.46	230.00
Crit W.S. (ft)	2000.56	Flow Area (sq ft)	27.91	23.00	11.44
E.G. Slope (ft/ft)	0.007363	Area (sq ft)	27.91	23.00	11.44
Q Total (cfs)	247.00	Flow (cfs)	88.62	121.40	36.98
Top Width (ft)	100.69	Top Width (ft)	56.80	21.00	22.89
Vel Total (ft/s)	3.96	Avg. Vel. (ft/s)	3.18	5.28	3.23
Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)	0.49	1.10	0.50
Conv. Total (cfs)	2878.6	Conv. (cfs)	1032.8	1414.8	430.9
Length Wtd. (ft)	254.37	Wetted Per. (ft)	56.81	21.84	23.58
Min Ch El (ft)	1998.00	Shear (lb/sq ft)	0.23	0.48	0.22
Alpha	1.20	Stream Power (lb/ft s)	0.72	2.56	0.72
Frctn Loss (ft)	1.49	Cum Volume (acre-ft)	0.54	1.57	0.32

C & E Loss (ft)	0.03	Cum SA (acres)	1.25	2.47	0.97

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - Divided flow computed for this cross-section.
Warning - The cross-section end points had to be extended vertically for the computed water surface.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 8.1

INPUT
Description: 44+19.79
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2004	27	2004	36	2000	71	2000	142	1996
169	1996	266	1994	277	1995.5	292	1996	324	2000
353	2000								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	169	.025	292	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
169	292	80 119.32	170	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1995.59	Element			
Vel Head (ft)	0.19	Wt. n-Val.		0.025	
E.G. Elev (ft)	1995.78	Reach Len. (ft)	80.00	119.32	170.00
Crit W.S. (ft)	1995.36	Flow Area (sq ft)		71.01	
E.G. Slope (ft/ft)	0.004784	Area (sq ft)		71.01	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	91.11	Top Width (ft)		91.11	
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)		3.48	
Max Chl Dpth (ft)	1.59	Hydr. Depth (ft)		0.78	

Conv. Total (cfs)	3571.3	Conv. (cfs)		3571.3	
Length Wtd. (ft)	119.32	Wetted Per. (ft)		91.23	
Min Ch El (ft)	1994.00	Shear (lb/sq ft)		0.23	
Alpha	1.00	Stream Power (lb/ft s)		0.81	
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	0.46	1.30	0.29
C & E Loss (ft)	0.01	Cum SA (acres)	1.08	2.14	0.91

Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 7.1

INPUT
Description: 45+39.11
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2000	17	1997	25	1997	36	1996	101	1995
152	1995.5	290	1993.5	296	1994	366	1996	376	1998
389	1997	396	1996						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	152	.025	366	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
152	366	200 160.91	120	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1994.65	Element			
Vel Head (ft)	0.28	Wt. n-Val.		0.025	
E.G. Elev (ft)	1994.93	Reach Len. (ft)	200.00	160.91	120.00
Crit W.S. (ft)	1994.65	Flow Area (sq ft)		58.22	
E.G. Slope (ft/ft)	0.011603	Area (sq ft)		58.22	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	107.91	Top Width (ft)		107.91	
Vel Total (ft/s)	4.24	Avg. Vel. (ft/s)		4.24	
Max Chl Dpth (ft)	1.15	Hydr. Depth (ft)		0.54	
Conv. Total (cfs)	2293.1	Conv. (cfs)		2293.1	
Length Wtd. (ft)	160.91	Wetted Per. (ft)		107.95	
Min Ch El (ft)	1993.50	Shear (lb/sq ft)		0.39	

Alpha	1.00	Stream Power (lb/ft s)		1.66	
Frctn Loss (ft)	1.73	Cum Volume (acre-ft)	0.46	1.12	0.29
C & E Loss (ft)	0.01	Cum SA (acres)	1.08	1.87	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 6.1

INPUT
Description: 47+00.02
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1992	142	1991	216	1989	230	1988	240	1988
286	1991.5	294	1991.5	326	1991	337	1992	431	1992

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	142	.025	286	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
142	286	320 309.01	270	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1989.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.		0.025	
E.G. Elev (ft)	1989.90	Reach Len. (ft)	320.00	309.01	270.00
Crit W.S. (ft)	1989.51	Flow Area (sq ft)		48.97	
E.G. Slope (ft/ft)	0.010023	Area (sq ft)		48.97	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	62.67	Top Width (ft)		62.67	
Vel Total (ft/s)	5.04	Avg. Vel. (ft/s)		5.04	
Max Chl Dpth (ft)	1.51	Hydr. Depth (ft)		0.78	
Conv. Total (cfs)	2467.1	Conv. (cfs)		2467.1	

Length Wtd. (ft)	314.50	Wetted Per. (ft)		62.77	
Min Ch El (ft)	1988.00	Shear (lb/sq ft)		0.49	
Alpha	1.00	Stream Power (lb/ft s)		2.46	
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)	0.46	0.92	0.29
C & E Loss (ft)	0.06	Cum SA (acres)	1.08	1.55	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program selected the water surface that had the least amount of error between computed and assumed values.

Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 5.1

INPUT
Description: 50+09.03

Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1988	30	1988	223	1985.5	288	1985.5	411	1987
498	1986.5	505	1986	575	1988	584	1988	620	1987.5
646	1987.5	687	1988	805	1988				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	411	.025	575	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
411	575	250 210.09	160	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1986.10	Element			
Vel Head (ft)	0.21	Wt. n-Val.	0.025	0.025	
E.G. Elev (ft)	1986.31	Reach Len. (ft)	250.00	210.09	160.00
Crit W.S. (ft)	1986.10	Flow Area (sq ft)	67.38	0.24	
E.G. Slope (ft/ft)	0.012057	Area (sq ft)	67.38	0.24	
Q Total (cfs)	247.00	Flow (cfs)	246.79	0.21	

Top Width (ft)	165.06	Top Width (ft)	160.24	4.82	
Vel Total (ft/s)	3.65	Avg. Vel. (ft/s)	3.66	0.87	
Max Chl Dpth (ft)	0.60	Hydr. Depth (ft)	0.42	0.05	
Conv. Total (cfs)	2249.5	Conv. (cfs)	2247.6	1.9	
Length Wtd. (ft)	230.03	Wetted Per. (ft)	160.25	4.82	
Min Ch El (ft)	1986.00	Shear (lb/sq ft)	0.32	0.04	
Alpha	1.00	Stream Power (lb/ft s)	1.16	0.03	
Frctn Loss (ft)	2.70	Cum Volume (acre-ft)	0.21	0.75	0.29
C & E Loss (ft)	0.01	Cum SA (acres)	0.50	1.31	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - Divided flow computed for this cross-section.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 4.1

INPUT
Description: 52+19.12
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1984	12	1984	89	1983	127	1983	200	1983.5
325	1983.5	377	1982	417	1982	547	1984	826	1984
893	1988								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	325	.025	547	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
325	547	230 170.63	110	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1982.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.025	

E.G. Elev (ft)	1983.03	Reach Len. (ft)	230.00	170.63	110.00
Crit W.S. (ft)	1982.77	Flow Area (sq ft)		60.41	
E.G. Slope (ft/ft)	0.011403	Area (sq ft)		60.41	
Q Total (cfs)	247.00	Flow (cfs)		247.00	
Top Width (ft)	116.79	Top Width (ft)		116.79	
Vel Total (ft/s)	4.09	Avg. Vel. (ft/s)		4.09	
Max Chl Dpth (ft)	0.77	Hydr. Depth (ft)		0.52	
Conv. Total (cfs)	2313.1	Conv. (cfs)		2313.1	
Length Wtd. (ft)	144.71	Wetted Per. (ft)		116.81	
Min Ch El (ft)	1982.00	Shear (lb/sq ft)		0.37	
Alpha	1.00	Stream Power (lb/ft s)		1.51	
Frctn Loss (ft)	1.90	Cum Volume (acre-ft)	0.02	0.60	0.29
C & E Loss (ft)	0.03	Cum SA (acres)	0.04	1.02	0.91

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 3.1

INPUT
Description: 53+89.75
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1984	92	1981.5	188	1981.5	265	1980	388	1980
391	1979	398	1979.5	441	1979.75	572	1979.75	632	1979.5
695	1978.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	388	.025	441	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
388	441	156 156.24	156	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1979.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.025	0.025
E.G. Elev (ft)	1979.95	Reach Len. (ft)	156.00	156.24	156.00
Crit W.S. (ft)	1979.81	Flow Area (sq ft)		12.61	68.80
E.G. Slope (ft/ft)	0.015324	Area (sq ft)		12.61	68.80
Q Total (cfs)	247.00	Flow (cfs)		35.83	211.17
Top Width (ft)	306.42	Top Width (ft)		52.42	254.00
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)		2.84	3.07
Max Chl Dpth (ft)	1.31	Hydr. Depth (ft)		0.24	0.27
Conv. Total (cfs)	1995.3	Conv. (cfs)		289.5	1705.8
Length Wtd. (ft)	156.12	Wetted Per. (ft)		52.57	255.31
Min Ch El (ft)	1979.00	Shear (lb/sq ft)		0.23	0.26
Alpha	1.00	Stream Power (lb/ft s)		0.65	0.79
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	0.02	0.46	0.21
C & E Loss (ft)	0.03	Cum SA (acres)	0.04	0.69	0.59

Warning - The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning - The cross-section end points had to be extended vertically for the computed water surface.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning - During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 2.1

INPUT
Description: 55+45.99
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1980	22	1980	92	1979	213	1978.5	268	1977.5
270	1976.5	301	1976.25	445	1977	477	1976.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	270	.025	445	.025

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
270	445	115	115.4	115	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

			Left OB	Channel	Right OB
W.S. Elev (ft)	1977.31	Element			
Vel Head (ft)	0.04	Wt. n-Val.	0.025	0.025	0.025
E.G. Elev (ft)	1977.36	Reach Len. (ft)	115.00	115.40	115.00
Crit W.S. (ft)		Flow Area (sq ft)	0.66	128.23	18.03
E.G. Slope (ft/ft)	0.001269	Area (sq ft)	0.66	128.23	18.03
Q Total (cfs)	247.00	Flow (cfs)	0.71	220.68	25.61
Top Width (ft)	208.63	Top Width (ft)	1.63	175.00	32.00
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)	1.08	1.72	1.42
Max Chl Dpth (ft)	1.06	Hydr. Depth (ft)	0.41	0.73	0.56
Conv. Total (cfs)	6933.8	Conv. (cfs)	20.0	6194.8	718.9
Length Wtd. (ft)	115.28	Wetted Per. (ft)	1.82	175.00	32.82
Min Ch El (ft)	1976.25	Shear (lb/sq ft)	0.03	0.06	0.04
Alpha	1.01	Stream Power (lb/ft s)	0.03	0.10	0.06
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	0.01	0.20	0.05
C & E Loss (ft)	0.03	Cum SA (acres)	0.03	0.28	0.08

Warning - The cross-section end points had to be extended vertically for the computed water surface.
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION RIVER: Equestrian Outfa
REACH: 1 RS: 1.1

INPUT
Description: 56+61.39
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1976.5	23	1976	60	1976	88	1976

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	23	.025	60	.025

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
23	60	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #PF#1

W.S. Elev (ft)	1976.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.025	0.025	0.025
E.G. Elev (ft)	1977.01	Reach Len. (ft)			
Crit W.S. (ft)	1976.70	Flow Area (sq ft)	10.32	25.86	19.57
E.G. Slope (ft/ft)	0.010009	Area (sq ft)	10.32	25.86	19.57
Q Total (cfs)	247.00	Flow (cfs)	35.78	121.09	90.14
Top Width (ft)	88.00	Top Width (ft)	23.00	37.00	28.00
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)	3.47	4.68	4.61
Max Chl Dpth (ft)	0.70	Hydr. Depth (ft)	0.45	0.70	0.70
Conv. Total (cfs)	2468.9	Conv. (cfs)	357.6	1210.3	901.0
Length Wtd. (ft)		Wetted Per. (ft)	23.20	37.00	28.70
Min Ch El (ft)	1976.00	Shear (lb/sq ft)	0.28	0.44	0.43
Alpha	1.03	Stream Power (lb/ft s)	0.96	2.04	1.96
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Equestrian Outfa

Reach	River Sta.	n1	n2	n3
1	33.2	.025	.025	.025
1	32.1	.025	.025	.025
1	31.1	.025	.025	.025
1	30.1	.025	.025	.025
1	29.1	.025	.025	.025
1	28.1	.025	.025	.025
1	27.1	.025	.025	.025
1	26.1	.025	.025	.025
1	25.1	.025	.025	.025
1	24.1	.025	.025	.025
1	23.1	.025	.025	.025
1	22.1	.025	.025	.025
1	21.1	.025	.025	.025
1	20.1	.025	.025	.025
1	19.1	.025	.025	.025
1	17.1	.025	.025	.025

1	16.1	.025	.025	.025
1	15.1	.025	.025	.025
1	14.1	.025	.025	.025
1	13.1	.025	.025	.025
1	12.1	.025	.025	.025
1	11.1	.025	.025	.025
1	10.1	.025	.025	.025
1	9.1	.025	.025	.025
1	8.1	.025	.025	.025
1	7.1	.025	.025	.025
1	6.1	.025	.025	.025
1	5.1	.025	.025	.025
1	4.1	.025	.025	.025
1	3.1	.025	.025	.025
1	2.1	.025	.025	.025
1	1.1	.025	.025	.025

SUMMARY OF REACH LENGTHS

River: Equestrian Outfa

Reach	River Sta.	Left	Channel	Right
1	33.2	75	101.1	125
1	32.1	75	101.1	125
1	31.1	110	90	50
1	30.1	85	85.31	85
1	29.1	110	97.76	65
1	28.1	50	74.34	120
1	27.1	132	132.64	132
1	26.1	110	106.66	90
1	25.1	87	87.56	87
1	24.1	85	103.66	115
1	23.1	80	153.17	190
1	22.1	60	124.14	130
1	21.1	89	89.54	89
1	20.1	100	171.62	180
1	19.1	50	127.18	150
1	17.1	190	176.7	90
1	16.1	70	62.62	40

1	15.1	130	146.19	170
1	14.1	180	226.45	270
1	13.1	159	159.95	159
1	12.1	170	227.83	290
1	11.1	270	312.72	170
1	10.1	230	202.36	150
1	9.1	260	255.46	230
1	8.1	80	119.32	170
1	7.1	200	160.91	120
1	6.1	320	309.01	270
1	5.1	250	210.09	160
1	4.1	230	170.63	110
1	3.1	156	156.24	156
1	2.1	115	115.4	115
1	1.1	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Equestrian Outfa

Reach	River Sta.	Contr.	Expan.
1	33.2	.1	.3
1	32.1	.1	.3
1	31.1	.1	.3
1	30.1	.1	.3
1	29.1	.1	.3
1	28.1	.1	.3
1	27.1	.1	.3
1	26.1	.1	.3
1	25.1	.1	.3
1	24.1	.1	.3
1	23.1	.1	.3
1	22.1	.1	.3
1	21.1	.1	.3
1	20.1	.1	.3
1	19.1	.1	.3
1	17.1	.1	.3
1	16.1	.1	.3
1	15.1	.1	.3

1	14.1	.1	.3
1	13.1	.1	.3
1	12.1	.1	.3
1	11.1	.1	.3
1	10.1	.1	.3
1	9.1	.1	.3
1	8.1	.1	.3
1	7.1	.1	.3
1	6.1	.1	.3
1	5.1	.1	.3
1	4.1	.1	.3
1	3.1	.1	.3
1	2.1	.1	.3
1	1.1	.1	.3

APPENDIX V

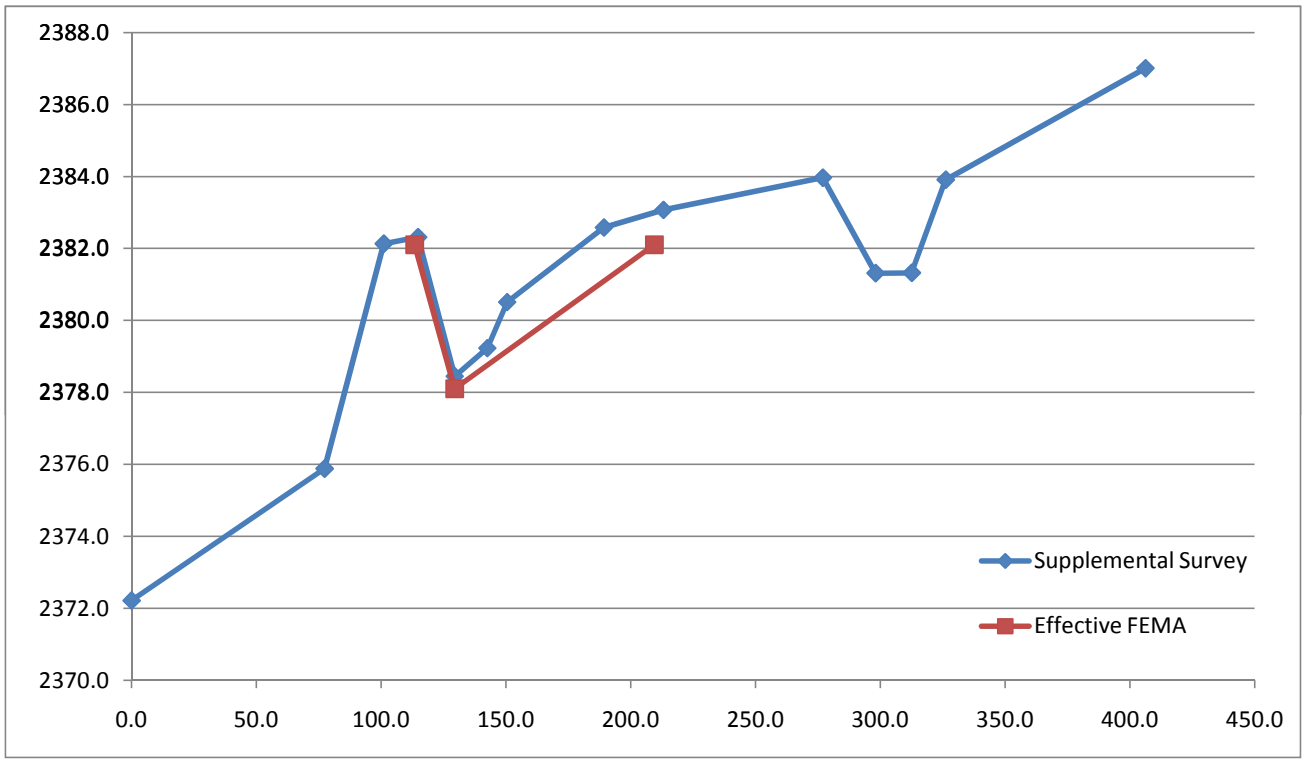
Supplemental Survey Map


HORIZONTAL GEODETIC DATA BASED ON US STATE PLANE, NEVADA EAST ZONE (2701), NAD 1983 DATUM.
THE SURVEY WAS COMPLETED ON SEPTEMBER 8, 2009.
BENCHMARK
CITY OF HENDERSON BENCHMARK No. 508 (REVISION DATE: 2004)
2" BRASS CAP IN THE TOP OF CURB AT THE SOUTHWEST CORNER OF EQUESTRIAN DRIVE AND APPALOOSA ROAD.
ELEVATION = 643.161m (NAVD'88)
= 2110.10ft (NAVD'88)
N
Supplemental Survey Alignments
0 500 1,000 2,000 3,000 4,000
Feet

APPENDIX VI

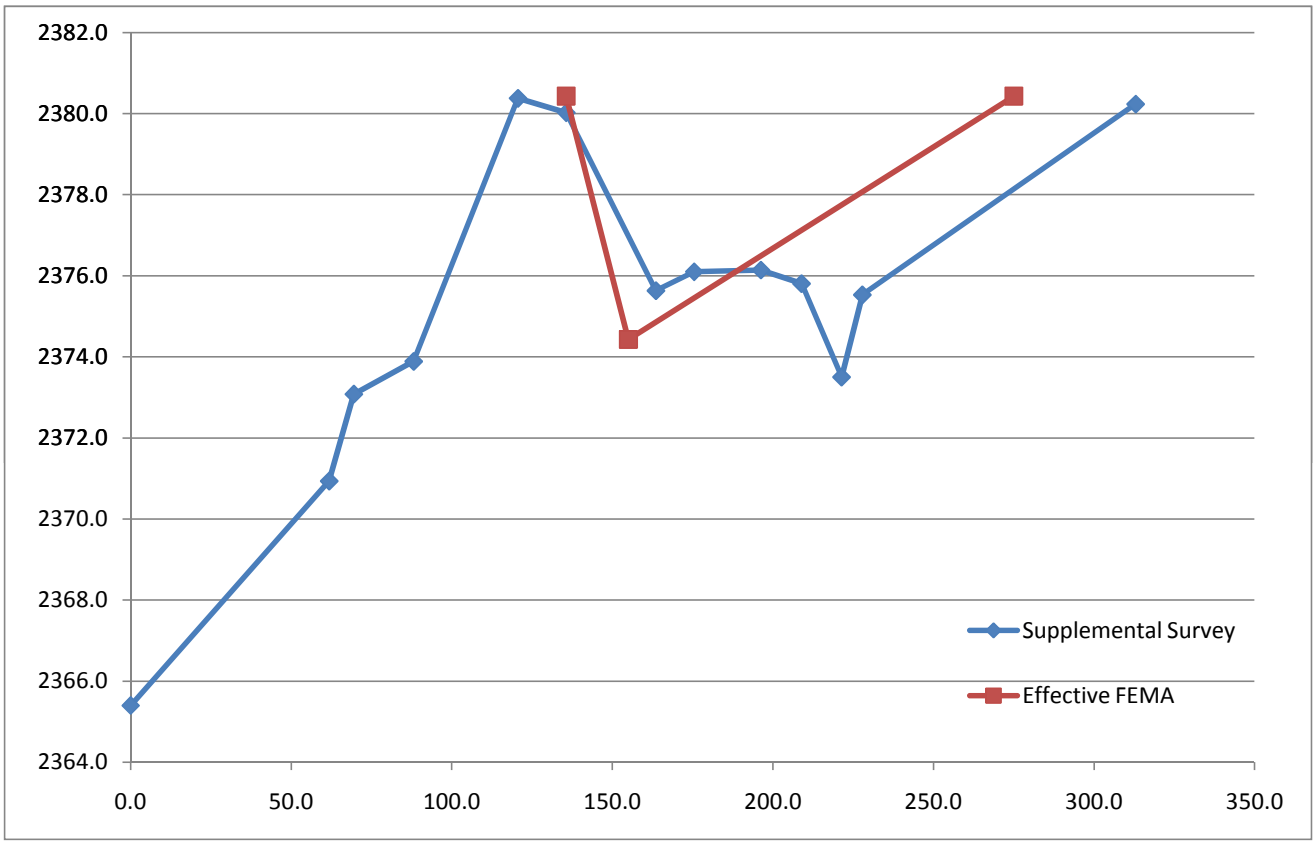
Channel Cross-Section Comparison Plots

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2372.2	113.5	2382.1	0.2	-2.9	0.3	N/A	N/A
77.3	2375.9	129.5	2378.1					
101.1	2382.1	209.5	2382.1					
114.8	2382.3							
129.5	2378.4							
142.5	2379.2							
150.5	2380.5							
189.3	2382.6							
213.1	2383.1							
276.9	2384.0							
298.1	2381.3							
312.6	2381.3							
326.2	2383.9							
406.2	2387.0							



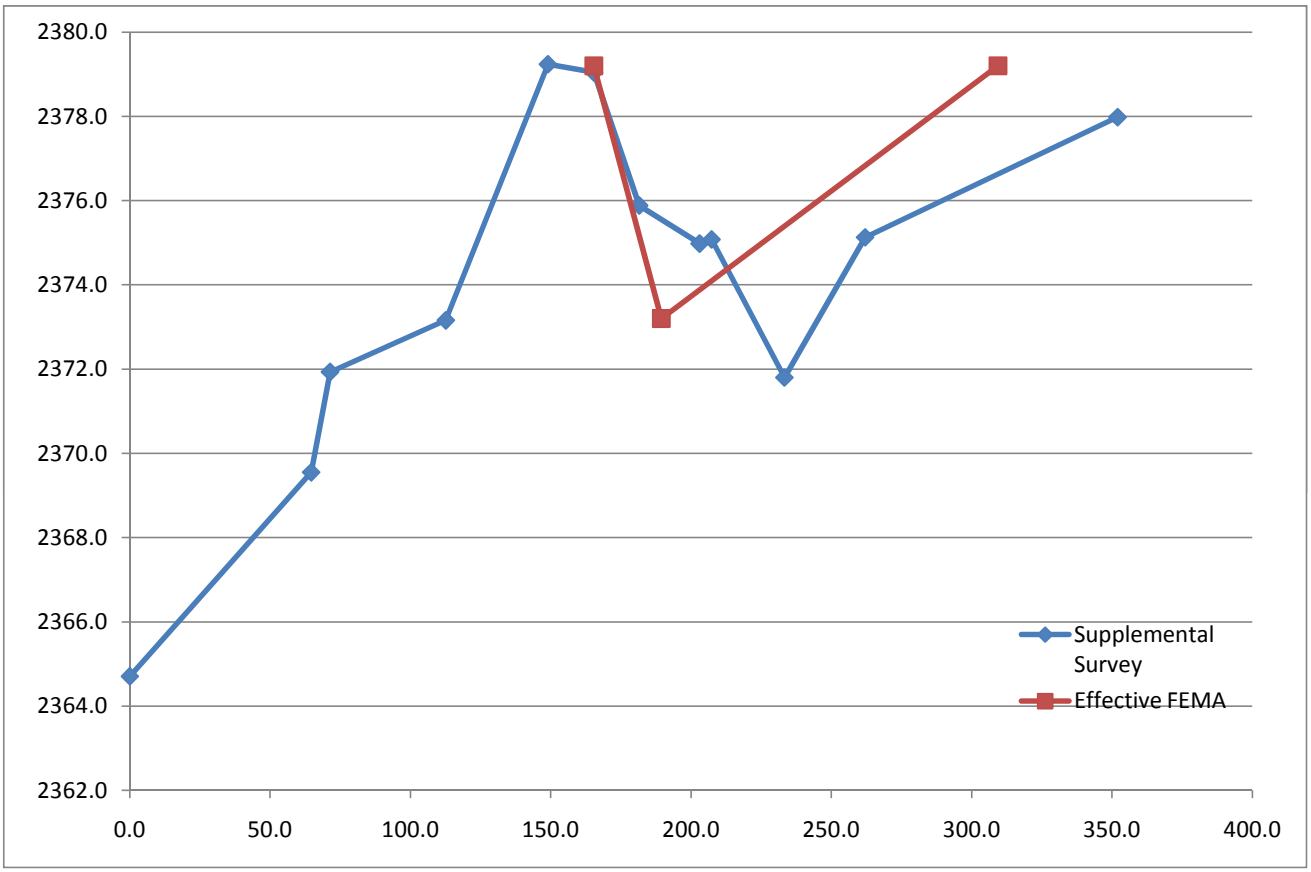
Station 167+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2365.4	135.6	2380.4	-0.4	-0.2	-0.9	N/A	N/A
61.8	2370.9	155.0	2374.4					
69.5	2373.1	275.0	2380.4					
88.1	2373.9							
120.6	2380.4							
135.6	2380.0							
163.6	2375.6							
175.5	2376.1							
196.3	2376.1							
208.9	2375.8							
221.4	2373.5							
227.9	2375.5							
313.0	2380.2							



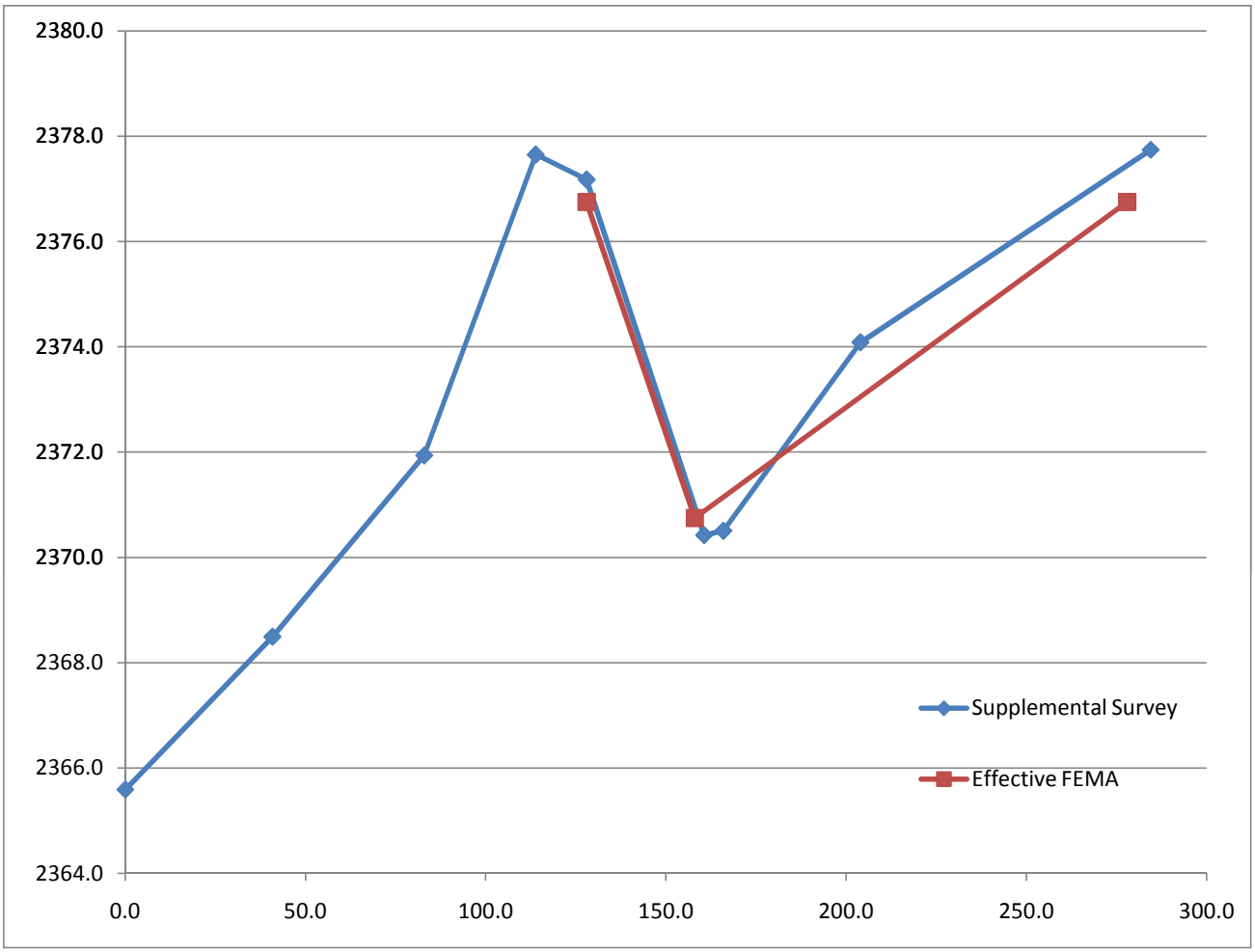
Station 165+50

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2364.7	165.4	2379.2	-0.2	-1.2	-1.4	N/A	N/A
64.6	2369.5	189.4	2373.2					
71.4	2371.9	309.4	2379.2					
112.6	2373.2							
149.0	2379.2							
165.4	2379.0							
181.5	2375.9							
203.1	2375.0							
207.3	2375.1							
233.3	2371.8							
262.1	2375.1							
352.1	2378.0							



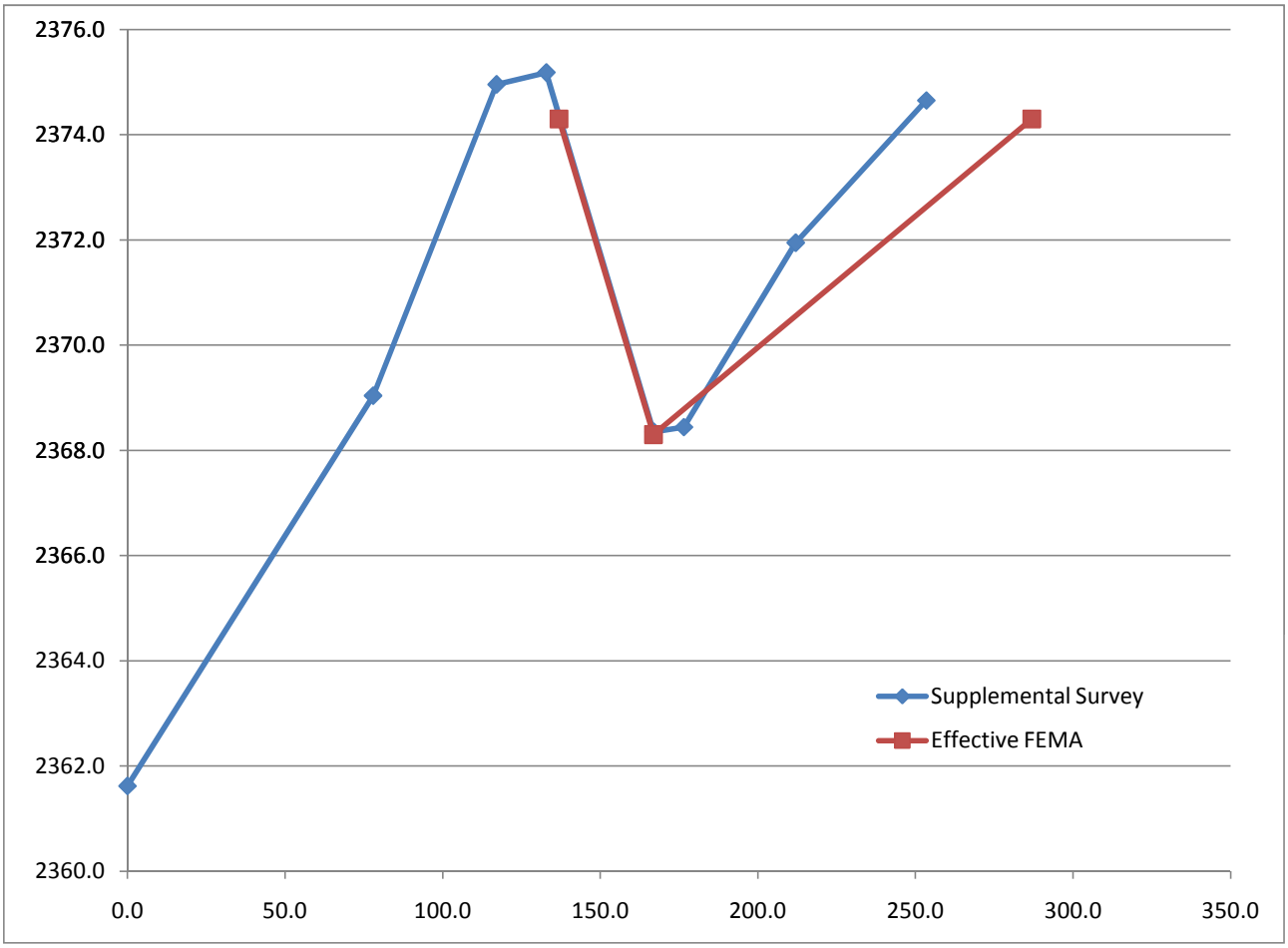
Station 165+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2365.6	128.0	2376.8	0.4	1.0	-0.3	N/A	N/A
40.8	2368.5	158.0	2370.8					
82.9	2371.9	278.0	2376.8					
113.9	2377.7							
128.0	2377.2							
160.6	2370.4							
166.0	2370.5							
204.0	2374.1							
284.5	2377.7							



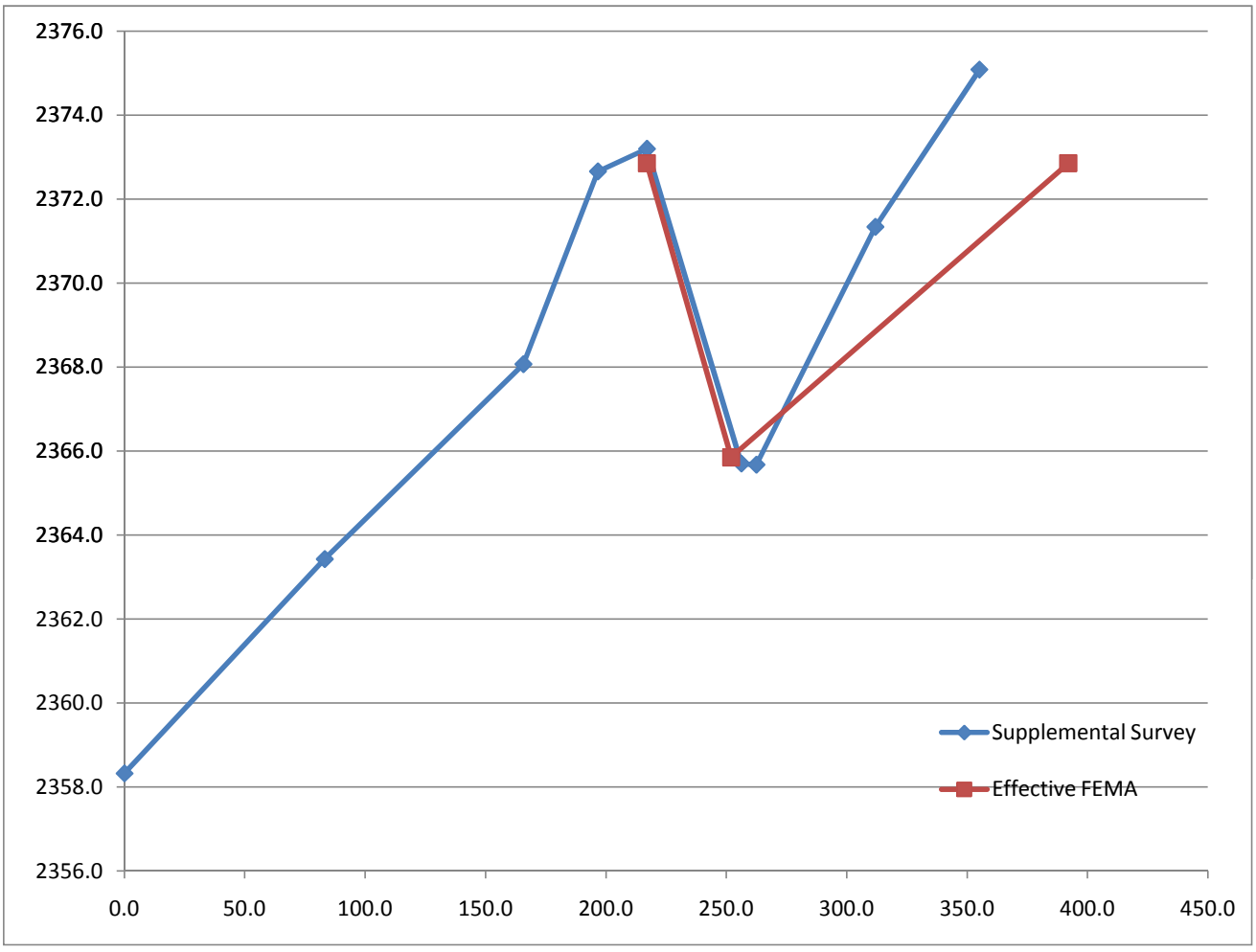
Station 164+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2361.6	136.9	2374.3	0.9	0.3	0.0	N/A	N/A
77.9	2369.0	166.9	2368.3					
117.1	2375.0	286.9	2374.3					
132.9	2375.2							
166.9	2368.4							
176.5	2368.4							
212.0	2371.9							
253.4	2374.7							



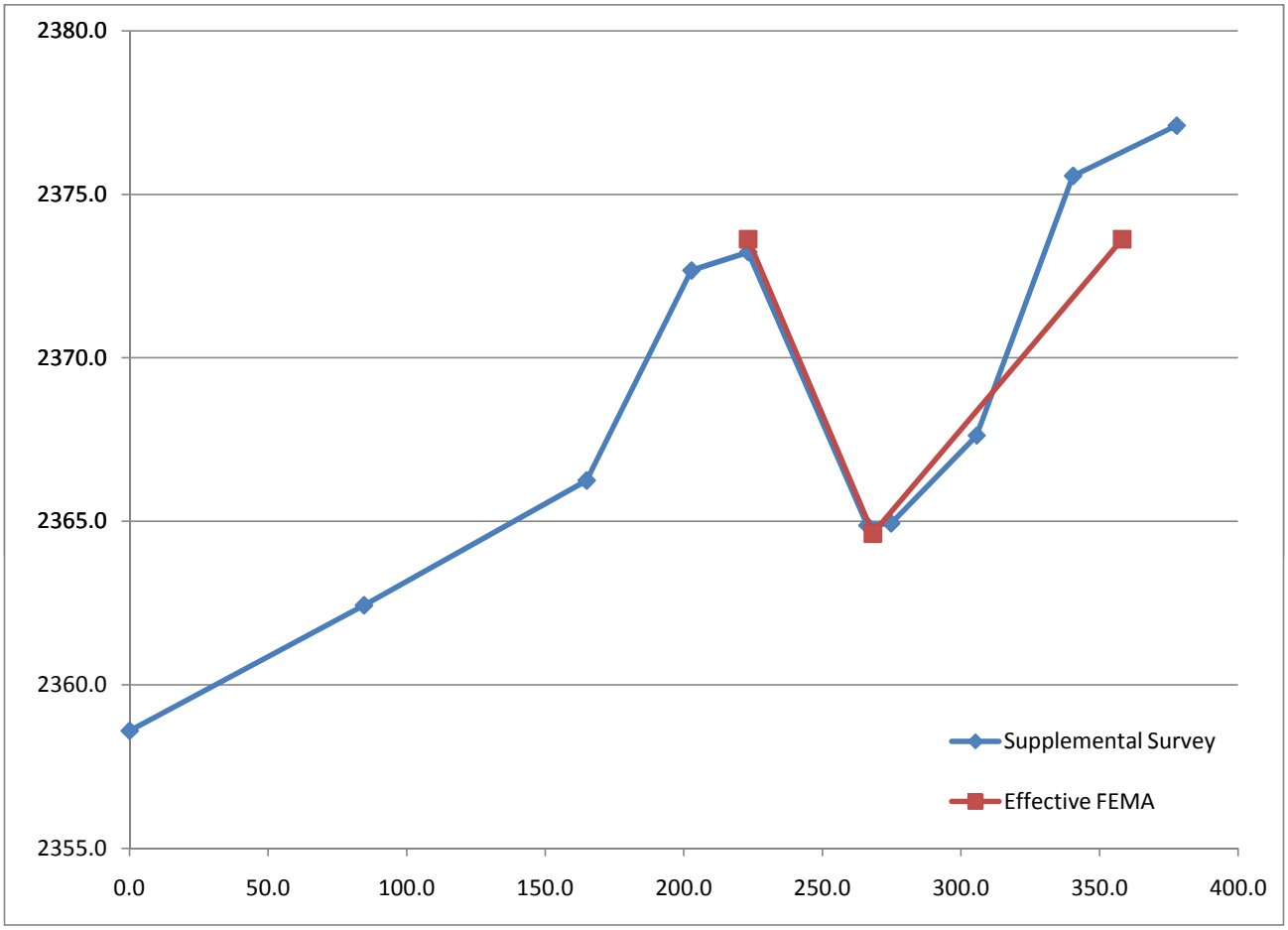
Station 163+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2358.3	217.0	2372.9	0.3	2.2	-0.1	N/A	N/A
83.2	2363.4	252.0	2365.9					
165.7	2368.1	392.0	2372.9					
196.7	2372.7							
217.0	2373.2							
256.3	2365.7							
262.5	2365.7							
311.8	2371.3							
355.1	2375.1							



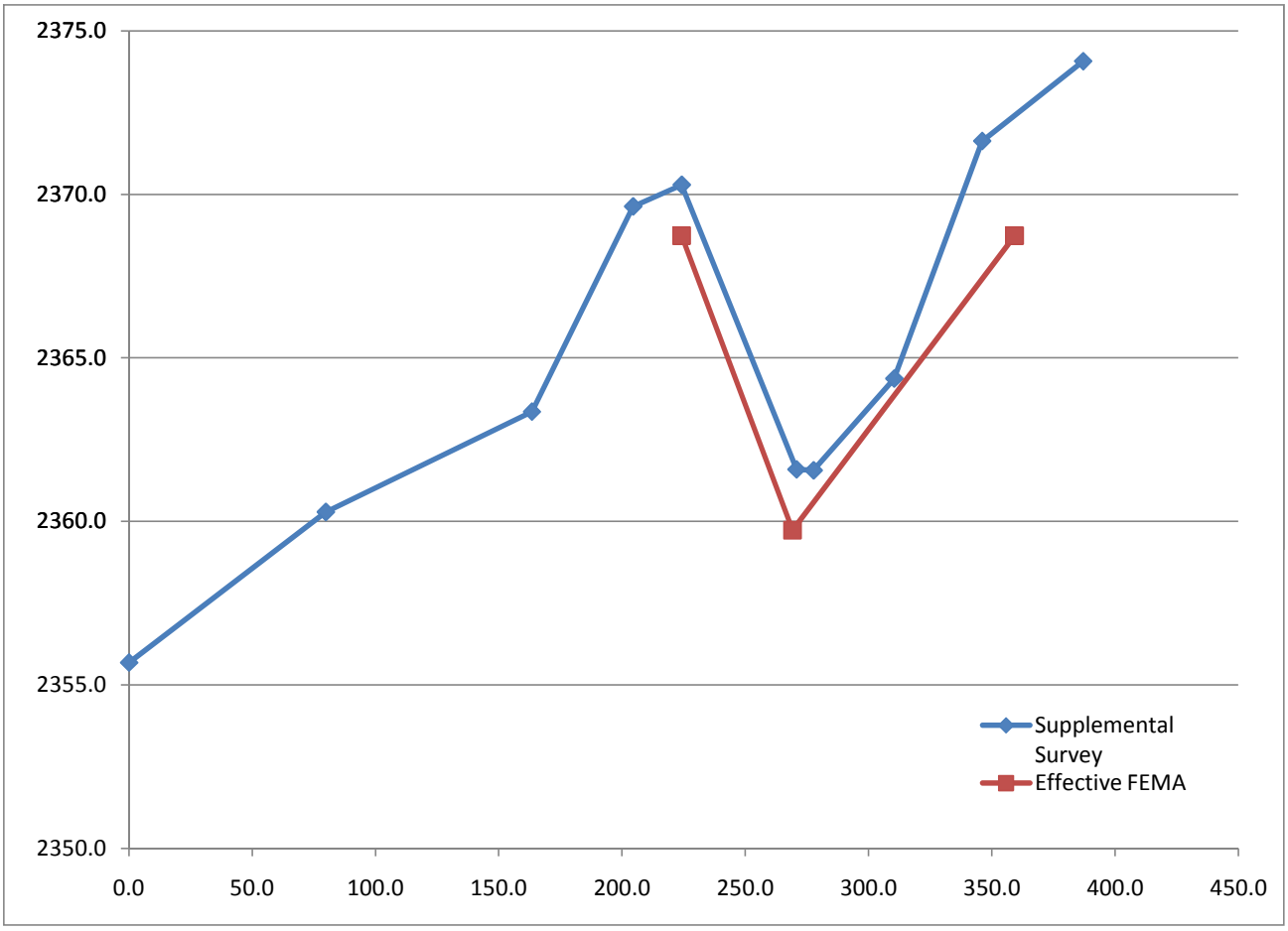
Station 162+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2358.6	223.2	2373.6	-0.4	1.9	0.2	N/A	N/A
84.6	2362.4	268.2	2364.6					
164.9	2366.2	358.2	2373.6					
202.8	2372.7							
223.2	2373.2							
266.1	2364.9							
274.8	2364.9							
305.7	2367.6							
340.5	2375.6							
377.8	2377.1							



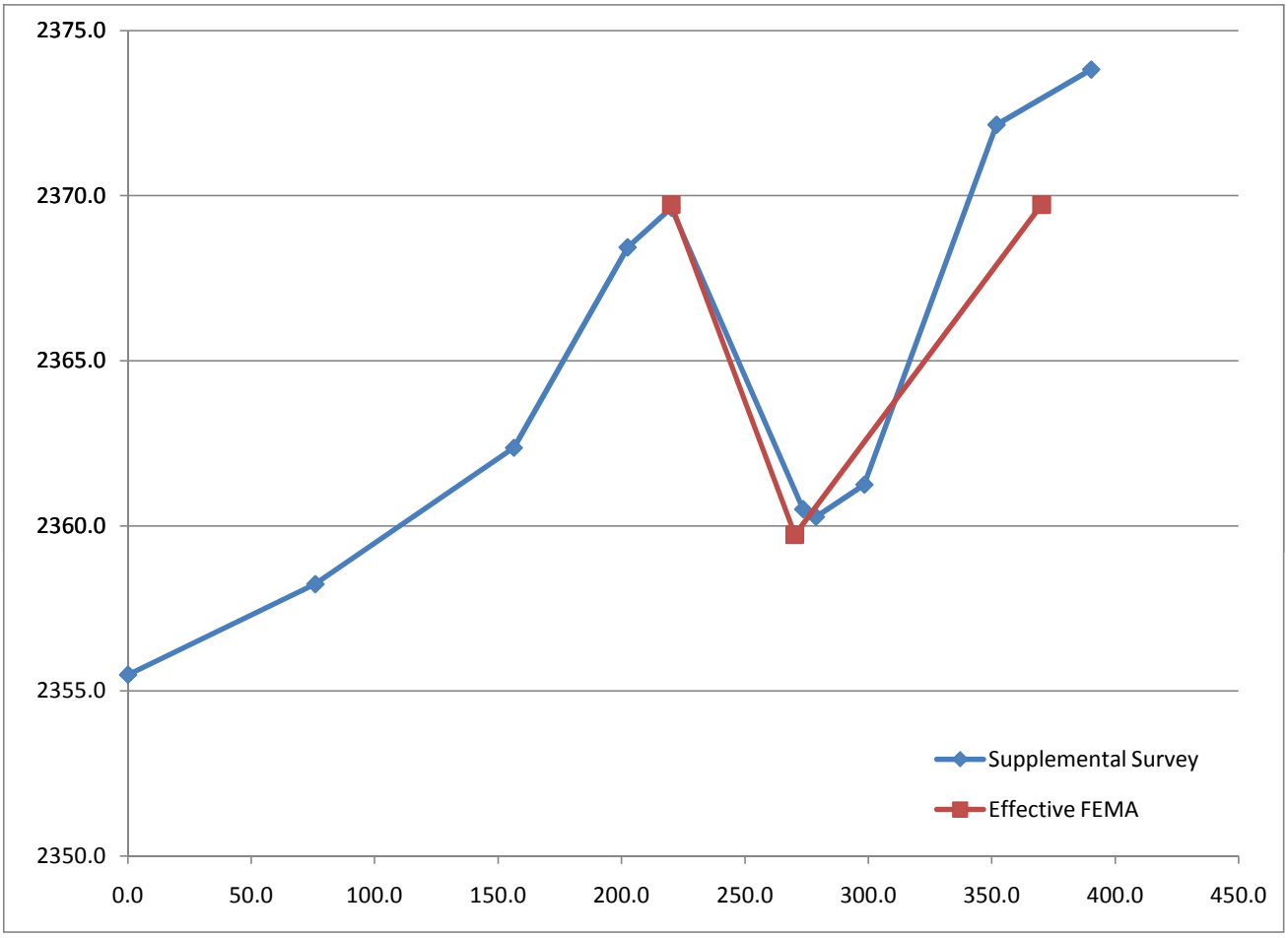
Station 161+50

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2355.7	224.2	2368.7	1.6	2.9	1.9	N/A	N/A
79.9	2360.3	269.2	2359.7					
163.4	2363.4	359.2	2368.7					
204.5	2369.6							
224.2	2370.3							
270.8	2361.6							
277.7	2361.6							
310.4	2364.4							
346.1	2371.6							
387.0	2374.1							



Station 160+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2355.5	220.2	2369.7	-0.1	2.4	0.5	N/A	N/A
75.9	2358.2	270.2	2359.7					
156.4	2362.4	370.2	2369.7					
202.5	2368.4							
220.2	2369.6							
273.6	2360.5							
278.8	2360.3							
298.4	2361.2							
352.0	2372.1							
390.3	2373.8							



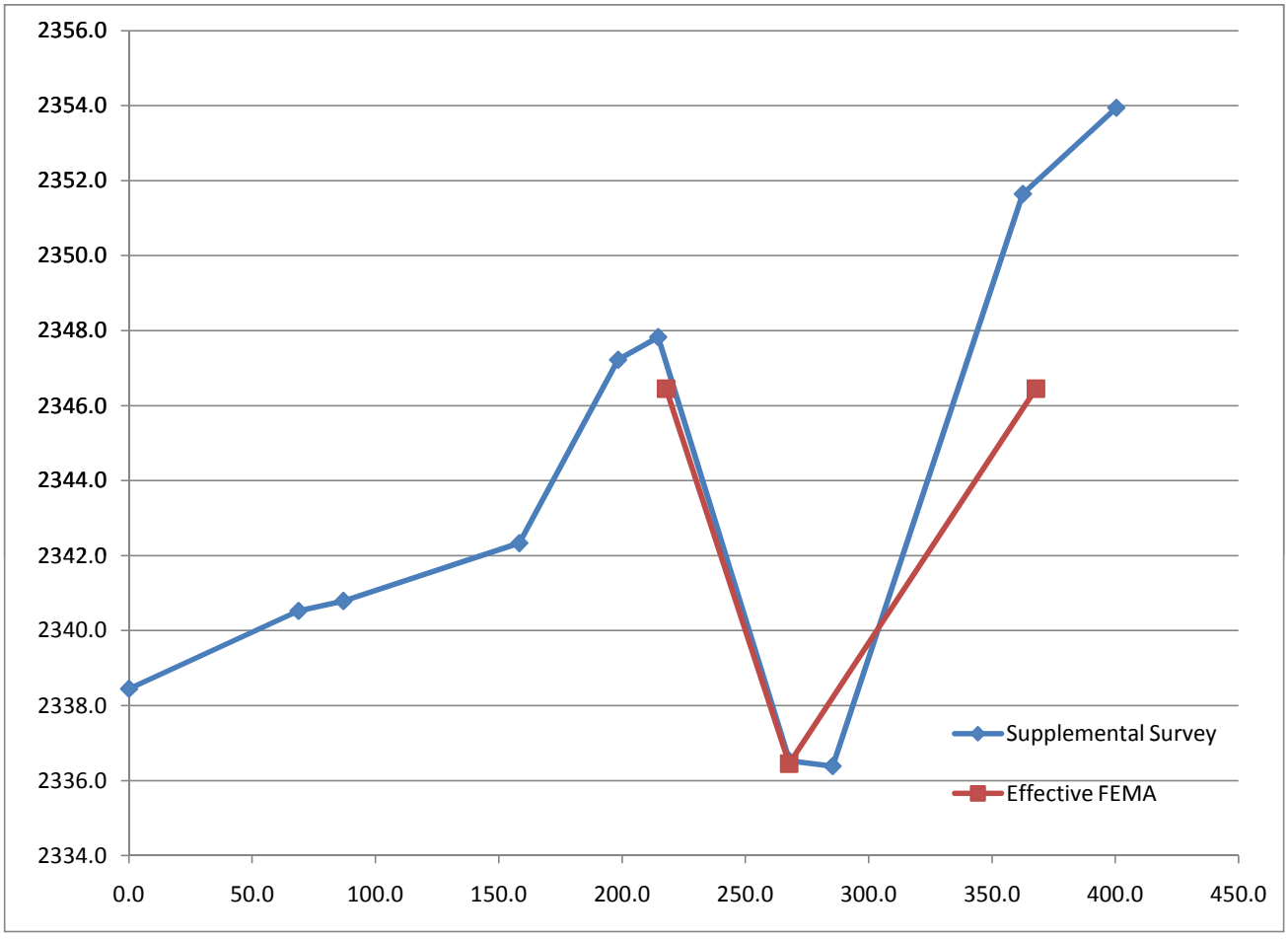
Station 159+50

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2351.2							
44.4	2353.4							
89.3	2355.5							
166.3	2359.6							
181.2	2360.6							
233.1	2349.7							
252.2	2348.5							
269.8	2350.6							
335.0	2364.8							
374.6	2366.0							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 155+00

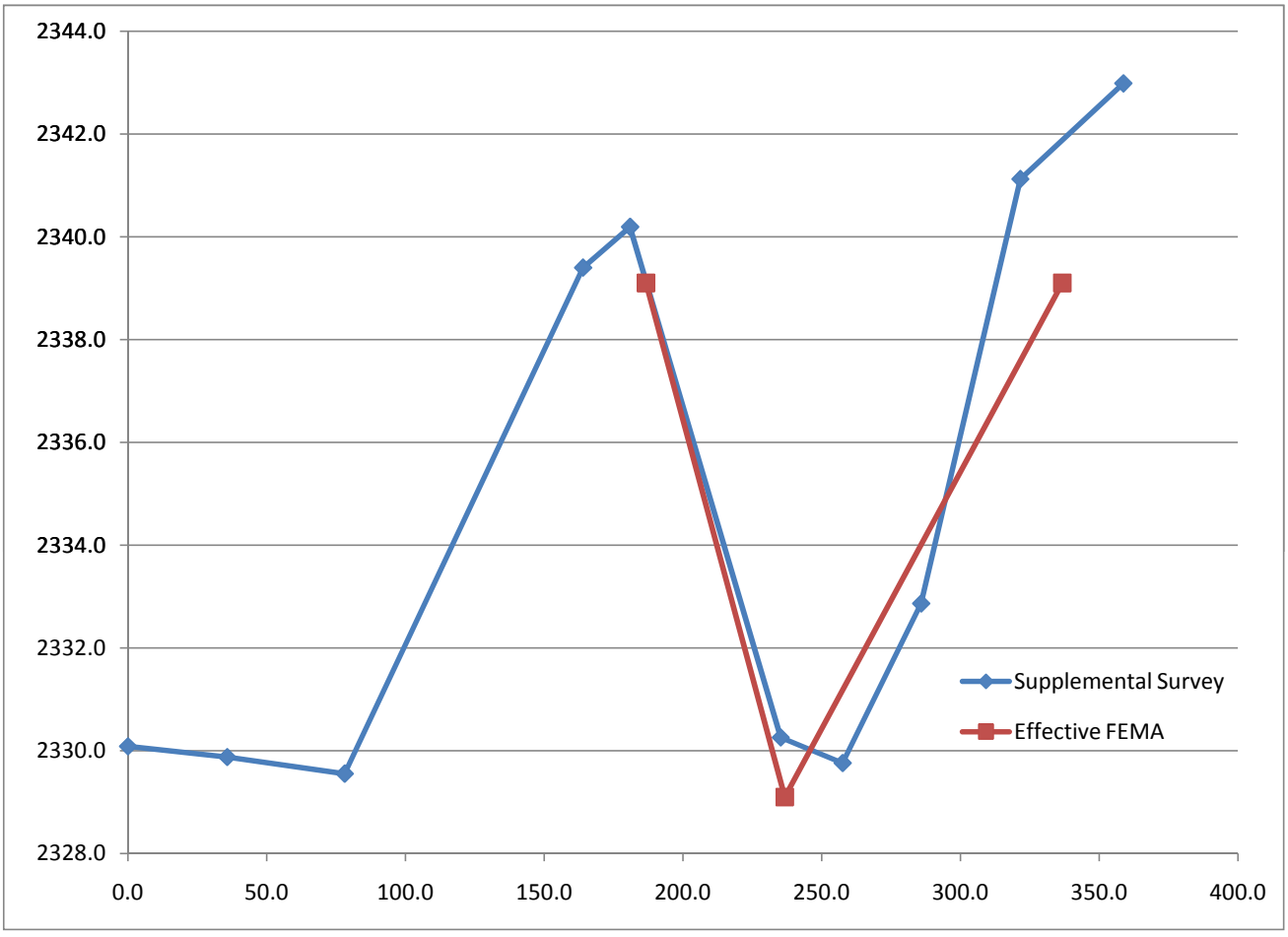
Station 155+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2338.4	217.8	2346.5	1.4	5.2	-0.1	N/A	N/A
68.8	2340.5	267.8	2336.5					
86.9	2340.8	367.8	2346.5					
158.3	2342.3							
198.4	2347.2							
214.6	2347.8							
267.8	2336.5							
285.4	2336.4							
362.5	2351.6							
400.5	2353.9							



Station 150+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2330.1	186.7	2339.1	1.1	2.0	0.7	N/A	N/A
35.8	2329.9	236.7	2329.1					
78.1	2329.6	336.7	2339.1					
164.0	2339.4							
180.9	2340.2							
235.2	2330.3							
257.5	2329.8							
285.8	2332.9							
321.5	2341.1							
358.7	2343.0							



Station 147+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2321.6							
56.8	2323.1							
88.5	2323.8							
183.0	2335.2							
197.4	2335.6							
254.2	2324.6							
274.7	2324.7							
334.4	2335.3							
373.6	2336.3							

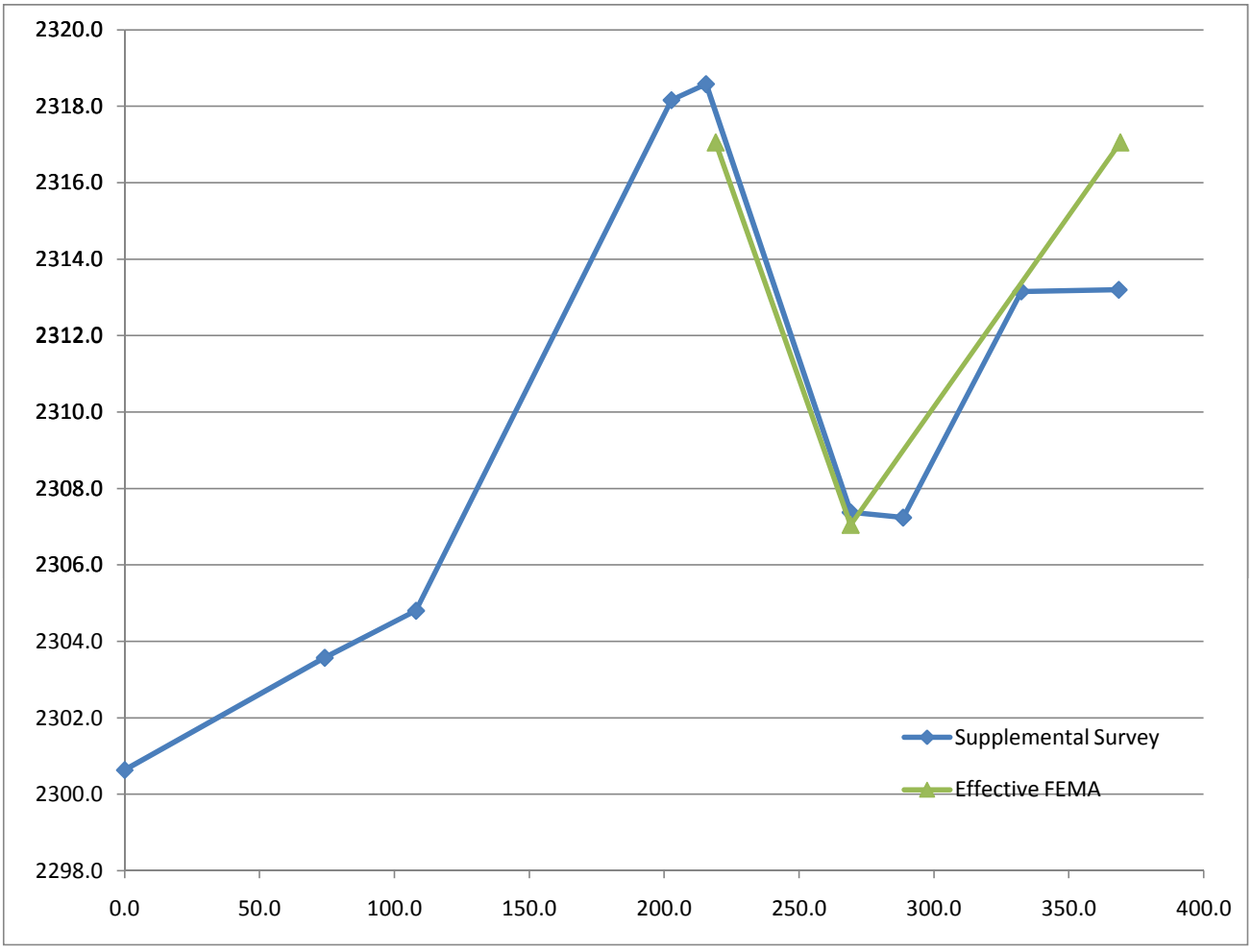
**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 145+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2307.7							
57.4	2308.8							
94.3	2310.2							
190.5	2323.4							
204.4	2323.9							
262.9	2312.8							
281.6	2312.8							
326.2	2319.4							
364.8	2320.7							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 140+00

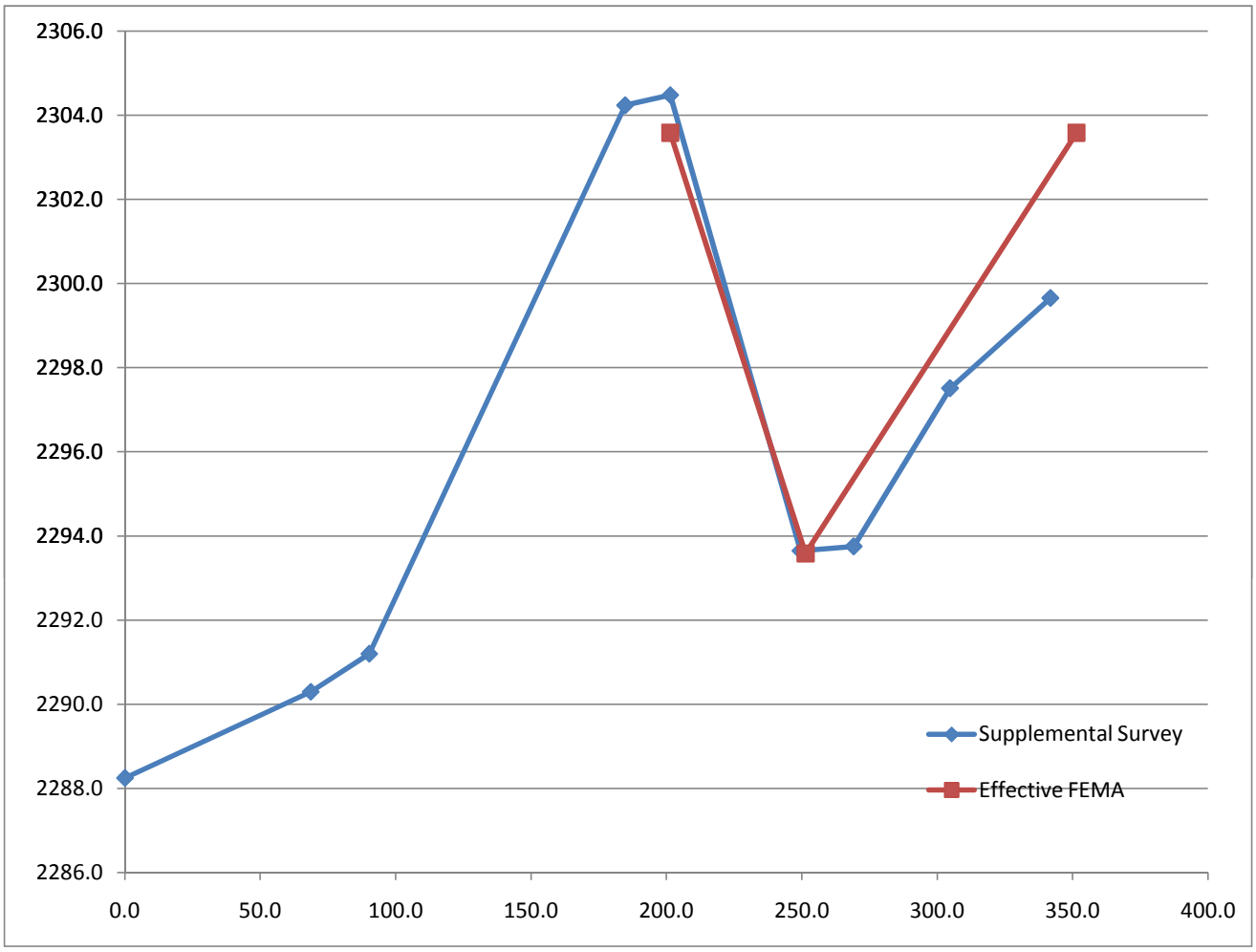
Station 140+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2300.6	219.1	2317.1	1.5	-3.9	0.2	N/A	N/A
74.1	2303.6	269.1	2307.1					
108.0	2304.8	369.1	2317.1					
202.7	2318.2							
215.5	2318.6							
269.1	2307.4							
288.6	2307.2							
332.4	2313.2							
368.6	2313.2							



Station 138+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2288.2	201.4	2303.6	0.9	-3.9	0.1	N/A	N/A
68.7	2290.3	251.4	2293.6					
90.3	2291.2	351.4	2303.6					
184.8	2304.2							
201.4	2304.5							
249.5	2293.6							
269.2	2293.8							
304.8	2297.5							
341.8	2299.7							



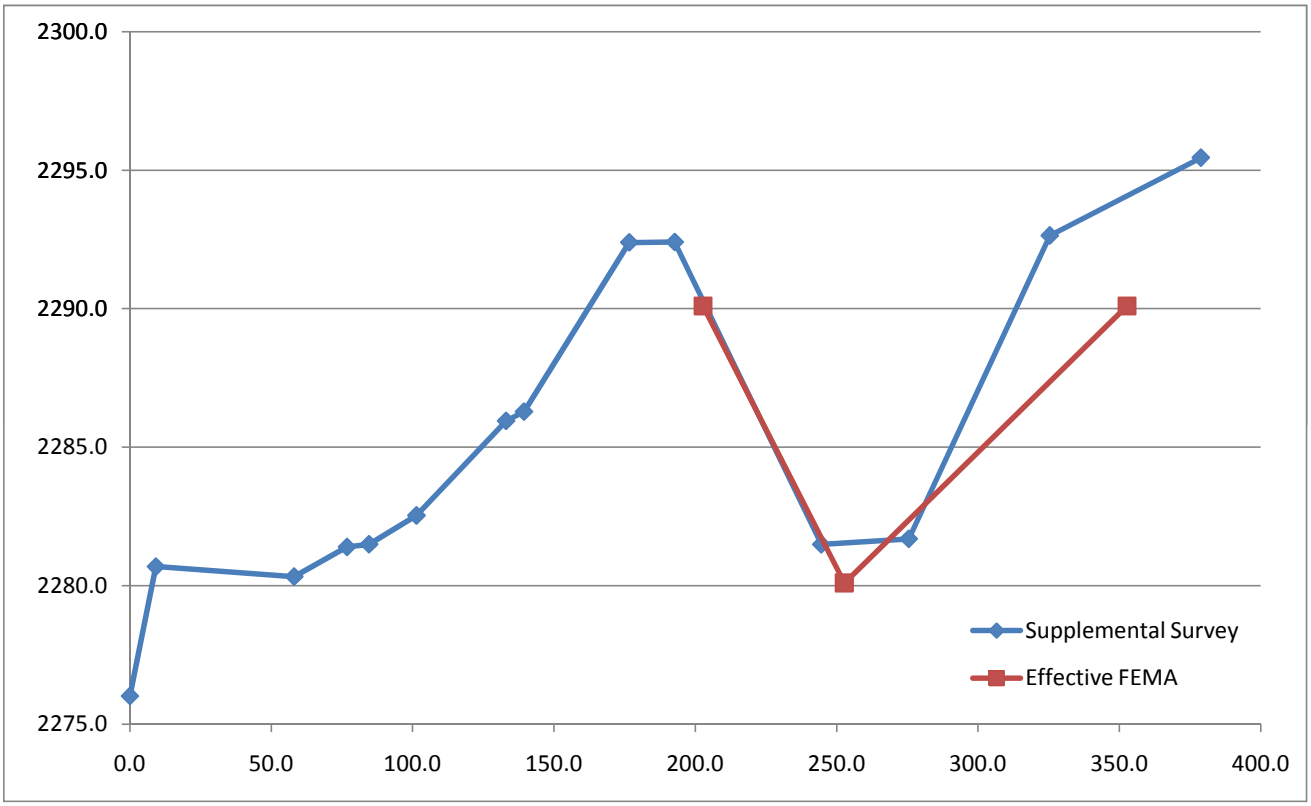
Station 132+50

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2279.9							
12.8	2279.6							
21.6	2282.8							
68.0	2284.8							
98.3	2285.9							
192.7	2299.6							
209.1	2299.5							
269.1	2287.9							
288.1	2287.7							
328.5	2295.6							
370.0	2297.6							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 130+00

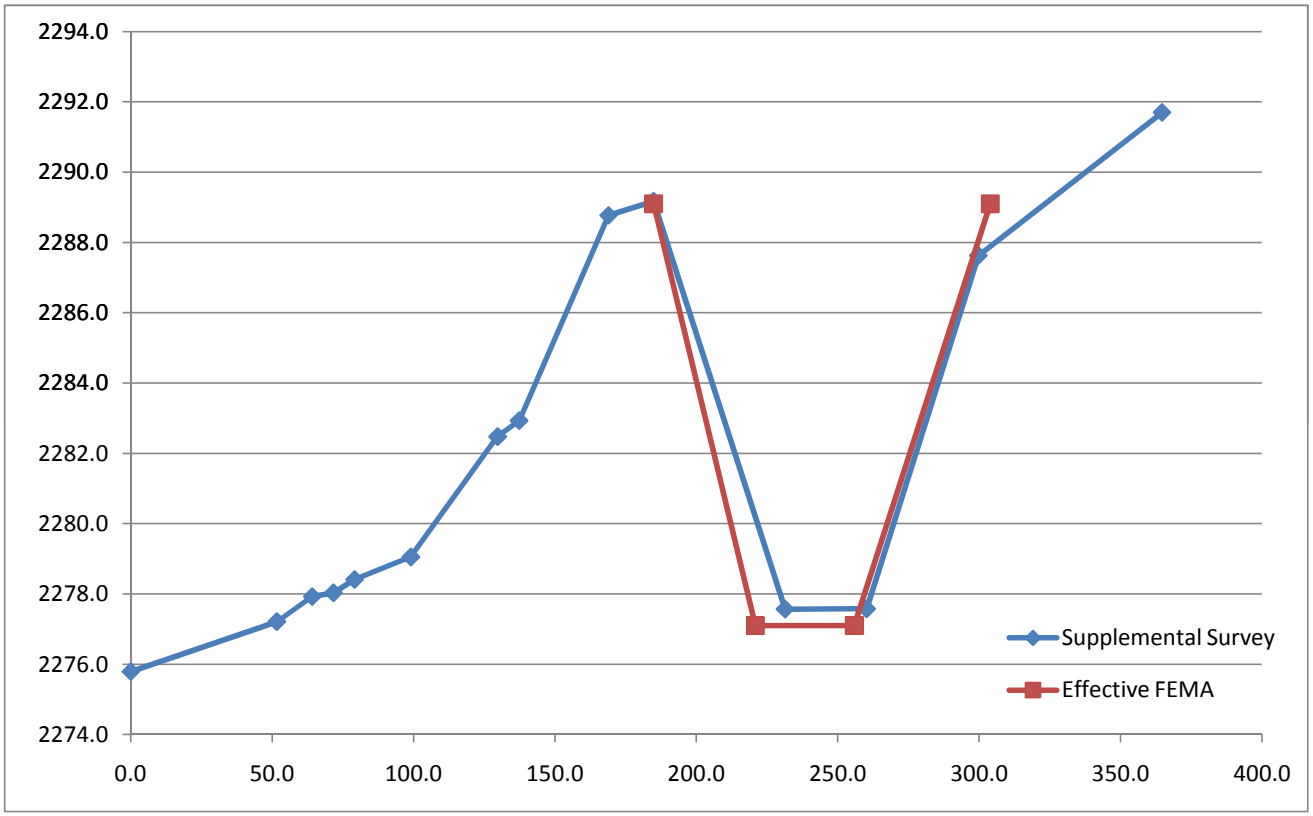
Station 130+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2276.0	202.7	2290.1	2.3	2.5	1.4	N/A	N/A
9.2	2280.7	252.7	2280.1					
58.1	2280.3	352.7	2290.1					
76.8	2281.4							
84.6	2281.5							
101.4	2282.5							
133.1	2285.9							
139.4	2286.3							
176.6	2292.4							
192.7	2292.4							
244.6	2281.5							
275.5	2281.7							
325.4	2292.6							
378.9	2295.5							



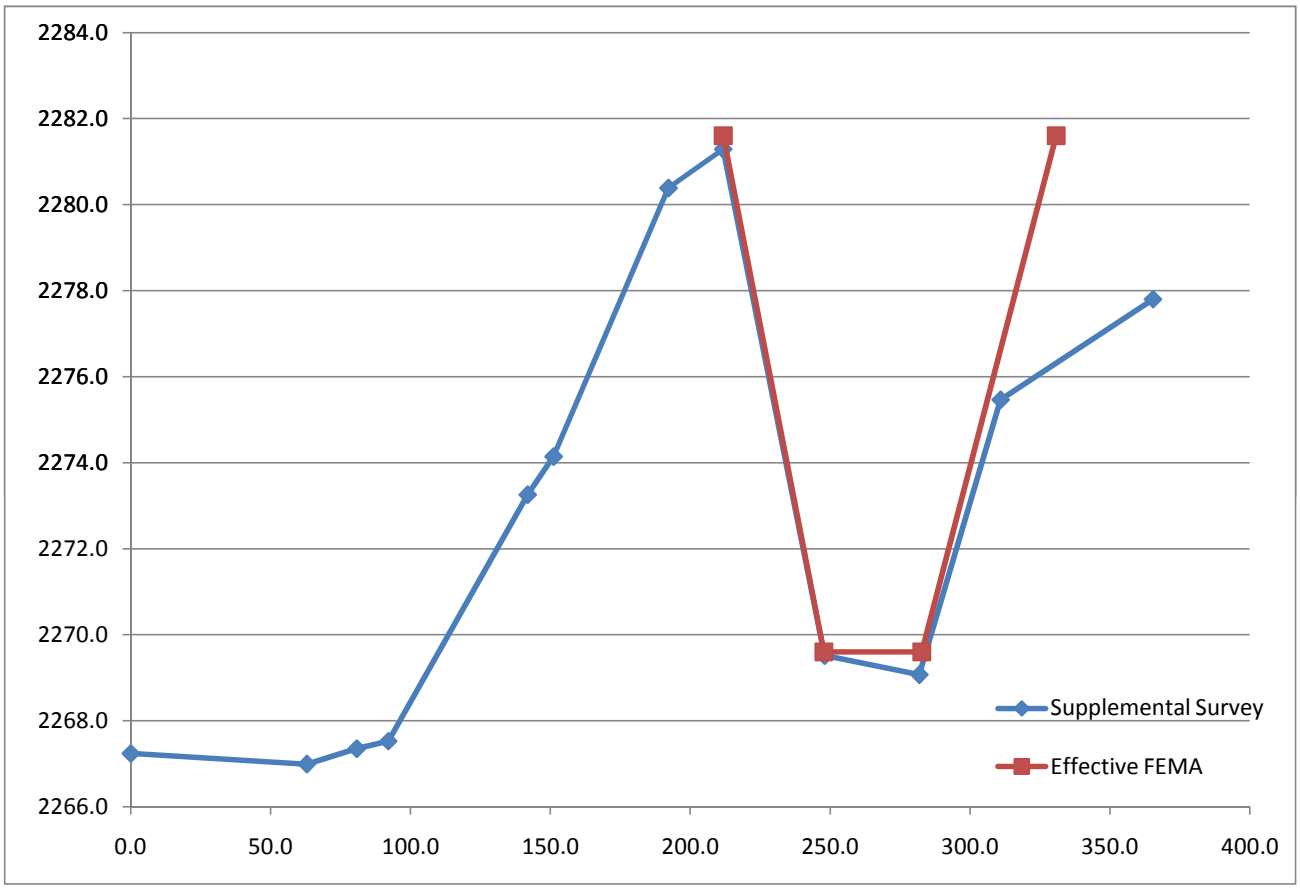
Station 127+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2275.8	184.9	2289.1	0.1	-1.5	0.5	0.5	-6.2
51.7	2277.2	220.9	2277.1					
64.1	2277.9	255.9	2277.1					
71.7	2278.0	303.9	2289.1					
79.1	2278.4							
99.0	2279.1							
129.7	2282.5							
137.4	2282.9							
168.9	2288.8							
184.9	2289.2							
231.4	2277.6							
260.2	2277.6							
299.7	2287.6							
364.7	2291.7							



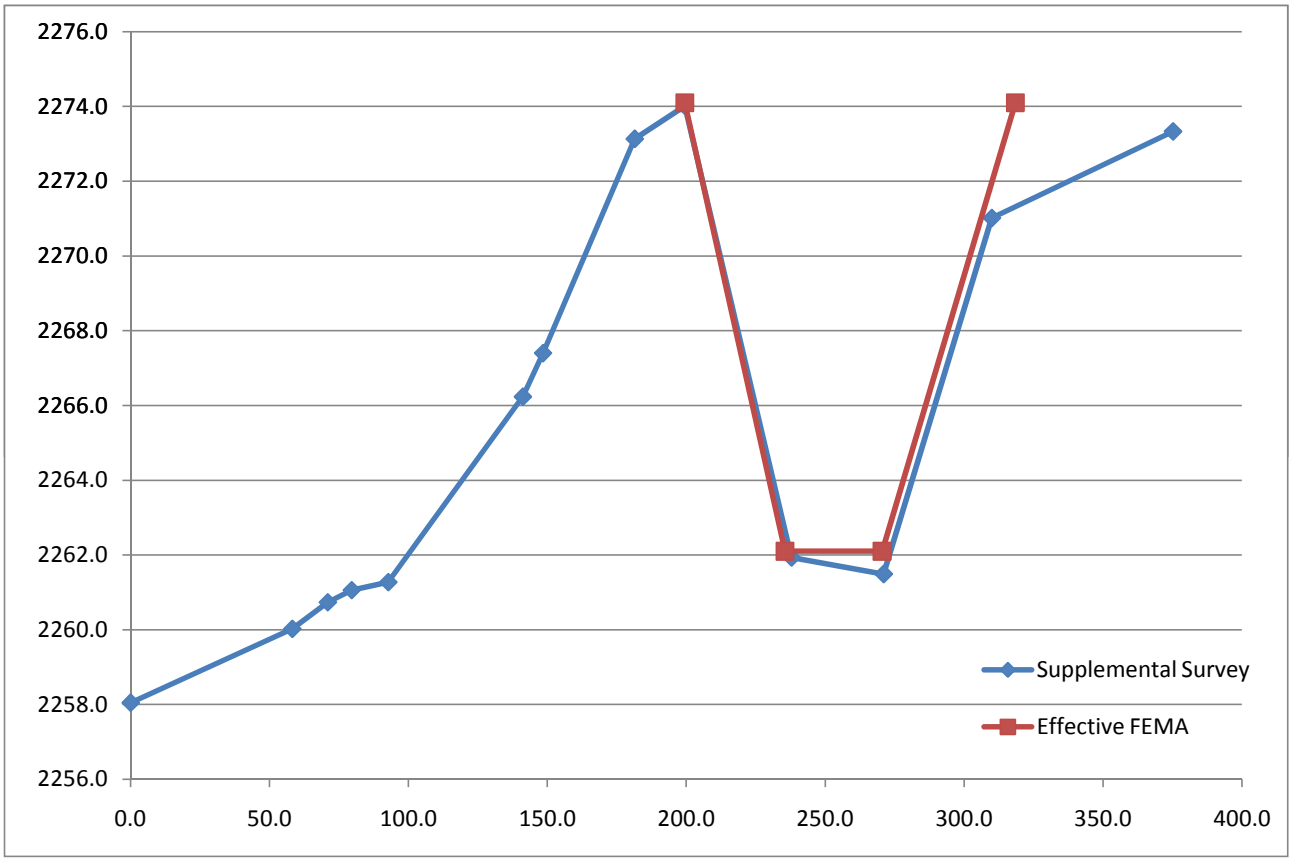
Station 125+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2267.2	211.8	2281.6	-0.3	-3.8	-0.1	-0.5	-1.2
63.0	2267.0	247.8	2269.6					
80.8	2267.4	282.8	2269.6					
92.1	2267.5	330.8	2281.6					
141.9	2273.3							
151.2	2274.1							
192.2	2280.4							
211.8	2281.3							
248.0	2269.5							
281.9	2269.1							
310.9	2275.5							
365.4	2277.8							



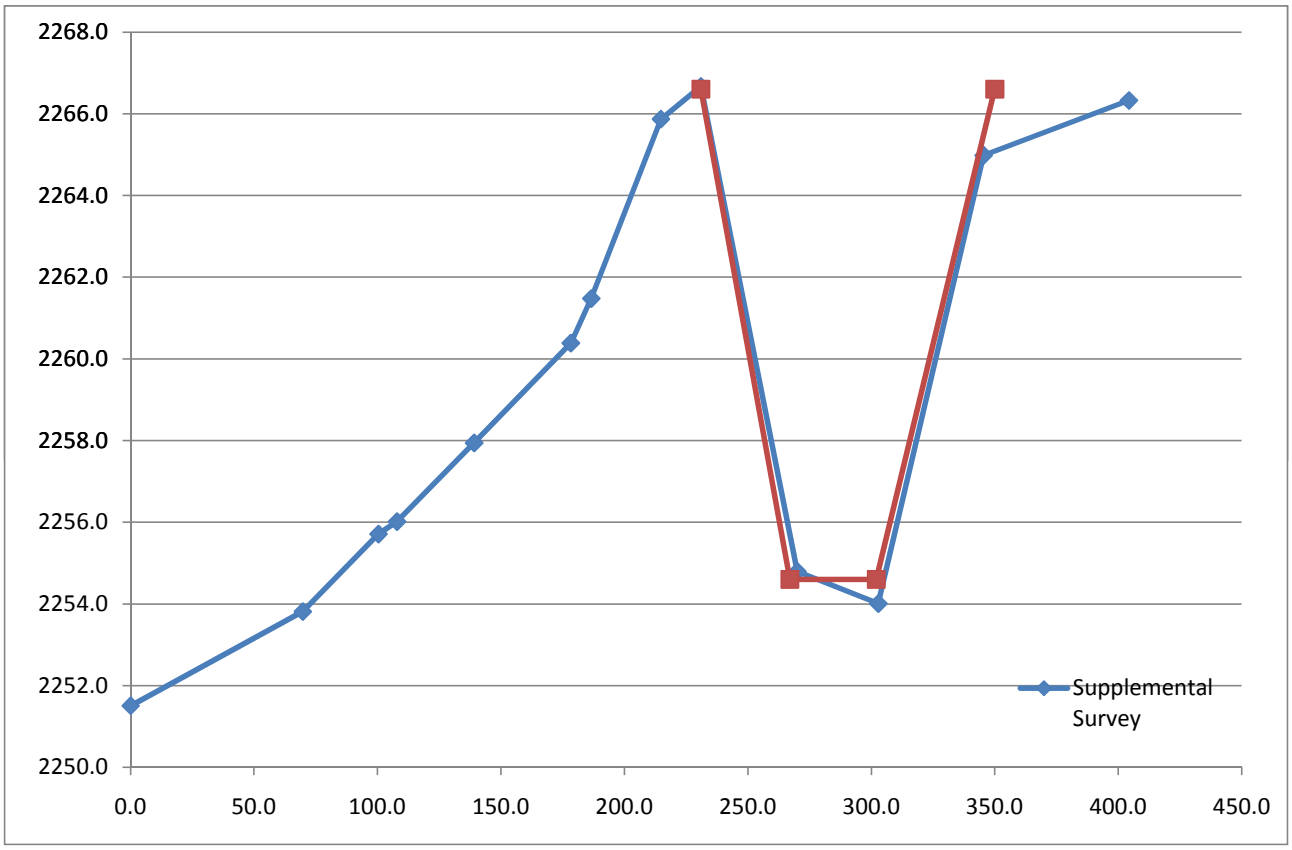
Station 120+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2258.1	199.5	2274.1	-0.1	-0.8	-0.2	-0.6	-1.8
58.2	2260.0	235.5	2262.1					
70.9	2260.7	270.5	2262.1					
79.6	2261.1	318.5	2274.1					
92.7	2261.3							
141.2	2266.2							
148.4	2267.4							
181.4	2273.1							
199.5	2274.0							
237.9	2261.9							
271.0	2261.5							
310.0	2271.0							
375.2	2273.3							



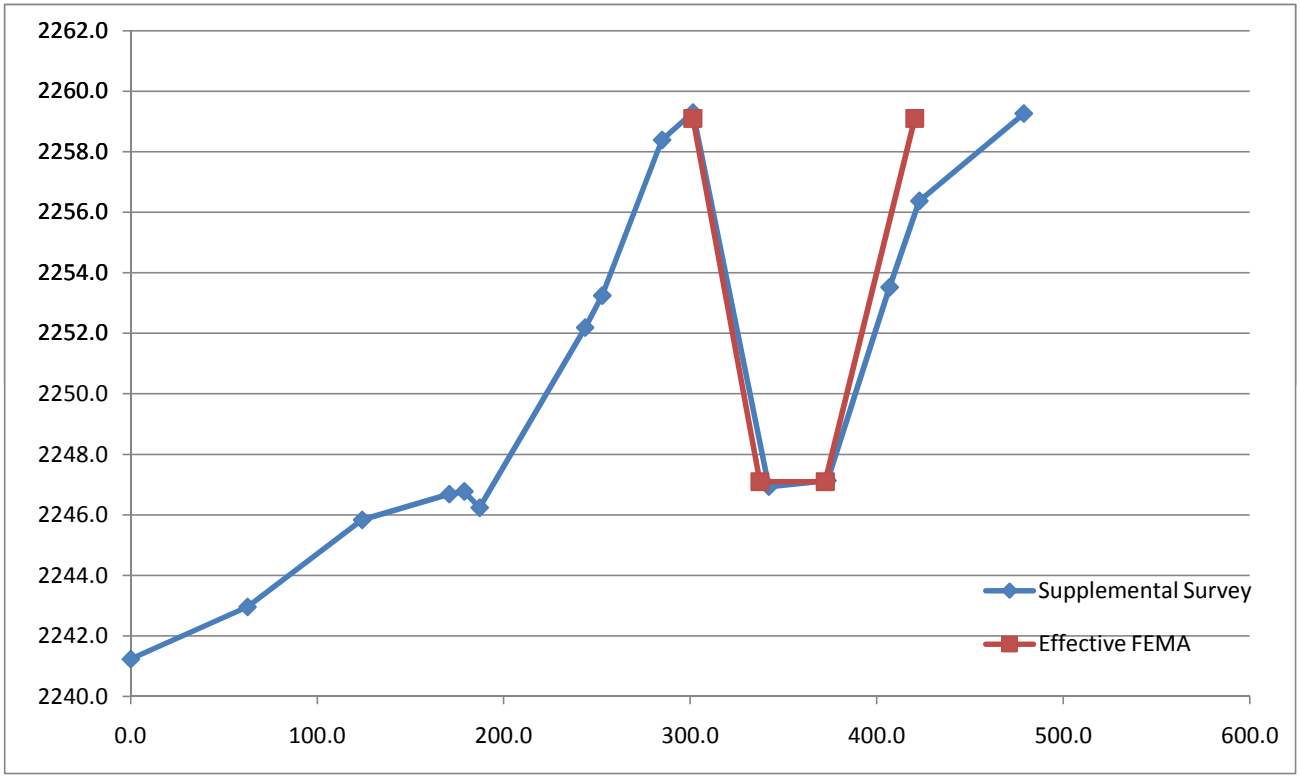
Station 115+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2251.5	231.0	2266.6	0.1	-0.3	0.2	-0.6	-2.2
69.7	2253.8	267.0	2254.6					
100.4	2255.7	302.0	2254.6					
107.9	2256.0	350.0	2266.6					
139.2	2257.9							
178.3	2260.4							
186.6	2261.5							
214.8	2265.9							
231.0	2266.7							
270.0	2254.8							
302.8	2254.0							
345.5	2265.0							
404.4	2266.3							



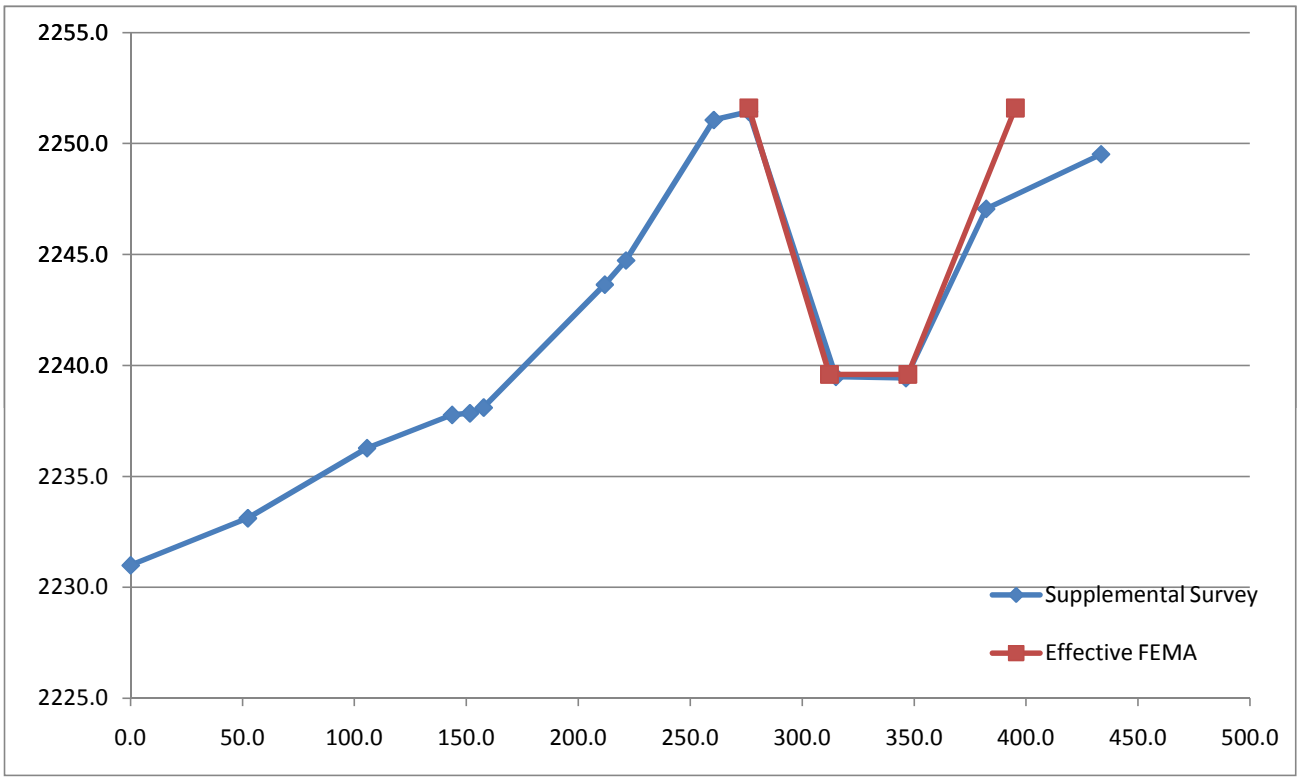
Station 110+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2241.2	301.4	2259.1	0.2	0.2	-0.2	0.0	-3.6
62.6	2243.0	337.4	2247.1					
124.0	2245.8	372.4	2247.1					
170.8	2246.7	420.4	2259.1					
178.8	2246.8							
187.1	2246.2							
243.6	2252.2							
252.8	2253.2							
284.9	2258.4							
301.4	2259.3							
342.1	2246.9							
373.5	2247.1							
406.9	2253.5							
422.8	2256.4							
478.8	2259.3							



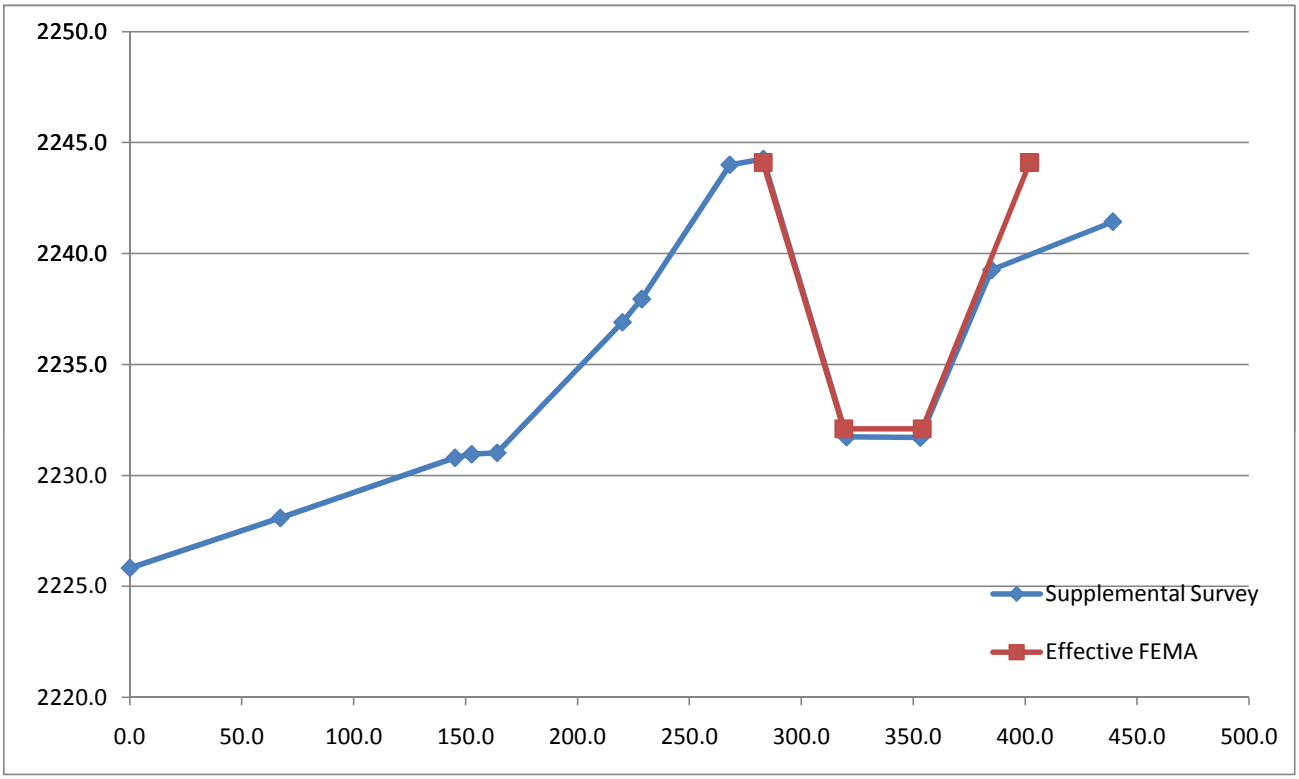
Station 105+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2231.0	276.2	2251.6	-0.2	-2.1	-0.1	-0.2	-3.7
52.4	2233.1	312.2	2239.6					
105.6	2236.3	347.2	2239.6					
143.6	2237.8	395.2	2251.6					
151.6	2237.9							
157.7	2238.1							
211.8	2243.6							
221.3	2244.7							
260.5	2251.1							
276.2	2251.4							
315.0	2239.5							
346.3	2239.4							
382.2	2247.1							
433.5	2249.5							



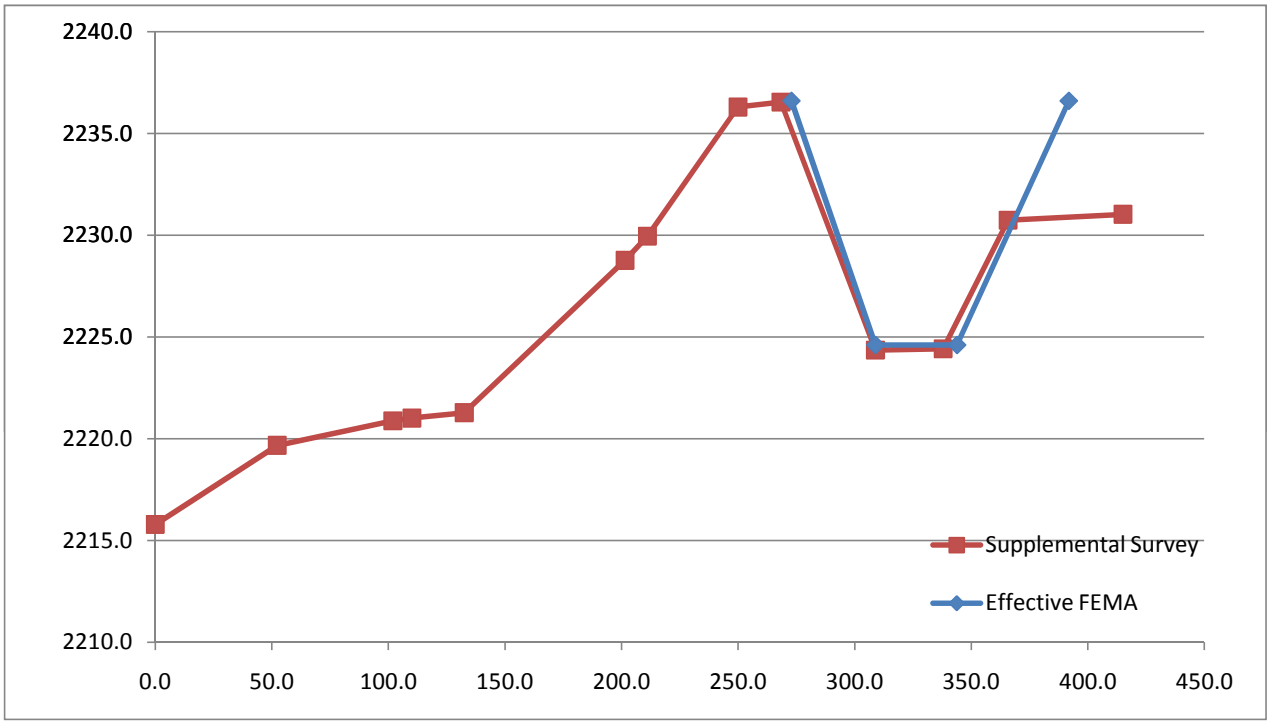
Station 100+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2225.8	283.0	2244.1	0.2	-2.7	-0.4	-0.4	-2.0
67.2	2228.1	319.0	2232.1					
145.3	2230.8	354.0	2232.1					
152.7	2231.0	402.0	2244.1					
164.0	2231.0							
220.1	2236.9							
228.7	2238.0							
268.1	2244.0							
283.0	2244.3							
320.2	2231.7							
353.2	2231.7							
385.0	2239.3							
439.2	2241.4							



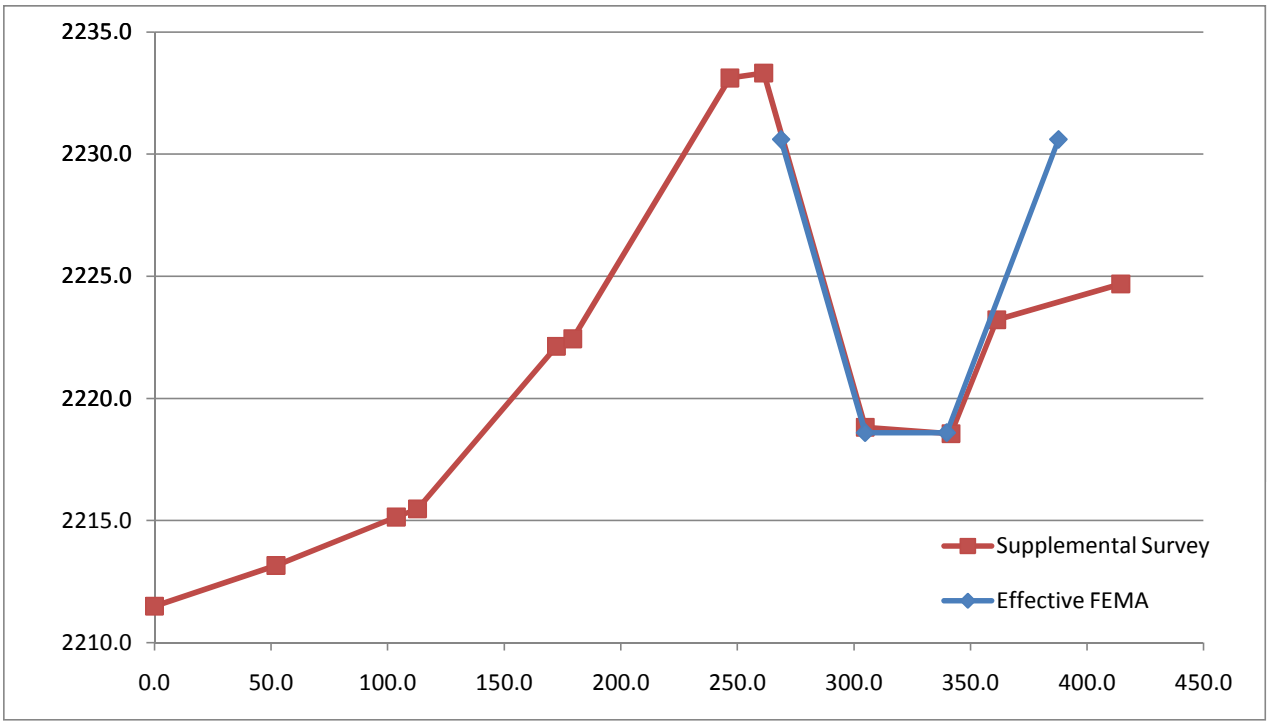
Station 095+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2215.8	272.9	2236.6	0.3	0.1	0.2	0.2	6.0
52.3	2219.7	308.9	2224.6					
101.9	2220.9	343.9	2224.6					
110.1	2221.0	391.9	2236.6					
132.5	2221.3							
201.5	2228.8							
211.1	2229.9							
249.9	2236.3							
268.4	2236.5							
308.9	2224.4							
337.9	2224.4							
365.8	2230.7							
415.1	2231.0							



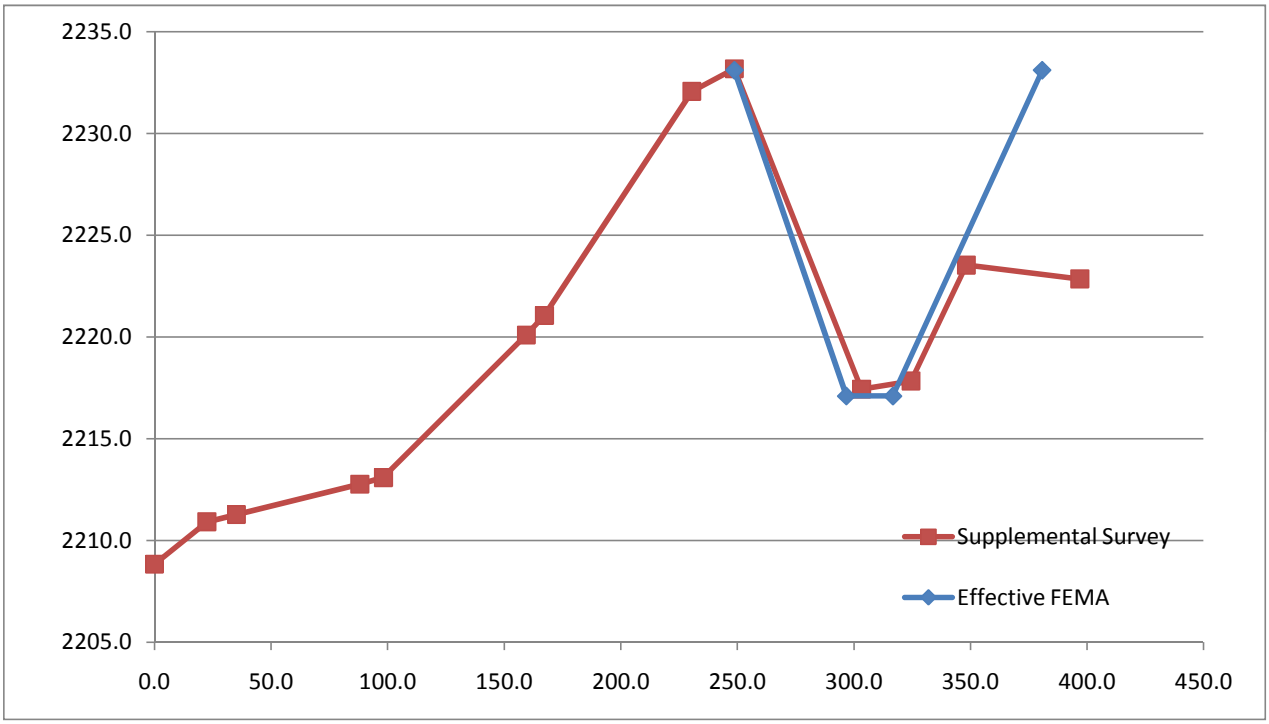
Station 090+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2211.5	268.8	2230.6	2.7	-5.9	0.2	0.0	1.9
52.1	2213.2	304.8	2218.6					
103.7	2215.1	339.8	2218.6					
112.8	2215.5	387.8	2230.6					
172.4	2222.1							
179.4	2222.4							
246.8	2233.1							
261.3	2233.3							
304.8	2218.8							
341.7	2218.6							
361.3	2223.2							
414.5	2224.7							



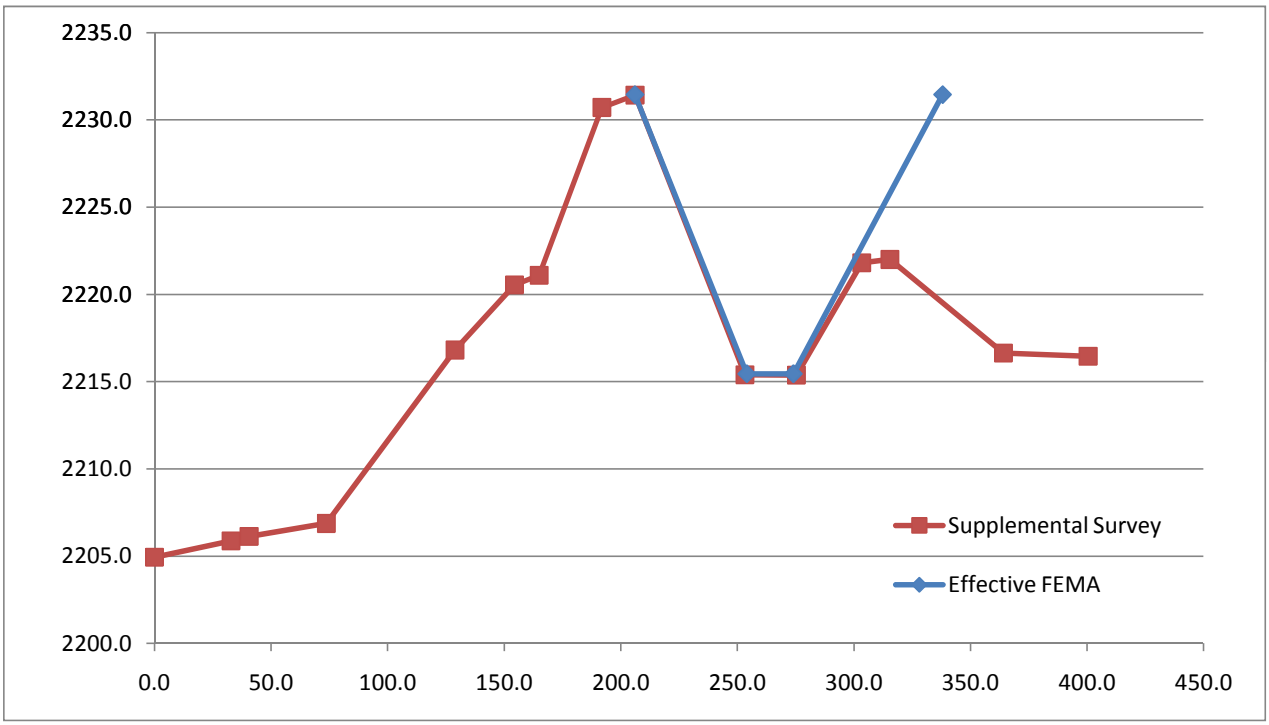
Station 086+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2208.8	248.7	2233.1	0.1	-9.6	0.3	0.7	1.2
22.5	2210.9	296.7	2217.1					
35.2	2211.3	316.7	2217.1					
88.1	2212.8	380.7	2233.1					
98.2	2213.1							
159.5	2220.1							
167.3	2221.1							
230.5	2232.1							
248.7	2233.2							
303.3	2217.4							
324.5	2217.8							
348.2	2223.5							
396.9	2222.9							



Station 085+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2204.9	206.1	2231.5	0.0	-14.8	-0.1	-0.1	2.2
32.8	2205.9	254.1	2215.5					
40.6	2206.1	274.1	2215.5					
73.7	2206.9	338.1	2231.5					
128.9	2216.8							
154.5	2220.5							
165.0	2221.1							
191.9	2230.7							
206.1	2231.4							
253.2	2215.4							
275.4	2215.4							
303.3	2221.8							
315.5	2222.0							
364.1	2216.6							
400.4	2216.5							



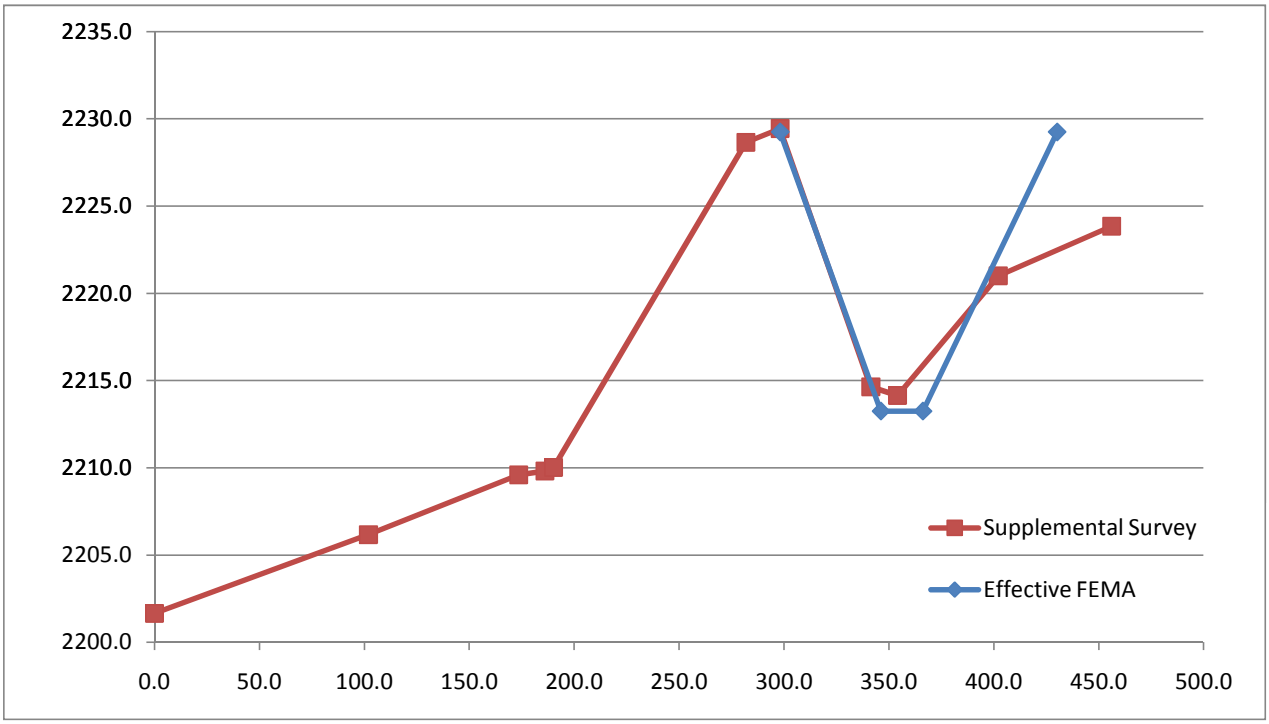
Station 082+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2203.4							
73.7	2207.7							
82.3	2208.2							
95.1	2208.7							
104.1	2208.4							
164.5	2221.8							
172.4	2222.9							
206.5	2230.1							
220.7	2230.5							
271.7	2215.1							
304.1	2215.1							
336.3	2221.1							
385.2	2217.5							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 81+50

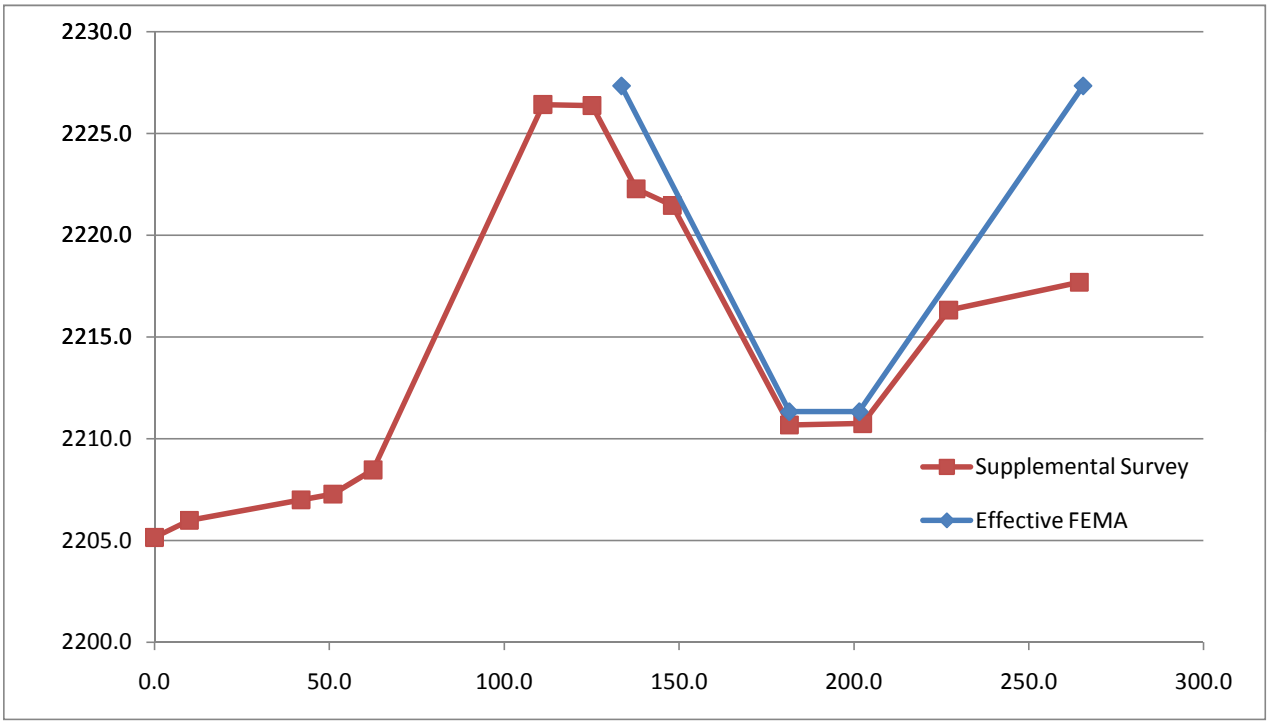
Station 081+50

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2201.7	298.2	2229.3	0.2	-5.4	1.4	0.9	-7.3
102.0	2206.2	346.2	2213.3					
173.6	2209.6	366.2	2213.3					
186.1	2209.8	430.2	2229.3					
190.2	2210.0							
281.9	2228.6							
298.2	2229.4							
341.4	2214.6							
354.1	2214.1							
402.1	2221.0							
456.2	2223.8							



Station 078+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2205.2	133.5	2227.3	-1.0	-9.6	-0.7	-0.6	1.0
10.0	2206.0	181.5	2211.3					
42.0	2207.0	201.5	2211.3					
51.0	2207.3	265.5	2227.3					
62.5	2208.5							
111.1	2226.4							
125.1	2226.4							
137.8	2222.3							
148.1	2221.5							
181.5	2210.7							
202.5	2210.7							
227.1	2216.3							
264.4	2217.7							



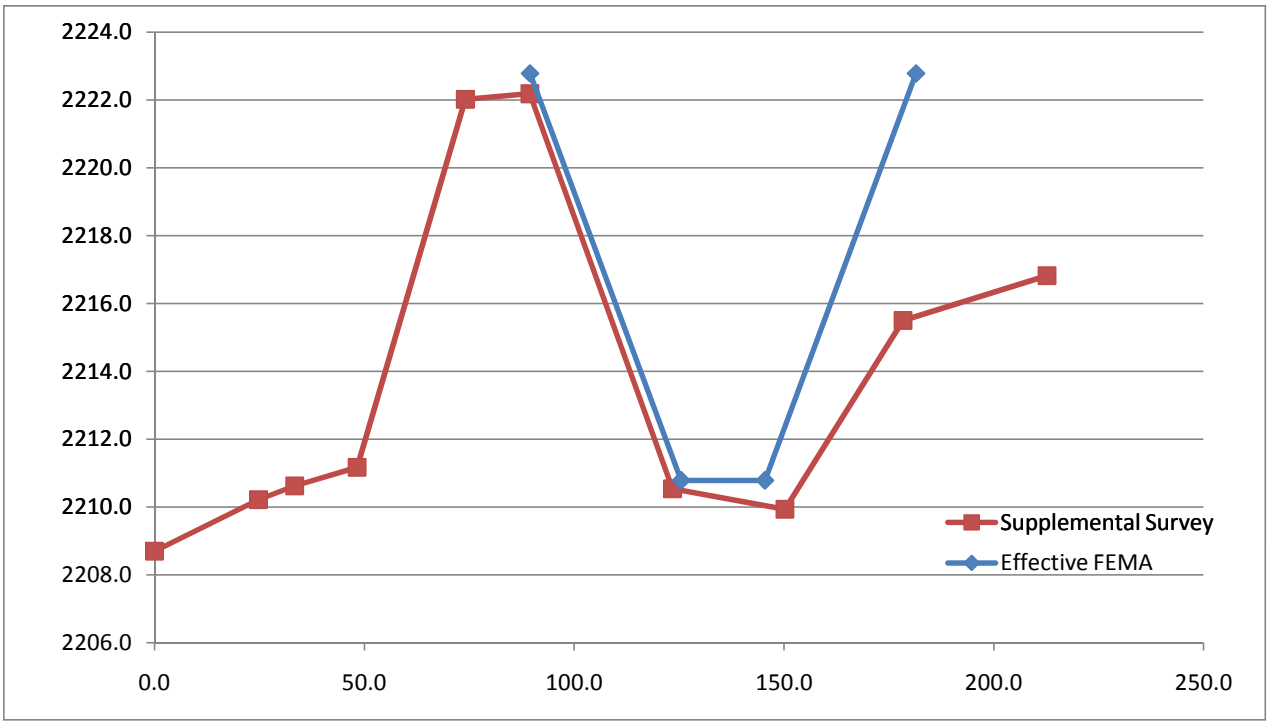
Station 074+50

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2206.8							
20.3	2208.1							
35.7	2208.7							
44.1	2209.0							
92.2	2224.8							
106.7	2224.9							
134.5	2215.6							
143.1	2214.9							
157.3	2210.6							
179.4	2210.5							
204.6	2216.6							
237.1	2217.6							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 74+23

Station 074+23

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2208.7	89.5	2222.8	-0.6	-6.0	-0.2	-0.8	6.7
24.8	2210.2	125.5	2210.8					
33.4	2210.6	145.5	2210.8					
48.3	2211.2	181.5	2222.8					
74.1	2222.0							
89.5	2222.2							
123.5	2210.5							
150.2	2209.9							
178.4	2215.5							
212.7	2216.8							



Station 073+50

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2207.0							
29.7	2211.1							
49.2	2212.5							
58.0	2212.9							
61.8	2213.4							
78.8	2221.0							
95.8	2221.6							
133.0	2210.0							
150.0	2209.9							
177.4	2215.9							
212.9	2217.4							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 72+38

Station 072+38

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2207.9							
13.5	2207.6							
31.3	2213.9							
43.1	2214.3							
51.3	2214.3							
55.0	2214.4							
74.0	2220.9							
88.9	2221.0							
128.6	2209.5							
152.3	2209.4							
180.1	2216.2							
225.8	2218.8							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 71+00

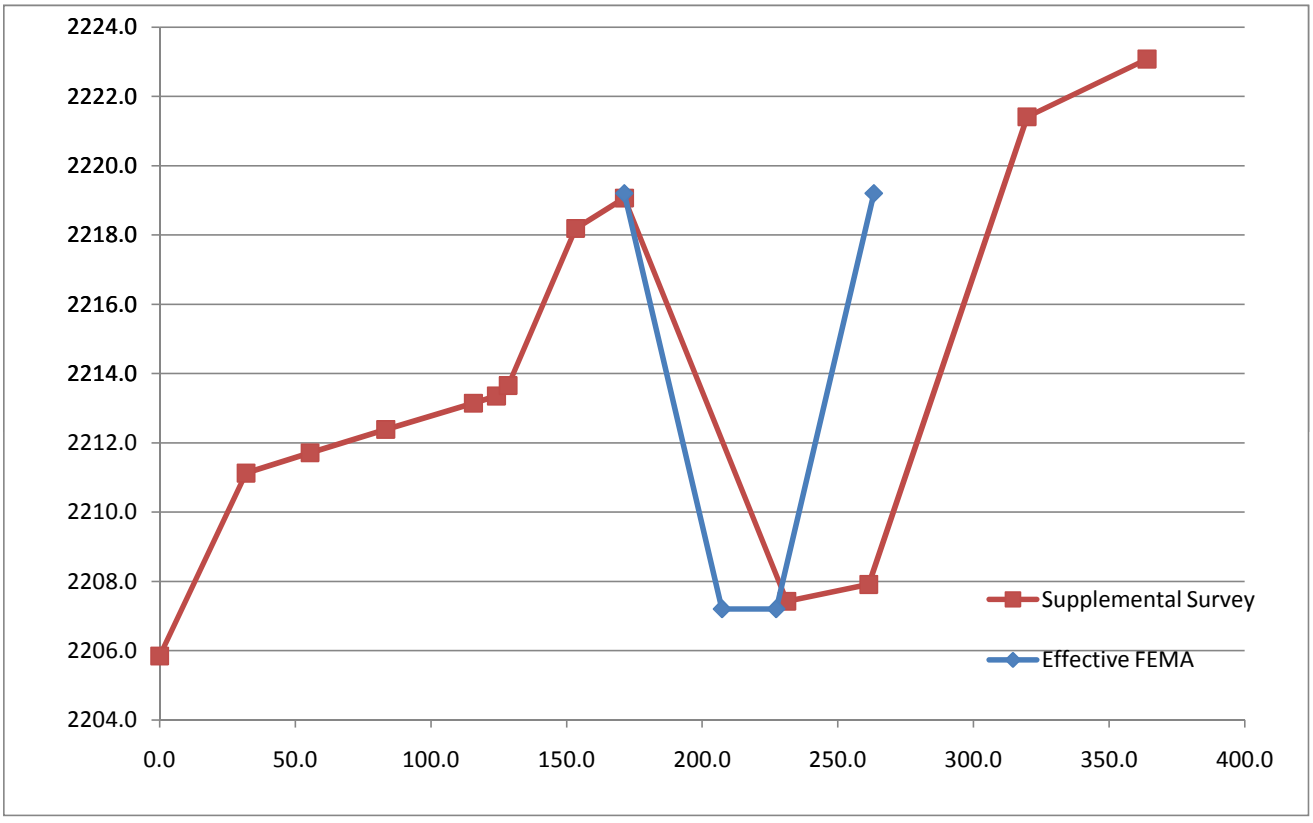
Station 071+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2206.1							
36.4	2213.8							
54.7	2214.0							
65.0	2213.1							
73.2	2213.1							
75.0	2213.2							
96.2	2220.4							
111.7	2220.5							
147.0	2209.2							
168.9	2209.1							
204.2	2218.3							
238.0	2219.2							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 70+00

Station 070+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2205.8	171.3	2219.2	-0.1	2.2	0.2	0.7	10.2
31.9	2211.1	207.3	2207.2					
55.4	2211.7	227.3	2207.2					
83.4	2212.4	263.3	2219.2					
115.7	2213.1							
124.2	2213.4							
128.5	2213.6							
153.3	2218.2							
171.3	2219.1							
231.2	2207.4							
261.4	2207.9							
319.7	2221.4							
364.0	2223.1							



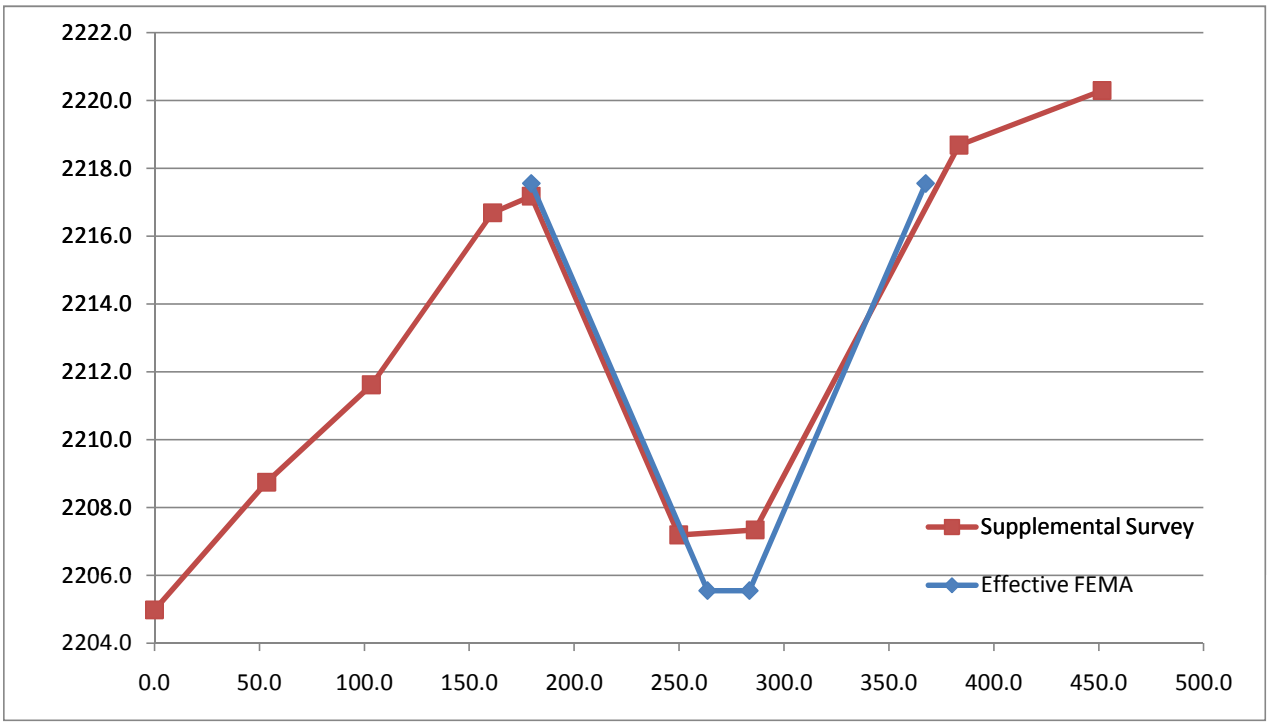
Station 067+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2203.3							
25.8	2209.1							
60.7	2208.7							
92.1	2210.0							
143.1	2212.6							
152.5	2213.0							
180.9	2216.8							
198.2	2217.4							
269.6	2207.6							
302.7	2207.8							
386.9	2220.5							
428.8	2222.6							
439.4	2223.0							

**FEMA HEC-RAS MODEL DOES NOT INCLUDE STATION 65+00

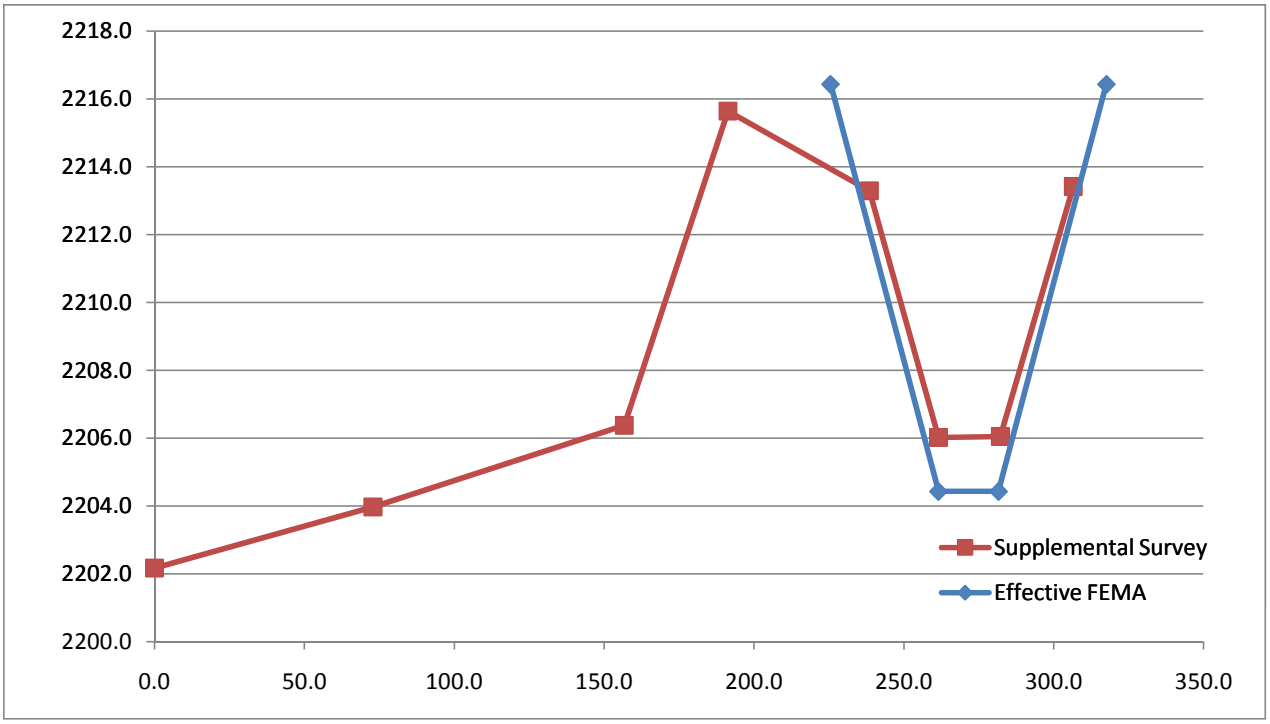
Station 065+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2205.0	179.5	2217.6	-0.4	1.1	1.6	1.8	16.5
53.5	2208.7	263.5	2205.6					
103.4	2211.6	283.5	2205.6					
161.1	2216.7	367.5	2217.6					
179.5	2217.2							
249.8	2207.2							
286.3	2207.3							
383.4	2218.7							
451.5	2220.3							



Station 064+00

Supplemental Survey		Effective FEMA		Topographic Differences (ft)				
X	Y	X	Y	Top Left	Top Right	Chan Left	Chan Right	Chan Width
0.0	2202.2	225.5	2216.4	-3.1	-3.0	1.6	1.6	0.7
72.9	2204.0	261.5	2204.4					
156.7	2206.4	281.5	2204.4					
191.3	2215.6	317.5	2216.4					
238.5	2213.3							
261.5	2206.0							
282.2	2206.1							
306.5	2213.4							



Station 062+00

APPENDIX VII

New HEC-RAS Model

HEC-RAS Summary Tables

SUBCRITICAL HEC-RAS SUMMARY (EquestrianLeveeChan.prj)

River Sta	Q Total	Min Ch El	W.S. Elev	Hydr Depth	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)	(ft/s)	(sq ft)	(ft)	
16700	189	2378.5	2380.4	1.2	2380.4	2381.0	0.0	6.5	31.8	27.8	1.0
16550	189	2373.5	2376.2	0.6	2376.2	2376.5	0.0	4.4	43.7	80.0	1.0
16500	189	2371.8	2373.8	1.0	2373.8	2374.4	0.0	6.3	34.3	33.7	1.1
16400	189	2370.4	2372.2	1.0	2372.2	2372.7	0.0	5.8	32.7	32.2	1.0
16300	189	2368.4	2370.0	1.0	2370.0	2370.5	0.0	5.7	33.1	33.1	1.0
16200	189	2365.7	2369.4	2.0		2369.4	0.0	1.6	117.8	57.8	0.2
16150	915	2364.9	2368.1	2.0	2368.1	2369.1	0.0	8.0	114.5	58.7	1.0
16000	915	2361.6	2364.9	1.9	2364.9	2365.9	0.0	8.0	115.0	59.8	1.0
15950	915	2360.3	2363.5	2.1	2363.5	2364.6	0.0	8.2	111.3	54.1	1.0
15500	915	2348.5	2351.9	2.1	2351.9	2353.0	0.0	8.3	110.8	53.3	1.0
15000	1046	2336.4	2339.9	2.3	2339.9	2341.1	0.0	8.7	119.9	51.5	1.0
14700	1046	2329.8	2332.9	2.0	2332.9	2333.9	0.0	8.1	129.5	65.4	1.0
14500	1046	2324.6	2327.9	2.2	2327.9	2329.0	0.0	8.5	123.1	55.5	1.0
14000	1046	2312.8	2316.1	2.2	2316.1	2317.2	0.0	8.4	124.9	58.0	1.0
13800	1046	2307.2	2310.5	2.1	2310.5	2311.6	0.0	8.3	125.9	58.8	1.0
13250	1315	2293.7	2297.2	2.3	2297.2	2298.3	0.0	8.6	153.5	68.2	1.0
13000	1315	2287.8	2291.6	2.5	2291.6	2292.9	0.0	9.0	145.5	58.1	1.0
12700	1315	2281.5	2284.8	2.4	2284.8	2286.0	0.0	8.9	147.9	60.9	1.0
12500	1315	2277.6	2281.0	2.6	2281.0	2282.3	0.0	9.2	143.6	55.8	1.0
12000	1315	2269.1	2272.4	2.5	2272.4	2273.7	0.0	9.0	145.5	58.2	1.0
11500	1315	2261.5	2264.9	2.6	2264.9	2266.2	0.0	9.1	144.2	56.6	1.0
11000	1315	2254.0	2257.6	2.6	2257.6	2258.9	0.0	9.2	143.7	56.1	1.0
10500	1315	2246.9	2250.3	2.5	2250.3	2251.5	0.0	9.0	146.1	58.9	1.0
10000	1315	2239.4	2242.7	2.5	2242.7	2244.0	0.0	9.1	145.0	57.4	1.0
9500	1315	2231.7	2235.0	2.6	2235.0	2236.3	0.0	9.1	143.8	56.2	1.0
9000	1315	2224.4	2227.8	2.6	2227.8	2229.1	0.0	9.2	143.2	55.3	1.0
8600	1315	2218.6	2223.1	3.4		2223.6	0.0	5.7	231.1	68.5	0.6
8500	1315	2217.4	2221.5	2.7	2221.5	2222.9	0.0	9.5	139.0	50.7	1.0
8200	1438	2215.4	2220.8	3.7		2221.4	0.0	6.4	226.2	61.5	0.6
8150	1438	2215.1	2220.8	4.0		2221.1	0.0	4.4	324.5	81.7	0.4
7800	1438	2214.2	2218.7	2.7	2218.7	2220.1	0.0	9.4	153.0	56.7	1.0
7450	1494	2210.7	2216.1	3.6		2216.8	0.0	6.8	219.6	61.1	0.6
7423	1494	2210.5	2215.9	3.4		2216.6	0.0	6.6	227.9	68.0	0.6
7350	1494	2209.9	2215.9	3.5		2216.3	0.0	5.3	285.6	81.1	0.5
7238	1494	2209.9	2214.9	3.2		2216.0	0.0	8.3	179.6	55.6	0.8
7100	1494	2209.4	2214.6	3.6		2215.3	0.0	6.7	222.5	62.7	0.6
7000	1494	2209.1	2213.3	3.0	2213.3	2214.8	0.0	9.8	153.0	51.1	1.0
6700	1494	2207.4	2212.8	3.6		2213.2	0.0	5.3	281.1	79.0	0.5
6500	1494	2207.6	2212.5	3.2		2212.8	0.0	4.7	315.7	99.5	0.5
6400	1494	2207.2	2212.4	3.4		2212.6	0.0	3.8	391.4	116.4	0.4
6200	1494	2206.0	2210.4	3.1	2210.4	2211.9	0.0	10.0	149.4	48.6	1.0

SUPERCRITICAL HEC-RAS SUMMARY (EquestrianLeveeChan.prj)

River Sta	Q Total	Min Ch El	W.S. Elev	Hydr Depth	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)	(ft/s)	(sq ft)	(ft)	
16700	189	2378.5	2380.0	0.9	2380.4	2381.3	0.0	9.5	21.4	23.7	1.7
16550	189	2373.5	2376.2	0.5	2376.2	2376.5	0.0	4.6	41.2	79.2	1.1
16500	189	2371.8	2373.5	0.8	2373.8	2374.6	0.0	9.5	23.0	27.6	1.8
16400	189	2370.4	2372.2	1.0	2372.2	2372.7	0.0	5.8	32.7	32.2	1.0
16300	189	2368.4	2369.6	0.8	2370.0	2370.7	0.0	8.5	22.2	27.6	1.7
16200	189	2365.7	2367.4	1.0	2367.5	2368.0	0.0	6.4	29.6	29.5	1.1
16150	915	2364.9	2368.2	2.0	2368.2	2369.1	0.0	8.0	115.0	58.8	1.0
16000	915	2361.6	2364.2	1.5	2364.9	2366.4	0.0	11.8	77.3	51.8	1.7
15950	915	2360.3	2362.9	1.7	2363.5	2365.0	0.0	11.4	80.1	47.5	1.6
15500	915	2348.5	2351.4	1.7	2351.9	2353.3	0.0	11.1	82.4	48.0	1.5
15000	1046	2336.4	2339.3	2.0	2339.9	2341.4	0.0	11.7	89.4	45.3	1.5
14700	1046	2329.8	2332.3	1.7	2332.9	2334.3	0.0	11.1	94.3	57.3	1.5
14500	1046	2324.6	2327.3	1.9	2327.9	2329.3	0.0	11.5	91.3	48.9	1.5
14000	1046	2312.8	2315.5	1.8	2316.1	2317.5	0.0	11.4	91.5	50.6	1.5
13800	1046	2307.2	2309.8	1.8	2310.5	2312.0	0.0	11.8	88.6	50.4	1.6
13250	1315	2293.7	2296.6	1.9	2297.2	2298.6	0.0	11.4	115.7	59.9	1.4
13000	1315	2287.8	2290.9	2.1	2291.6	2293.3	0.0	12.4	106.2	50.6	1.5
12700	1315	2281.5	2284.2	2.1	2284.8	2286.3	0.0	11.5	113.9	55.5	1.4
12500	1315	2277.6	2280.5	2.3	2281.0	2282.4	0.0	11.0	119.2	52.2	1.3
12000	1315	2269.1	2272.0	2.2	2272.5	2273.9	0.0	11.2	118.0	54.4	1.3
11500	1315	2261.5	2264.7	2.4	2264.9	2266.2	0.0	9.8	134.2	55.3	1.1
11000	1315	2254.0	2257.2	2.3	2257.6	2259.0	0.0	10.9	120.6	53.0	1.3
10500	1315	2246.9	2250.0	2.3	2250.3	2251.6	0.0	10.1	129.6	56.4	1.2
10000	1315	2239.4	2242.3	2.3	2242.7	2244.1	0.0	10.8	121.4	54.0	1.3
9500	1315	2231.7	2234.7	2.4	2235.0	2236.3	0.0	10.3	127.3	54.1	1.2
9000	1315	2224.4	2227.5	2.4	2227.8	2229.2	0.0	10.4	126.6	52.9	1.2
8600	1315	2218.6	2221.3	2.2	2221.7	2223.2	0.0	11.0	119.5	55.6	1.3
8500	1315	2217.4	2221.5	2.8	2221.5	2222.9	0.0	9.4	139.6	50.7	1.0
8200	1438	2215.4	2219.4	2.9	2219.4	2220.9	0.0	9.7	148.6	51.6	1.0
8150	1438	2215.1	2218.5	2.6	2218.5	2219.7	0.0	9.1	158.1	61.6	1.0
7800	1438	2214.2	2218.7	2.7	2218.7	2220.1	0.0	9.4	153.2	56.8	1.0
7450	1494	2210.7	2214.7	2.8	2214.9	2216.4	0.0	10.6	141.1	50.6	1.1
7423	1494	2210.5	2214.7	2.9	2214.7	2216.1	0.0	9.7	153.6	52.6	1.0
7350	1494	2209.9	2213.7	2.6	2214.0	2215.4	0.0	10.6	141.1	54.7	1.2
7238	1494	2209.9	2214.4	3.0	2214.4	2215.9	0.0	9.8	152.3	51.6	1.0
7100	1494	2209.4	2213.4	2.9	2213.4	2214.9	0.0	9.7	154.5	53.9	1.0
7000	1494	2209.1	2213.3	3.0	2213.3	2214.8	0.0	9.8	152.3	51.0	1.0
6700	1494	2207.4	2211.1	2.6	2211.1	2212.4	0.0	9.2	163.2	63.3	1.0
6500	1494	2207.6	2210.9	2.3	2210.9	2212.0	0.0	8.6	174.3	77.2	1.0
6400	1494	2207.2	2210.3	2.2	2210.3	2211.4	0.0	8.3	179.2	83.2	1.0
6200	1494	2206.0	2210.4	3.1	2210.4	2211.9	0.0	10.0	149.2	48.6	1.0

HEC-RAS Subcritical Detailed Output

Plan: 0.03 riprap Equestrian Levee 1 RS: 16700 Profile: PF 1

E.G. Elev (ft)	2380.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2380.40	Reach Len. (ft)	165.85	161.49	163.63
Crit W.S. (ft)	2380.40	Flow Area (sq ft)	6.59	25.25	
E.G. Slope (ft/ft)	0.013102	Area (sq ft)	6.59	25.25	
Q Total (cfs)	189.00	Flow (cfs)	26.16	162.84	
Top Width (ft)	27.76	Top Width (ft)	7.08	20.68	
Vel Total (ft/s)	5.94	Avg. Vel. (ft/s)	3.97	6.45	
Max Chl Dpth (ft)	1.95	Hydr. Depth (ft)	0.93	1.22	
Conv. Total (cfs)	1651.2	Conv. (cfs)	228.5	1422.6	
Length Wtd. (ft)	161.81	Wetted Per. (ft)	7.32	20.81	
Min Ch El (ft)	2378.45	Shear (lb/sq ft)	0.74	0.99	
Alpha	1.08	Stream Power (lb/ft s)	2.92	6.40	
Frctn Loss (ft)	2.41	Cum Volume (acre-ft)	0.04	37.26	0.00
C & E Loss (ft)	0.09	Cum SA (acres)	0.05	14.29	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16550 Profile: PF 1

E.G. Elev (ft)	2376.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2376.20	Reach Len. (ft)	58.02	63.70	62.30
Crit W.S. (ft)	2376.20	Flow Area (sq ft)	0.77	42.95	
E.G. Slope (ft/ft)	0.017064	Area (sq ft)	0.77	42.95	
Q Total (cfs)	189.00	Flow (cfs)	1.45	187.55	
Top Width (ft)	80.03	Top Width (ft)	3.12	76.91	
Vel Total (ft/s)	4.32	Avg. Vel. (ft/s)	1.89	4.37	
Max Chl Dpth (ft)	2.70	Hydr. Depth (ft)	0.25	0.56	
Conv. Total (cfs)	1446.9	Conv. (cfs)	11.1	1435.8	
Length Wtd. (ft)	62.83	Wetted Per. (ft)	3.16	77.47	
Min Ch El (ft)	2373.50	Shear (lb/sq ft)	0.26	0.59	
Alpha	1.01	Stream Power (lb/ft s)	0.49	2.58	
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	0.03	37.13	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.03	14.11	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16500 Profile: PF 1

E.G. Elev (ft)	2374.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2373.84	Reach Len. (ft)	118.90	93.39	59.36
Crit W.S. (ft)	2373.84	Flow Area (sq ft)	13.36	20.97	
E.G. Slope (ft/ft)	0.014606	Area (sq ft)	13.36	20.97	
Q Total (cfs)	189.00	Flow (cfs)	56.39	132.61	
Top Width (ft)	33.72	Top Width (ft)	14.54	19.18	
Vel Total (ft/s)	5.51	Avg. Vel. (ft/s)	4.22	6.32	
Max Chl Dpth (ft)	2.04	Hydr. Depth (ft)	0.92	1.09	
Conv. Total (cfs)	1563.8	Conv. (cfs)	466.6	1097.3	
Length Wtd. (ft)	97.20	Wetted Per. (ft)	14.66	19.31	
Min Ch El (ft)	2371.80	Shear (lb/sq ft)	0.83	0.99	
Alpha	1.10	Stream Power (lb/ft s)	3.51	6.26	
Frctn Loss (ft)	1.36	Cum Volume (acre-ft)	0.02	37.08	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	14.04	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16400 Profile: PF 1

E.G. Elev (ft)	2372.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.		0.030	
W.S. Elev (ft)	2372.22	Reach Len. (ft)	103.50	90.65	81.49
Crit W.S. (ft)	2372.22	Flow Area (sq ft)		32.69	
E.G. Slope (ft/ft)	0.013488	Area (sq ft)		32.69	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	32.18	Top Width (ft)		32.18	
Vel Total (ft/s)	5.78	Avg. Vel. (ft/s)		5.78	
Max Chl Dpth (ft)	1.80	Hydr. Depth (ft)		1.02	
Conv. Total (cfs)	1627.4	Conv. (cfs)		1627.4	
Length Wtd. (ft)	90.65	Wetted Per. (ft)		32.45	
Min Ch El (ft)	2370.42	Shear (lb/sq ft)		0.85	
Alpha	1.00	Stream Power (lb/ft s)		4.90	
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)		37.02	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		13.99	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16300 Profile: PF 1

E.G. Elev (ft)	2370.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.		0.030	
W.S. Elev (ft)	2369.95	Reach Len. (ft)	105.13	104.41	105.30
Crit W.S. (ft)	2369.95	Flow Area (sq ft)		33.08	
E.G. Slope (ft/ft)	0.013427	Area (sq ft)		33.08	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	33.08	Top Width (ft)		33.08	
Vel Total (ft/s)	5.71	Avg. Vel. (ft/s)		5.71	
Max Chl Dpth (ft)	1.55	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	1631.1	Conv. (cfs)		1631.1	
Length Wtd. (ft)	104.41	Wetted Per. (ft)		33.31	
Min Ch El (ft)	2368.40	Shear (lb/sq ft)		0.83	
Alpha	1.00	Stream Power (lb/ft s)		4.76	
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)		36.96	0.00
C & E Loss (ft)	0.14	Cum SA (acres)		13.92	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16200 Profile: PF 1

E.G. Elev (ft)	2369.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.030	
W.S. Elev (ft)	2369.38	Reach Len. (ft)	53.24	50.64	50.16
Crit W.S. (ft)		Flow Area (sq ft)		117.76	
E.G. Slope (ft/ft)	0.000412	Area (sq ft)		117.76	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	57.84	Top Width (ft)		57.84	
Vel Total (ft/s)	1.60	Avg. Vel. (ft/s)		1.60	
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)		2.04	
Conv. Total (cfs)	9309.7	Conv. (cfs)		9309.7	
Length Wtd. (ft)	50.64	Wetted Per. (ft)		58.40	
Min Ch El (ft)	2365.70	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)		0.08	
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)		36.78	0.00
C & E Loss (ft)	0.10	Cum SA (acres)		13.81	0.02

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16150 Profile: PF 1

E.G. Elev (ft)	2369.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.		0.030	
W.S. Elev (ft)	2368.14	Reach Len. (ft)	145.06	148.97	149.37
Crit W.S. (ft)	2368.14	Flow Area (sq ft)		114.52	

Plan: 0.03 riprap Equestrian Levee 1 RS: 16150 Profile: PF 1 (Continued)

E.G. Slope (ft/ft)	0.010799	Area (sq ft)		114.52	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	58.72	Top Width (ft)		58.72	
Vel Total (ft/s)	7.99	Avg. Vel. (ft/s)		7.99	
Max Chl Dpth (ft)	3.24	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	8805.1	Conv. (cfs)		8805.1	
Length Wtd. (ft)	148.97	Wetted Per. (ft)		59.21	
Min Ch El (ft)	2364.90	Shear (lb/sq ft)		1.30	
Alpha	1.00	Stream Power (lb/ft s)		10.42	
Frctn Loss (ft)	1.62	Cum Volume (acre-ft)		36.64	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		13.74	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16000 Profile: PF 1

E.G. Elev (ft)	2365.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.		0.030	
W.S. Elev (ft)	2364.91	Reach Len. (ft)	48.94	47.28	46.67
Crit W.S. (ft)	2364.91	Flow Area (sq ft)		114.97	
E.G. Slope (ft/ft)	0.010916	Area (sq ft)		114.97	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	59.80	Top Width (ft)		59.80	
Vel Total (ft/s)	7.96	Avg. Vel. (ft/s)		7.96	
Max Chl Dpth (ft)	3.30	Hydr. Depth (ft)		1.92	
Conv. Total (cfs)	8757.7	Conv. (cfs)		8757.7	
Length Wtd. (ft)	47.28	Wetted Per. (ft)		60.28	
Min Ch El (ft)	2361.60	Shear (lb/sq ft)		1.30	
Alpha	1.00	Stream Power (lb/ft s)		10.34	
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)		36.25	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		13.54	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 15950 Profile: PF 1

E.G. Elev (ft)	2364.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.		0.030	
W.S. Elev (ft)	2363.54	Reach Len. (ft)	453.40	452.43	454.29
Crit W.S. (ft)	2363.54	Flow Area (sq ft)		111.30	
E.G. Slope (ft/ft)	0.010659	Area (sq ft)		111.30	

Plan: 0.03 riprap Equestrian Levee 1 RS: 15950 Profile: PF 1 (Continued)

Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	54.09	Top Width (ft)		54.09	
Vel Total (ft/s)	8.22	Avg. Vel. (ft/s)		8.22	
Max Chl Dpth (ft)	3.23	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	8862.6	Conv. (cfs)		8862.6	
Length Wtd. (ft)	452.43	Wetted Per. (ft)		54.60	
Min Ch El (ft)	2360.30	Shear (lb/sq ft)		1.36	
Alpha	1.00	Stream Power (lb/ft s)		11.15	
Frctn Loss (ft)	4.81	Cum Volume (acre-ft)		36.12	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		13.48	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 15500 Profile: PF 1

E.G. Elev (ft)	2352.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.06	Wt. n-Val.		0.030	
W.S. Elev (ft)	2351.91	Reach Len. (ft)	477.39	497.84	515.70
Crit W.S. (ft)	2351.91	Flow Area (sq ft)		110.78	
E.G. Slope (ft/ft)	0.010611	Area (sq ft)		110.78	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	53.25	Top Width (ft)		53.25	
Vel Total (ft/s)	8.26	Avg. Vel. (ft/s)		8.26	
Max Chl Dpth (ft)	3.41	Hydr. Depth (ft)		2.08	
Conv. Total (cfs)	8882.5	Conv. (cfs)		8882.5	
Length Wtd. (ft)	497.84	Wetted Per. (ft)		53.78	
Min Ch El (ft)	2348.50	Shear (lb/sq ft)		1.36	
Alpha	1.00	Stream Power (lb/ft s)		11.27	
Frctn Loss (ft)	5.18	Cum Volume (acre-ft)		34.97	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		12.92	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 15000 Profile: PF 1

E.G. Elev (ft)	2341.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.18	Wt. n-Val.		0.030	
W.S. Elev (ft)	2339.92	Reach Len. (ft)	291.41	291.65	296.07
Crit W.S. (ft)	2339.92	Flow Area (sq ft)		119.87	
E.G. Slope (ft/ft)	0.010236	Area (sq ft)		119.87	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	

Plan: 0.03 riprap Equestrian Levee 1 RS: 15000 Profile: PF 1 (Continued)

Top Width (ft)	51.46	Top Width (ft)		51.46	
Vel Total (ft/s)	8.73	Avg. Vel. (ft/s)		8.73	
Max Chl Dpth (ft)	3.54	Hydr. Depth (ft)		2.33	
Conv. Total (cfs)	10338.9	Conv. (cfs)		10338.9	
Length Wtd. (ft)	291.65	Wetted Per. (ft)		52.16	
Min Ch El (ft)	2336.38	Shear (lb/sq ft)		1.47	
Alpha	1.00	Stream Power (lb/ft s)		12.81	
Frctn Loss (ft)	3.06	Cum Volume (acre-ft)		33.65	0.00
C & E Loss (ft)	0.05	Cum SA (acres)		12.32	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 14700 Profile: PF 1

E.G. Elev (ft)	2333.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.01	Wt. n-Val.		0.030	
W.S. Elev (ft)	2332.91	Reach Len. (ft)	201.79	199.36	194.11
Crit W.S. (ft)	2332.91	Flow Area (sq ft)		129.51	
E.G. Slope (ft/ft)	0.010776	Area (sq ft)		129.51	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	65.36	Top Width (ft)		65.36	
Vel Total (ft/s)	8.08	Avg. Vel. (ft/s)		8.08	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		1.98	
Conv. Total (cfs)	10076.2	Conv. (cfs)		10076.2	
Length Wtd. (ft)	199.36	Wetted Per. (ft)		65.78	
Min Ch El (ft)	2329.76	Shear (lb/sq ft)		1.32	
Alpha	1.00	Stream Power (lb/ft s)		10.70	
Frctn Loss (ft)	2.10	Cum Volume (acre-ft)		32.82	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		11.93	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 14500 Profile: PF 1

E.G. Elev (ft)	2329.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.12	Wt. n-Val.		0.030	
W.S. Elev (ft)	2327.88	Reach Len. (ft)	488.30	492.11	499.23
Crit W.S. (ft)	2327.88	Flow Area (sq ft)		123.08	
E.G. Slope (ft/ft)	0.010311	Area (sq ft)		123.08	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	55.45	Top Width (ft)		55.45	

Plan: 0.03 riprap Equestrian Levee 1 RS: 14500 Profile: PF 1 (Continued)

Vel Total (ft/s)	8.50	Avg. Vel. (ft/s)		8.50	
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)		2.22	
Conv. Total (cfs)	10301.1	Conv. (cfs)		10301.1	
Length Wtd. (ft)	492.11	Wetted Per. (ft)		56.04	
Min Ch El (ft)	2324.61	Shear (lb/sq ft)		1.41	
Alpha	1.00	Stream Power (lb/ft s)		12.02	
Frctn Loss (ft)	5.10	Cum Volume (acre-ft)		32.24	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		11.65	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 14000 Profile: PF 1

E.G. Elev (ft)	2317.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.09	Wt. n-Val.		0.030	
W.S. Elev (ft)	2316.07	Reach Len. (ft)	211.60	212.66	211.08
Crit W.S. (ft)	2316.07	Flow Area (sq ft)		124.89	
E.G. Slope (ft/ft)	0.010419	Area (sq ft)		124.89	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	58.03	Top Width (ft)		58.03	
Vel Total (ft/s)	8.38	Avg. Vel. (ft/s)		8.38	
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)		2.15	
Conv. Total (cfs)	10247.3	Conv. (cfs)		10247.3	
Length Wtd. (ft)	212.66	Wetted Per. (ft)		58.57	
Min Ch El (ft)	2312.78	Shear (lb/sq ft)		1.39	
Alpha	1.00	Stream Power (lb/ft s)		11.62	
Frctn Loss (ft)	2.20	Cum Volume (acre-ft)		30.84	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		11.01	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 13800 Profile: PF 1

E.G. Elev (ft)	2311.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.		0.030	
W.S. Elev (ft)	2310.52	Reach Len. (ft)	557.87	552.29	550.96
Crit W.S. (ft)	2310.52	Flow Area (sq ft)		125.90	
E.G. Slope (ft/ft)	0.010311	Area (sq ft)		125.90	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	58.76	Top Width (ft)		58.76	
Vel Total (ft/s)	8.31	Avg. Vel. (ft/s)		8.31	

Plan: 0.03 riprap Equestrian Levee 1 RS: 13800 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)		2.14	
Conv. Total (cfs)	10300.8	Conv. (cfs)		10300.8	
Length Wtd. (ft)	552.29	Wetted Per. (ft)		59.30	
Min Ch El (ft)	2307.24	Shear (lb/sq ft)		1.37	
Alpha	1.00	Stream Power (lb/ft s)		11.35	
Frctn Loss (ft)	5.68	Cum Volume (acre-ft)		30.23	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		10.73	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 13250 Profile: PF 1

E.G. Elev (ft)	2298.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.14	Wt. n-Val.		0.030	
W.S. Elev (ft)	2297.20	Reach Len. (ft)	239.07	232.43	224.09
Crit W.S. (ft)	2297.20	Flow Area (sq ft)		153.45	
E.G. Slope (ft/ft)	0.010260	Area (sq ft)		153.45	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	68.16	Top Width (ft)		68.16	
Vel Total (ft/s)	8.57	Avg. Vel. (ft/s)		8.57	
Max Chl Dpth (ft)	3.55	Hydr. Depth (ft)		2.25	
Conv. Total (cfs)	12982.4	Conv. (cfs)		12982.4	
Length Wtd. (ft)	232.43	Wetted Per. (ft)		68.73	
Min Ch El (ft)	2293.65	Shear (lb/sq ft)		1.43	
Alpha	1.00	Stream Power (lb/ft s)		12.25	
Frctn Loss (ft)	2.35	Cum Volume (acre-ft)		28.46	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		9.92	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 13000 Profile: PF 1

E.G. Elev (ft)	2292.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.27	Wt. n-Val.		0.030	
W.S. Elev (ft)	2291.61	Reach Len. (ft)	318.36	308.42	296.29
Crit W.S. (ft)	2291.61	Flow Area (sq ft)		145.50	
E.G. Slope (ft/ft)	0.009954	Area (sq ft)		145.50	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	58.11	Top Width (ft)		58.11	
Vel Total (ft/s)	9.04	Avg. Vel. (ft/s)		9.04	
Max Chl Dpth (ft)	3.86	Hydr. Depth (ft)		2.50	

Plan: 0.03 riprap Equestrian Levee 1 RS: 13000 Profile: PF 1 (Continued)

Conv. Total (cfs)	13180.1	Conv. (cfs)		13180.1	
Length Wtd. (ft)	308.42	Wetted Per. (ft)		58.83	
Min Ch El (ft)	2287.75	Shear (lb/sq ft)		1.54	
Alpha	1.00	Stream Power (lb/ft s)		13.89	
Frctn Loss (ft)	3.08	Cum Volume (acre-ft)		27.66	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		9.59	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 12700 Profile: PF 1

E.G. Elev (ft)	2286.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.23	Wt. n-Val.		0.030	
W.S. Elev (ft)	2284.81	Reach Len. (ft)	206.38	204.91	200.49
Crit W.S. (ft)	2284.81	Flow Area (sq ft)		147.91	
E.G. Slope (ft/ft)	0.010019	Area (sq ft)		147.91	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	60.91	Top Width (ft)		60.91	
Vel Total (ft/s)	8.89	Avg. Vel. (ft/s)		8.89	
Max Chl Dpth (ft)	3.32	Hydr. Depth (ft)		2.43	
Conv. Total (cfs)	13137.4	Conv. (cfs)		13137.4	
Length Wtd. (ft)	204.91	Wetted Per. (ft)		61.59	
Min Ch El (ft)	2281.49	Shear (lb/sq ft)		1.50	
Alpha	1.00	Stream Power (lb/ft s)		13.35	
Frctn Loss (ft)	2.04	Cum Volume (acre-ft)		26.62	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		9.17	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 12500 Profile: PF 1

E.G. Elev (ft)	2282.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.30	Wt. n-Val.		0.030	
W.S. Elev (ft)	2280.97	Reach Len. (ft)	486.51	484.94	479.60
Crit W.S. (ft)	2280.97	Flow Area (sq ft)		143.62	
E.G. Slope (ft/ft)	0.009880	Area (sq ft)		143.62	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	55.80	Top Width (ft)		55.80	
Vel Total (ft/s)	9.16	Avg. Vel. (ft/s)		9.16	
Max Chl Dpth (ft)	3.41	Hydr. Depth (ft)		2.57	
Conv. Total (cfs)	13229.6	Conv. (cfs)		13229.6	

Plan: 0.03 riprap Equestrian Levee 1 RS: 12500 Profile: PF 1 (Continued)

Length Wtd. (ft)	484.94	Wetted Per. (ft)		56.62	
Min Ch El (ft)	2277.56	Shear (lb/sq ft)		1.56	
Alpha	1.00	Stream Power (lb/ft s)		14.32	
Frctn Loss (ft)	4.82	Cum Volume (acre-ft)		25.94	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		8.89	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 12000 Profile: PF 1

E.G. Elev (ft)	2273.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.27	Wt. n-Val.		0.030	
W.S. Elev (ft)	2272.44	Reach Len. (ft)	507.89	506.83	513.43
Crit W.S. (ft)	2272.44	Flow Area (sq ft)		145.54	
E.G. Slope (ft/ft)	0.009984	Area (sq ft)		145.54	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	58.17	Top Width (ft)		58.17	
Vel Total (ft/s)	9.04	Avg. Vel. (ft/s)		9.04	
Max Chl Dpth (ft)	3.37	Hydr. Depth (ft)		2.50	
Conv. Total (cfs)	13160.8	Conv. (cfs)		13160.8	
Length Wtd. (ft)	506.83	Wetted Per. (ft)		59.00	
Min Ch El (ft)	2269.07	Shear (lb/sq ft)		1.54	
Alpha	1.00	Stream Power (lb/ft s)		13.89	
Frctn Loss (ft)	5.05	Cum Volume (acre-ft)		24.33	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		8.26	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 11500 Profile: PF 1

E.G. Elev (ft)	2266.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.29	Wt. n-Val.		0.030	
W.S. Elev (ft)	2264.91	Reach Len. (ft)	503.11	506.08	506.93
Crit W.S. (ft)	2264.91	Flow Area (sq ft)		144.20	
E.G. Slope (ft/ft)	0.009945	Area (sq ft)		144.20	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	56.61	Top Width (ft)		56.61	
Vel Total (ft/s)	9.12	Avg. Vel. (ft/s)		9.12	
Max Chl Dpth (ft)	3.42	Hydr. Depth (ft)		2.55	
Conv. Total (cfs)	13186.3	Conv. (cfs)		13186.3	
Length Wtd. (ft)	506.08	Wetted Per. (ft)		57.49	

Plan: 0.03 riprap Equestrian Levee 1 RS: 11500 Profile: PF 1 (Continued)

Min Ch El (ft)	2261.49	Shear (lb/sq ft)		1.56	
Alpha	1.00	Stream Power (lb/ft s)		14.20	
Frctn Loss (ft)	5.03	Cum Volume (acre-ft)		22.64	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		7.59	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 11000 Profile: PF 1

E.G. Elev (ft)	2258.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.30	Wt. n-Val.		0.030	
W.S. Elev (ft)	2257.61	Reach Len. (ft)	488.17	484.98	483.12
Crit W.S. (ft)	2257.61	Flow Area (sq ft)		143.66	
E.G. Slope (ft/ft)	0.009949	Area (sq ft)		143.66	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	56.08	Top Width (ft)		56.08	
Vel Total (ft/s)	9.15	Avg. Vel. (ft/s)		9.15	
Max Chl Dpth (ft)	3.60	Hydr. Depth (ft)		2.56	
Conv. Total (cfs)	13183.6	Conv. (cfs)		13183.6	
Length Wtd. (ft)	484.98	Wetted Per. (ft)		56.96	
Min Ch El (ft)	2254.01	Shear (lb/sq ft)		1.57	
Alpha	1.00	Stream Power (lb/ft s)		14.34	
Frctn Loss (ft)	4.84	Cum Volume (acre-ft)		20.97	0.00
C & E Loss (ft)	0.01	Cum SA (acres)		6.93	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 10500 Profile: PF 1

E.G. Elev (ft)	2251.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.26	Wt. n-Val.		0.030	
W.S. Elev (ft)	2250.28	Reach Len. (ft)	489.27	487.90	486.53
Crit W.S. (ft)	2250.28	Flow Area (sq ft)		146.14	
E.G. Slope (ft/ft)	0.009990	Area (sq ft)		146.14	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	58.85	Top Width (ft)		58.85	
Vel Total (ft/s)	9.00	Avg. Vel. (ft/s)		9.00	
Max Chl Dpth (ft)	3.35	Hydr. Depth (ft)		2.48	
Conv. Total (cfs)	13156.3	Conv. (cfs)		13156.3	
Length Wtd. (ft)	487.90	Wetted Per. (ft)		59.64	
Min Ch El (ft)	2246.93	Shear (lb/sq ft)		1.53	

Plan: 0.03 riprap Equestrian Levee 1 RS: 10500 Profile: PF 1 (Continued)

Alpha	1.00	Stream Power (lb/ft s)		13.75	
Frctn Loss (ft)	4.86	Cum Volume (acre-ft)		19.35	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		6.29	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 10000 Profile: PF 1

E.G. Elev (ft)	2244.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.28	Wt. n-Val.		0.030	
W.S. Elev (ft)	2242.73	Reach Len. (ft)	505.70	509.20	513.80
Crit W.S. (ft)	2242.73	Flow Area (sq ft)		144.97	
E.G. Slope (ft/ft)	0.009931	Area (sq ft)		144.97	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	57.36	Top Width (ft)		57.36	
Vel Total (ft/s)	9.07	Avg. Vel. (ft/s)		9.07	
Max Chl Dpth (ft)	3.30	Hydr. Depth (ft)		2.53	
Conv. Total (cfs)	13195.7	Conv. (cfs)		13195.7	
Length Wtd. (ft)	509.20	Wetted Per. (ft)		58.19	
Min Ch El (ft)	2239.43	Shear (lb/sq ft)		1.54	
Alpha	1.00	Stream Power (lb/ft s)		14.01	
Frctn Loss (ft)	5.06	Cum Volume (acre-ft)		17.72	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		5.64	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 9500 Profile: PF 1

E.G. Elev (ft)	2236.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.30	Wt. n-Val.		0.030	
W.S. Elev (ft)	2234.95	Reach Len. (ft)	510.84	507.98	503.79
Crit W.S. (ft)	2234.95	Flow Area (sq ft)		143.83	
E.G. Slope (ft/ft)	0.009941	Area (sq ft)		143.83	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	56.20	Top Width (ft)		56.20	
Vel Total (ft/s)	9.14	Avg. Vel. (ft/s)		9.14	
Max Chl Dpth (ft)	3.24	Hydr. Depth (ft)		2.56	
Conv. Total (cfs)	13189.1	Conv. (cfs)		13189.1	
Length Wtd. (ft)	507.98	Wetted Per. (ft)		57.10	
Min Ch El (ft)	2231.71	Shear (lb/sq ft)		1.56	
Alpha	1.00	Stream Power (lb/ft s)		14.29	

Plan: 0.03 riprap Equestrian Levee 1 RS: 9500 Profile: PF 1 (Continued)

Frctn Loss (ft)	5.03	Cum Volume (acre-ft)		16.04	0.00
C & E Loss (ft)	0.00	Cum SA (acres)		4.98	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 9000 Profile: PF 1

E.G. Elev (ft)	2229.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.31	Wt. n-Val.		0.030	
W.S. Elev (ft)	2227.78	Reach Len. (ft)	370.90	376.74	384.81
Crit W.S. (ft)	2227.78	Flow Area (sq ft)		143.23	
E.G. Slope (ft/ft)	0.009862	Area (sq ft)		143.23	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	55.29	Top Width (ft)		55.29	
Vel Total (ft/s)	9.18	Avg. Vel. (ft/s)		9.18	
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)		2.59	
Conv. Total (cfs)	13241.4	Conv. (cfs)		13241.4	
Length Wtd. (ft)	376.74	Wetted Per. (ft)		56.17	
Min Ch El (ft)	2224.35	Shear (lb/sq ft)		1.57	
Alpha	1.00	Stream Power (lb/ft s)		14.41	
Frctn Loss (ft)	1.74	Cum Volume (acre-ft)		14.36	0.00
C & E Loss (ft)	0.24	Cum SA (acres)		4.33	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8600 Profile: PF 1

E.G. Elev (ft)	2223.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.		0.030	
W.S. Elev (ft)	2223.06	Reach Len. (ft)	127.50	125.18	122.70
Crit W.S. (ft)		Flow Area (sq ft)		231.07	
E.G. Slope (ft/ft)	0.002672	Area (sq ft)		231.07	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	68.52	Top Width (ft)		68.52	
Vel Total (ft/s)	5.69	Avg. Vel. (ft/s)		5.69	
Max Chl Dpth (ft)	4.50	Hydr. Depth (ft)		3.37	
Conv. Total (cfs)	25438.6	Conv. (cfs)		25438.6	

Plan: 0.03 riprap Equestrian Levee 1 RS: 8600 Profile: PF 1 (Continued)

Length Wtd. (ft)	125.18	Wetted Per. (ft)		69.73	
Min Ch El (ft)	2218.56	Shear (lb/sq ft)		0.55	
Alpha	1.00	Stream Power (lb/ft s)		3.15	
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)		12.74	0.00
C & E Loss (ft)	0.09	Cum SA (acres)		3.79	0.02

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8500 Profile: PF 1

E.G. Elev (ft)	2222.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.39	Wt. n-Val.		0.030	
W.S. Elev (ft)	2221.51	Reach Len. (ft)	237.20	250.13	271.01
Crit W.S. (ft)	2221.51	Flow Area (sq ft)		138.95	
E.G. Slope (ft/ft)	0.009761	Area (sq ft)		138.95	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	50.65	Top Width (ft)		50.65	
Vel Total (ft/s)	9.46	Avg. Vel. (ft/s)		9.46	
Max Chl Dpth (ft)	4.07	Hydr. Depth (ft)		2.74	
Conv. Total (cfs)	13310.3	Conv. (cfs)		13310.3	
Length Wtd. (ft)	250.13	Wetted Per. (ft)		51.66	
Min Ch El (ft)	2217.44	Shear (lb/sq ft)		1.64	
Alpha	1.00	Stream Power (lb/ft s)		15.51	
Frctn Loss (ft)	1.21	Cum Volume (acre-ft)		12.21	0.00
C & E Loss (ft)	0.23	Cum SA (acres)		3.62	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8200 Profile: PF 1

E.G. Elev (ft)	2221.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.030	
W.S. Elev (ft)	2220.78	Reach Len. (ft)	126.81	126.78	146.01
Crit W.S. (ft)		Flow Area (sq ft)		226.20	
E.G. Slope (ft/ft)	0.002998	Area (sq ft)		226.20	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	61.52	Top Width (ft)		61.52	
Vel Total (ft/s)	6.36	Avg. Vel. (ft/s)		6.36	
Max Chl Dpth (ft)	5.41	Hydr. Depth (ft)		3.68	
Conv. Total (cfs)	26264.4	Conv. (cfs)		26264.4	

Plan: 0.03 riprap Equestrian Levee 1 RS: 8200 Profile: PF 1 (Continued)

Length Wtd. (ft)	126.78	Wetted Per. (ft)		63.02	
Min Ch El (ft)	2215.37	Shear (lb/sq ft)		0.67	
Alpha	1.00	Stream Power (lb/ft s)		4.27	
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)		11.16	0.00
C & E Loss (ft)	0.10	Cum SA (acres)		3.30	0.02

Errors Warnings and Notes

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8150 Profile: PF 1

E.G. Elev (ft)	2221.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.		0.030	
W.S. Elev (ft)	2220.77	Reach Len. (ft)	276.71	311.53	329.29
Crit W.S. (ft)		Flow Area (sq ft)		324.48	
E.G. Slope (ft/ft)	0.001300	Area (sq ft)		324.48	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	81.66	Top Width (ft)		81.66	
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)		4.43	
Max Chl Dpth (ft)	5.71	Hydr. Depth (ft)		3.97	
Conv. Total (cfs)	39877.6	Conv. (cfs)		39877.6	
Length Wtd. (ft)	311.53	Wetted Per. (ft)		83.02	
Min Ch El (ft)	2215.06	Shear (lb/sq ft)		0.32	
Alpha	1.00	Stream Power (lb/ft s)		1.41	
Frctn Loss (ft)	0.87	Cum Volume (acre-ft)		10.36	0.00
C & E Loss (ft)	0.11	Cum SA (acres)		3.09	0.02

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7800 Profile: PF 1

E.G. Elev (ft)	2220.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.37	Wt. n-Val.		0.030	
W.S. Elev (ft)	2218.72	Reach Len. (ft)	371.21	338.75	316.55
Crit W.S. (ft)	2218.72	Flow Area (sq ft)		153.01	
E.G. Slope (ft/ft)	0.009819	Area (sq ft)		153.01	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	56.74	Top Width (ft)		56.74	
Vel Total (ft/s)	9.40	Avg. Vel. (ft/s)		9.40	
Max Chl Dpth (ft)	4.57	Hydr. Depth (ft)		2.70	
Conv. Total (cfs)	14511.8	Conv. (cfs)		14511.8	
Length Wtd. (ft)	338.75	Wetted Per. (ft)		57.75	
Min Ch El (ft)	2214.15	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		15.26	
Frctn Loss (ft)	1.85	Cum Volume (acre-ft)		8.65	0.00
C & E Loss (ft)	0.20	Cum SA (acres)		2.60	0.02

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Errors Warnings and Notes (Continued)

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to critical
	depth, the calculated water surface came back below critical depth. This indicates that there
	is not a valid subcritical answer. The program defaulted to critical depth.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7450 Profile: PF 1

E.G. Elev (ft)	2216.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.		0.030	
W.S. Elev (ft)	2216.06	Reach Len. (ft)	53.71	56.71	50.31
Crit W.S. (ft)		Flow Area (sq ft)		219.55	
E.G. Slope (ft/ft)	0.003538	Area (sq ft)		219.55	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	61.10	Top Width (ft)		61.10	
Vel Total (ft/s)	6.80	Avg. Vel. (ft/s)		6.80	
Max Chl Dpth (ft)	5.39	Hydr. Depth (ft)		3.59	
Conv. Total (cfs)	25118.1	Conv. (cfs)		25118.1	
Length Wtd. (ft)	56.71	Wetted Per. (ft)		62.54	
Min Ch El (ft)	2210.67	Shear (lb/sq ft)		0.78	
Alpha	1.00	Stream Power (lb/ft s)		5.28	
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)		7.21	0.00
C & E Loss (ft)	0.02	Cum SA (acres)		2.14	0.02

Plan: 0.03 riprap Equestrian Levee 1 RS: 7423 Profile: PF 1

E.G. Elev (ft)	2216.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.67	Wt. n-Val.		0.030	
W.S. Elev (ft)	2215.90	Reach Len. (ft)	77.11	63.35	45.09
Crit W.S. (ft)		Flow Area (sq ft)		227.87	
E.G. Slope (ft/ft)	0.003585	Area (sq ft)		227.87	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	67.97	Top Width (ft)		67.97	
Vel Total (ft/s)	6.56	Avg. Vel. (ft/s)		6.56	
Max Chl Dpth (ft)	5.37	Hydr. Depth (ft)		3.35	
Conv. Total (cfs)	24951.6	Conv. (cfs)		24951.6	
Length Wtd. (ft)	63.34	Wetted Per. (ft)		69.32	
Min Ch El (ft)	2210.53	Shear (lb/sq ft)		0.74	
Alpha	1.00	Stream Power (lb/ft s)		4.82	
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)		6.91	0.00
C & E Loss (ft)	0.07	Cum SA (acres)		2.06	0.02

Plan: 0.03 riprap Equestrian Levee 1 RS: 7350 Profile: PF 1

E.G. Elev (ft)	2216.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.030	0.030
W.S. Elev (ft)	2215.91	Reach Len. (ft)	107.12	101.83	91.00
Crit W.S. (ft)		Flow Area (sq ft)		283.48	2.16
E.G. Slope (ft/ft)	0.001818	Area (sq ft)		283.48	2.16
Q Total (cfs)	1494.00	Flow (cfs)		1492.42	1.58
Top Width (ft)	81.12	Top Width (ft)		70.57	10.55
Vel Total (ft/s)	5.23	Avg. Vel. (ft/s)		5.26	0.73

Plan: 0.03 riprap Equestrian Levee 1 RS: 7350 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	5.98	Hydr. Depth (ft)		4.02	0.20
Conv. Total (cfs)	35042.2	Conv. (cfs)		35005.1	37.1
Length Wtd. (ft)	101.82	Wetted Per. (ft)		72.01	10.56
Min Ch El (ft)	2209.93	Shear (lb/sq ft)		0.45	0.02
Alpha	1.01	Stream Power (lb/ft s)		2.35	0.02
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)		6.54	0.00
C & E Loss (ft)	0.06	Cum SA (acres)		1.95	0.01

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7238 Profile: PF 1

E.G. Elev (ft)	2215.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.		0.030	
W.S. Elev (ft)	2214.89	Reach Len. (ft)	138.64	118.47	119.62
Crit W.S. (ft)		Flow Area (sq ft)		179.59	
E.G. Slope (ft/ft)	0.006081	Area (sq ft)		179.59	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	55.55	Top Width (ft)		55.55	
Vel Total (ft/s)	8.32	Avg. Vel. (ft/s)		8.32	
Max Chl Dpth (ft)	5.04	Hydr. Depth (ft)		3.23	
Conv. Total (cfs)	19157.9	Conv. (cfs)		19157.9	
Length Wtd. (ft)	118.47	Wetted Per. (ft)		56.82	
Min Ch El (ft)	2209.85	Shear (lb/sq ft)		1.20	
Alpha	1.00	Stream Power (lb/ft s)		9.98	
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)		6.00	
C & E Loss (ft)	0.11	Cum SA (acres)		1.81	

Plan: 0.03 riprap Equestrian Levee 1 RS: 7100 Profile: PF 1

E.G. Elev (ft)	2215.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.		0.030	
W.S. Elev (ft)	2214.61	Reach Len. (ft)	72.03	82.47	73.42
Crit W.S. (ft)		Flow Area (sq ft)		222.45	
E.G. Slope (ft/ft)	0.003495	Area (sq ft)		222.45	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	62.69	Top Width (ft)		62.69	
Vel Total (ft/s)	6.72	Avg. Vel. (ft/s)		6.72	
Max Chl Dpth (ft)	5.21	Hydr. Depth (ft)		3.55	
Conv. Total (cfs)	25271.8	Conv. (cfs)		25271.8	
Length Wtd. (ft)	82.47	Wetted Per. (ft)		64.04	
Min Ch El (ft)	2209.40	Shear (lb/sq ft)		0.76	
Alpha	1.00	Stream Power (lb/ft s)		5.09	
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)		5.46	
C & E Loss (ft)	0.08	Cum SA (acres)		1.65	

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7000 Profile: PF 1

E.G. Elev (ft)	2214.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.48	Wt. n-Val.		0.030	
W.S. Elev (ft)	2213.31	Reach Len. (ft)	312.84	314.62	317.21
Crit W.S. (ft)	2213.28	Flow Area (sq ft)		153.00	
E.G. Slope (ft/ft)	0.009289	Area (sq ft)		153.00	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	51.11	Top Width (ft)		51.11	
Vel Total (ft/s)	9.76	Avg. Vel. (ft/s)		9.76	
Max Chl Dpth (ft)	4.25	Hydr. Depth (ft)		2.99	
Conv. Total (cfs)	15500.9	Conv. (cfs)		15500.9	
Length Wtd. (ft)	314.62	Wetted Per. (ft)		52.30	
Min Ch El (ft)	2209.06	Shear (lb/sq ft)		1.70	
Alpha	1.00	Stream Power (lb/ft s)		16.57	
Frctn Loss (ft)	1.24	Cum Volume (acre-ft)		5.10	
C & E Loss (ft)	0.31	Cum SA (acres)		1.54	

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 6700 Profile: PF 1

E.G. Elev (ft)	2213.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.030	
W.S. Elev (ft)	2212.80	Reach Len. (ft)	199.94	201.89	205.00
Crit W.S. (ft)		Flow Area (sq ft)		281.09	
E.G. Slope (ft/ft)	0.002158	Area (sq ft)		281.09	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	78.97	Top Width (ft)		78.97	
Vel Total (ft/s)	5.32	Avg. Vel. (ft/s)		5.32	
Max Chl Dpth (ft)	5.38	Hydr. Depth (ft)		3.56	
Conv. Total (cfs)	32163.8	Conv. (cfs)		32163.8	
Length Wtd. (ft)	201.89	Wetted Per. (ft)		80.05	
Min Ch El (ft)	2207.42	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)		2.51	
Frctn Loss (ft)	0.42	Cum Volume (acre-ft)		3.53	
C & E Loss (ft)	0.03	Cum SA (acres)		1.07	

Plan: 0.03 riprap Equestrian Levee 1 RS: 6500 Profile: PF 1

E.G. Elev (ft)	2212.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.		0.030	
W.S. Elev (ft)	2212.45	Reach Len. (ft)	86.71	92.02	103.63
Crit W.S. (ft)		Flow Area (sq ft)		315.67	
E.G. Slope (ft/ft)	0.001976	Area (sq ft)		315.67	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	99.49	Top Width (ft)		99.49	
Vel Total (ft/s)	4.73	Avg. Vel. (ft/s)		4.73	
Max Chl Dpth (ft)	4.89	Hydr. Depth (ft)		3.17	
Conv. Total (cfs)	33608.2	Conv. (cfs)		33608.2	
Length Wtd. (ft)	92.02	Wetted Per. (ft)		100.17	

Plan: 0.03 riprap Equestrian Levee 1 RS: 6500 Profile: PF 1 (Continued)

Min Ch El (ft)	2207.56	Shear (lb/sq ft)		0.39	
Alpha	1.00	Stream Power (lb/ft s)		1.84	
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)		2.15	
C & E Loss (ft)	0.04	Cum SA (acres)		0.66	

Plan: 0.03 riprap Equestrian Levee 1 RS: 6400 Profile: PF 1

E.G. Elev (ft)	2212.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.030	
W.S. Elev (ft)	2212.39	Reach Len. (ft)	207.89	225.93	234.71
Crit W.S. (ft)		Flow Area (sq ft)		391.41	
E.G. Slope (ft/ft)	0.001187	Area (sq ft)		391.41	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	116.35	Top Width (ft)		116.35	
Vel Total (ft/s)	3.82	Avg. Vel. (ft/s)		3.82	
Max Chl Dpth (ft)	5.20	Hydr. Depth (ft)		3.36	
Conv. Total (cfs)	43363.4	Conv. (cfs)		43363.4	
Length Wtd. (ft)	225.93	Wetted Per. (ft)		117.01	
Min Ch El (ft)	2207.19	Shear (lb/sq ft)		0.25	
Alpha	1.00	Stream Power (lb/ft s)		0.95	
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)		1.40	
C & E Loss (ft)	0.13	Cum SA (acres)		0.43	

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 6200 Profile: PF 1

E.G. Elev (ft)	2211.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.55	Wt. n-Val.		0.030	
W.S. Elev (ft)	2210.35	Reach Len. (ft)			
Crit W.S. (ft)	2210.35	Flow Area (sq ft)		149.35	
E.G. Slope (ft/ft)	0.009453	Area (sq ft)		149.35	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	48.60	Top Width (ft)		48.60	
Vel Total (ft/s)	10.00	Avg. Vel. (ft/s)		10.00	
Max Chl Dpth (ft)	4.33	Hydr. Depth (ft)		3.07	
Conv. Total (cfs)	15365.9	Conv. (cfs)		15365.9	
Length Wtd. (ft)		Wetted Per. (ft)		49.88	
Min Ch El (ft)	2206.02	Shear (lb/sq ft)		1.77	
Alpha	1.00	Stream Power (lb/ft s)		17.68	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS Supercritical Detailed Output

Plan: 0.03 riprap Equestrian Levee 1 RS: 16700 Profile: PF 1

E.G. Elev (ft)	2381.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.30	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2379.99	Reach Len. (ft)	165.85	161.49	163.63
Crit W.S. (ft)	2380.40	Flow Area (sq ft)	4.03	17.34	
E.G. Slope (ft/ft)	0.039716	Area (sq ft)	4.03	17.34	
Q Total (cfs)	189.00	Flow (cfs)	23.59	165.41	
Top Width (ft)	23.68	Top Width (ft)	5.53	18.15	
Vel Total (ft/s)	8.85	Avg. Vel. (ft/s)	5.86	9.54	
Max Chl Dpth (ft)	1.54	Hydr. Depth (ft)	0.73	0.96	
Conv. Total (cfs)	948.4	Conv. (cfs)	118.4	830.0	
Length Wtd. (ft)	161.78	Wetted Per. (ft)	5.72	18.25	
Min Ch El (ft)	2378.45	Shear (lb/sq ft)	1.75	2.36	
Alpha	1.07	Stream Power (lb/ft s)	10.23	22.48	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.03	27.94	
C & E Loss (ft)		Cum SA (acres)	0.04	12.79	

Plan: 0.03 riprap Equestrian Levee 1 RS: 16550 Profile: PF 1

E.G. Elev (ft)	2376.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2376.17	Reach Len. (ft)	58.02	63.70	62.30
Crit W.S. (ft)	2376.20	Flow Area (sq ft)	0.67	40.50	
E.G. Slope (ft/ft)	0.020574	Area (sq ft)	0.67	40.50	
Q Total (cfs)	189.00	Flow (cfs)	1.33	187.67	
Top Width (ft)	79.24	Top Width (ft)	2.92	76.33	
Vel Total (ft/s)	4.59	Avg. Vel. (ft/s)	1.98	4.63	
Max Chl Dpth (ft)	2.67	Hydr. Depth (ft)	0.23	0.53	
Conv. Total (cfs)	1317.7	Conv. (cfs)	9.2	1308.4	
Length Wtd. (ft)	62.89	Wetted Per. (ft)	2.95	76.89	
Min Ch El (ft)	2373.50	Shear (lb/sq ft)	0.29	0.68	
Alpha	1.01	Stream Power (lb/ft s)	0.58	3.14	
Frctn Loss (ft)	4.50	Cum Volume (acre-ft)	0.02	27.83	
C & E Loss (ft)	0.29	Cum SA (acres)	0.03	12.62	

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16500 Profile: PF 1

E.G. Elev (ft)	2374.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.16	Wt. n-Val.	0.040	0.030	
W.S. Elev (ft)	2373.47	Reach Len. (ft)	118.90	93.39	59.36
Crit W.S. (ft)	2373.84	Flow Area (sq ft)	8.52	14.46	
E.G. Slope (ft/ft)	0.041933	Area (sq ft)	8.52	14.46	
Q Total (cfs)	189.00	Flow (cfs)	52.41	136.59	
Top Width (ft)	27.59	Top Width (ft)	11.61	15.98	
Vel Total (ft/s)	8.23	Avg. Vel. (ft/s)	6.15	9.45	
Max Chl Dpth (ft)	1.67	Hydr. Depth (ft)	0.73	0.91	
Conv. Total (cfs)	923.0	Conv. (cfs)	255.9	667.0	
Length Wtd. (ft)		Wetted Per. (ft)	11.70	16.08	
Min Ch El (ft)	2371.80	Shear (lb/sq ft)	1.90	2.35	
Alpha	1.11	Stream Power (lb/ft s)	11.72	22.23	

Plan: 0.03 riprap Equestrian Levee 1 RS: 16500 Profile: PF 1 (Continued)

Frctn Loss (ft)	1.79	Cum Volume (acre-ft)	0.01	27.79	
C & E Loss (ft)	0.08	Cum SA (acres)	0.02	12.55	

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16400 Profile: PF 1

E.G. Elev (ft)	2372.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.		0.030	
W.S. Elev (ft)	2372.22	Reach Len. (ft)	103.50	90.65	81.49
Crit W.S. (ft)	2372.22	Flow Area (sq ft)		32.68	
E.G. Slope (ft/ft)	0.013505	Area (sq ft)		32.68	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	32.18	Top Width (ft)		32.18	
Vel Total (ft/s)	5.78	Avg. Vel. (ft/s)		5.78	
Max Chl Dpth (ft)	1.80	Hydr. Depth (ft)		1.02	
Conv. Total (cfs)	1626.3	Conv. (cfs)		1626.3	
Length Wtd. (ft)	90.65	Wetted Per. (ft)		32.44	
Min Ch El (ft)	2370.42	Shear (lb/sq ft)		0.85	
Alpha	1.00	Stream Power (lb/ft s)		4.91	
Frctn Loss (ft)		Cum Volume (acre-ft)		27.74	
C & E Loss (ft)		Cum SA (acres)		12.50	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16300 Profile: PF 1

E.G. Elev (ft)	2370.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.13	Wt. n-Val.		0.030	
W.S. Elev (ft)	2369.59	Reach Len. (ft)	105.13	104.41	105.30
Crit W.S. (ft)	2369.95	Flow Area (sq ft)		22.16	
E.G. Slope (ft/ft)	0.040103	Area (sq ft)		22.16	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	27.63	Top Width (ft)		27.63	
Vel Total (ft/s)	8.53	Avg. Vel. (ft/s)		8.53	
Max Chl Dpth (ft)	1.19	Hydr. Depth (ft)		0.80	
Conv. Total (cfs)	943.8	Conv. (cfs)		943.8	
Length Wtd. (ft)	104.41	Wetted Per. (ft)		27.81	
Min Ch El (ft)	2368.40	Shear (lb/sq ft)		2.00	
Alpha	1.00	Stream Power (lb/ft s)		17.02	
Frctn Loss (ft)	1.96	Cum Volume (acre-ft)		27.68	

Plan: 0.03 riprap Equestrian Levee 1 RS: 16300 Profile: PF 1 (Continued)

C & E Loss (ft)	0.06	Cum SA (acres)		12.44	

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16200 Profile: PF 1

E.G. Elev (ft)	2367.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.030	
W.S. Elev (ft)	2367.36	Reach Len. (ft)	53.24	50.64	50.16
Crit W.S. (ft)	2367.45	Flow Area (sq ft)		29.59	
E.G. Slope (ft/ft)	0.016744	Area (sq ft)		29.59	
Q Total (cfs)	189.00	Flow (cfs)		189.00	
Top Width (ft)	29.49	Top Width (ft)		29.49	
Vel Total (ft/s)	6.39	Avg. Vel. (ft/s)		6.39	
Max Chl Dpth (ft)	1.66	Hydr. Depth (ft)		1.00	
Conv. Total (cfs)	1460.6	Conv. (cfs)		1460.6	
Length Wtd. (ft)	50.64	Wetted Per. (ft)		29.74	
Min Ch El (ft)	2365.70	Shear (lb/sq ft)		1.04	
Alpha	1.00	Stream Power (lb/ft s)		6.64	
Frctn Loss (ft)	2.58	Cum Volume (acre-ft)		27.62	
C & E Loss (ft)	0.15	Cum SA (acres)		12.37	

Errors Warnings and Notes

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16150 Profile: PF 1

E.G. Elev (ft)	2369.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.		0.030	
W.S. Elev (ft)	2368.15	Reach Len. (ft)	145.06	148.97	149.37
Crit W.S. (ft)	2368.15	Flow Area (sq ft)		115.04	
E.G. Slope (ft/ft)	0.010658	Area (sq ft)		115.04	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	58.81	Top Width (ft)		58.81	
Vel Total (ft/s)	7.95	Avg. Vel. (ft/s)		7.95	
Max Chl Dpth (ft)	3.25	Hydr. Depth (ft)		1.96	
Conv. Total (cfs)	8862.9	Conv. (cfs)		8862.9	
Length Wtd. (ft)	148.97	Wetted Per. (ft)		59.30	
Min Ch El (ft)	2364.90	Shear (lb/sq ft)		1.29	
Alpha	1.00	Stream Power (lb/ft s)		10.27	
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)		27.54	
C & E Loss (ft)	0.03	Cum SA (acres)		12.32	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Errors Warnings and Notes (Continued)

Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 16000 Profile: PF 1

E.G. Elev (ft)	2366.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.18	Wt. n-Val.		0.030	
W.S. Elev (ft)	2364.24	Reach Len. (ft)	48.94	47.28	46.67
Crit W.S. (ft)	2364.91	Flow Area (sq ft)		77.30	
E.G. Slope (ft/ft)	0.033785	Area (sq ft)		77.30	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	51.78	Top Width (ft)		51.78	
Vel Total (ft/s)	11.84	Avg. Vel. (ft/s)		11.84	
Max Chl Dpth (ft)	2.63	Hydr. Depth (ft)		1.49	
Conv. Total (cfs)	4978.0	Conv. (cfs)		4978.0	
Length Wtd. (ft)	47.28	Wetted Per. (ft)		52.14	
Min Ch El (ft)	2361.60	Shear (lb/sq ft)		3.13	
Alpha	1.00	Stream Power (lb/ft s)		37.02	
Frctn Loss (ft)	2.60	Cum Volume (acre-ft)		27.21	
C & E Loss (ft)	0.12	Cum SA (acres)		12.13	

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
	0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 15950 Profile: PF 1

E.G. Elev (ft)	2364.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.03	Wt. n-Val.		0.030	
W.S. Elev (ft)	2362.92	Reach Len. (ft)	453.40	452.43	454.29
Crit W.S. (ft)	2363.54	Flow Area (sq ft)		80.07	
E.G. Slope (ft/ft)	0.026802	Area (sq ft)		80.07	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	47.45	Top Width (ft)		47.45	
Vel Total (ft/s)	11.43	Avg. Vel. (ft/s)		11.43	
Max Chl Dpth (ft)	2.62	Hydr. Depth (ft)		1.69	
Conv. Total (cfs)	5589.0	Conv. (cfs)		5589.0	
Length Wtd. (ft)	452.43	Wetted Per. (ft)		47.85	
Min Ch El (ft)	2360.30	Shear (lb/sq ft)		2.80	
Alpha	1.00	Stream Power (lb/ft s)		31.99	
Frctn Loss (ft)	1.42	Cum Volume (acre-ft)		27.12	
C & E Loss (ft)	0.04	Cum SA (acres)		12.07	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 15500 Profile: PF 1

E.G. Elev (ft)	2353.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.92	Wt. n-Val.		0.030	
W.S. Elev (ft)	2351.35	Reach Len. (ft)	477.39	497.84	515.70
Crit W.S. (ft)	2351.92	Flow Area (sq ft)		82.39	
E.G. Slope (ft/ft)	0.024746	Area (sq ft)		82.39	
Q Total (cfs)	915.00	Flow (cfs)		915.00	
Top Width (ft)	48.00	Top Width (ft)		48.00	
Vel Total (ft/s)	11.11	Avg. Vel. (ft/s)		11.11	
Max Chl Dpth (ft)	2.85	Hydr. Depth (ft)		1.72	
Conv. Total (cfs)	5816.7	Conv. (cfs)		5816.7	
Length Wtd. (ft)	497.84	Wetted Per. (ft)		48.41	
Min Ch El (ft)	2348.50	Shear (lb/sq ft)		2.63	
Alpha	1.00	Stream Power (lb/ft s)		29.20	
Frctn Loss (ft)	11.65	Cum Volume (acre-ft)		26.28	
C & E Loss (ft)	0.03	Cum SA (acres)		11.58	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 15000 Profile: PF 1

E.G. Elev (ft)	2341.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.12	Wt. n-Val.		0.030	
W.S. Elev (ft)	2339.30	Reach Len. (ft)	291.41	291.65	296.07
Crit W.S. (ft)	2339.94	Flow Area (sq ft)		89.43	
E.G. Slope (ft/ft)	0.022913	Area (sq ft)		89.43	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	45.33	Top Width (ft)		45.33	
Vel Total (ft/s)	11.70	Avg. Vel. (ft/s)		11.70	
Max Chl Dpth (ft)	2.91	Hydr. Depth (ft)		1.97	
Conv. Total (cfs)	6910.2	Conv. (cfs)		6910.2	
Length Wtd. (ft)	291.65	Wetted Per. (ft)		45.90	
Min Ch El (ft)	2336.38	Shear (lb/sq ft)		2.79	
Alpha	1.00	Stream Power (lb/ft s)		32.60	
Frctn Loss (ft)	11.82	Cum Volume (acre-ft)		25.30	
C & E Loss (ft)	0.02	Cum SA (acres)		11.04	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 14700 Profile: PF 1

E.G. Elev (ft)	2334.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.91	Wt. n-Val.		0.030	
W.S. Elev (ft)	2332.34	Reach Len. (ft)	201.79	199.36	194.11
Crit W.S. (ft)	2332.93	Flow Area (sq ft)		94.31	
E.G. Slope (ft/ft)	0.025970	Area (sq ft)		94.31	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	57.25	Top Width (ft)		57.25	
Vel Total (ft/s)	11.09	Avg. Vel. (ft/s)		11.09	
Max Chl Dpth (ft)	2.58	Hydr. Depth (ft)		1.65	
Conv. Total (cfs)	6490.8	Conv. (cfs)		6490.8	
Length Wtd. (ft)	199.36	Wetted Per. (ft)		57.58	

Plan: 0.03 riprap Equestrian Levee 1 RS: 14700 Profile: PF 1 (Continued)

Min Ch El (ft)	2329.76	Shear (lb/sq ft)		2.66	
Alpha	1.00	Stream Power (lb/ft s)		29.45	
Frctn Loss (ft)	7.11	Cum Volume (acre-ft)		24.68	
C & E Loss (ft)	0.06	Cum SA (acres)		10.70	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 14500 Profile: PF 1

E.G. Elev (ft)	2329.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.04	Wt. n-Val.		0.030	
W.S. Elev (ft)	2327.27	Reach Len. (ft)	488.30	492.11	499.23
Crit W.S. (ft)	2327.88	Flow Area (sq ft)		91.31	
E.G. Slope (ft/ft)	0.023550	Area (sq ft)		91.31	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	48.87	Top Width (ft)		48.87	
Vel Total (ft/s)	11.46	Avg. Vel. (ft/s)		11.46	
Max Chl Dpth (ft)	2.66	Hydr. Depth (ft)		1.87	
Conv. Total (cfs)	6816.1	Conv. (cfs)		6816.1	
Length Wtd. (ft)	492.11	Wetted Per. (ft)		49.36	
Min Ch El (ft)	2324.61	Shear (lb/sq ft)		2.72	
Alpha	1.00	Stream Power (lb/ft s)		31.16	
Frctn Loss (ft)	4.93	Cum Volume (acre-ft)		24.26	
C & E Loss (ft)	0.01	Cum SA (acres)		10.46	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 14000 Profile: PF 1

E.G. Elev (ft)	2317.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.03	Wt. n-Val.		0.030	
W.S. Elev (ft)	2315.46	Reach Len. (ft)	211.60	212.66	211.08
Crit W.S. (ft)	2316.07	Flow Area (sq ft)		91.45	
E.G. Slope (ft/ft)	0.024499	Area (sq ft)		91.45	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	50.59	Top Width (ft)		50.59	
Vel Total (ft/s)	11.44	Avg. Vel. (ft/s)		11.44	
Max Chl Dpth (ft)	2.68	Hydr. Depth (ft)		1.81	
Conv. Total (cfs)	6682.7	Conv. (cfs)		6682.7	
Length Wtd. (ft)	212.66	Wetted Per. (ft)		51.03	
Min Ch El (ft)	2312.78	Shear (lb/sq ft)		2.74	
Alpha	1.00	Stream Power (lb/ft s)		31.35	
Frctn Loss (ft)	11.82	Cum Volume (acre-ft)		23.23	
C & E Loss (ft)	0.00	Cum SA (acres)		9.90	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 13800 Profile: PF 1

E.G. Elev (ft)	2312.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.16	Wt. n-Val.		0.030	
W.S. Elev (ft)	2309.84	Reach Len. (ft)	557.87	552.29	550.96
Crit W.S. (ft)	2310.51	Flow Area (sq ft)		88.63	
E.G. Slope (ft/ft)	0.027081	Area (sq ft)		88.63	
Q Total (cfs)	1046.00	Flow (cfs)		1046.00	
Top Width (ft)	50.44	Top Width (ft)		50.44	
Vel Total (ft/s)	11.80	Avg. Vel. (ft/s)		11.80	
Max Chl Dpth (ft)	2.60	Hydr. Depth (ft)		1.76	
Conv. Total (cfs)	6356.2	Conv. (cfs)		6356.2	
Length Wtd. (ft)	552.29	Wetted Per. (ft)		50.87	
Min Ch El (ft)	2307.24	Shear (lb/sq ft)		2.95	
Alpha	1.00	Stream Power (lb/ft s)		34.76	
Frctn Loss (ft)	5.47	Cum Volume (acre-ft)		22.79	
C & E Loss (ft)	0.01	Cum SA (acres)		9.65	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 13250 Profile: PF 1

E.G. Elev (ft)	2298.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.01	Wt. n-Val.		0.030	
W.S. Elev (ft)	2296.62	Reach Len. (ft)	239.07	232.43	224.09
Crit W.S. (ft)	2297.20	Flow Area (sq ft)		115.72	
E.G. Slope (ft/ft)	0.022129	Area (sq ft)		115.72	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	59.93	Top Width (ft)		59.93	
Vel Total (ft/s)	11.36	Avg. Vel. (ft/s)		11.36	
Max Chl Dpth (ft)	2.96	Hydr. Depth (ft)		1.93	
Conv. Total (cfs)	8839.9	Conv. (cfs)		8839.9	
Length Wtd. (ft)	232.43	Wetted Per. (ft)		60.41	
Min Ch El (ft)	2293.65	Shear (lb/sq ft)		2.65	
Alpha	1.00	Stream Power (lb/ft s)		30.07	
Frctn Loss (ft)	13.33	Cum Volume (acre-ft)		21.49	
C & E Loss (ft)	0.05	Cum SA (acres)		8.95	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 13000 Profile: PF 1

E.G. Elev (ft)	2293.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.38	Wt. n-Val.		0.030	
W.S. Elev (ft)	2290.89	Reach Len. (ft)	318.36	308.42	296.29
Crit W.S. (ft)	2291.61	Flow Area (sq ft)		106.23	
E.G. Slope (ft/ft)	0.023611	Area (sq ft)		106.23	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	50.63	Top Width (ft)		50.63	
Vel Total (ft/s)	12.38	Avg. Vel. (ft/s)		12.38	
Max Chl Dpth (ft)	3.14	Hydr. Depth (ft)		2.10	
Conv. Total (cfs)	8558.0	Conv. (cfs)		8558.0	
Length Wtd. (ft)	308.42	Wetted Per. (ft)		51.21	

Plan: 0.03 riprap Equestrian Levee 1 RS: 13000 Profile: PF 1 (Continued)

Min Ch El (ft)	2287.75	Shear (lb/sq ft)		3.06	
Alpha	1.00	Stream Power (lb/ft s)		37.85	
Frctn Loss (ft)	5.31	Cum Volume (acre-ft)		20.90	
C & E Loss (ft)	0.04	Cum SA (acres)		8.66	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 12700 Profile: PF 1

E.G. Elev (ft)	2286.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.07	Wt. n-Val.		0.030	
W.S. Elev (ft)	2284.23	Reach Len. (ft)	206.38	204.91	200.49
Crit W.S. (ft)	2284.81	Flow Area (sq ft)		113.91	
E.G. Slope (ft/ft)	0.021094	Area (sq ft)		113.91	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	55.48	Top Width (ft)		55.48	
Vel Total (ft/s)	11.54	Avg. Vel. (ft/s)		11.54	
Max Chl Dpth (ft)	2.74	Hydr. Depth (ft)		2.05	
Conv. Total (cfs)	9054.2	Conv. (cfs)		9054.2	
Length Wtd. (ft)	204.91	Wetted Per. (ft)		56.03	
Min Ch El (ft)	2281.49	Shear (lb/sq ft)		2.68	
Alpha	1.00	Stream Power (lb/ft s)		30.91	
Frctn Loss (ft)	6.88	Cum Volume (acre-ft)		20.12	
C & E Loss (ft)	0.09	Cum SA (acres)		8.28	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 12500 Profile: PF 1

E.G. Elev (ft)	2282.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.89	Wt. n-Val.		0.030	
W.S. Elev (ft)	2280.51	Reach Len. (ft)	486.51	484.94	479.60
Crit W.S. (ft)	2280.97	Flow Area (sq ft)		119.16	
E.G. Slope (ft/ft)	0.016817	Area (sq ft)		119.16	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	52.20	Top Width (ft)		52.20	
Vel Total (ft/s)	11.04	Avg. Vel. (ft/s)		11.04	
Max Chl Dpth (ft)	2.95	Hydr. Depth (ft)		2.28	
Conv. Total (cfs)	10140.4	Conv. (cfs)		10140.4	
Length Wtd. (ft)	484.94	Wetted Per. (ft)		52.92	
Min Ch El (ft)	2277.56	Shear (lb/sq ft)		2.36	
Alpha	1.00	Stream Power (lb/ft s)		26.09	
Frctn Loss (ft)	3.85	Cum Volume (acre-ft)		19.57	
C & E Loss (ft)	0.05	Cum SA (acres)		8.03	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 12000 Profile: PF 1

E.G. Elev (ft)	2273.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.93	Wt. n-Val.		0.030	
W.S. Elev (ft)	2271.95	Reach Len. (ft)	507.89	506.83	513.43
Crit W.S. (ft)	2272.45	Flow Area (sq ft)		117.98	
E.G. Slope (ft/ft)	0.018365	Area (sq ft)		117.98	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	54.44	Top Width (ft)		54.44	
Vel Total (ft/s)	11.15	Avg. Vel. (ft/s)		11.15	
Max Chl Dpth (ft)	2.88	Hydr. Depth (ft)		2.17	
Conv. Total (cfs)	9703.5	Conv. (cfs)		9703.5	
Length Wtd. (ft)	506.83	Wetted Per. (ft)		55.14	
Min Ch El (ft)	2269.07	Shear (lb/sq ft)		2.45	
Alpha	1.00	Stream Power (lb/ft s)		27.34	
Frctn Loss (ft)	8.52	Cum Volume (acre-ft)		18.25	
C & E Loss (ft)	0.00	Cum SA (acres)		7.43	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 11500 Profile: PF 1

E.G. Elev (ft)	2266.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.49	Wt. n-Val.		0.030	
W.S. Elev (ft)	2264.73	Reach Len. (ft)	503.11	506.08	506.93
Crit W.S. (ft)	2264.91	Flow Area (sq ft)		134.17	
E.G. Slope (ft/ft)	0.012257	Area (sq ft)		134.17	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	55.33	Top Width (ft)		55.33	
Vel Total (ft/s)	9.80	Avg. Vel. (ft/s)		9.80	
Max Chl Dpth (ft)	3.24	Hydr. Depth (ft)		2.43	
Conv. Total (cfs)	11877.7	Conv. (cfs)		11877.7	
Length Wtd. (ft)	506.08	Wetted Per. (ft)		56.15	
Min Ch El (ft)	2261.49	Shear (lb/sq ft)		1.83	
Alpha	1.00	Stream Power (lb/ft s)		17.92	
Frctn Loss (ft)	7.53	Cum Volume (acre-ft)		16.78	
C & E Loss (ft)	0.13	Cum SA (acres)		6.79	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 11000 Profile: PF 1

E.G. Elev (ft)	2259.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.85	Wt. n-Val.		0.030	
W.S. Elev (ft)	2257.19	Reach Len. (ft)	488.17	484.98	483.12
Crit W.S. (ft)	2257.62	Flow Area (sq ft)		120.61	
E.G. Slope (ft/ft)	0.016519	Area (sq ft)		120.61	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	53.04	Top Width (ft)		53.04	
Vel Total (ft/s)	10.90	Avg. Vel. (ft/s)		10.90	
Max Chl Dpth (ft)	3.18	Hydr. Depth (ft)		2.27	
Conv. Total (cfs)	10231.4	Conv. (cfs)		10231.4	
Length Wtd. (ft)	484.98	Wetted Per. (ft)		53.81	

Plan: 0.03 riprap Equestrian Levee 1 RS: 11000 Profile: PF 1 (Continued)

Min Ch El (ft)	2254.01	Shear (lb/sq ft)		2.31	
Alpha	1.00	Stream Power (lb/ft s)		25.20	
Frctn Loss (ft)	7.16	Cum Volume (acre-ft)		15.30	
C & E Loss (ft)	0.04	Cum SA (acres)		6.16	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 10500 Profile: PF 1

E.G. Elev (ft)	2251.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.60	Wt. n-Val.		0.030	
W.S. Elev (ft)	2249.99	Reach Len. (ft)	489.27	487.90	486.53
Crit W.S. (ft)	2250.27	Flow Area (sq ft)		129.64	
E.G. Slope (ft/ft)	0.014066	Area (sq ft)		129.64	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	56.41	Top Width (ft)		56.41	
Vel Total (ft/s)	10.14	Avg. Vel. (ft/s)		10.14	
Max Chl Dpth (ft)	3.06	Hydr. Depth (ft)		2.30	
Conv. Total (cfs)	11087.6	Conv. (cfs)		11087.6	
Length Wtd. (ft)	487.90	Wetted Per. (ft)		57.13	
Min Ch El (ft)	2246.93	Shear (lb/sq ft)		1.99	
Alpha	1.00	Stream Power (lb/ft s)		20.21	
Frctn Loss (ft)	7.38	Cum Volume (acre-ft)		13.91	
C & E Loss (ft)	0.07	Cum SA (acres)		5.56	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 10000 Profile: PF 1

E.G. Elev (ft)	2244.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.82	Wt. n-Val.		0.030	
W.S. Elev (ft)	2242.31	Reach Len. (ft)	505.70	509.20	513.80
Crit W.S. (ft)	2242.74	Flow Area (sq ft)		121.37	
E.G. Slope (ft/ft)	0.016535	Area (sq ft)		121.37	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	53.98	Top Width (ft)		53.98	
Vel Total (ft/s)	10.83	Avg. Vel. (ft/s)		10.83	
Max Chl Dpth (ft)	2.88	Hydr. Depth (ft)		2.25	
Conv. Total (cfs)	10226.4	Conv. (cfs)		10226.4	
Length Wtd. (ft)	509.20	Wetted Per. (ft)		54.70	
Min Ch El (ft)	2239.43	Shear (lb/sq ft)		2.29	
Alpha	1.00	Stream Power (lb/ft s)		24.81	
Frctn Loss (ft)	7.43	Cum Volume (acre-ft)		12.50	
C & E Loss (ft)	0.02	Cum SA (acres)		4.94	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 9500 Profile: PF 1

E.G. Elev (ft)	2236.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.66	Wt. n-Val.		0.030	
W.S. Elev (ft)	2234.65	Reach Len. (ft)	510.84	507.98	503.79
Crit W.S. (ft)	2234.96	Flow Area (sq ft)		127.29	
E.G. Slope (ft/ft)	0.014161	Area (sq ft)		127.29	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	54.05	Top Width (ft)		54.05	
Vel Total (ft/s)	10.33	Avg. Vel. (ft/s)		10.33	
Max Chl Dpth (ft)	2.94	Hydr. Depth (ft)		2.36	
Conv. Total (cfs)	11050.4	Conv. (cfs)		11050.4	
Length Wtd. (ft)	507.98	Wetted Per. (ft)		54.86	
Min Ch El (ft)	2231.71	Shear (lb/sq ft)		2.05	
Alpha	1.00	Stream Power (lb/ft s)		21.19	
Frctn Loss (ft)	7.78	Cum Volume (acre-ft)		11.05	
C & E Loss (ft)	0.05	Cum SA (acres)		4.31	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 9000 Profile: PF 1

E.G. Elev (ft)	2229.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.68	Wt. n-Val.		0.030	
W.S. Elev (ft)	2227.47	Reach Len. (ft)	370.90	376.74	384.81
Crit W.S. (ft)	2227.78	Flow Area (sq ft)		126.57	
E.G. Slope (ft/ft)	0.014028	Area (sq ft)		126.57	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	52.91	Top Width (ft)		52.91	
Vel Total (ft/s)	10.39	Avg. Vel. (ft/s)		10.39	
Max Chl Dpth (ft)	3.12	Hydr. Depth (ft)		2.39	
Conv. Total (cfs)	11102.5	Conv. (cfs)		11102.5	
Length Wtd. (ft)	376.74	Wetted Per. (ft)		53.71	
Min Ch El (ft)	2224.35	Shear (lb/sq ft)		2.06	
Alpha	1.00	Stream Power (lb/ft s)		21.44	
Frctn Loss (ft)	7.16	Cum Volume (acre-ft)		9.57	
C & E Loss (ft)	0.00	Cum SA (acres)		3.68	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8600 Profile: PF 1

E.G. Elev (ft)	2223.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.88	Wt. n-Val.		0.030	
W.S. Elev (ft)	2221.26	Reach Len. (ft)	127.50	125.18	122.70
Crit W.S. (ft)	2221.74	Flow Area (sq ft)		119.47	
E.G. Slope (ft/ft)	0.018109	Area (sq ft)		119.47	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	55.59	Top Width (ft)		55.59	
Vel Total (ft/s)	11.01	Avg. Vel. (ft/s)		11.01	
Max Chl Dpth (ft)	2.70	Hydr. Depth (ft)		2.15	
Conv. Total (cfs)	9772.0	Conv. (cfs)		9772.0	
Length Wtd. (ft)		Wetted Per. (ft)		56.30	

Plan: 0.03 riprap Equestrian Levee 1 RS: 8600 Profile: PF 1 (Continued)

Min Ch El (ft)	2218.56	Shear (lb/sq ft)		2.40	
Alpha	1.00	Stream Power (lb/ft s)		26.41	
Frctn Loss (ft)	5.98	Cum Volume (acre-ft)		8.51	
C & E Loss (ft)	0.02	Cum SA (acres)		3.21	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8500 Profile: PF 1

E.G. Elev (ft)	2222.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.38	Wt. n-Val.		0.030	
W.S. Elev (ft)	2221.52	Reach Len. (ft)	237.20	250.13	271.01
Crit W.S. (ft)	2221.52	Flow Area (sq ft)		139.57	
E.G. Slope (ft/ft)	0.009641	Area (sq ft)		139.57	
Q Total (cfs)	1315.00	Flow (cfs)		1315.00	
Top Width (ft)	50.74	Top Width (ft)		50.74	
Vel Total (ft/s)	9.42	Avg. Vel. (ft/s)		9.42	
Max Chl Dpth (ft)	4.08	Hydr. Depth (ft)		2.75	
Conv. Total (cfs)	13392.6	Conv. (cfs)		13392.6	
Length Wtd. (ft)		Wetted Per. (ft)		51.76	
Min Ch El (ft)	2217.44	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		15.29	
Frctn Loss (ft)		Cum Volume (acre-ft)		8.14	
C & E Loss (ft)		Cum SA (acres)		3.06	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8200 Profile: PF 1

E.G. Elev (ft)	2220.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.45	Wt. n-Val.		0.030	
W.S. Elev (ft)	2219.41	Reach Len. (ft)	126.81	126.78	146.01
Crit W.S. (ft)	2219.41	Flow Area (sq ft)		148.62	
E.G. Slope (ft/ft)	0.009567	Area (sq ft)		148.62	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	51.55	Top Width (ft)		51.55	
Vel Total (ft/s)	9.68	Avg. Vel. (ft/s)		9.68	
Max Chl Dpth (ft)	4.04	Hydr. Depth (ft)		2.88	
Conv. Total (cfs)	14701.5	Conv. (cfs)		14701.5	
Length Wtd. (ft)		Wetted Per. (ft)		52.66	
Min Ch El (ft)	2215.37	Shear (lb/sq ft)		1.69	
Alpha	1.00	Stream Power (lb/ft s)		16.31	
Frctn Loss (ft)		Cum Volume (acre-ft)		7.31	
C & E Loss (ft)		Cum SA (acres)		2.77	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

Errors Warnings and Notes (Continued)

	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 8150 Profile: PF 1

E.G. Elev (ft)	2219.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.28	Wt. n-Val.		0.030	
W.S. Elev (ft)	2218.45	Reach Len. (ft)	276.71	311.53	329.29
Crit W.S. (ft)	2218.45	Flow Area (sq ft)		158.12	
E.G. Slope (ft/ft)	0.009754	Area (sq ft)		158.12	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	61.57	Top Width (ft)		61.57	
Vel Total (ft/s)	9.09	Avg. Vel. (ft/s)		9.09	
Max Chl Dpth (ft)	3.38	Hydr. Depth (ft)		2.57	
Conv. Total (cfs)	14560.3	Conv. (cfs)		14560.3	
Length Wtd. (ft)	311.53	Wetted Per. (ft)		62.38	
Min Ch El (ft)	2215.06	Shear (lb/sq ft)		1.54	
Alpha	1.00	Stream Power (lb/ft s)		14.04	
Frctn Loss (ft)		Cum Volume (acre-ft)		6.86	
C & E Loss (ft)		Cum SA (acres)		2.60	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7800 Profile: PF 1

E.G. Elev (ft)	2220.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.37	Wt. n-Val.		0.030	
W.S. Elev (ft)	2218.73	Reach Len. (ft)	371.21	338.75	316.55
Crit W.S. (ft)	2218.73	Flow Area (sq ft)		153.22	
E.G. Slope (ft/ft)	0.009783	Area (sq ft)		153.22	
Q Total (cfs)	1438.00	Flow (cfs)		1438.00	
Top Width (ft)	56.77	Top Width (ft)		56.77	
Vel Total (ft/s)	9.39	Avg. Vel. (ft/s)		9.39	
Max Chl Dpth (ft)	4.58	Hydr. Depth (ft)		2.70	
Conv. Total (cfs)	14538.4	Conv. (cfs)		14538.4	
Length Wtd. (ft)	338.75	Wetted Per. (ft)		57.79	
Min Ch El (ft)	2214.15	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		15.20	
Frctn Loss (ft)	3.04	Cum Volume (acre-ft)		5.75	
C & E Loss (ft)	0.01	Cum SA (acres)		2.18	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7450 Profile: PF 1

E.G. Elev (ft)	2216.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.74	Wt. n-Val.		0.030	
W.S. Elev (ft)	2214.66	Reach Len. (ft)	53.71	56.71	50.31
Crit W.S. (ft)	2214.90	Flow Area (sq ft)		141.11	
E.G. Slope (ft/ft)	0.011960	Area (sq ft)		141.11	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	

Plan: 0.03 riprap Equestrian Levee 1 RS: 7450 Profile: PF 1 (Continued)

Top Width (ft)	50.58	Top Width (ft)		50.58	
Vel Total (ft/s)	10.59	Avg. Vel. (ft/s)		10.59	
Max Chl Dpth (ft)	3.99	Hydr. Depth (ft)		2.79	
Conv. Total (cfs)	13661.3	Conv. (cfs)		13661.3	
Length Wtd. (ft)		Wetted Per. (ft)		51.64	
Min Ch El (ft)	2210.67	Shear (lb/sq ft)		2.04	
Alpha	1.00	Stream Power (lb/ft s)		21.60	
Frctn Loss (ft)	3.66	Cum Volume (acre-ft)		4.60	
C & E Loss (ft)	0.04	Cum SA (acres)		1.76	

Errors Warnings and Notes

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7423 Profile: PF 1

E.G. Elev (ft)	2216.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.47	Wt. n-Val.		0.030	
W.S. Elev (ft)	2214.67	Reach Len. (ft)	77.11	63.35	45.09
Crit W.S. (ft)	2214.67	Flow Area (sq ft)		153.62	
E.G. Slope (ft/ft)	0.009488	Area (sq ft)		153.62	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	52.58	Top Width (ft)		52.58	
Vel Total (ft/s)	9.73	Avg. Vel. (ft/s)		9.73	
Max Chl Dpth (ft)	4.13	Hydr. Depth (ft)		2.92	
Conv. Total (cfs)	15338.1	Conv. (cfs)		15338.1	
Length Wtd. (ft)	63.35	Wetted Per. (ft)		53.68	
Min Ch El (ft)	2210.53	Shear (lb/sq ft)		1.70	
Alpha	1.00	Stream Power (lb/ft s)		16.49	
Frctn Loss (ft)		Cum Volume (acre-ft)		4.41	
C & E Loss (ft)		Cum SA (acres)		1.69	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7350 Profile: PF 1

E.G. Elev (ft)	2215.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.74	Wt. n-Val.		0.030	
W.S. Elev (ft)	2213.66	Reach Len. (ft)	107.12	101.83	91.00
Crit W.S. (ft)	2213.96	Flow Area (sq ft)		141.05	
E.G. Slope (ft/ft)	0.013219	Area (sq ft)		141.05	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	54.71	Top Width (ft)		54.71	
Vel Total (ft/s)	10.59	Avg. Vel. (ft/s)		10.59	
Max Chl Dpth (ft)	3.73	Hydr. Depth (ft)		2.58	
Conv. Total (cfs)	12994.1	Conv. (cfs)		12994.1	
Length Wtd. (ft)	101.83	Wetted Per. (ft)		55.61	
Min Ch El (ft)	2209.93	Shear (lb/sq ft)		2.09	
Alpha	1.00	Stream Power (lb/ft s)		22.17	
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)		4.20	
C & E Loss (ft)	0.03	Cum SA (acres)		1.62	

Plan: 0.03 riprap Equestrian Levee 1 RS: 7238 Profile: PF 1

E.G. Elev (ft)	2215.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.49	Wt. n-Val.		0.030	
W.S. Elev (ft)	2214.38	Reach Len. (ft)	138.64	118.47	119.62
Crit W.S. (ft)	2214.38	Flow Area (sq ft)		152.26	
E.G. Slope (ft/ft)	0.009541	Area (sq ft)		152.26	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	51.58	Top Width (ft)		51.58	
Vel Total (ft/s)	9.81	Avg. Vel. (ft/s)		9.81	
Max Chl Dpth (ft)	4.53	Hydr. Depth (ft)		2.95	
Conv. Total (cfs)	15295.2	Conv. (cfs)		15295.2	
Length Wtd. (ft)		Wetted Per. (ft)		52.72	
Min Ch El (ft)	2209.85	Shear (lb/sq ft)		1.72	
Alpha	1.00	Stream Power (lb/ft s)		16.88	
Frctn Loss (ft)	1.14	Cum Volume (acre-ft)		3.85	
C & E Loss (ft)	0.07	Cum SA (acres)		1.49	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7100 Profile: PF 1

E.G. Elev (ft)	2214.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.45	Wt. n-Val.		0.030	
W.S. Elev (ft)	2213.44	Reach Len. (ft)	72.03	82.47	73.42
Crit W.S. (ft)	2213.44	Flow Area (sq ft)		154.45	
E.G. Slope (ft/ft)	0.009605	Area (sq ft)		154.45	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	53.87	Top Width (ft)		53.87	
Vel Total (ft/s)	9.67	Avg. Vel. (ft/s)		9.67	
Max Chl Dpth (ft)	4.04	Hydr. Depth (ft)		2.87	
Conv. Total (cfs)	15244.2	Conv. (cfs)		15244.2	
Length Wtd. (ft)		Wetted Per. (ft)		54.91	
Min Ch El (ft)	2209.40	Shear (lb/sq ft)		1.69	
Alpha	1.00	Stream Power (lb/ft s)		16.32	
Frctn Loss (ft)		Cum Volume (acre-ft)		3.44	
C & E Loss (ft)		Cum SA (acres)		1.35	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Plan: 0.03 riprap Equestrian Levee 1 RS: 7000 Profile: PF 1

E.G. Elev (ft)	2214.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.49	Wt. n-Val.		0.030	
W.S. Elev (ft)	2213.30	Reach Len. (ft)	312.84	314.62	317.21
Crit W.S. (ft)	2213.30	Flow Area (sq ft)		152.33	
E.G. Slope (ft/ft)	0.009404	Area (sq ft)		152.33	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	51.02	Top Width (ft)		51.02	
Vel Total (ft/s)	9.81	Avg. Vel. (ft/s)		9.81	
Max Chl Dpth (ft)	4.24	Hydr. Depth (ft)		2.99	
Conv. Total (cfs)	15406.2	Conv. (cfs)		15406.2	
Length Wtd. (ft)		Wetted Per. (ft)		52.21	

Plan: 0.03 riprap Equestrian Levee 1 RS: 7000 Profile: PF 1 (Continued)

Min Ch El (ft)	2209.06	Shear (lb/sq ft)		1.71	
Alpha	1.00	Stream Power (lb/ft s)		16.80	
Frctn Loss (ft)		Cum Volume (acre-ft)		3.15	
C & E Loss (ft)		Cum SA (acres)		1.25	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Plan: 0.03 riprap Equestrian Levee 1 RS: 6700 Profile: PF 1

E.G. Elev (ft)	2212.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.30	Wt. n-Val.		0.030	
W.S. Elev (ft)	2211.14	Reach Len. (ft)	199.94	201.89	205.00
Crit W.S. (ft)	2211.14	Flow Area (sq ft)		163.24	
E.G. Slope (ft/ft)	0.009801	Area (sq ft)		163.24	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	63.28	Top Width (ft)		63.28	
Vel Total (ft/s)	9.15	Avg. Vel. (ft/s)		9.15	
Max Chl Dpth (ft)	3.72	Hydr. Depth (ft)		2.58	
Conv. Total (cfs)	15090.6	Conv. (cfs)		15090.6	
Length Wtd. (ft)		Wetted Per. (ft)		64.02	
Min Ch El (ft)	2207.42	Shear (lb/sq ft)		1.56	
Alpha	1.00	Stream Power (lb/ft s)		14.28	
Frctn Loss (ft)		Cum Volume (acre-ft)		2.01	
C & E Loss (ft)		Cum SA (acres)		0.84	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: 0.03 riprap Equestrian Levee 1 RS: 6500 Profile: PF 1

E.G. Elev (ft)	2211.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.14	Wt. n-Val.		0.030	
W.S. Elev (ft)	2210.85	Reach Len. (ft)	86.71	92.02	103.63
Crit W.S. (ft)	2210.85	Flow Area (sq ft)		174.33	
E.G. Slope (ft/ft)	0.010181	Area (sq ft)		174.33	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	77.18	Top Width (ft)		77.18	
Vel Total (ft/s)	8.57	Avg. Vel. (ft/s)		8.57	
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)		2.26	
Conv. Total (cfs)	14806.5	Conv. (cfs)		14806.5	
Length Wtd. (ft)		Wetted Per. (ft)		77.63	
Min Ch El (ft)	2207.56	Shear (lb/sq ft)		1.43	
Alpha	1.00	Stream Power (lb/ft s)		12.23	
Frctn Loss (ft)		Cum Volume (acre-ft)		1.23	
C & E Loss (ft)		Cum SA (acres)		0.51	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Plan: 0.03 riprap Equestrian Levee 1 RS: 6400 Profile: PF 1

E.G. Elev (ft)	2211.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.08	Wt. n-Val.		0.030	
W.S. Elev (ft)	2210.27	Reach Len. (ft)	207.89	225.93	234.71
Crit W.S. (ft)	2210.27	Flow Area (sq ft)		179.23	
E.G. Slope (ft/ft)	0.010234	Area (sq ft)		179.23	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	83.15	Top Width (ft)		83.15	
Vel Total (ft/s)	8.34	Avg. Vel. (ft/s)		8.34	
Max Chl Dpth (ft)	3.08	Hydr. Depth (ft)		2.16	
Conv. Total (cfs)	14768.1	Conv. (cfs)		14768.1	
Length Wtd. (ft)	225.93	Wetted Per. (ft)		83.53	
Min Ch El (ft)	2207.19	Shear (lb/sq ft)		1.37	
Alpha	1.00	Stream Power (lb/ft s)		11.43	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.85	
C & E Loss (ft)		Cum SA (acres)		0.34	

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

Plan: 0.03 riprap Equestrian Levee 1 RS: 6200 Profile: PF 1

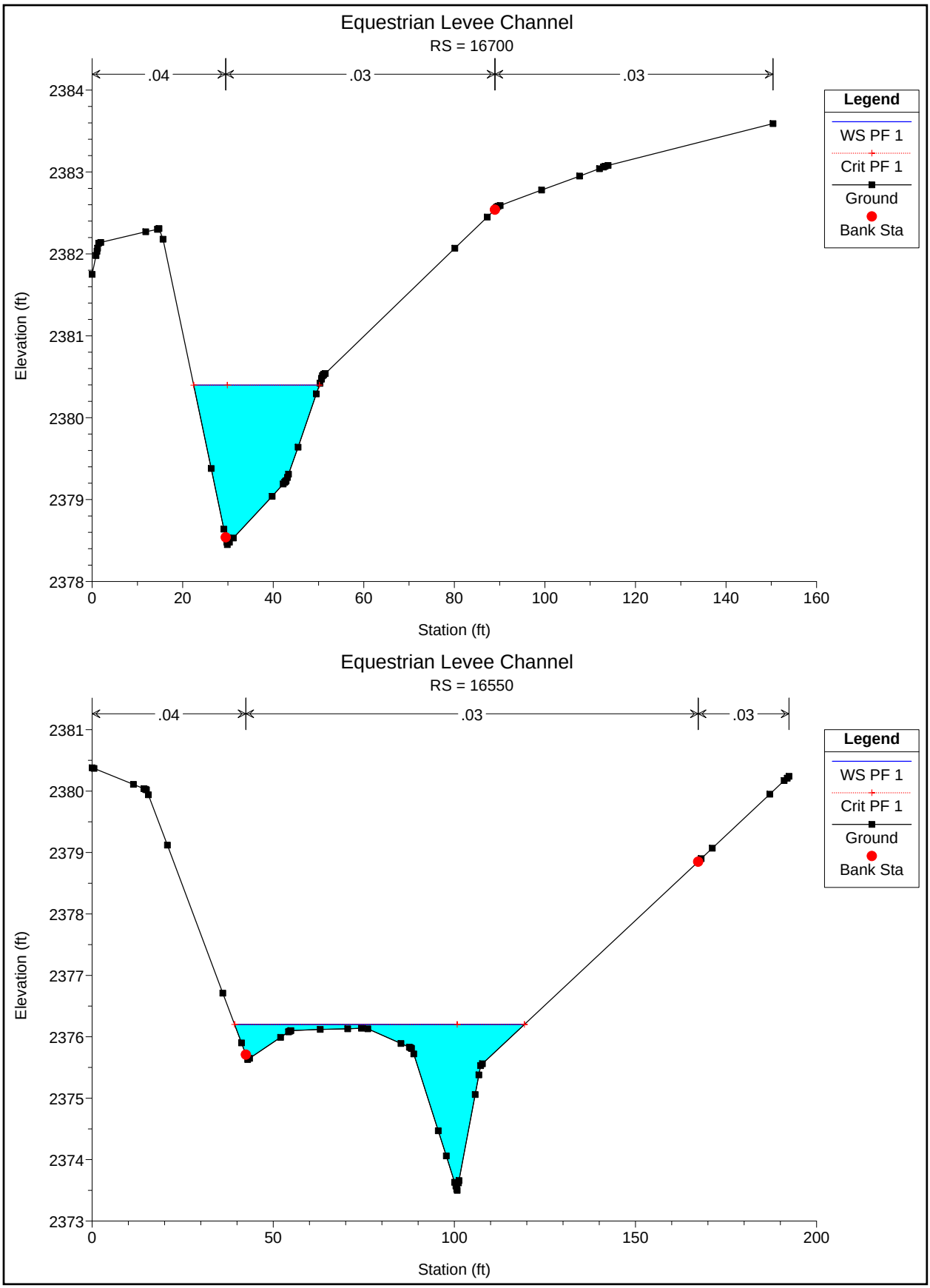
E.G. Elev (ft)	2211.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.56	Wt. n-Val.		0.030	
W.S. Elev (ft)	2210.35	Reach Len. (ft)			
Crit W.S. (ft)	2210.35	Flow Area (sq ft)		149.23	
E.G. Slope (ft/ft)	0.009474	Area (sq ft)		149.23	
Q Total (cfs)	1494.00	Flow (cfs)		1494.00	
Top Width (ft)	48.58	Top Width (ft)		48.58	
Vel Total (ft/s)	10.01	Avg. Vel. (ft/s)		10.01	
Max Chl Dpth (ft)	4.33	Hydr. Depth (ft)		3.07	
Conv. Total (cfs)	15349.0	Conv. (cfs)		15349.0	
Length Wtd. (ft)		Wetted Per. (ft)		49.87	
Min Ch El (ft)	2206.02	Shear (lb/sq ft)		1.77	
Alpha	1.00	Stream Power (lb/ft s)		17.72	
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)			
C & E Loss (ft)	0.05	Cum SA (acres)			

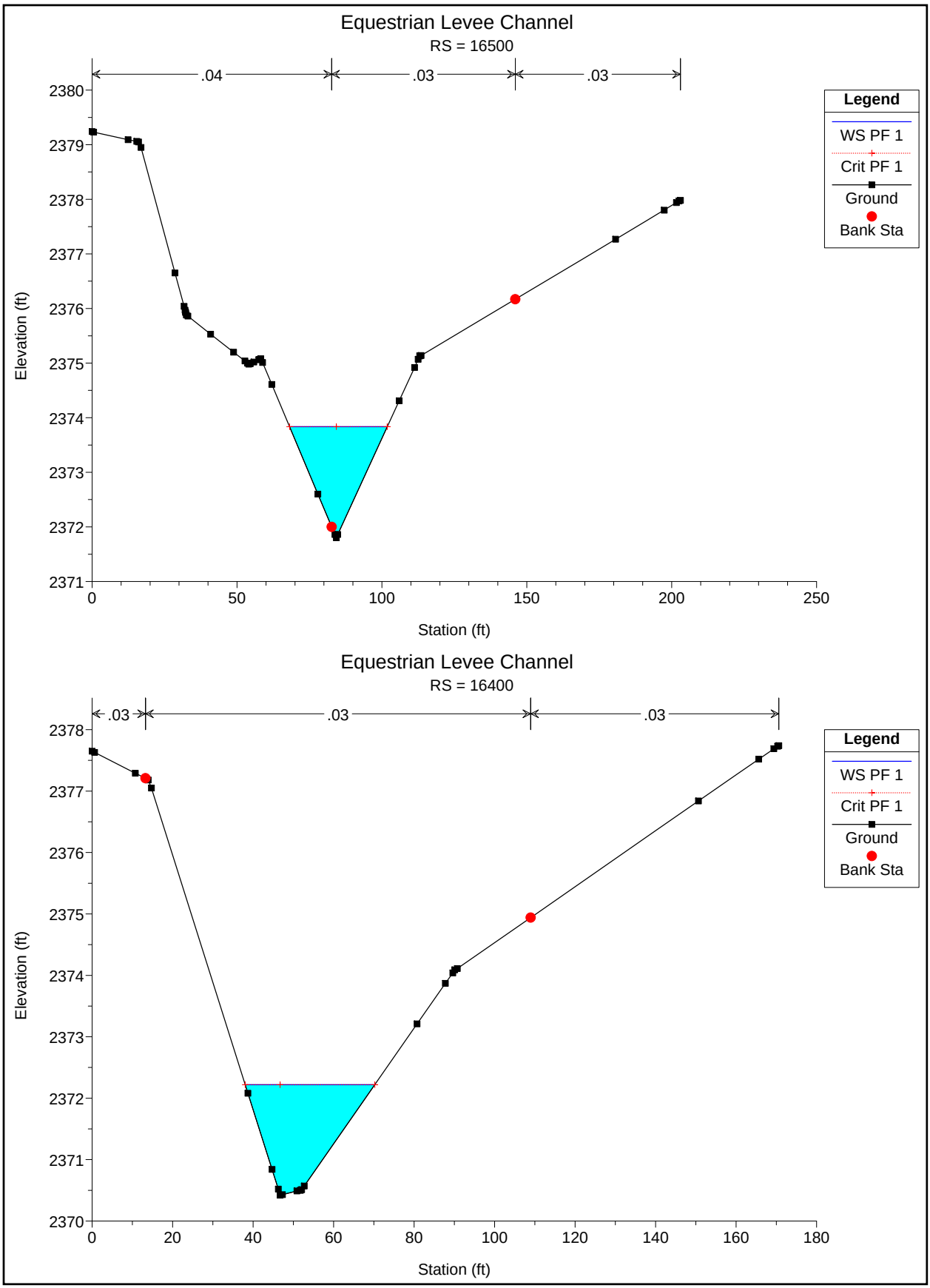
Errors Warnings and Notes

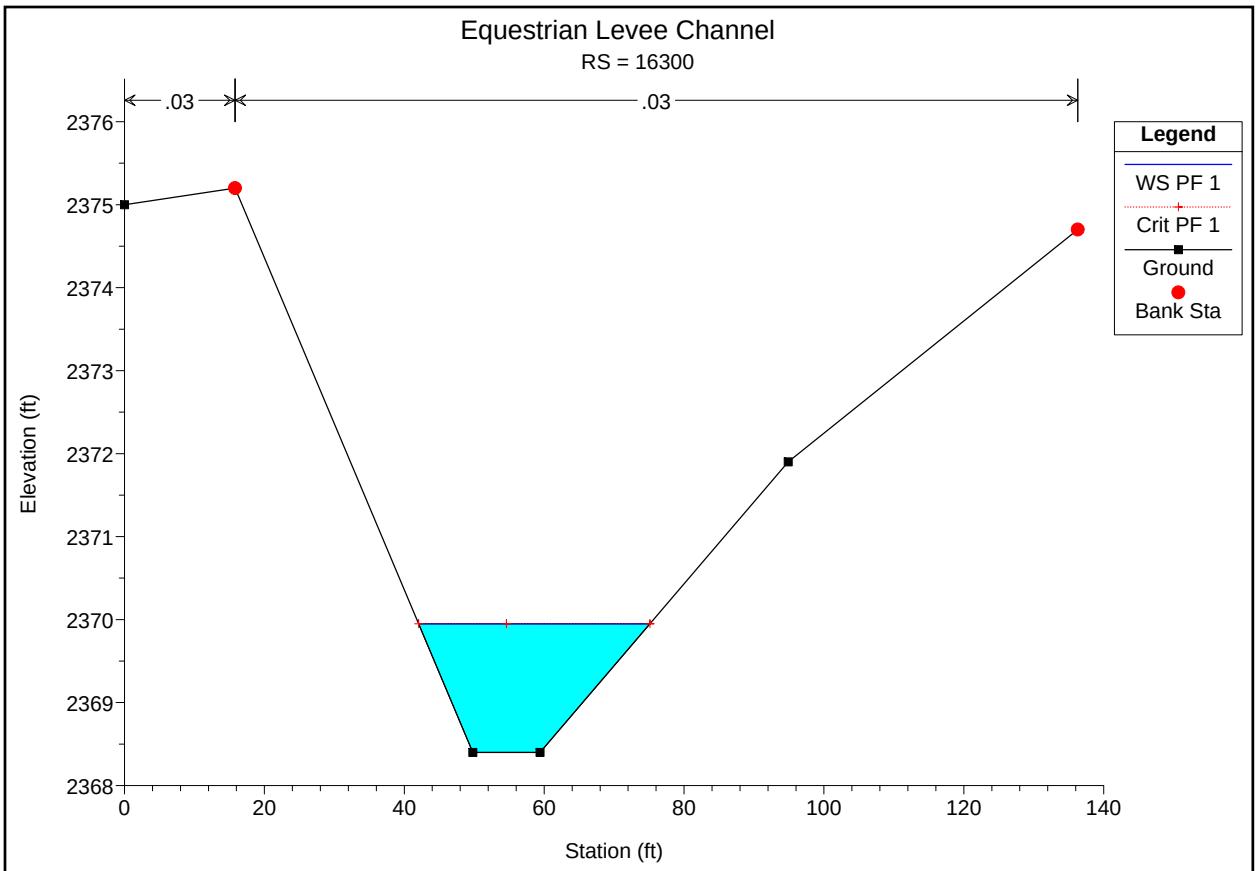
Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.

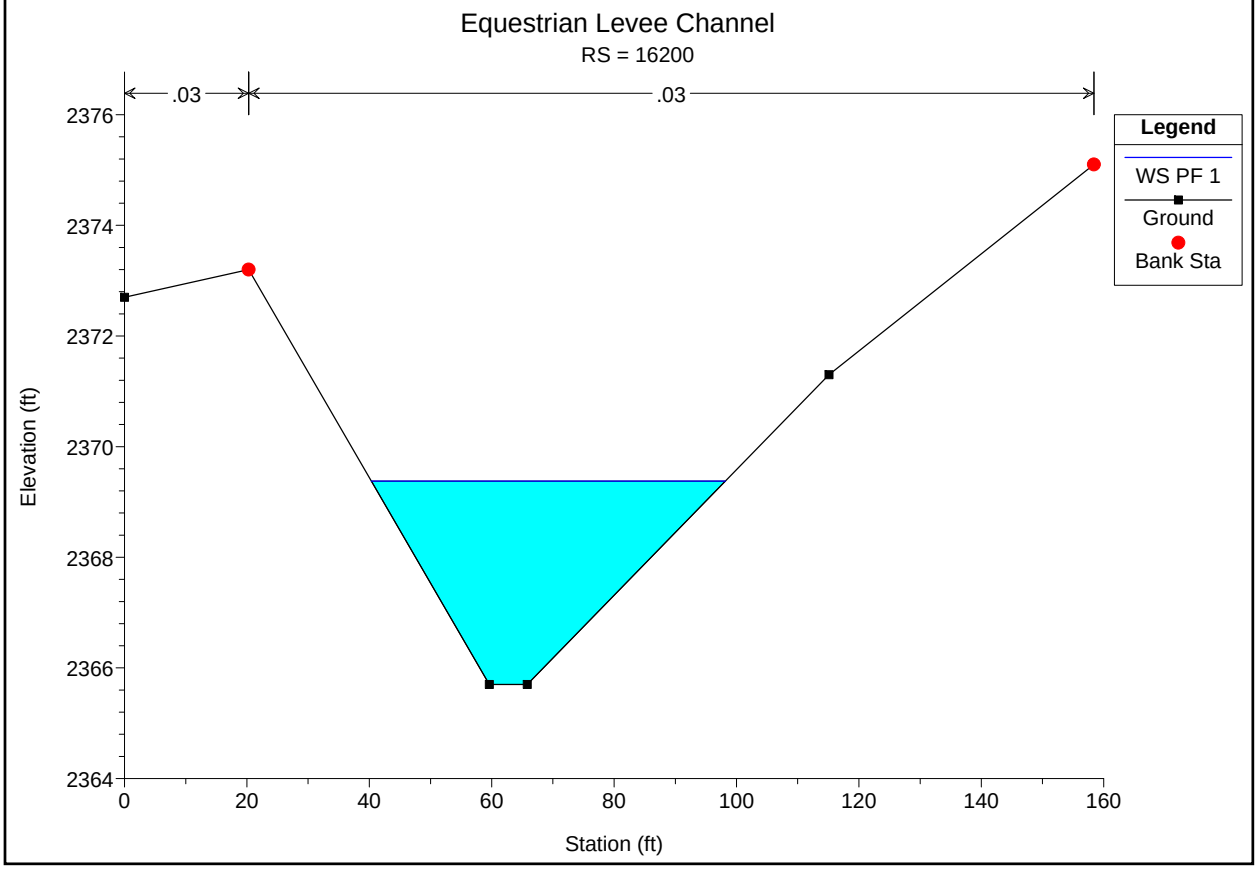
HEC-RAS Subcritical

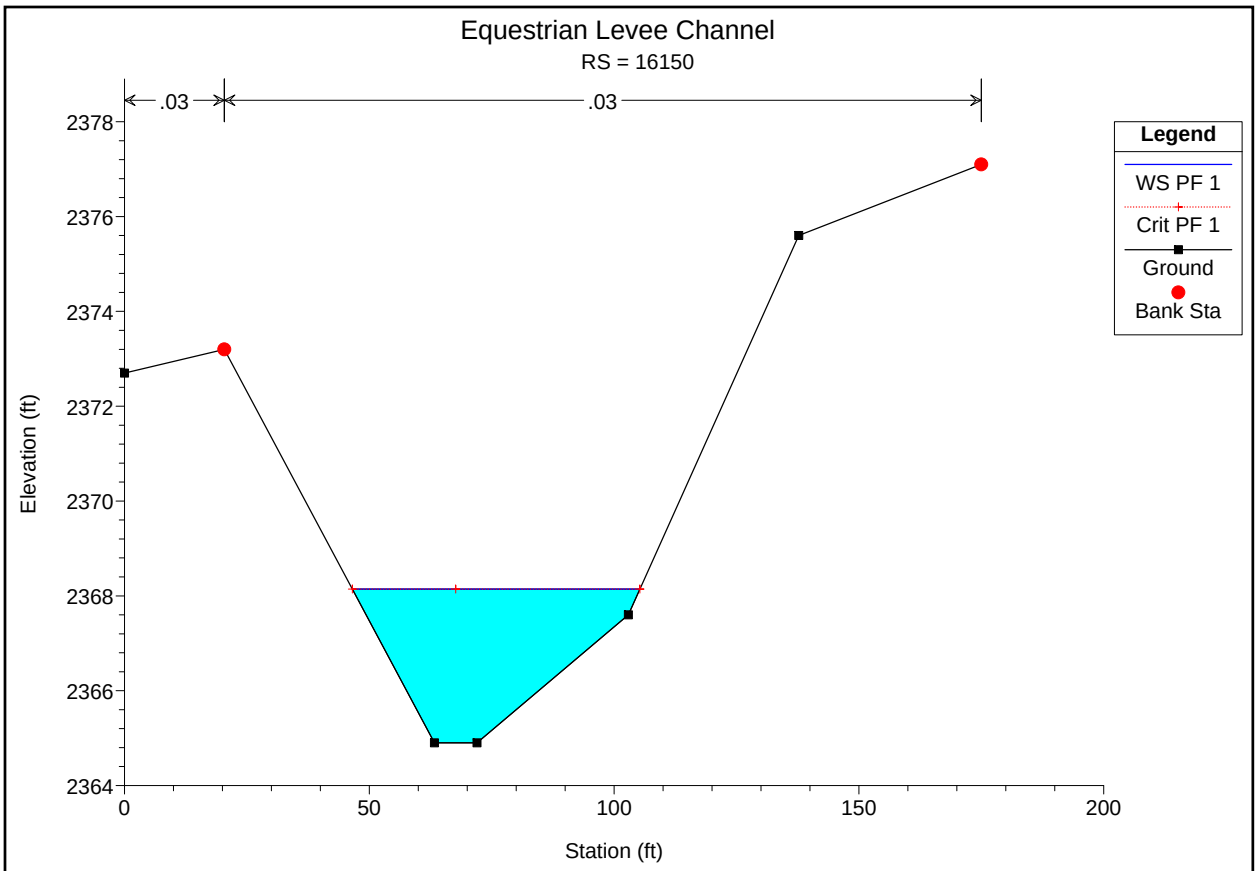
Station Plots

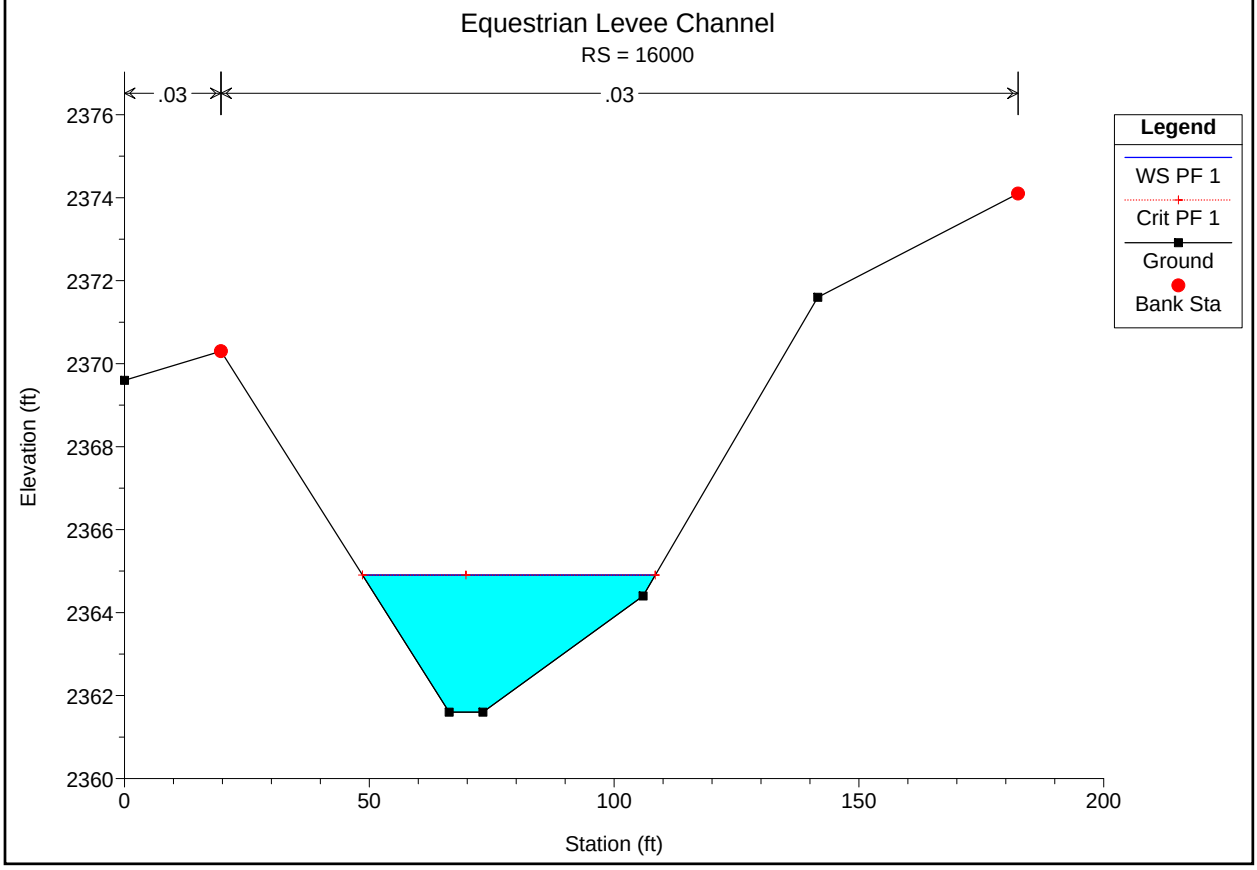

Equestrian Levee Channel
RS = 16700
.04
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2384
2383
2382
2381
2380
2379
2378
0
20
40
60
80
100
120
140
160
Equestrian Levee Channel
RS = 16550
.04
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2381
2380
2379
2378
2377
2376
2375
2374
2373
0
50
100
150
200

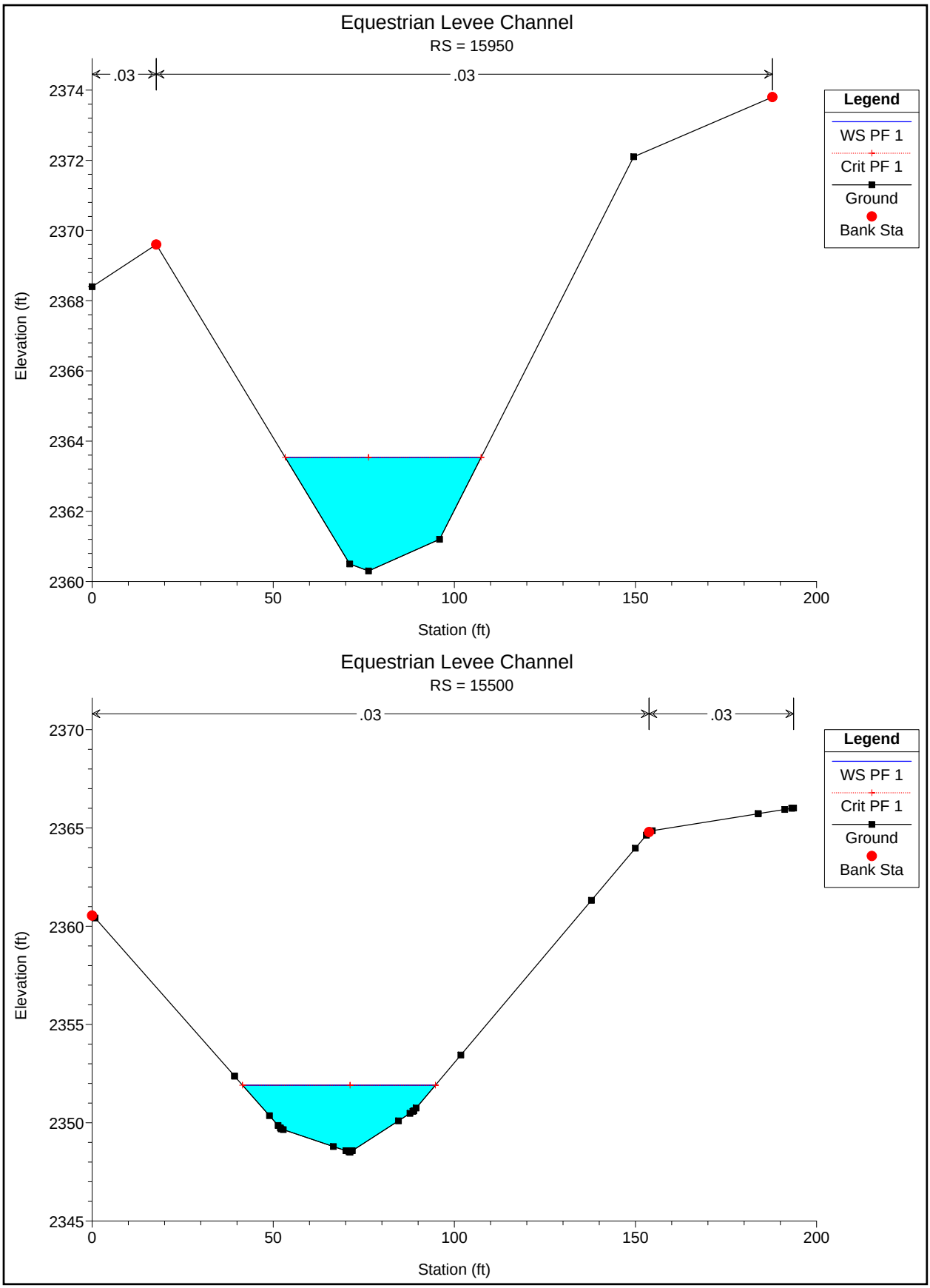

Equestrian Levee Channel
RS = 16500
.04
.03
.03
Elevation (ft)
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Equestrian Levee Channel
RS = 16400
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta

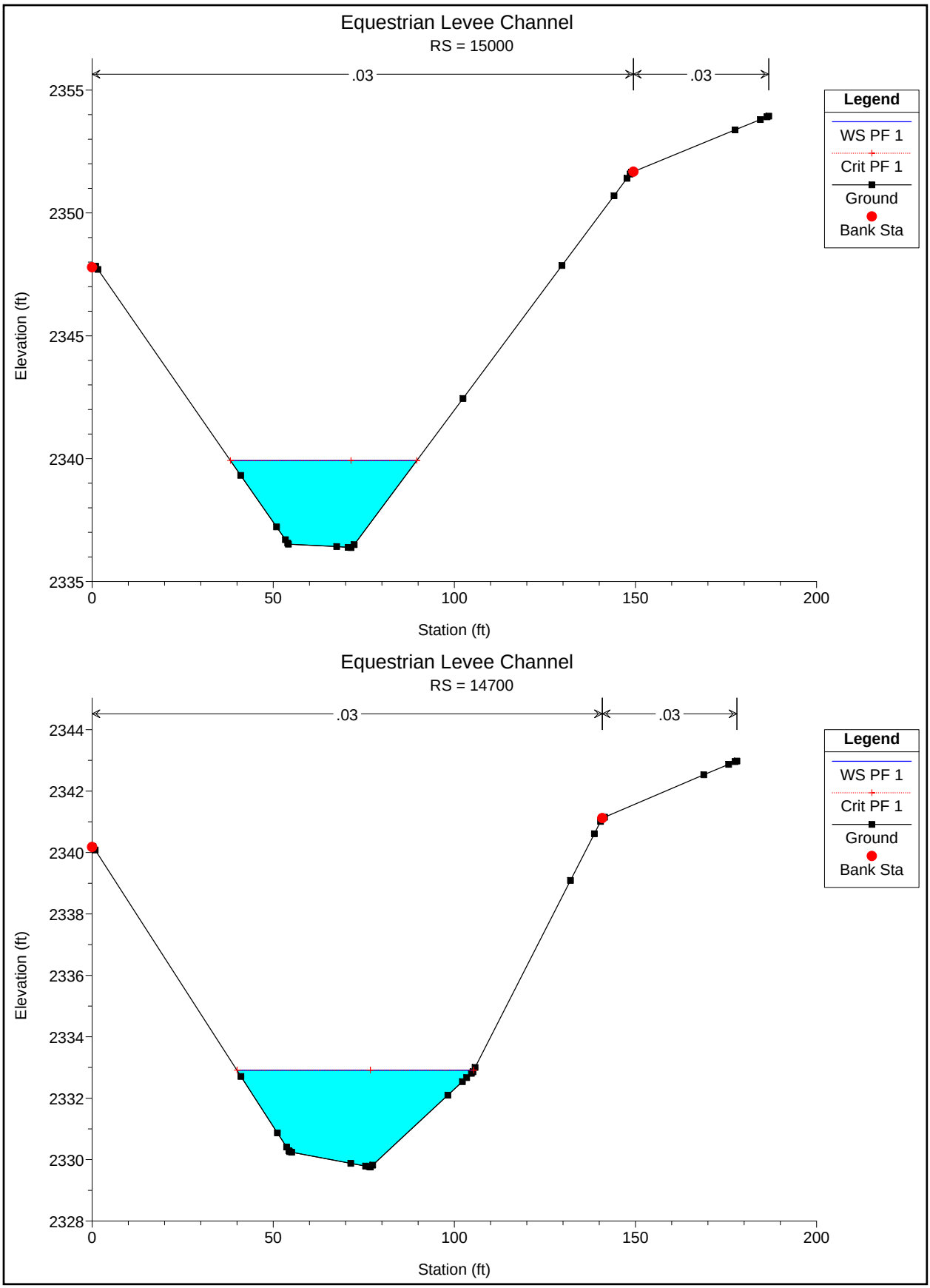

Equestrian Levee Channel
RS = 16300
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2376
2375
2374
2373
2372
2371
2370
2369
2368
0
20
40
60
80
100
120
140

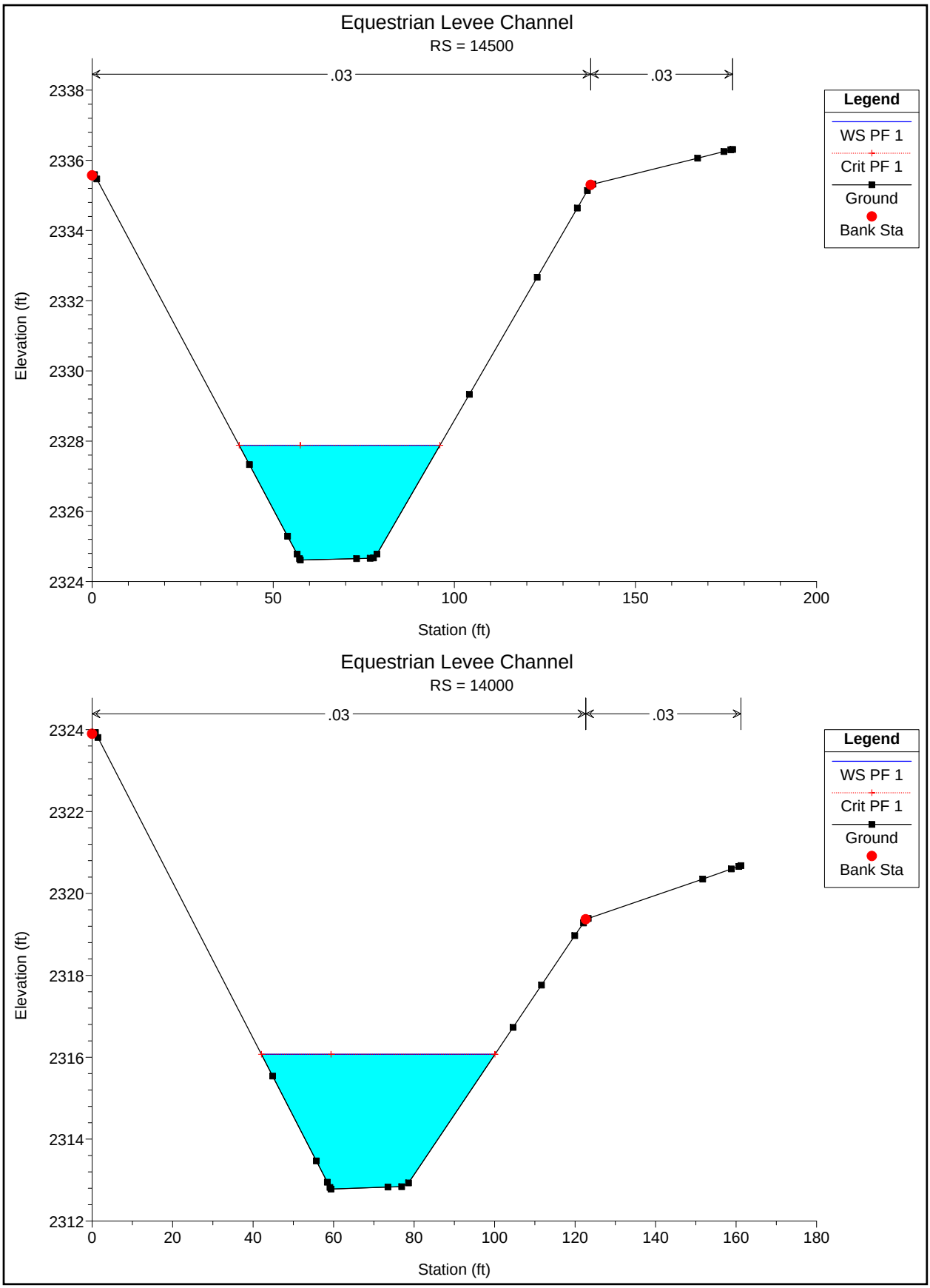

Equestrian Levee Channel
RS = 16200
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2376
2374
2372
2370
2368
2366
2364
0
20
40
60
80
100
120
140
160

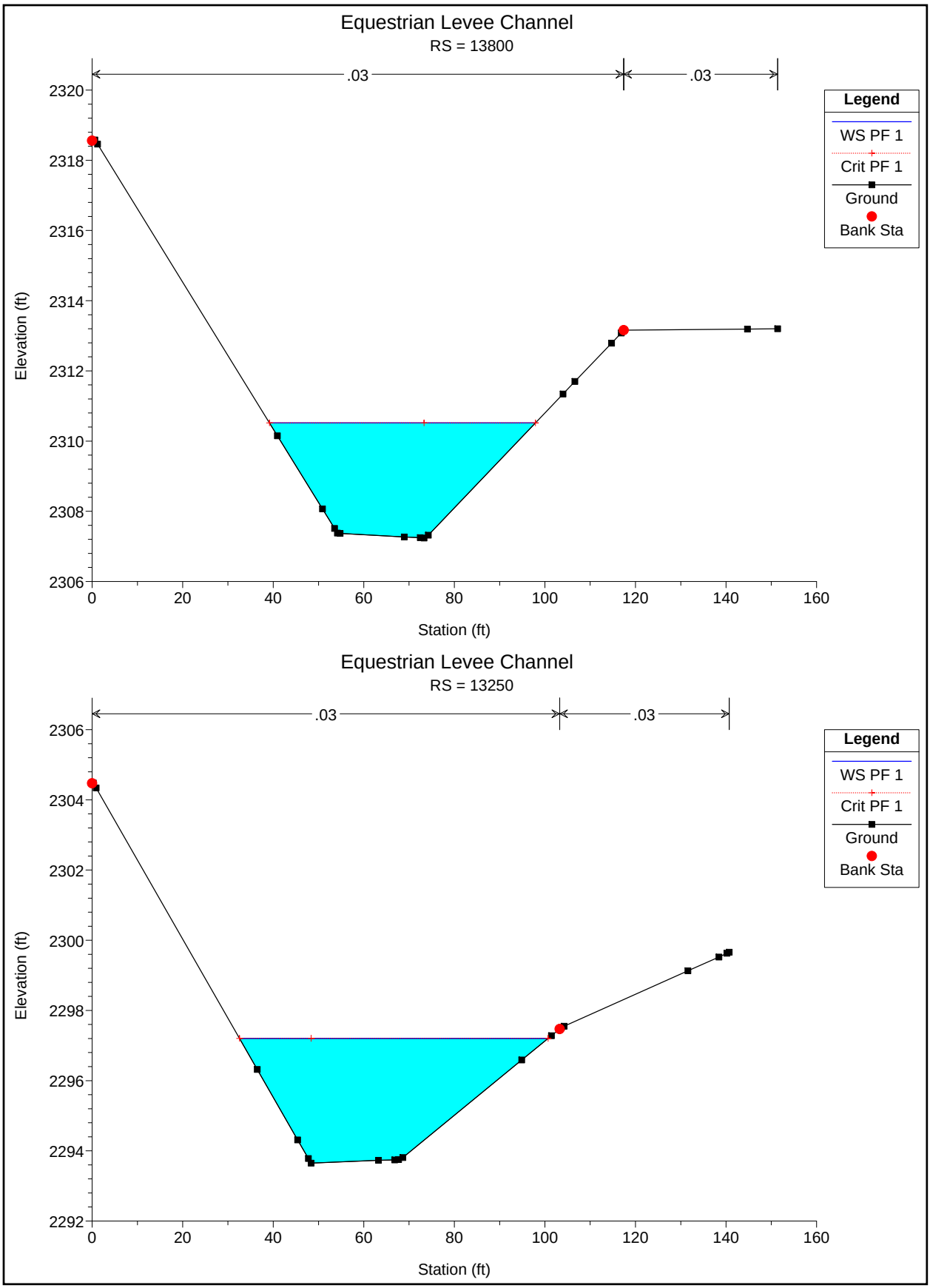

Equestrian Levee Channel
RS = 16150
.03
.03
2378
2376
2374
2372
2370
2368
2366
2364
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta

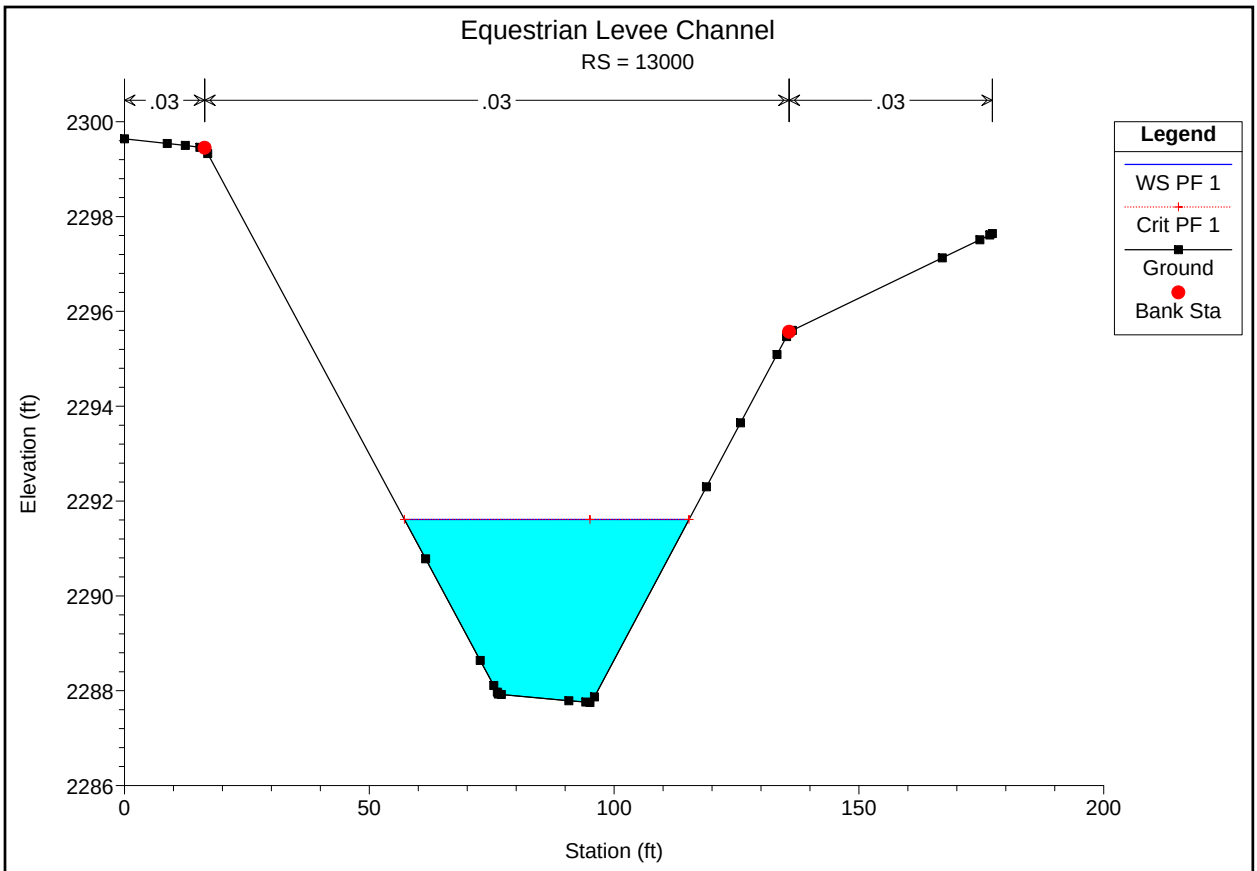

Equestrian Levee Channel
RS = 16000
.03
.03
2376
2374
2372
2370
2368
2366
2364
2362
2360
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta

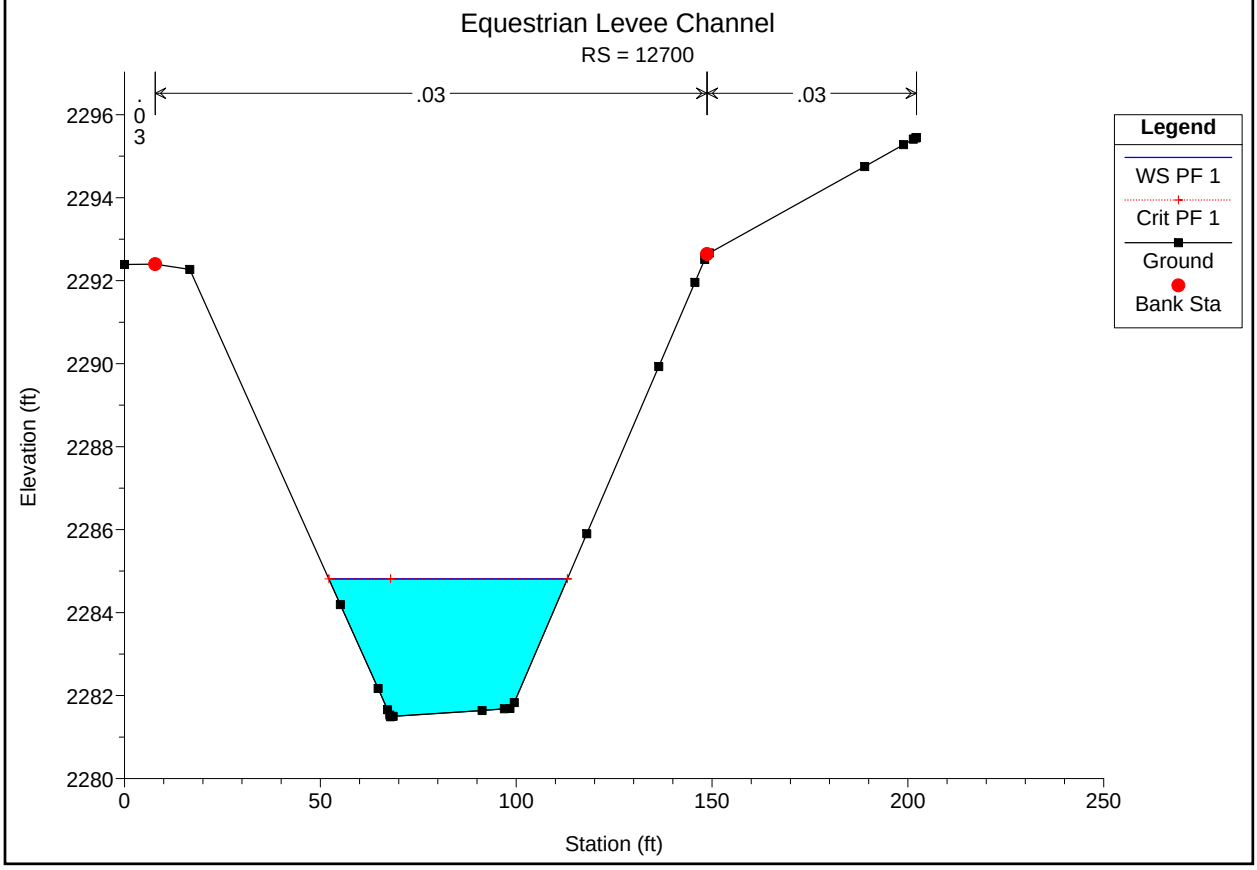

Equestrian Levee Channel
RS = 15950
.03
.03
2374
2372
2370
2368
2366
2364
2362
2360
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Equestrian Levee Channel
RS = 15500
.03
.03
2370
2365
2360
2355
2350
2345
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta

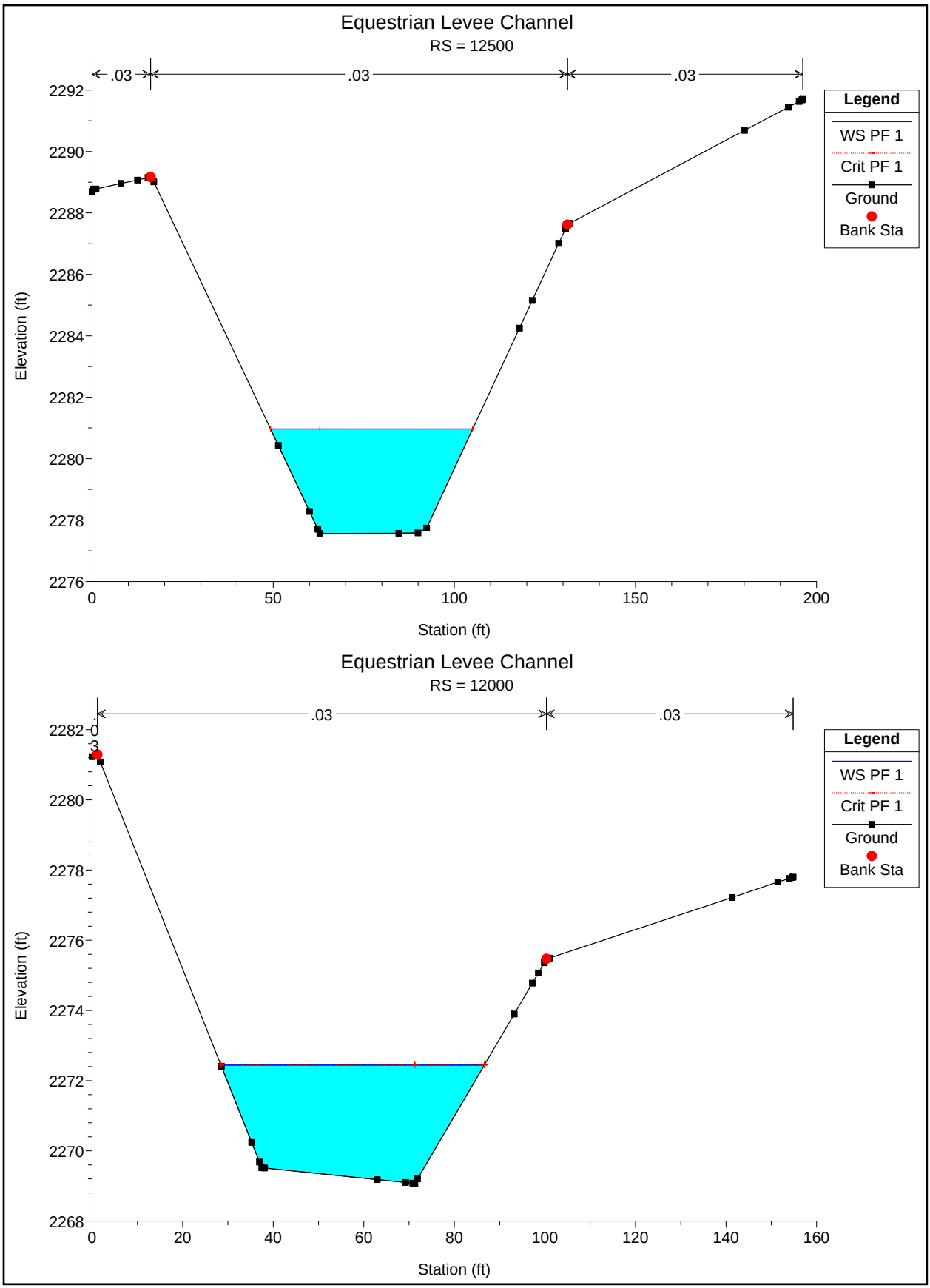

Equestrian Levee Channel
RS = 15000
.03
.03
2355
2350
2345
2340
2335
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Equestrian Levee Channel
RS = 14700
.03
.03
2344
2342
2340
2338
2336
2334
2332
2330
2328
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta

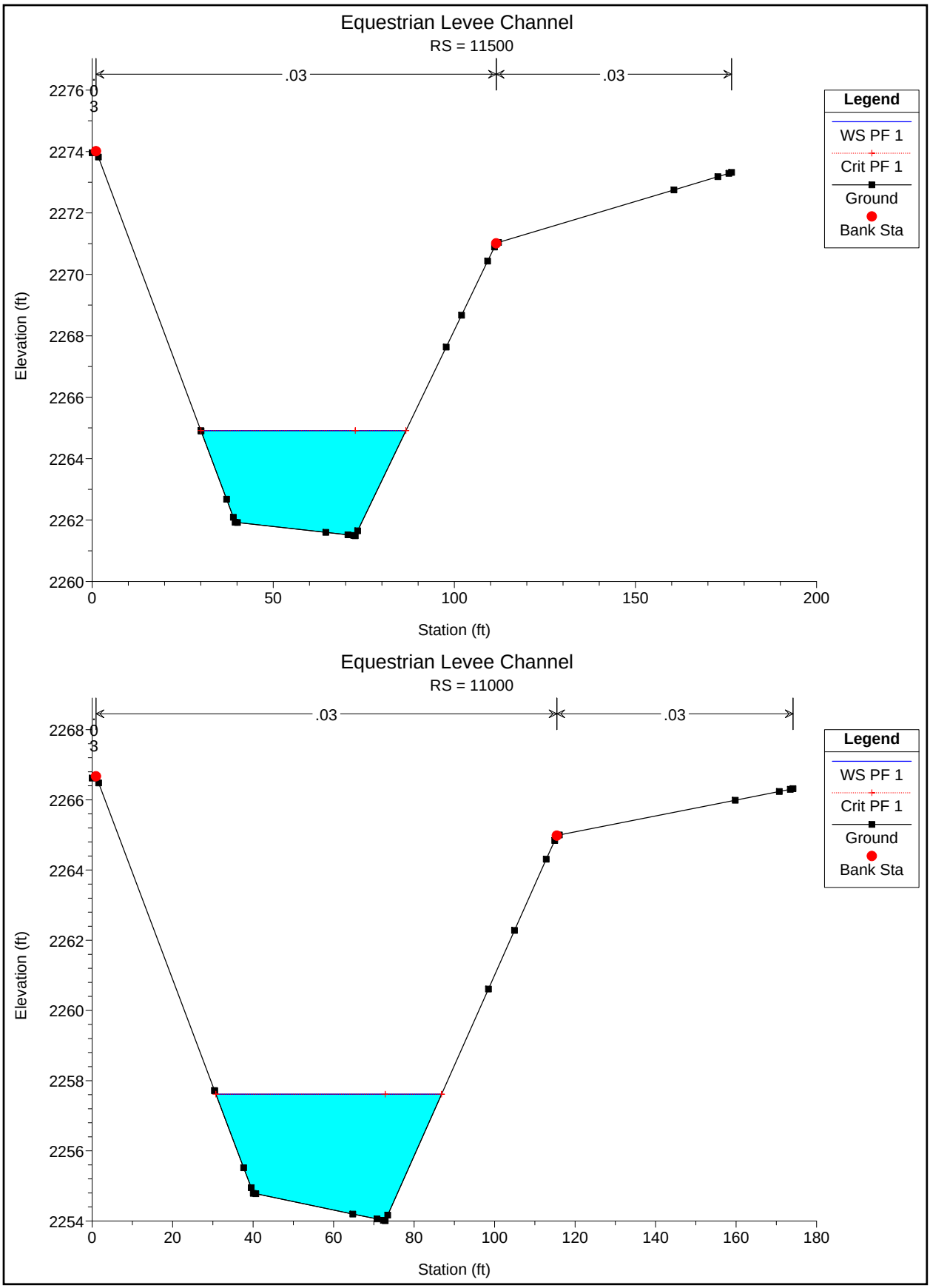

Equestrian Levee Channel
RS = 14500
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
2338
2336
2334
2332
2330
2328
2326
2324
0
50
100
150
200
Station (ft)
Equestrian Levee Channel
RS = 14000
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
2324
2322
2320
2318
2316
2314
2312
0
20
40
60
80
100
120
140
160
180
Station (ft)

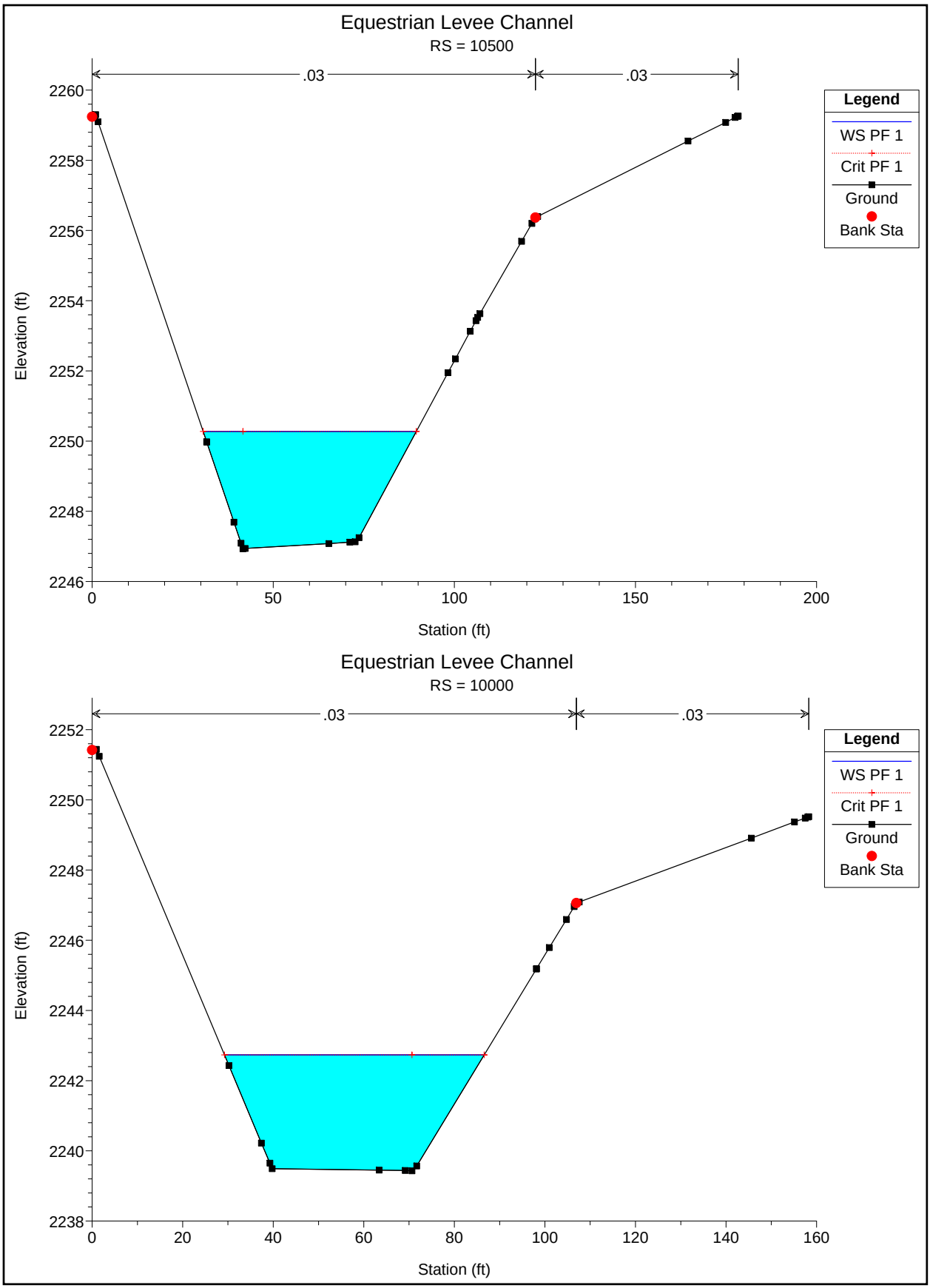

Equestrian Levee Channel
RS = 13800
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2320
2318
2316
2314
2312
2310
2308
2306
0
20
40
60
80
100
120
140
160
Equestrian Levee Channel
RS = 13250
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2306
2304
2302
2300
2298
2296
2294
2292
0
20
40
60
80
100
120
140
160

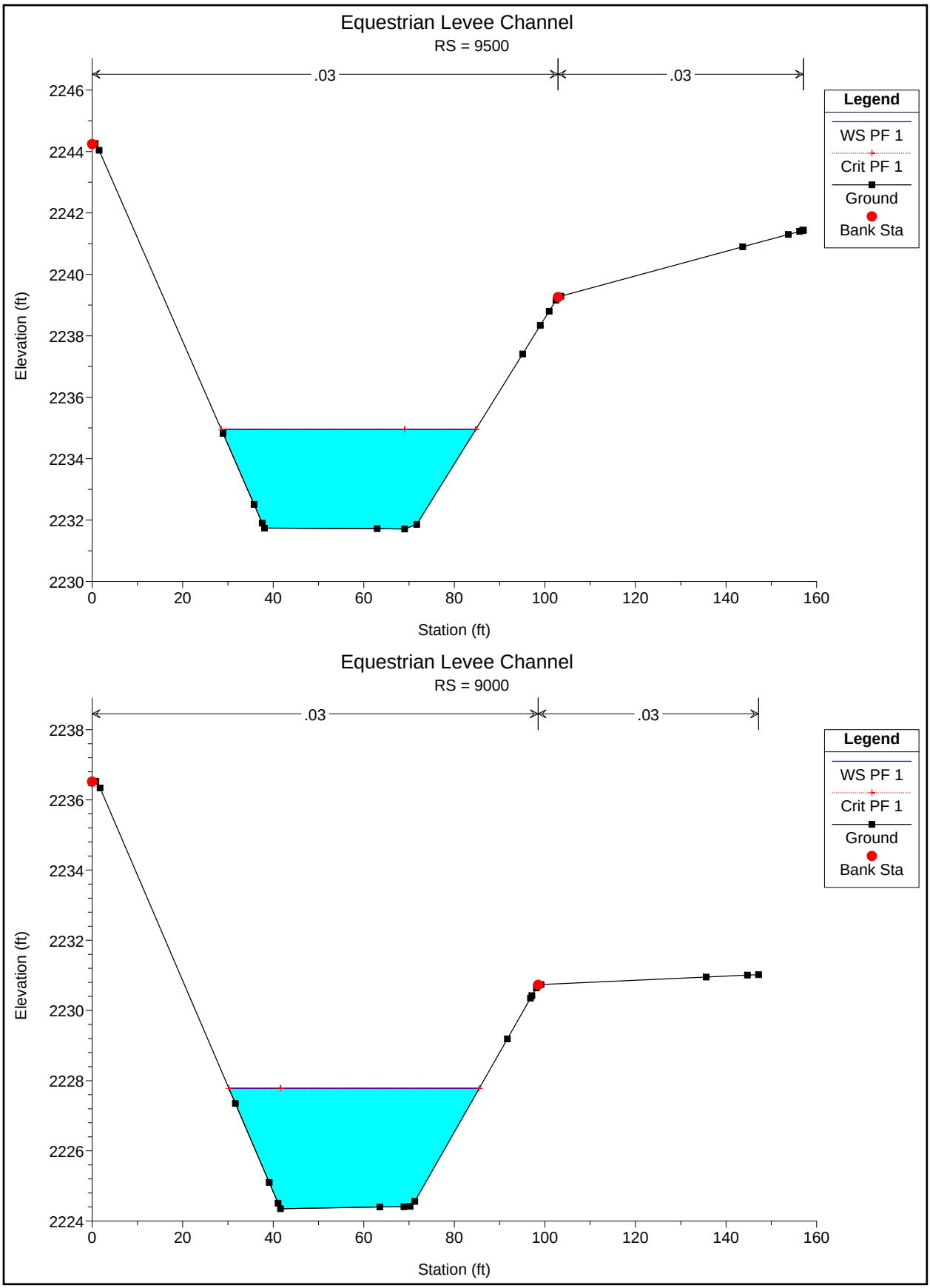

Equestrian Levee Channel
RS = 13000
.03
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2300
2298
2296
2294
2292
2290
2288
2286
0
50
100
150
200

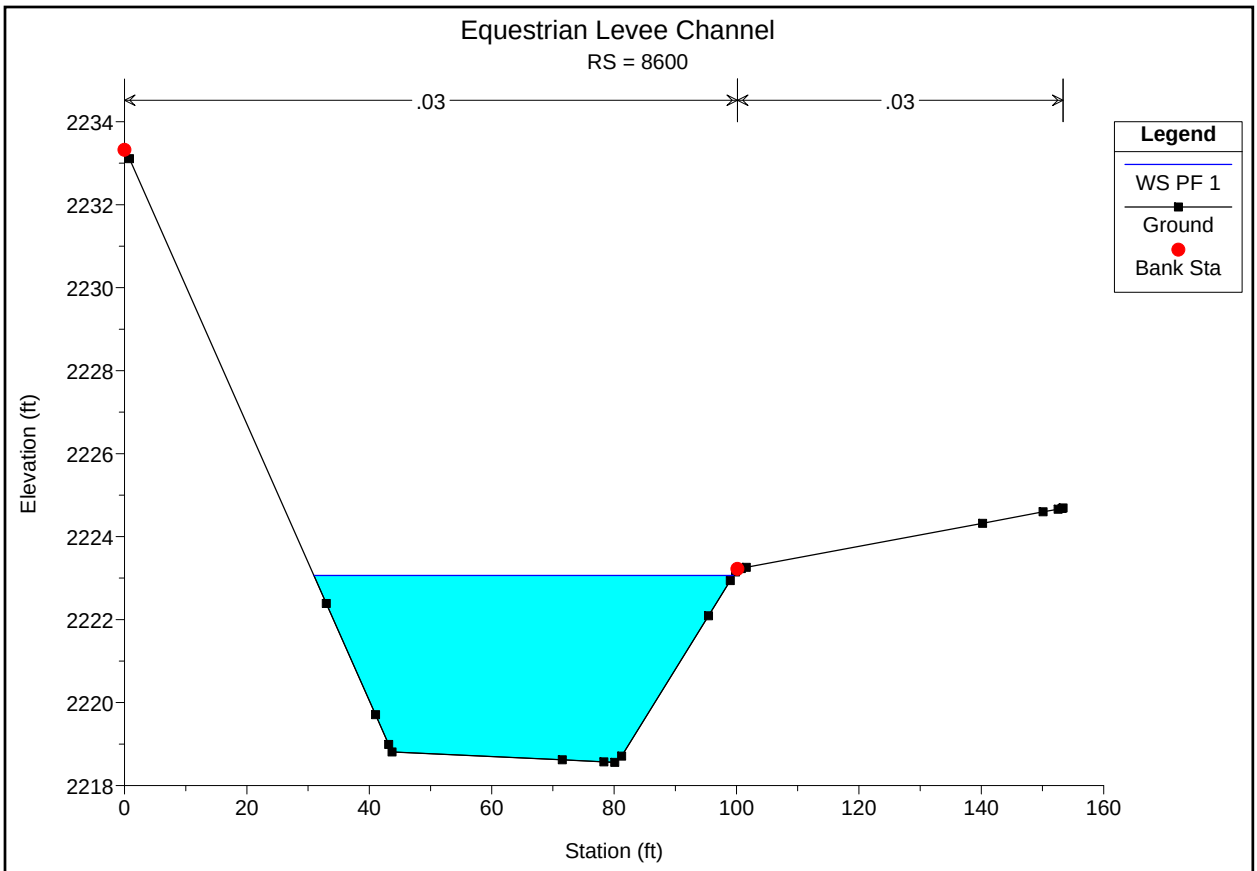

Equestrian Levee Channel
RS = 12700
.03
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2296
2294
2292
2290
2288
2286
2284
2282
2280
0
50
100
150
200
250

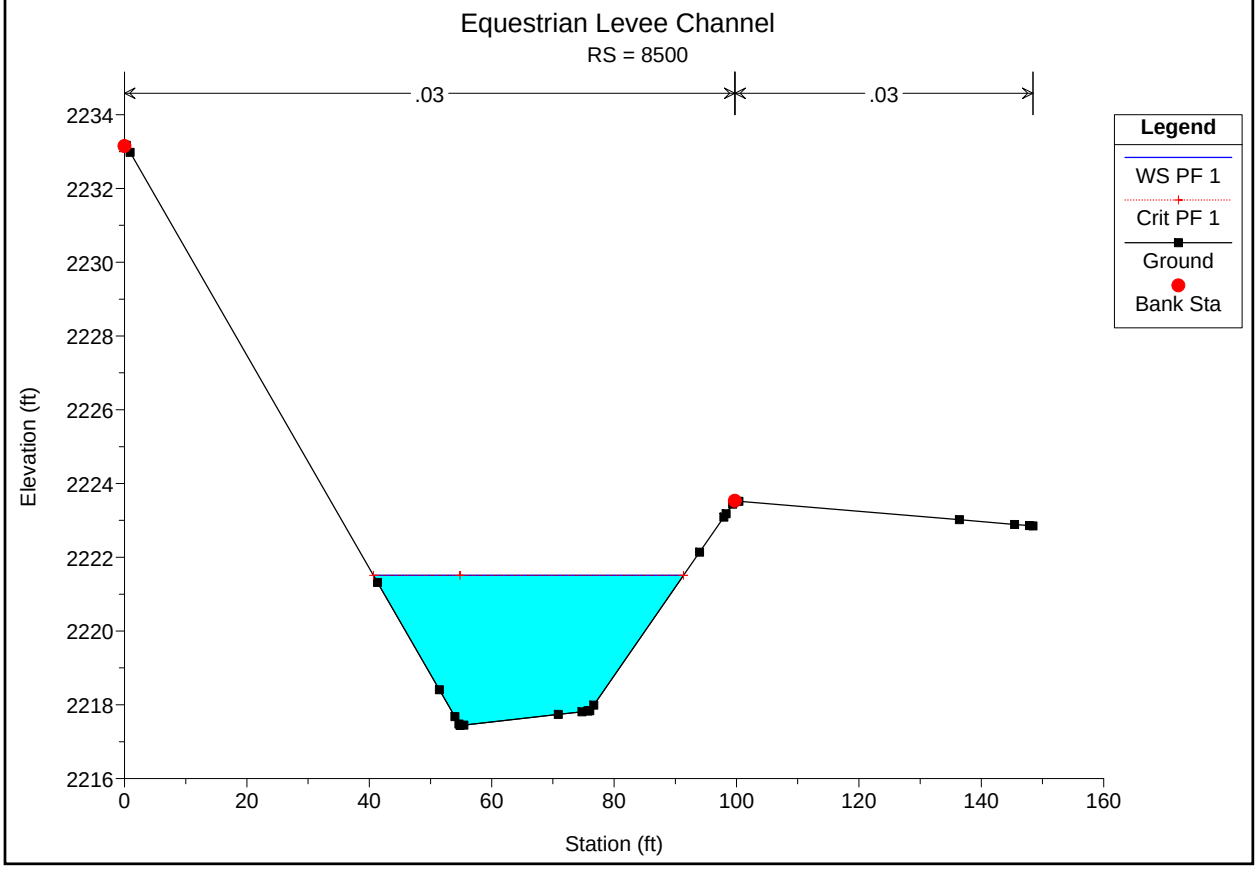

Equestrian Levee Channel
RS = 12500
.03
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2292
2290
2288
2286
2284
2282
2280
2278
2276
0
50
100
150
200
Equestrian Levee Channel
RS = 12000
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2282
2280
2278
2276
2274
2272
2270
2268
0
20
40
60
80
100
120
140
160

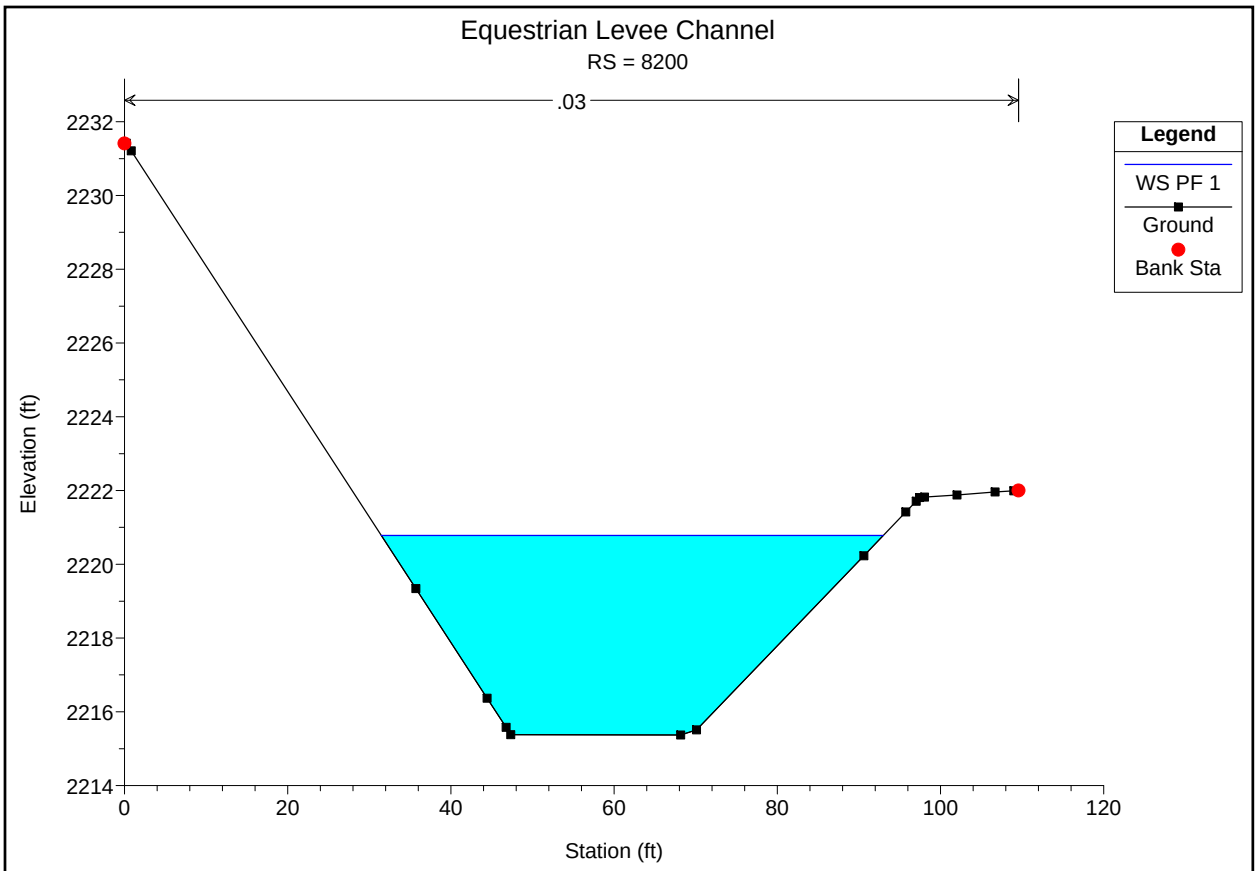

Equestrian Levee Channel
RS = 11500
.03
.03
0.3
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2276
2274
2272
2270
2268
2266
2264
2262
2260
0
50
100
150
200
Equestrian Levee Channel
RS = 11000
.03
.03
0.3
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2268
2266
2264
2262
2260
2258
2256
2254
0
20
40
60
80
100
120
140
160
180

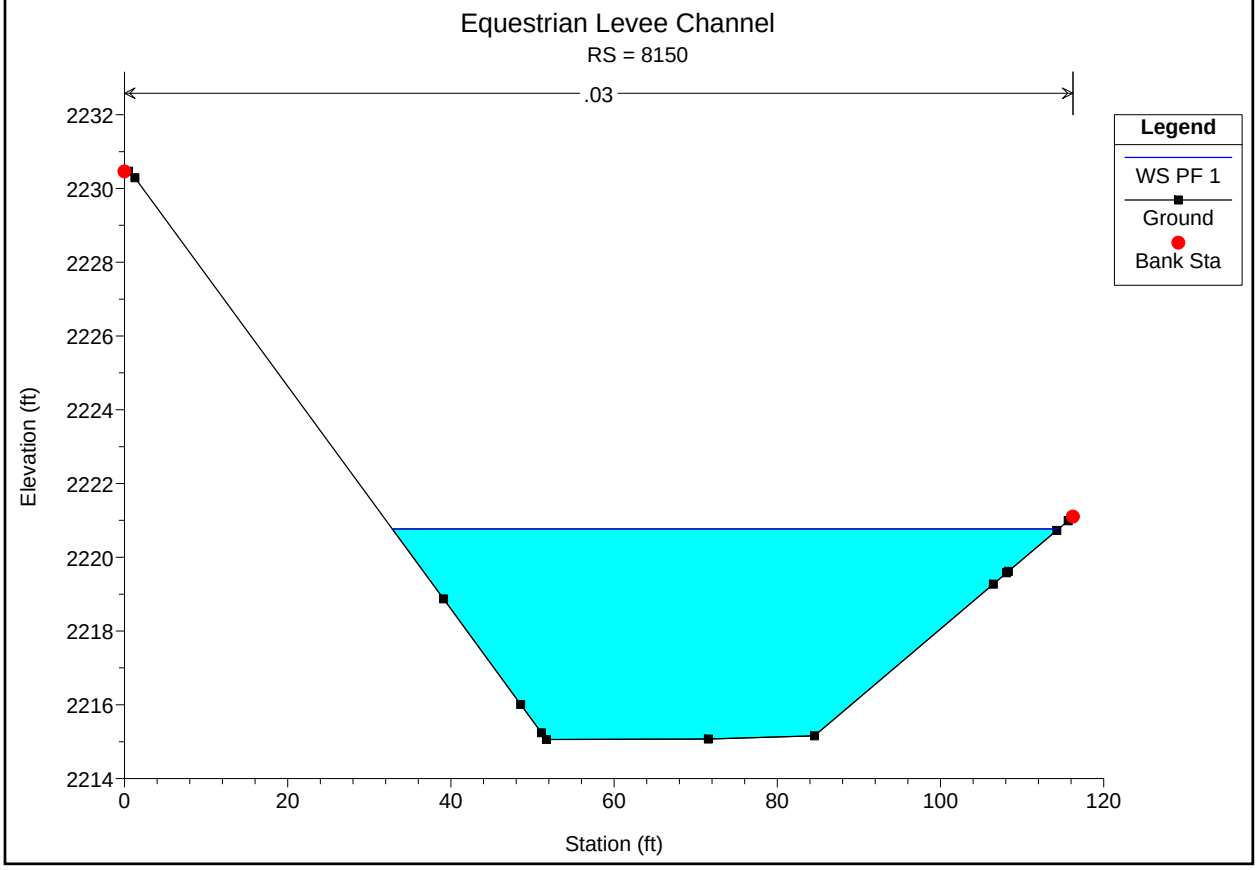

Equestrian Levee Channel
RS = 10500
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2260
2258
2256
2254
2252
2250
2248
2246
0
50
100
150
200
Equestrian Levee Channel
RS = 10000
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2252
2250
2248
2246
2244
2242
2240
2238
0
20
40
60
80
100
120
140
160

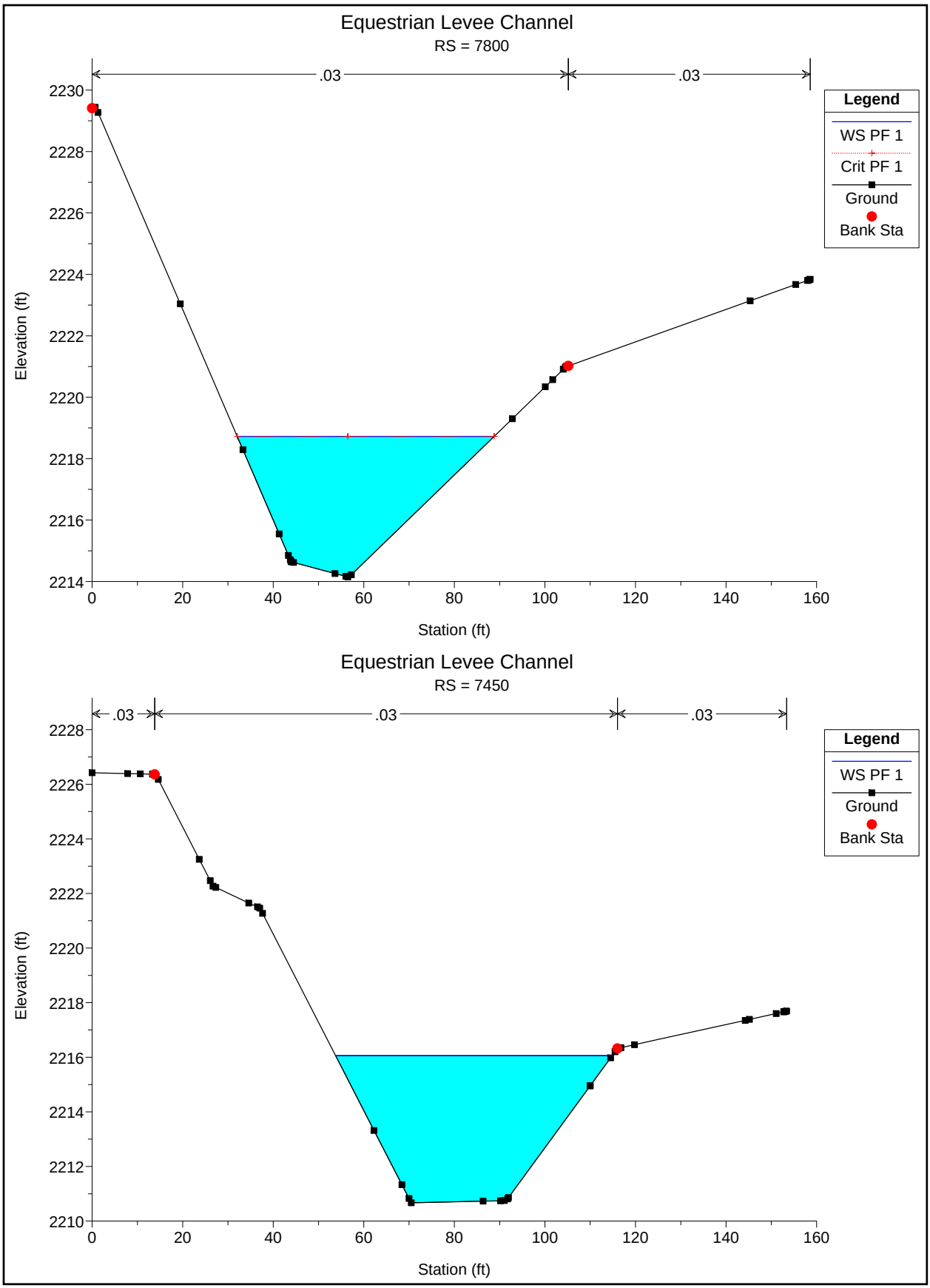

Equestrian Levee Channel
RS = 9500
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2246
2244
2242
2240
2238
2236
2234
2232
2230
0
20
40
60
80
100
120
140
160
Equestrian Levee Channel
RS = 9000
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2238
2236
2234
2232
2230
2228
2226
2224
0
20
40
60
80
100
120
140
160

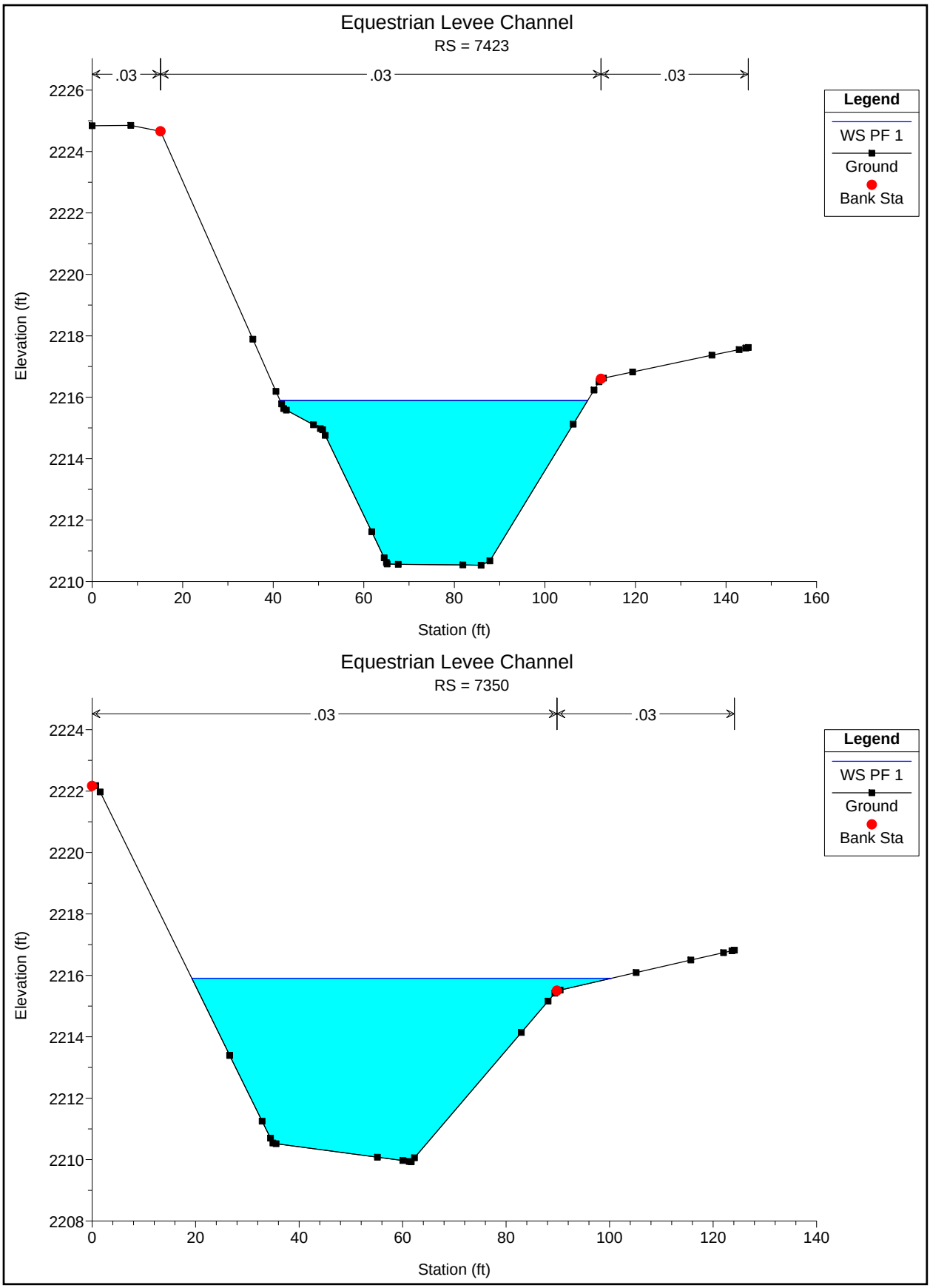

Equestrian Levee Channel
RS = 8600
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2234
2232
2230
2228
2226
2224
2222
2220
2218
0
20
40
60
80
100
120
140
160

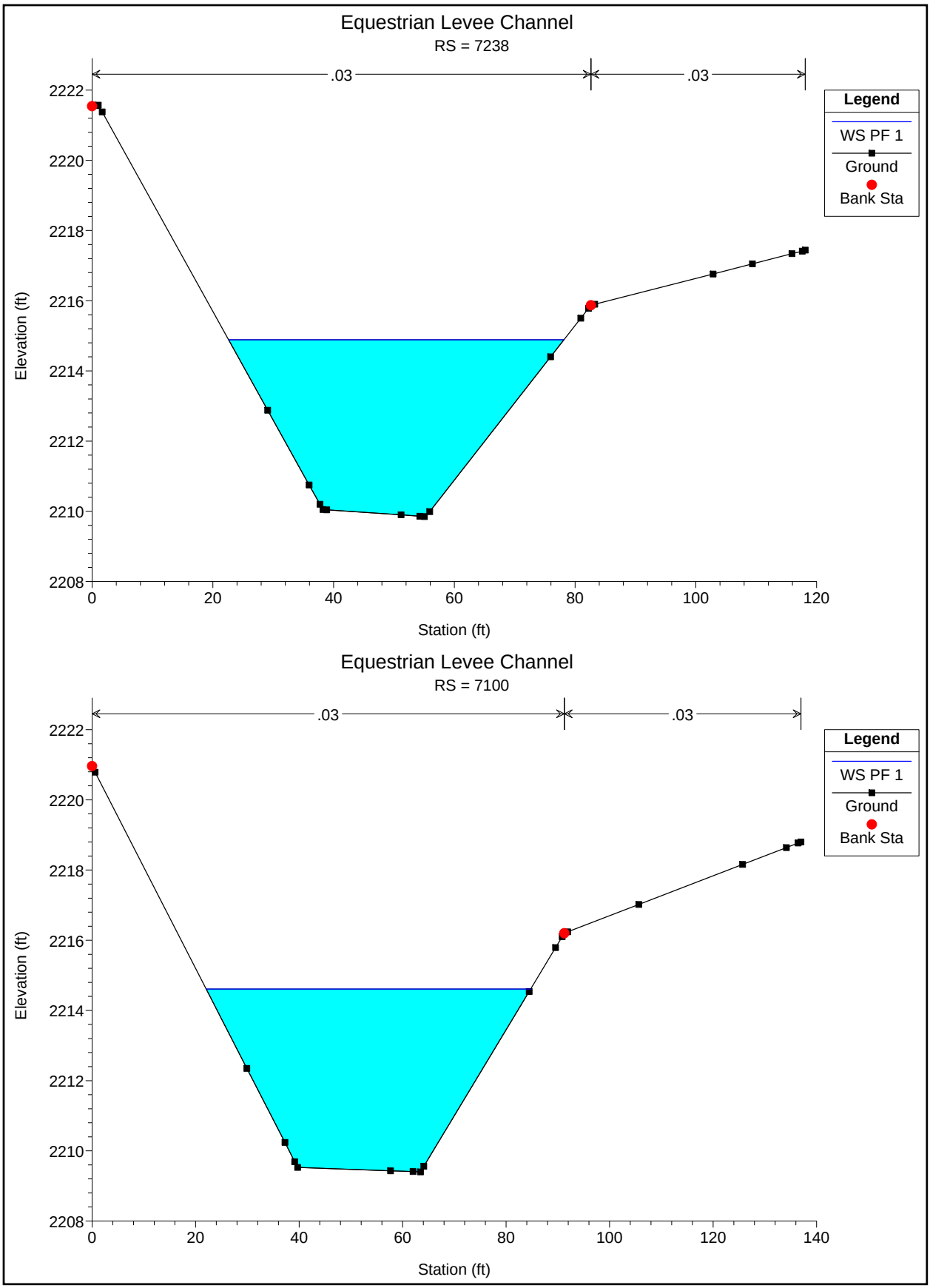

Equestrian Levee Channel
RS = 8500
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2234
2232
2230
2228
2226
2224
2222
2220
2218
2216
0
20
40
60
80
100
120
140
160

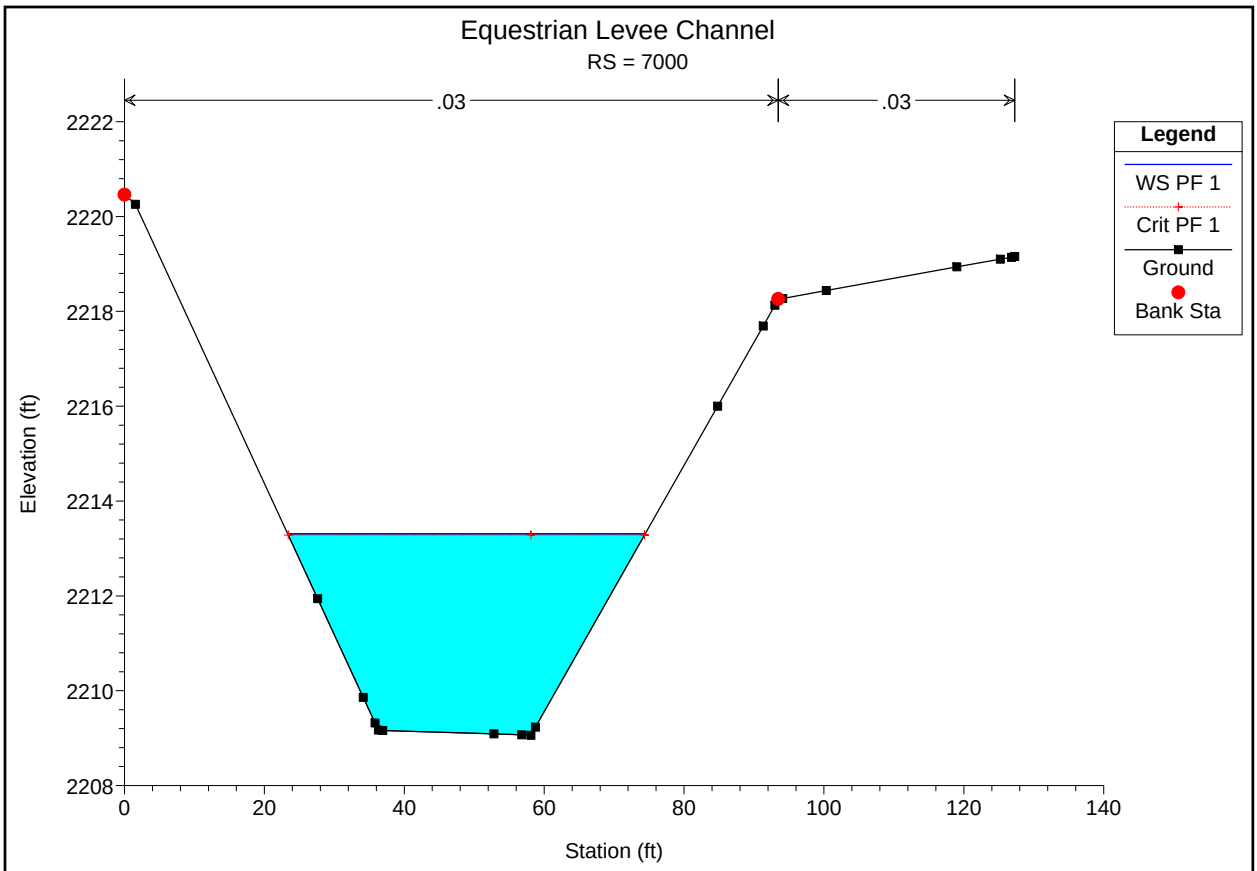

Equestrian Levee Channel
RS = 8200
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2232
2230
2228
2226
2224
2222
2220
2218
2216
2214
0
20
40
60
80
100
120

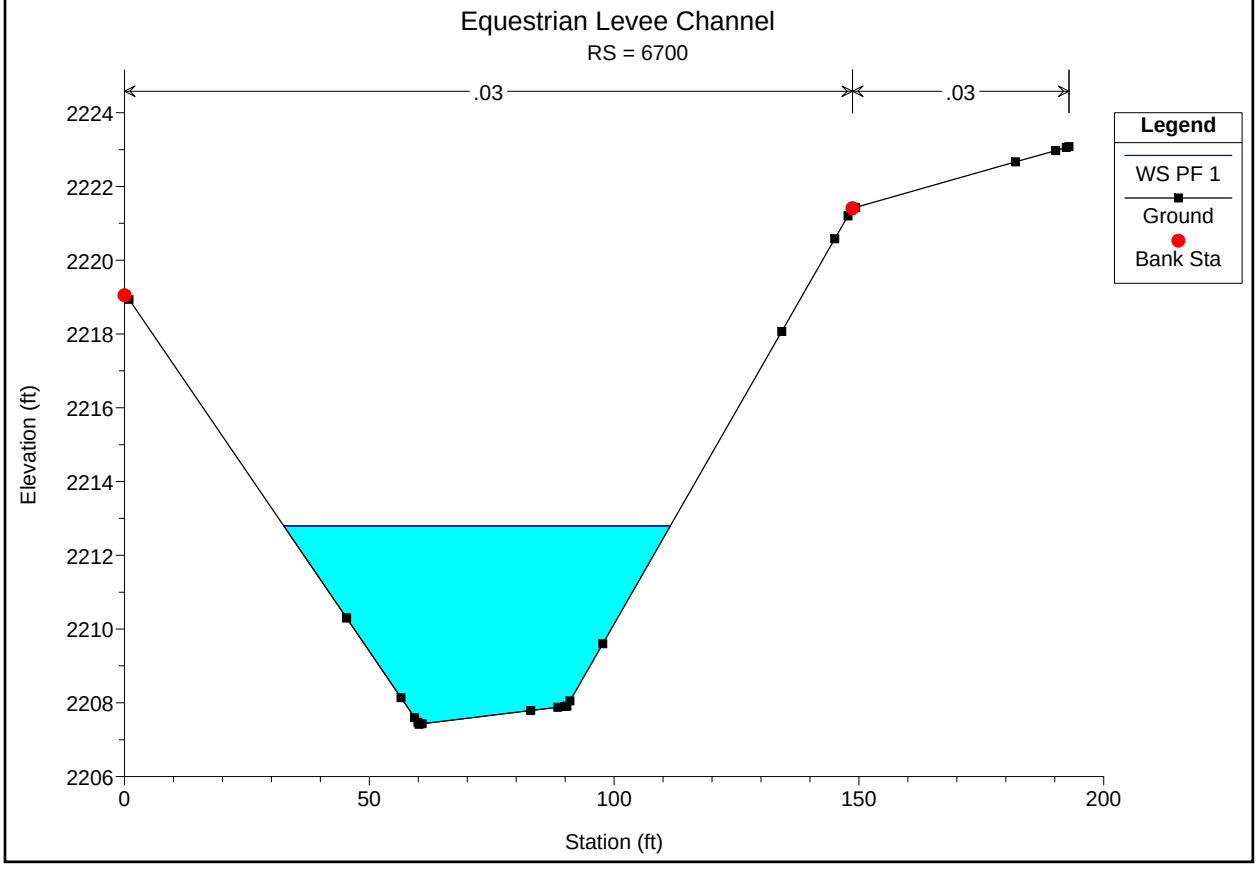

Equestrian Levee Channel
RS = 8150
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2232
2230
2228
2226
2224
2222
2220
2218
2216
2214
0
20
40
60
80
100
120

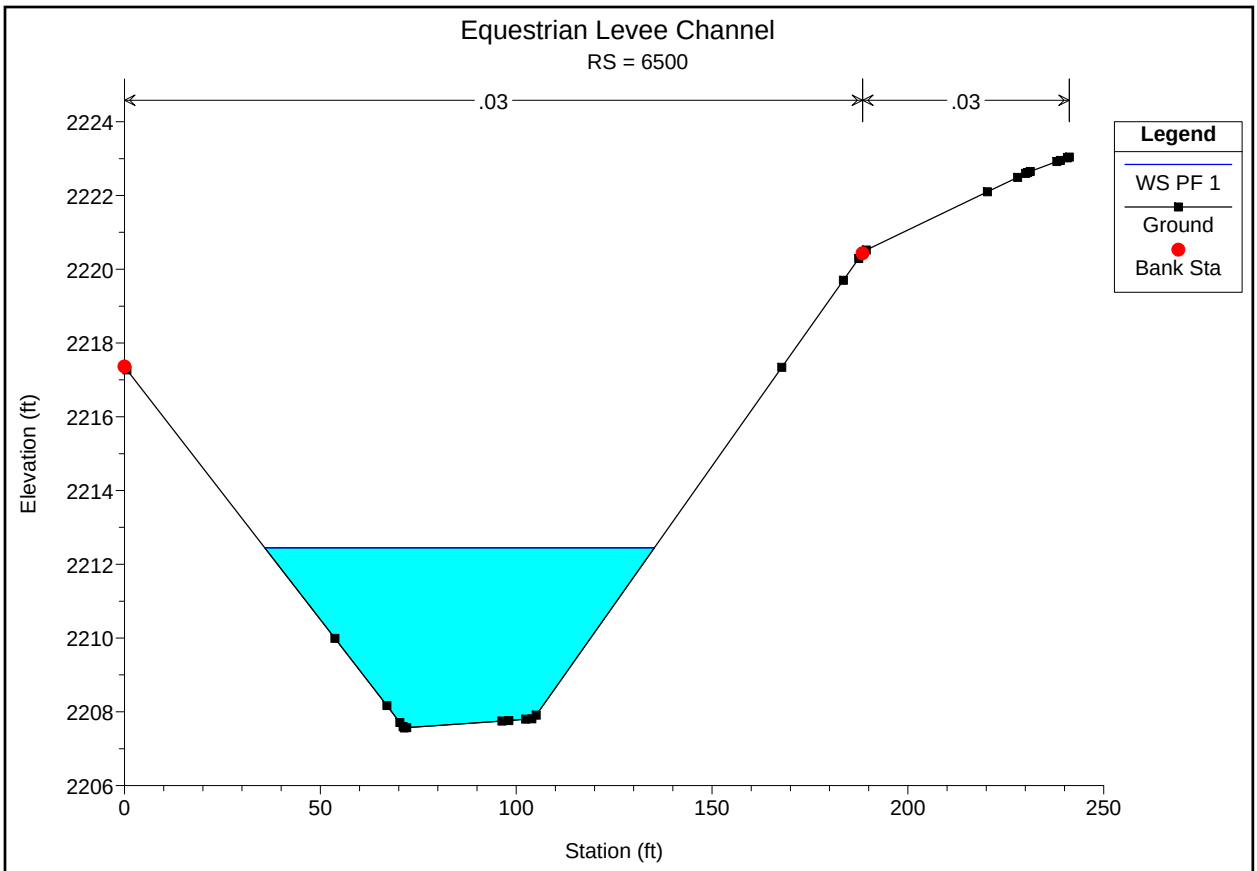

Equestrian Levee Channel
RS = 7800
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2230
2228
2226
2224
2222
2220
2218
2216
2214
0
20
40
60
80
100
120
140
160
Equestrian Levee Channel
RS = 7450
.03
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2228
2226
2224
2222
2220
2218
2216
2214
2212
2210
0
20
40
60
80
100
120
140
160

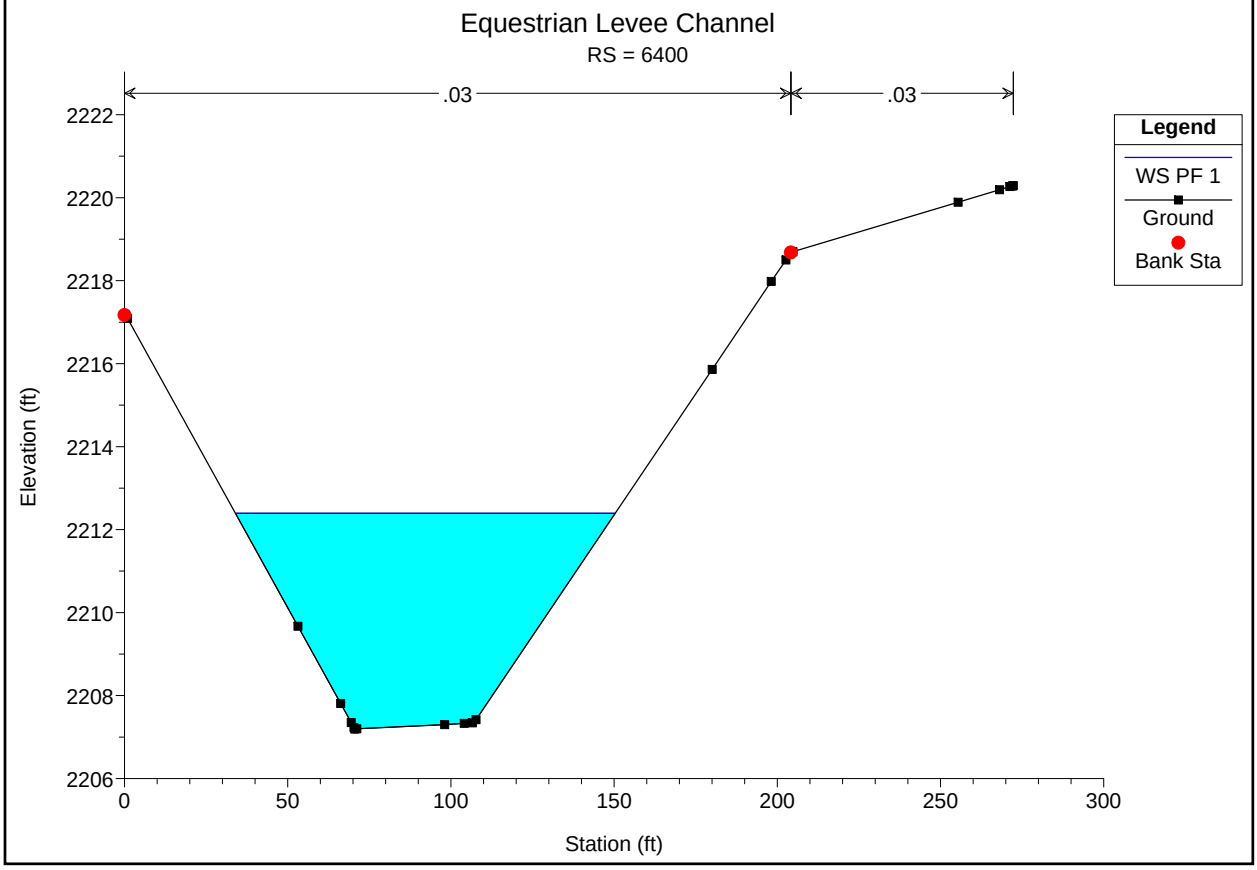

Equestrian Levee Channel
RS = 7423
.03
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2226
2224
2222
2220
2218
2216
2214
2212
2210
0
20
40
60
80
100
120
140
160
Equestrian Levee Channel
RS = 7350
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2224
2222
2220
2218
2216
2214
2212
2210
2208
0
20
40
60
80
100
120
140

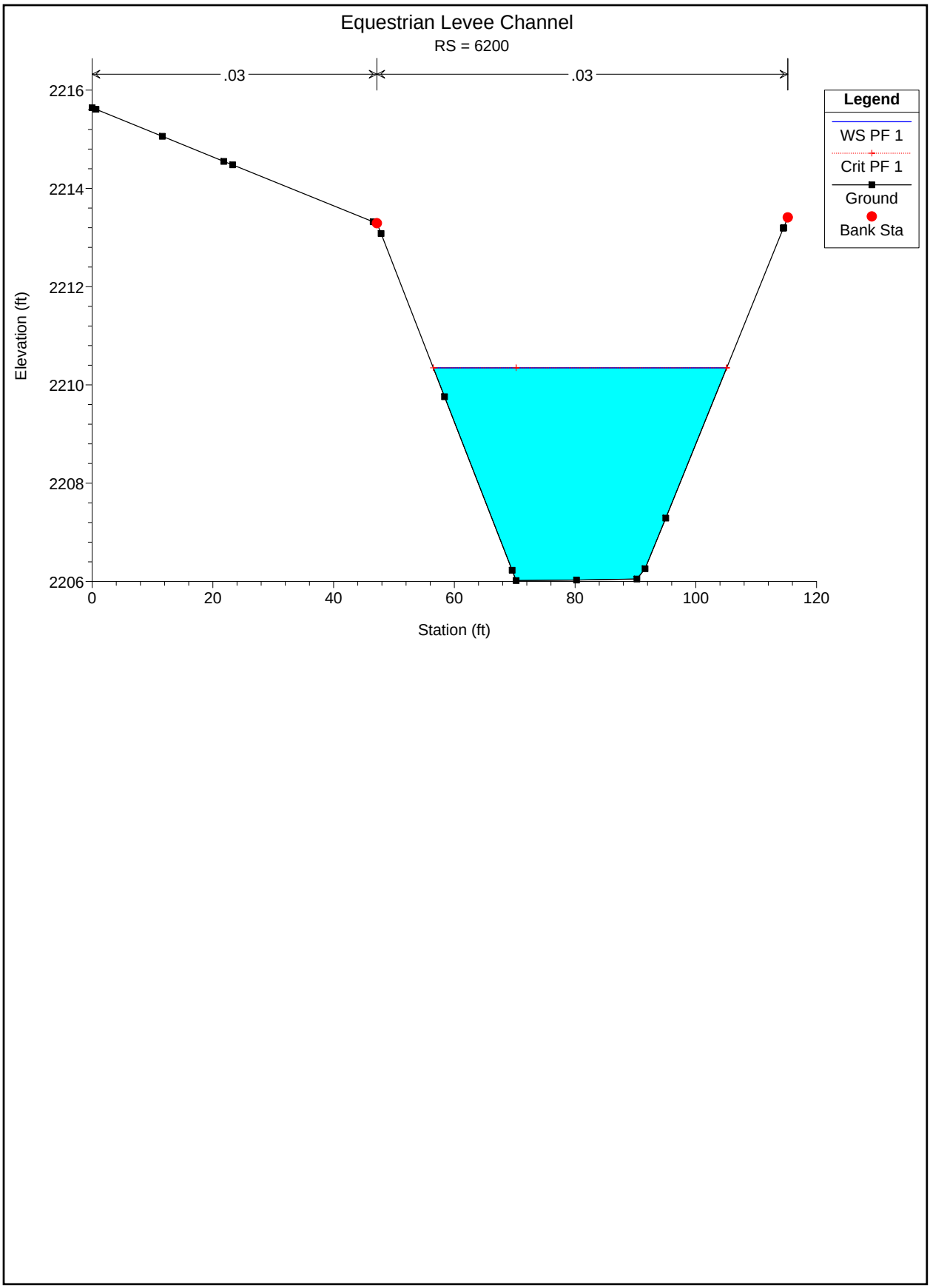

Equestrian Levee Channel
RS = 7238
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2222
2220
2218
2216
2214
2212
2210
2208
0
20
40
60
80
100
120
Equestrian Levee Channel
RS = 7100
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2222
2220
2218
2216
2214
2212
2210
2208
0
20
40
60
80
100
120
140


Equestrian Levee Channel
RS = 7000
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2222
2220
2218
2216
2214
2212
2210
2208
0
20
40
60
80
100
120
140


Equestrian Levee Channel
RS = 6700
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2224
2222
2220
2218
2216
2214
2212
2210
2208
2206
0
50
100
150
200

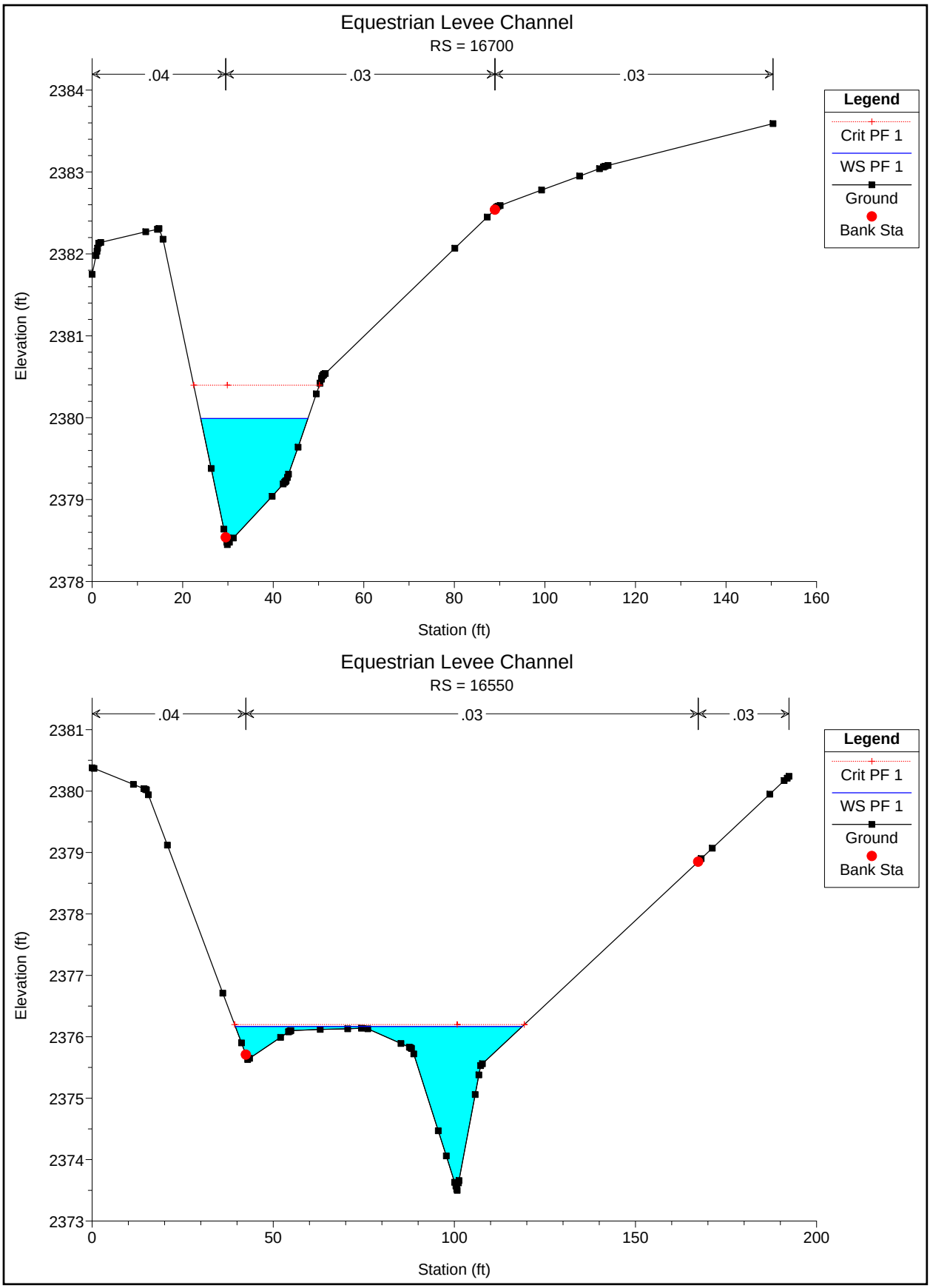

Equestrian Levee Channel
RS = 6500
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2224
2222
2220
2218
2216
2214
2212
2210
2208
2206
0
50
100
150
200
250

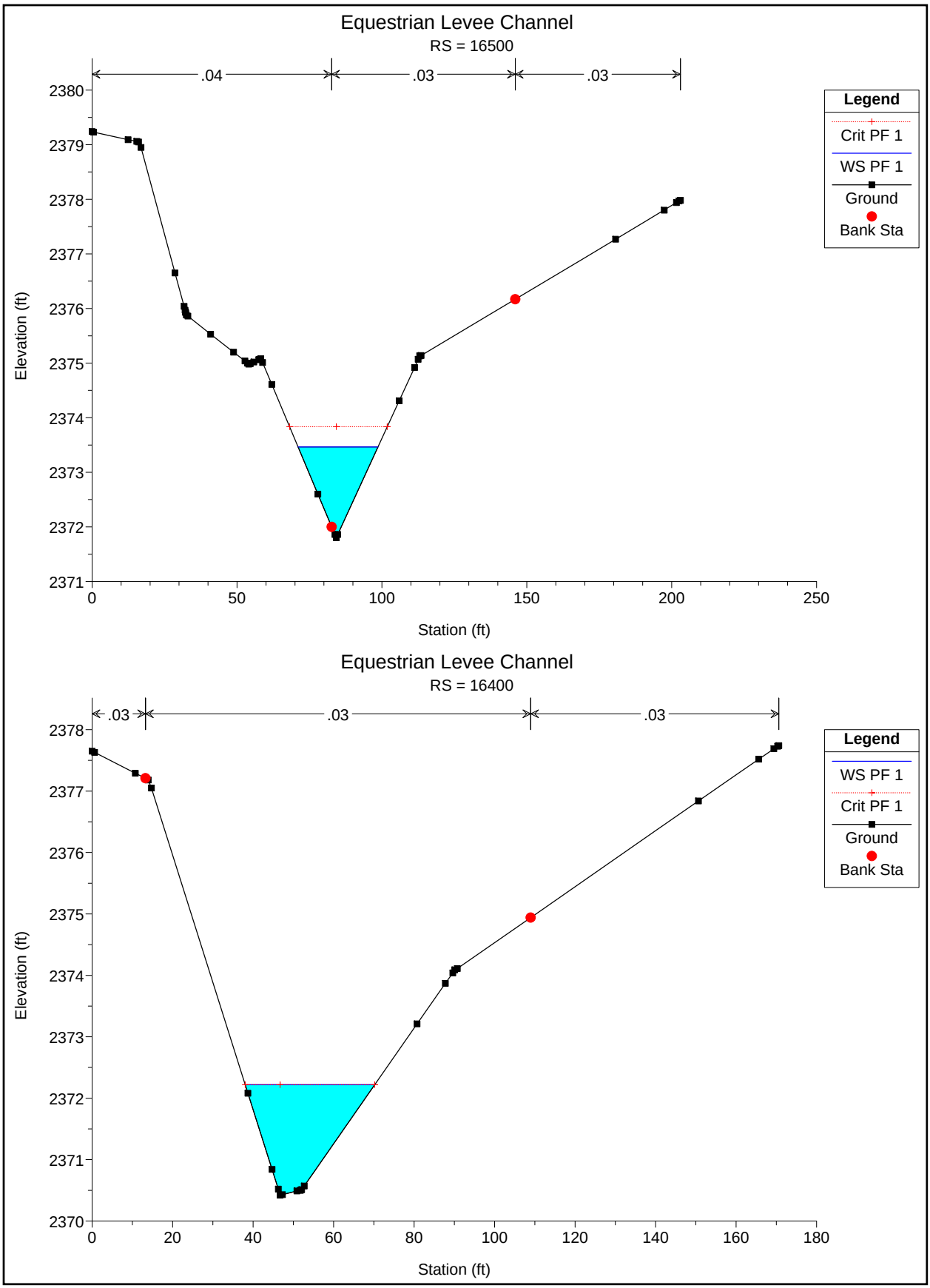

Equestrian Levee Channel
RS = 6400
.03
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2222
2220
2218
2216
2214
2212
2210
2208
2206
0
50
100
150
200
250
300

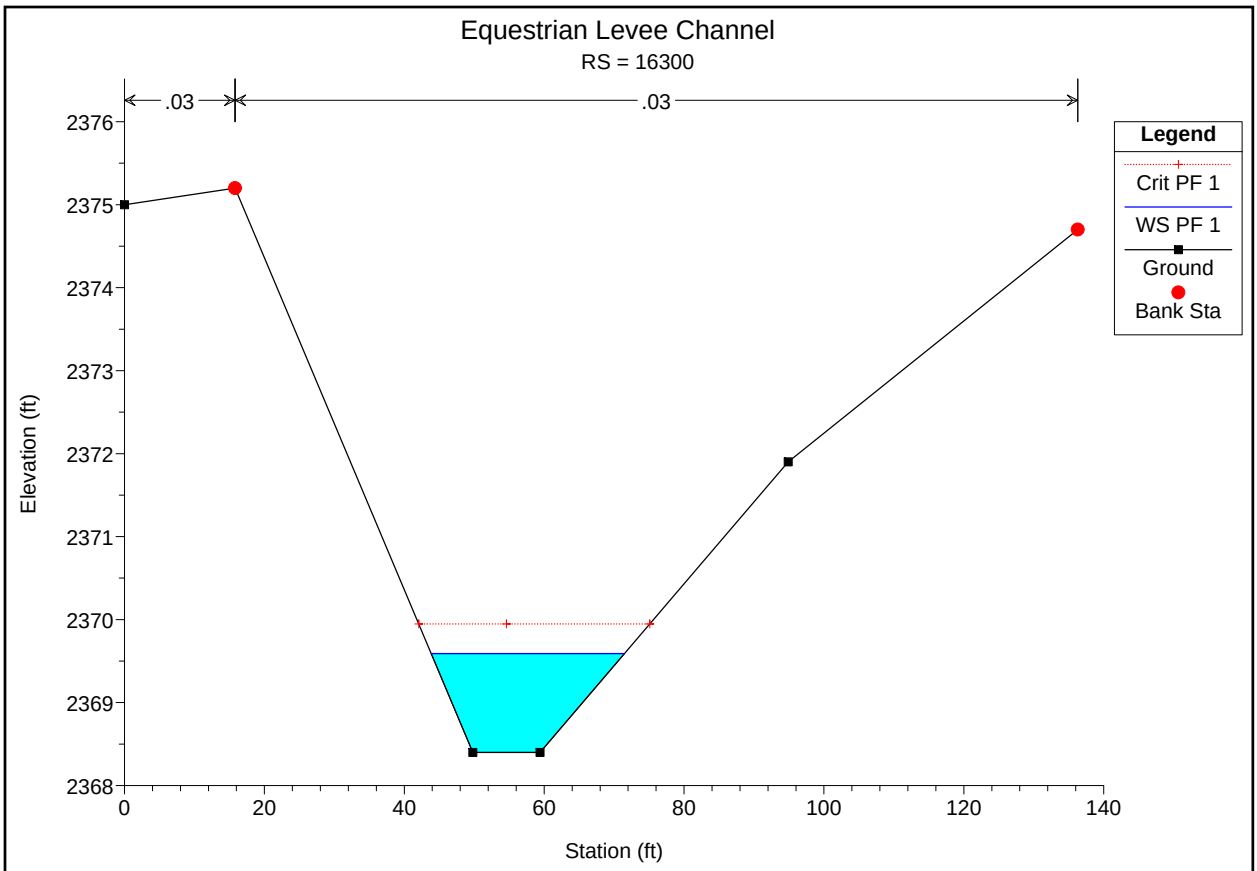

Equestrian Levee Channel
RS = 6200
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
2216
2214
2212
2210
2208
2206
0
20
40
60
80
100
120
Station (ft)

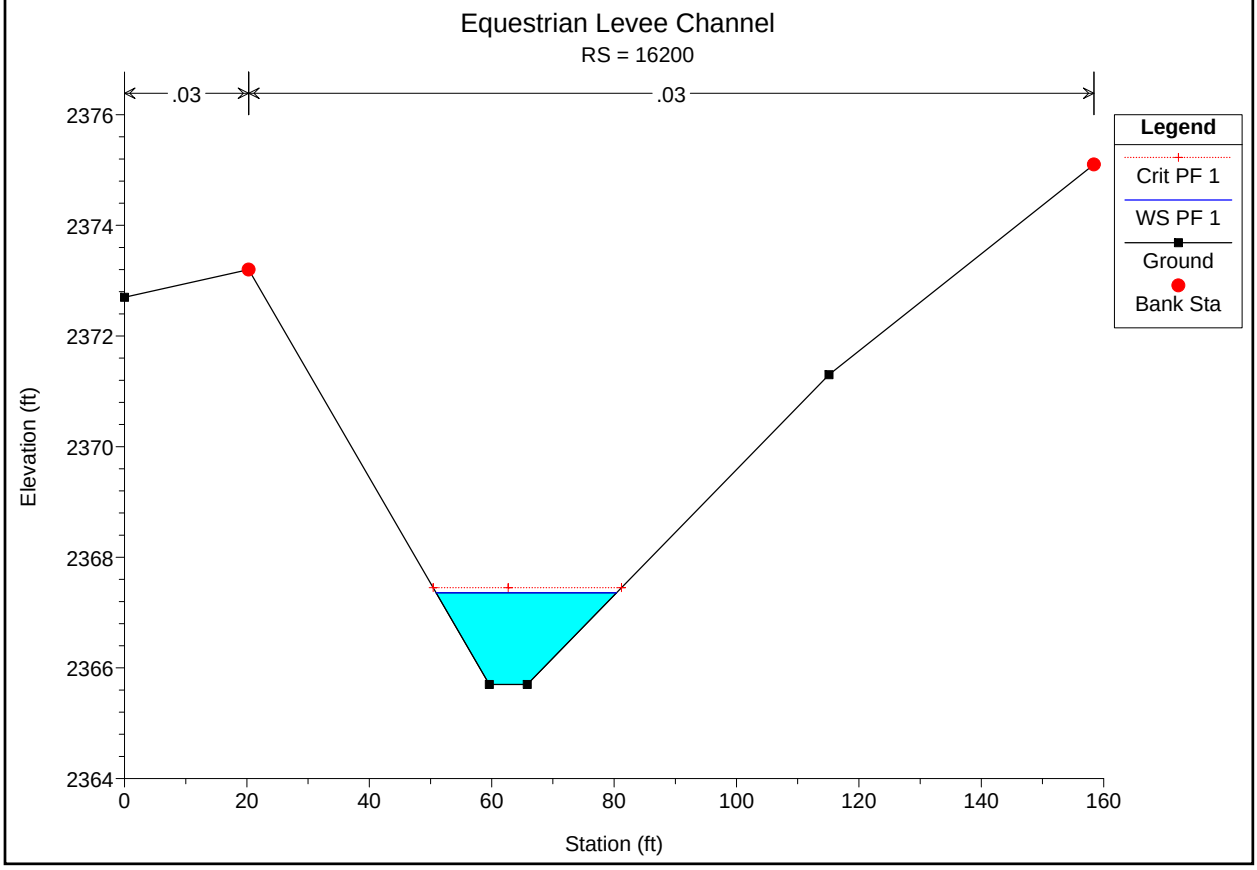
HEC-RAS Supercritical

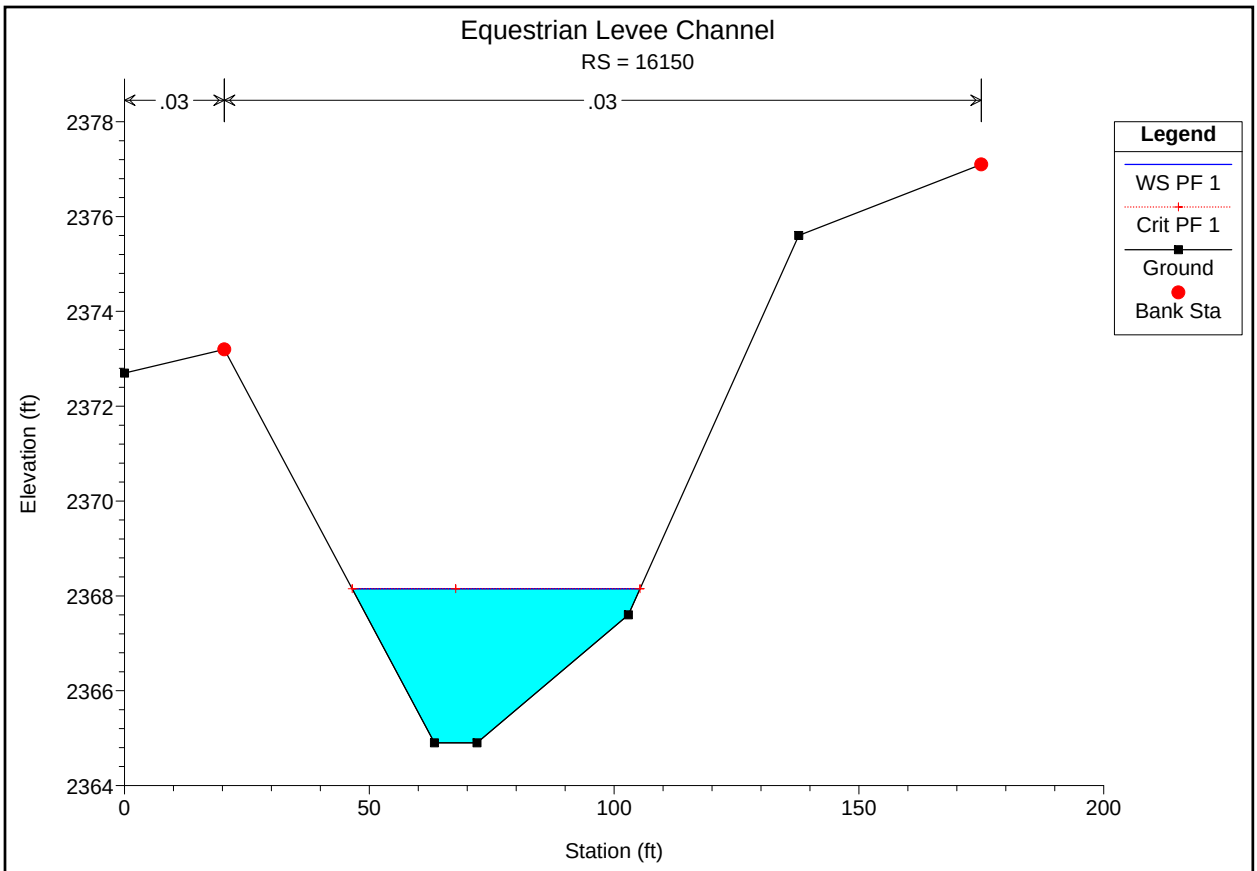
Station Plots

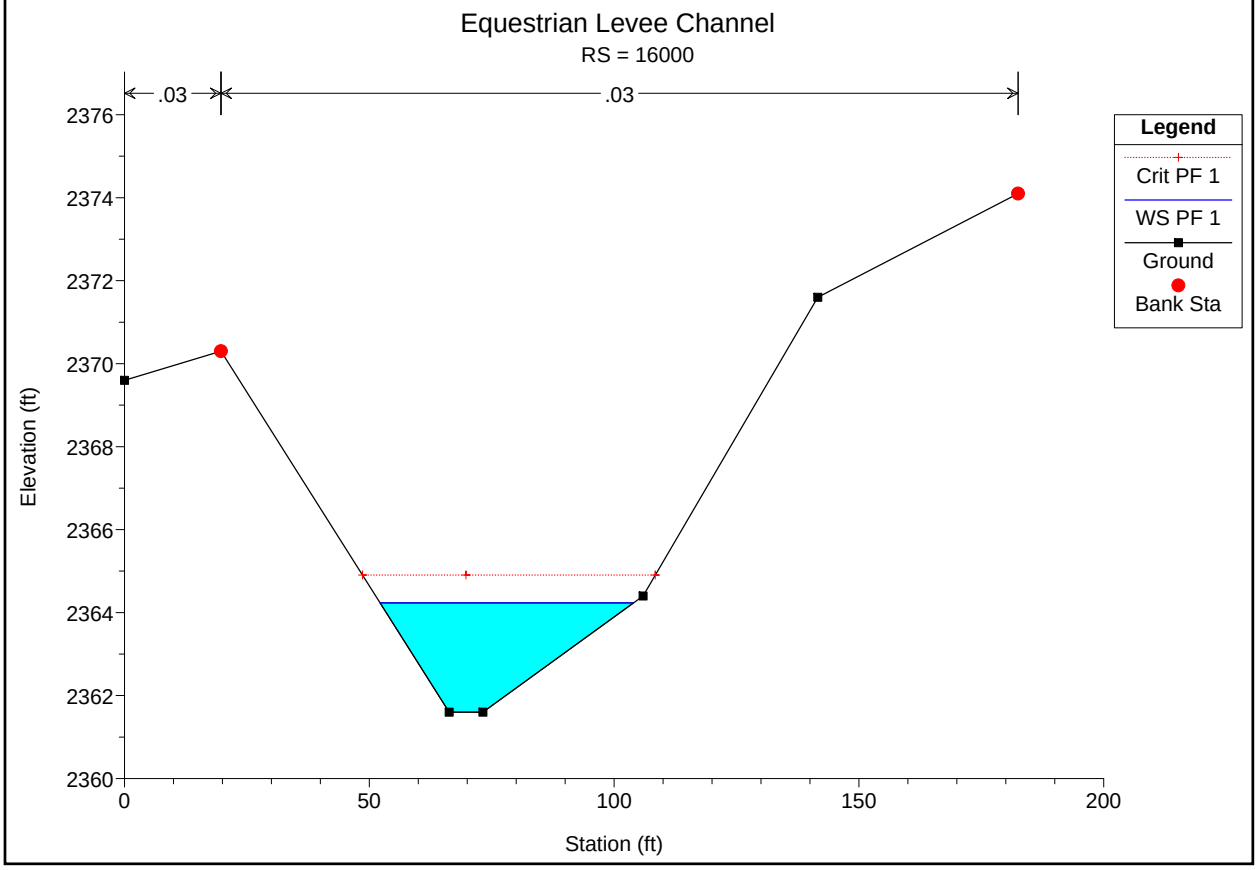

Equestrian Levee Channel
RS = 16700
.04
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2384
2383
2382
2381
2380
2379
2378
0
20
40
60
80
100
120
140
160
Equestrian Levee Channel
RS = 16550
.04
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2381
2380
2379
2378
2377
2376
2375
2374
2373
0
50
100
150
200

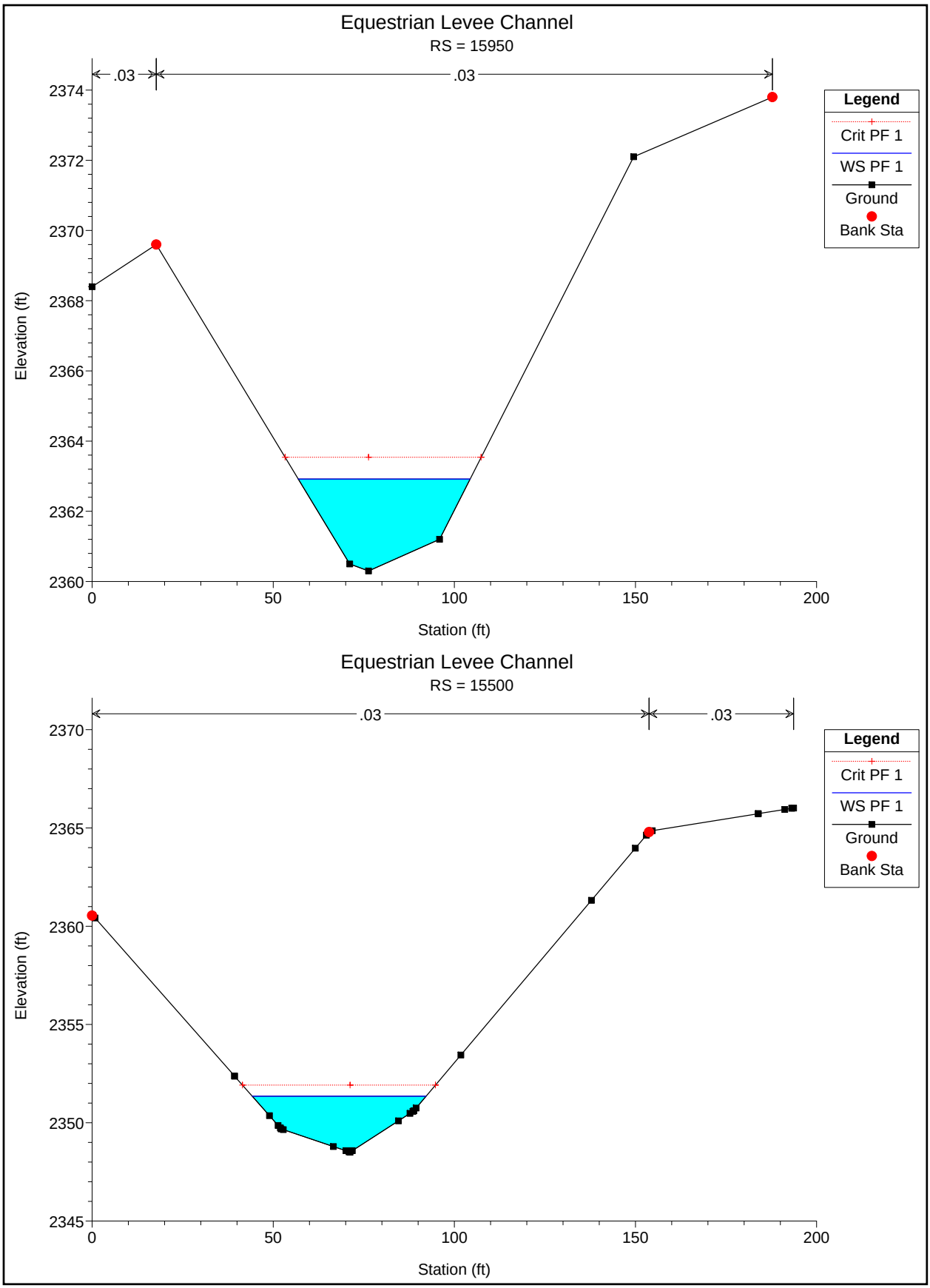

Equestrian Levee Channel
RS = 16500
.04
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2380
2379
2378
2377
2376
2375
2374
2373
2372
2371
0
50
100
150
200
250
Equestrian Levee Channel
RS = 16400
.03
.03
.03
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2378
2377
2376
2375
2374
2373
2372
2371
2370
0
20
40
60
80
100
120
140
160
180

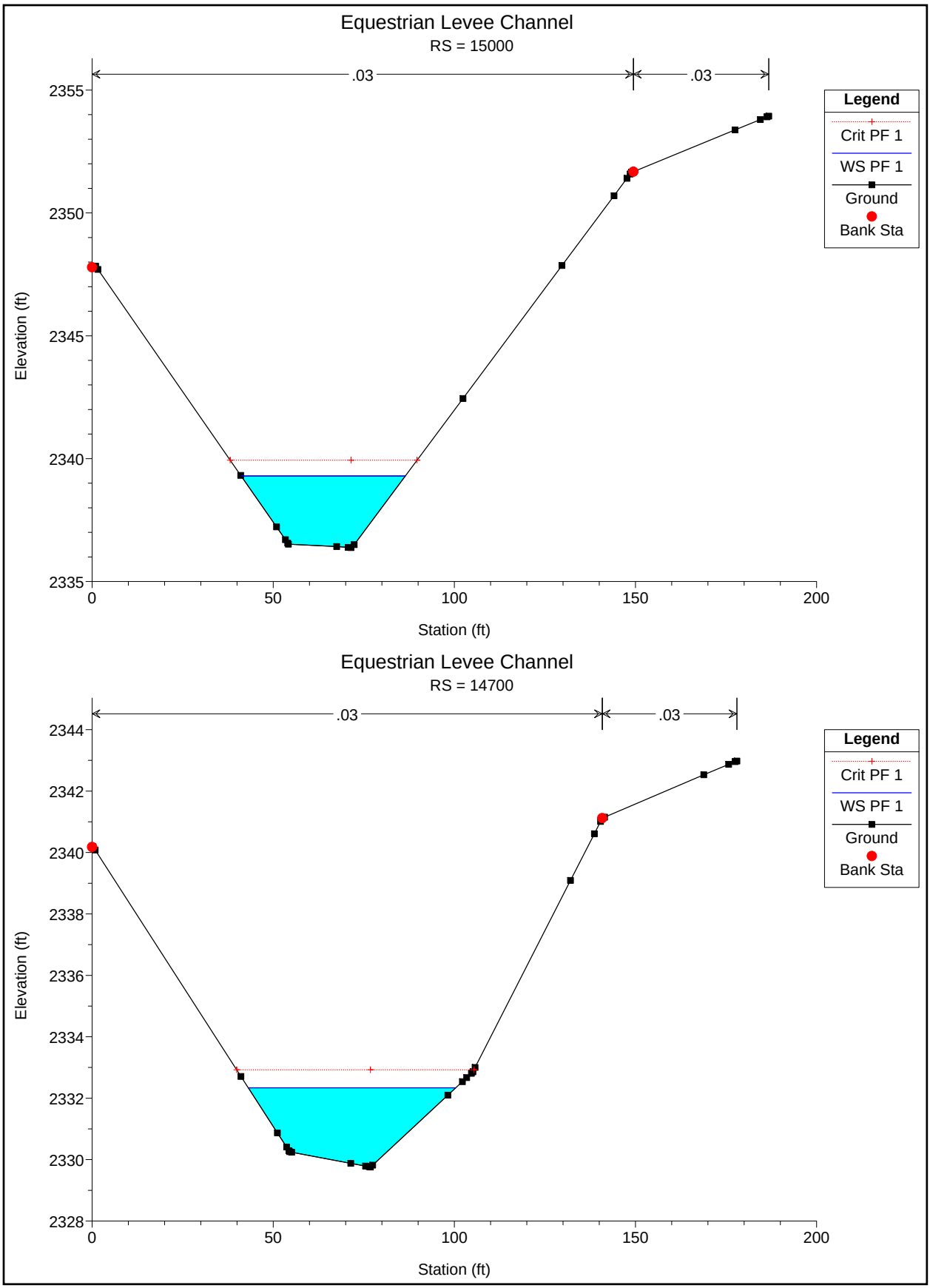

Equestrian Levee Channel
RS = 16300
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2376
2375
2374
2373
2372
2371
2370
2369
2368
0
20
40
60
80
100
120
140

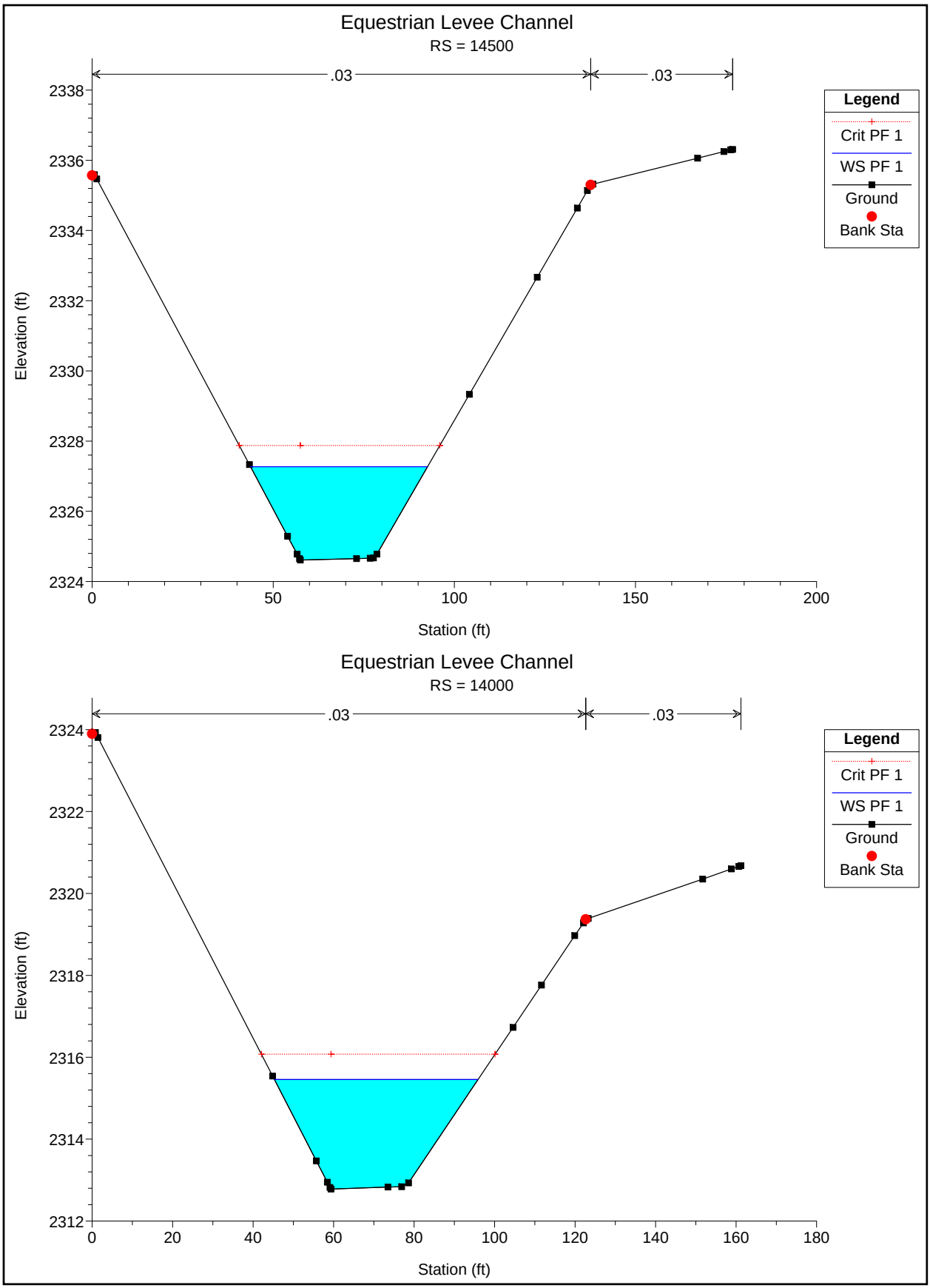

Equestrian Levee Channel
RS = 16200
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2376
2374
2372
2370
2368
2366
2364
0
20
40
60
80
100
120
140
160

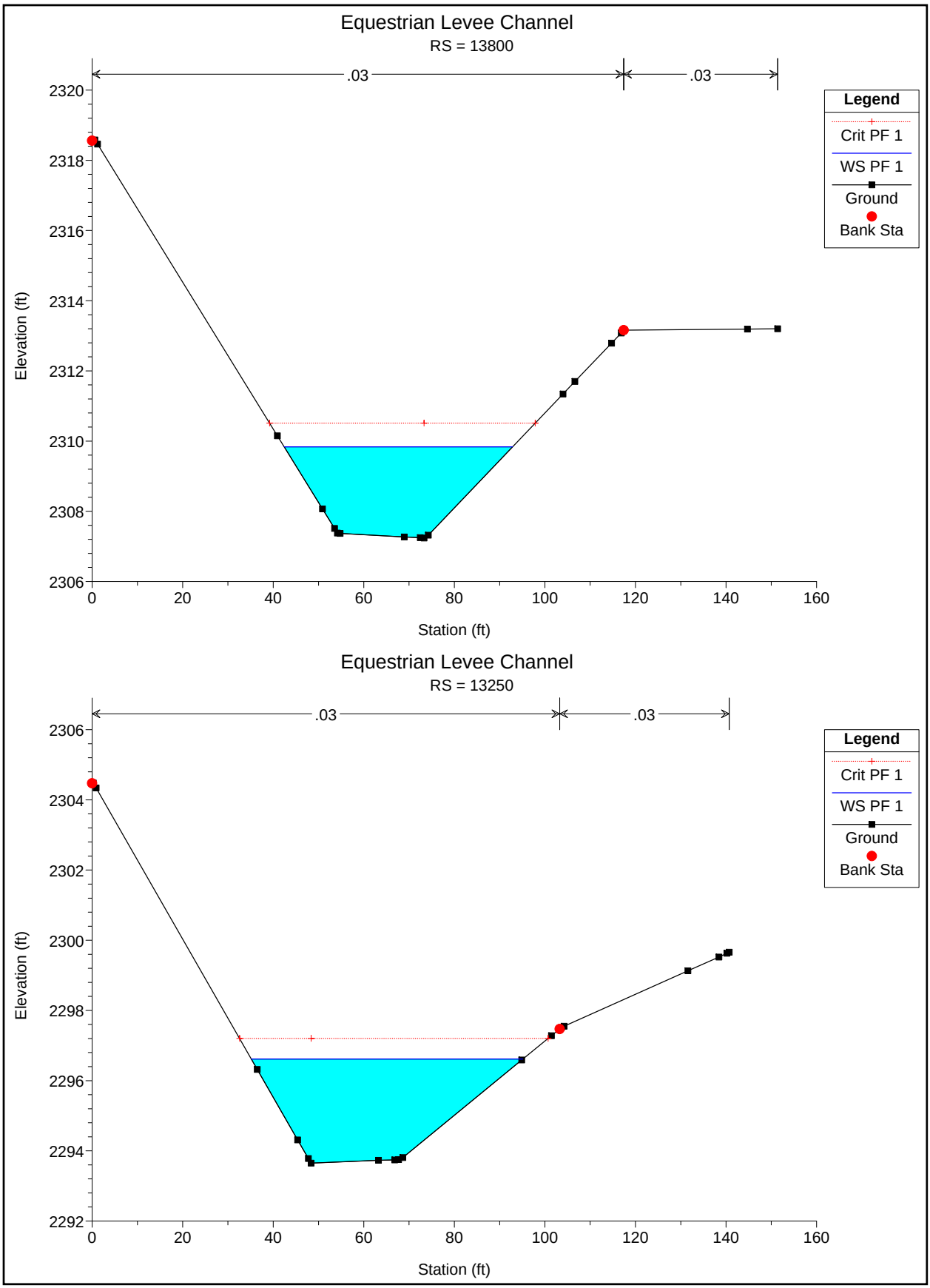

Equestrian Levee Channel
RS = 16150
.03
.03
2378
2376
2374
2372
2370
2368
2366
2364
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
WS PF 1
Crit PF 1
Ground
Bank Sta

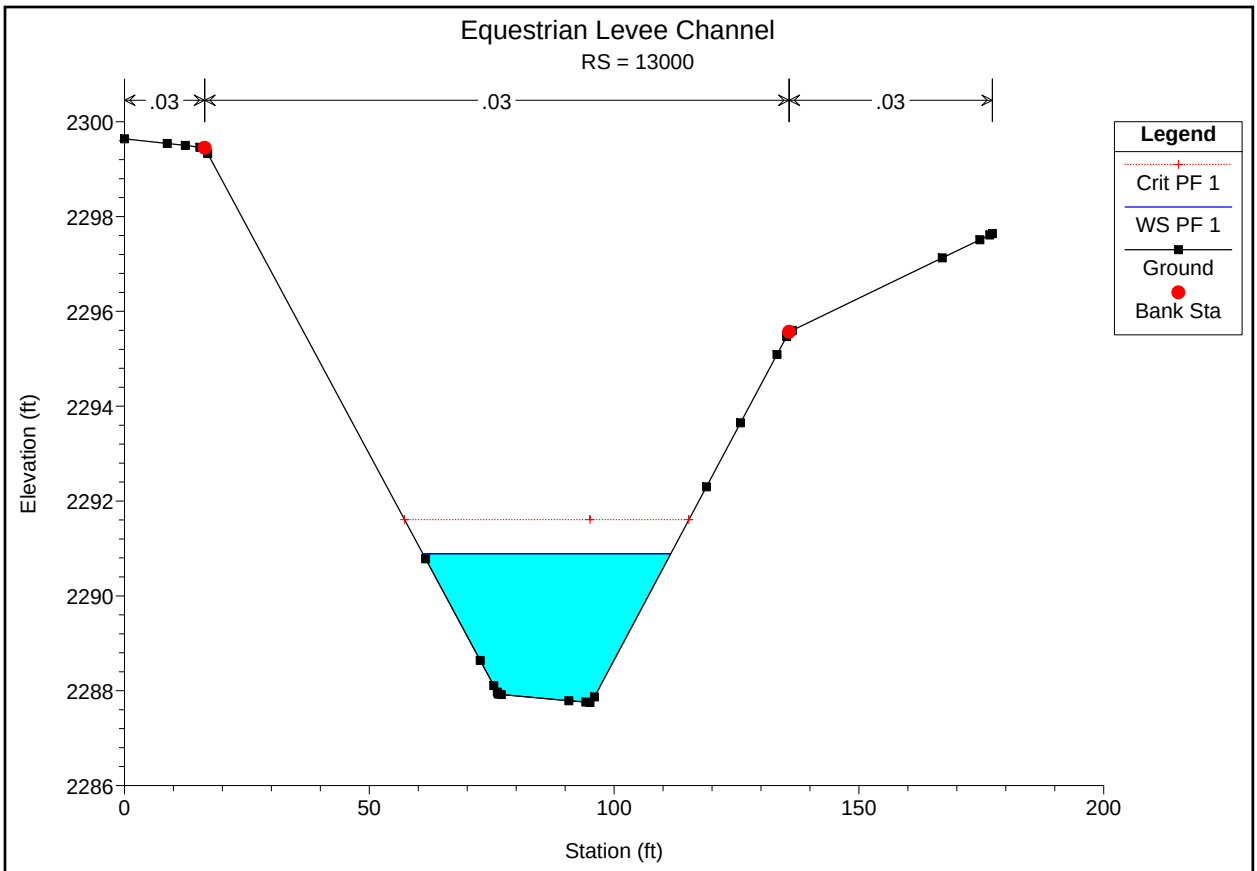

Equestrian Levee Channel
RS = 16000
.03
.03
2376
2374
2372
2370
2368
2366
2364
2362
2360
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta

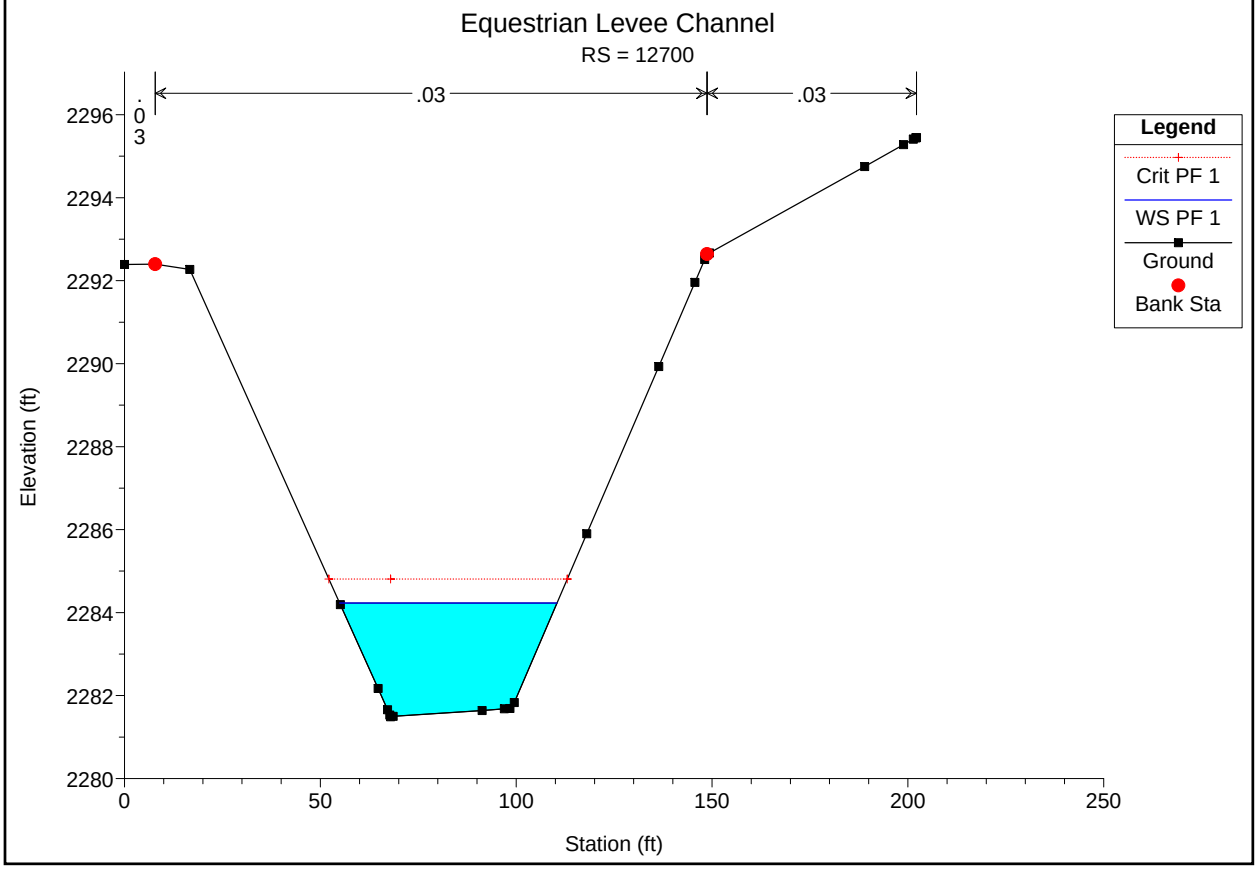

Equestrian Levee Channel
RS = 15950
.03
.03
2374
2372
2370
2368
2366
2364
2362
2360
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Equestrian Levee Channel
RS = 15500
.03
.03
2370
2365
2360
2355
2350
2345
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta

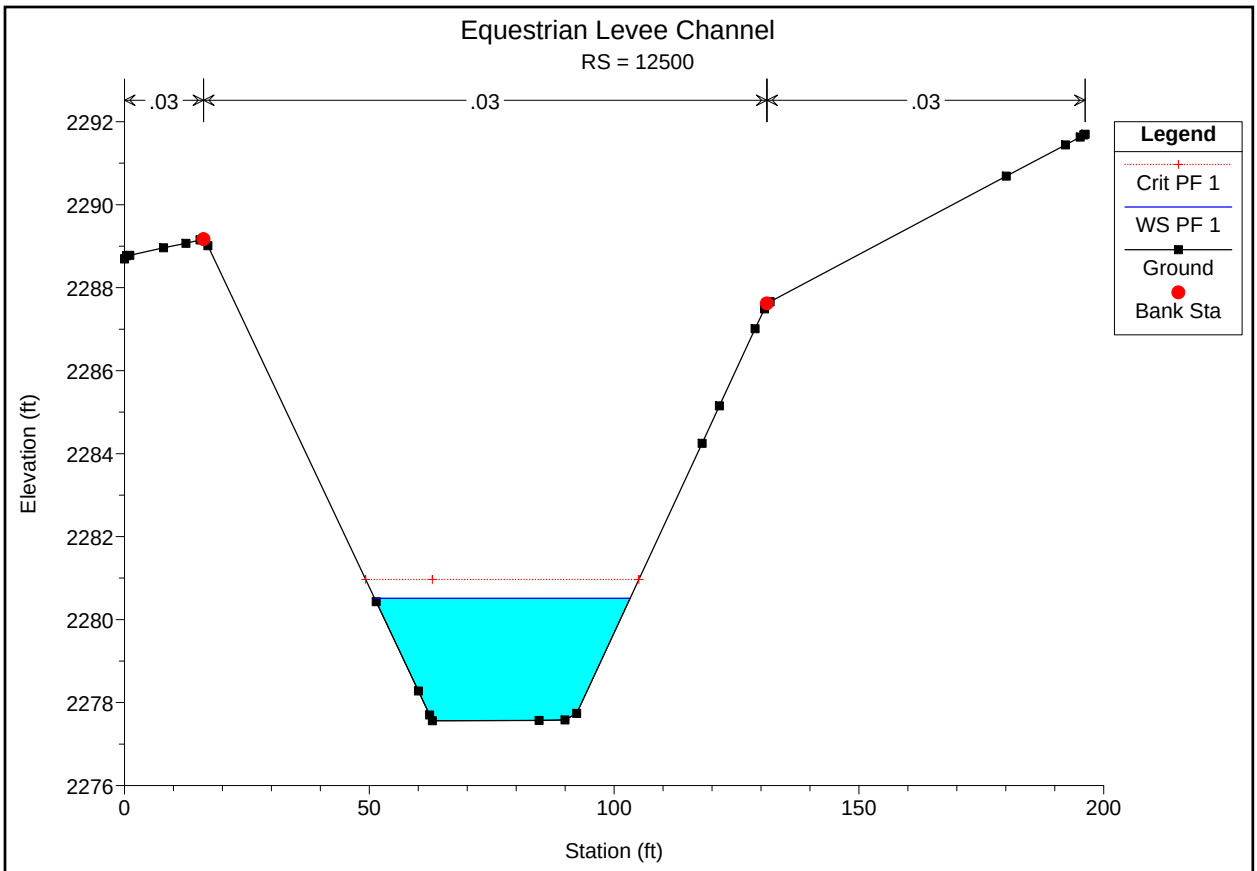

Equestrian Levee Channel
RS = 15000
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2355
2350
2345
2340
2335
0
50
100
150
200
Station (ft)
Equestrian Levee Channel
RS = 14700
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2344
2342
2340
2338
2336
2334
2332
2330
2328
0
50
100
150
200
Station (ft)

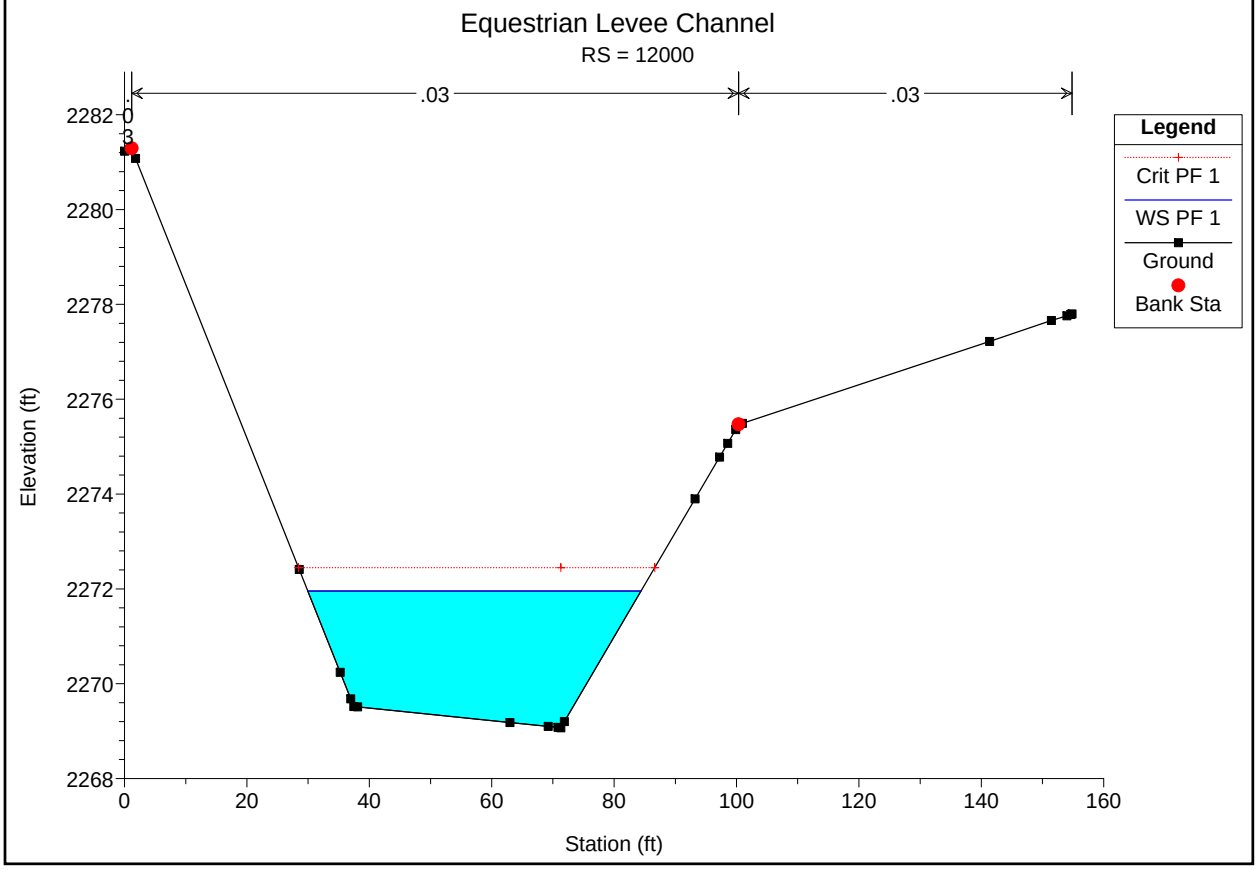

Equestrian Levee Channel
RS = 14500
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2338
2336
2334
2332
2330
2328
2326
2324
0
50
100
150
200
Equestrian Levee Channel
RS = 14000
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2324
2322
2320
2318
2316
2314
2312
0
20
40
60
80
100
120
140
160
180

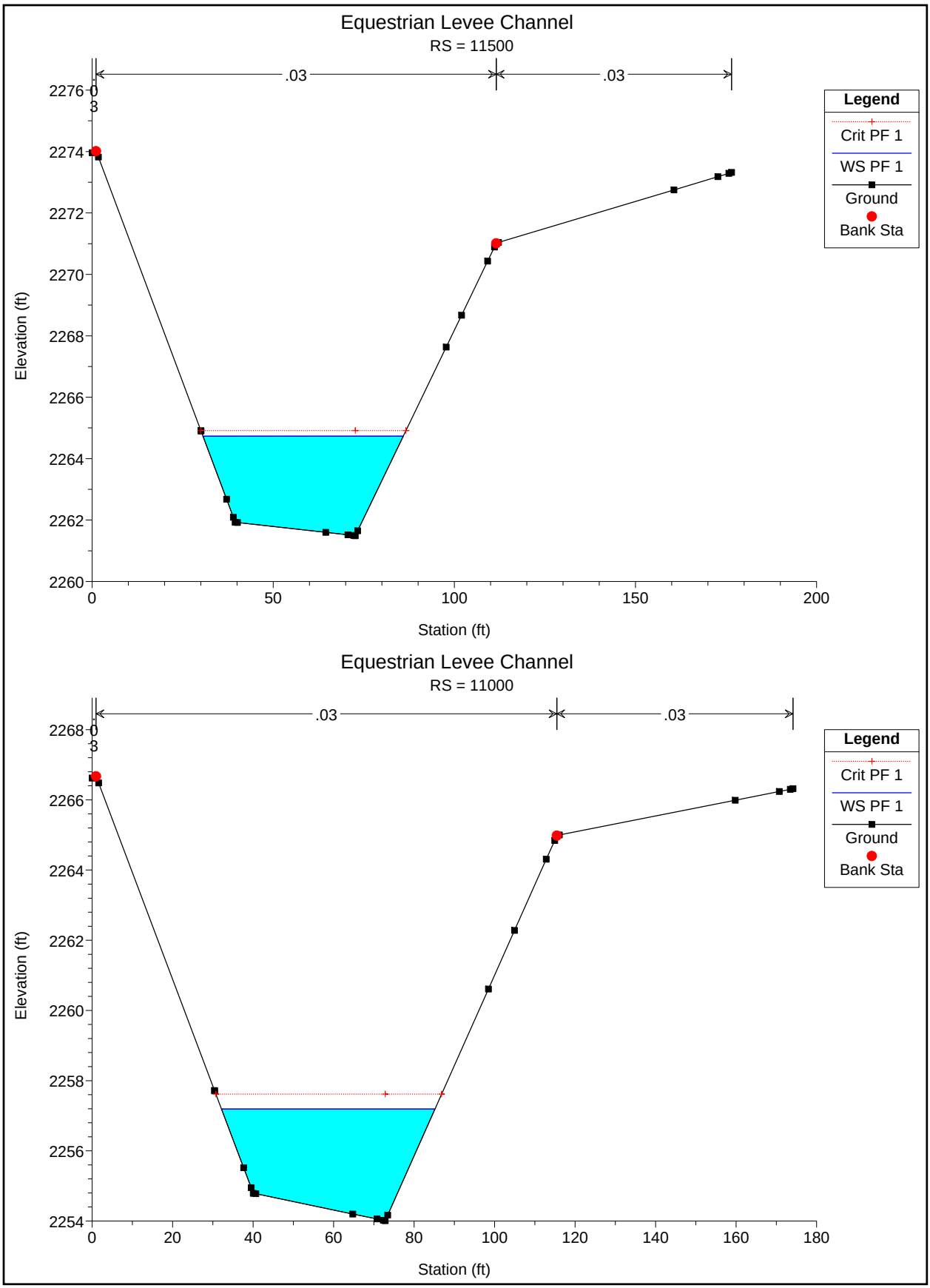

Equestrian Levee Channel
RS = 13800
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2320
2318
2316
2314
2312
2310
2308
2306
0
20
40
60
80
100
120
140
160
Equestrian Levee Channel
RS = 13250
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2306
2304
2302
2300
2298
2296
2294
2292
0
20
40
60
80
100
120
140
160

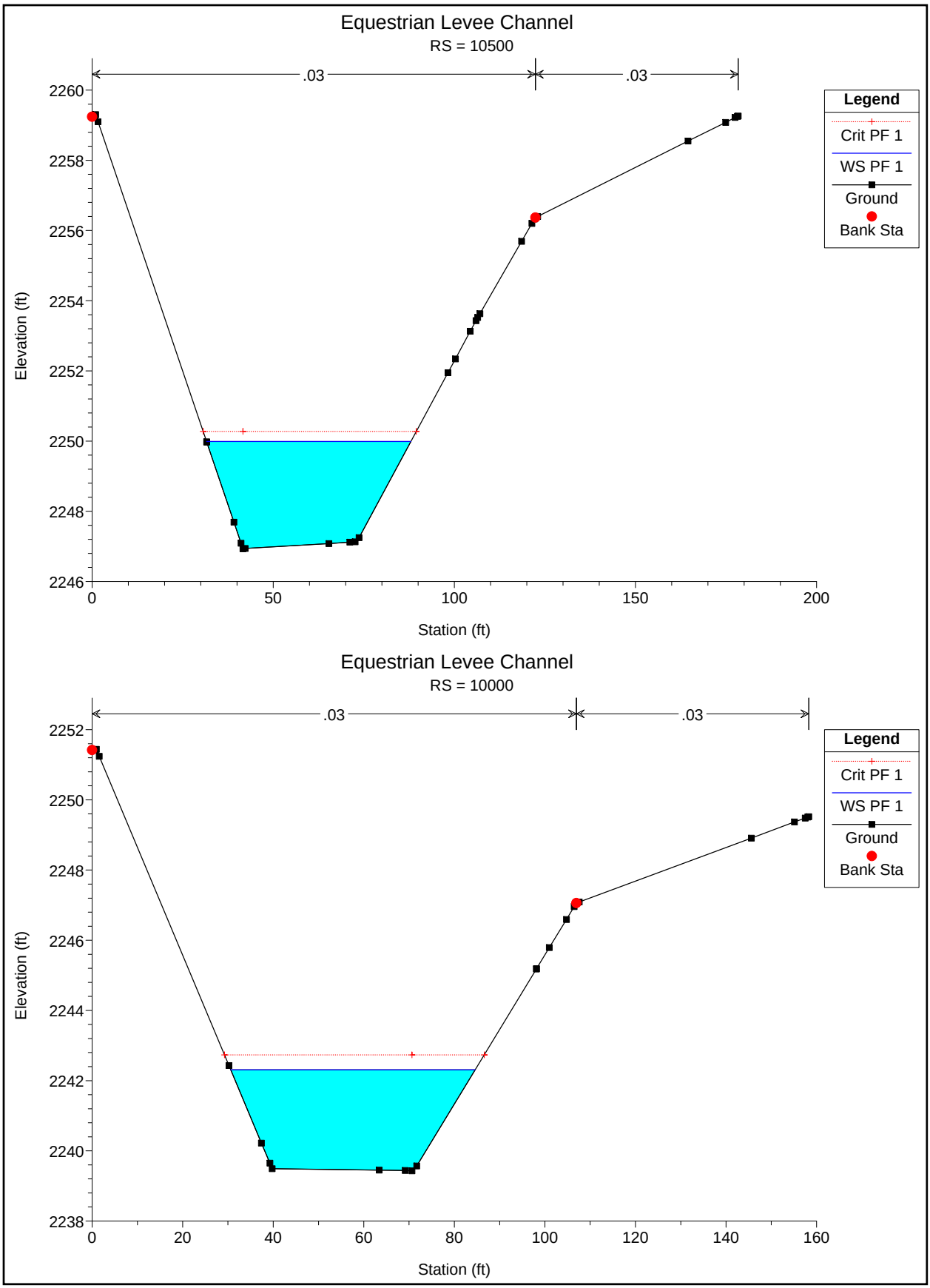

Equestrian Levee Channel
RS = 13000
.03
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2300
2298
2296
2294
2292
2290
2288
2286
0
50
100
150
200

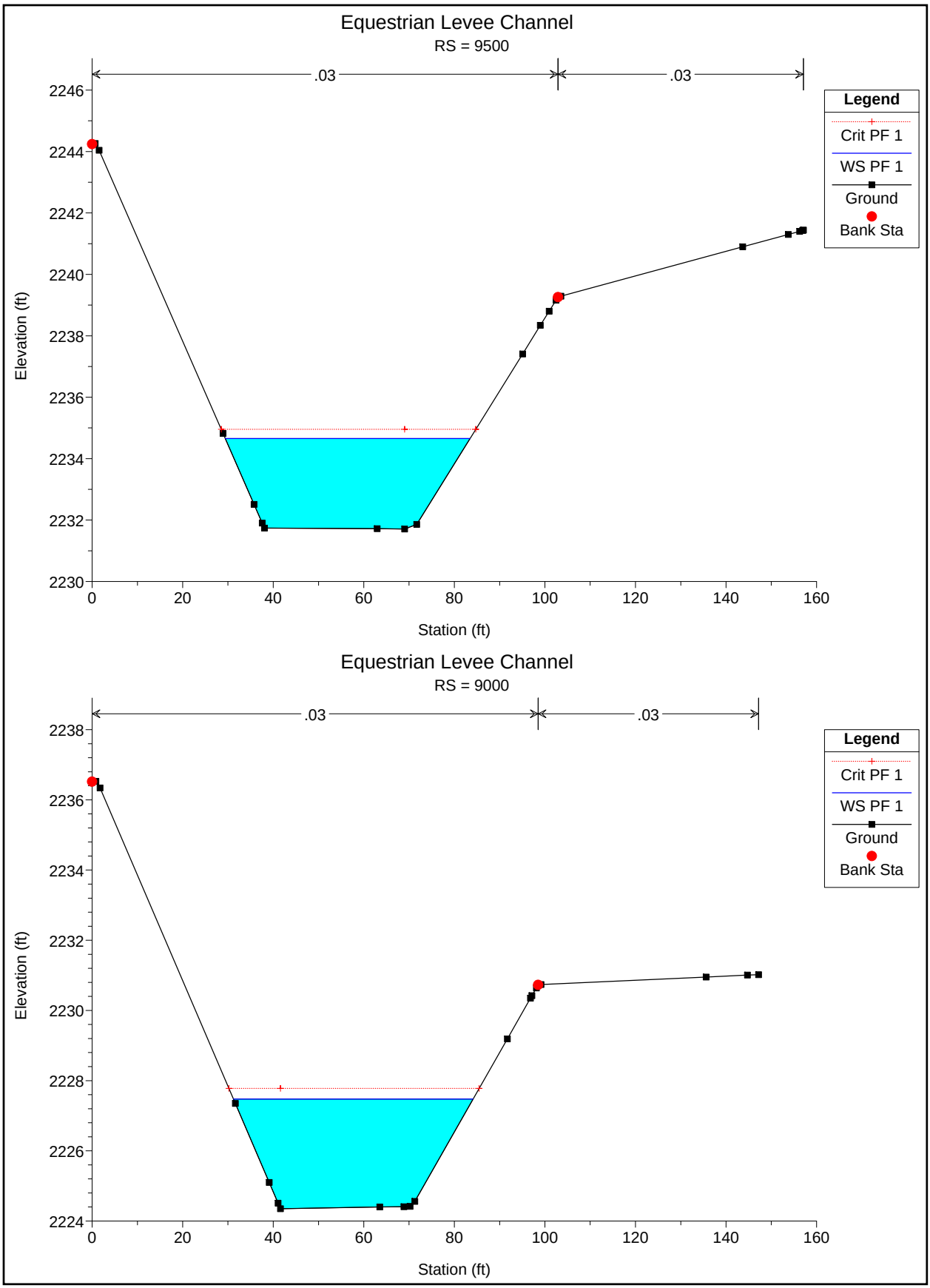

Equestrian Levee Channel
RS = 12700
.03
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2296
2294
2292
2290
2288
2286
2284
2282
2280
0
50
100
150
200
250

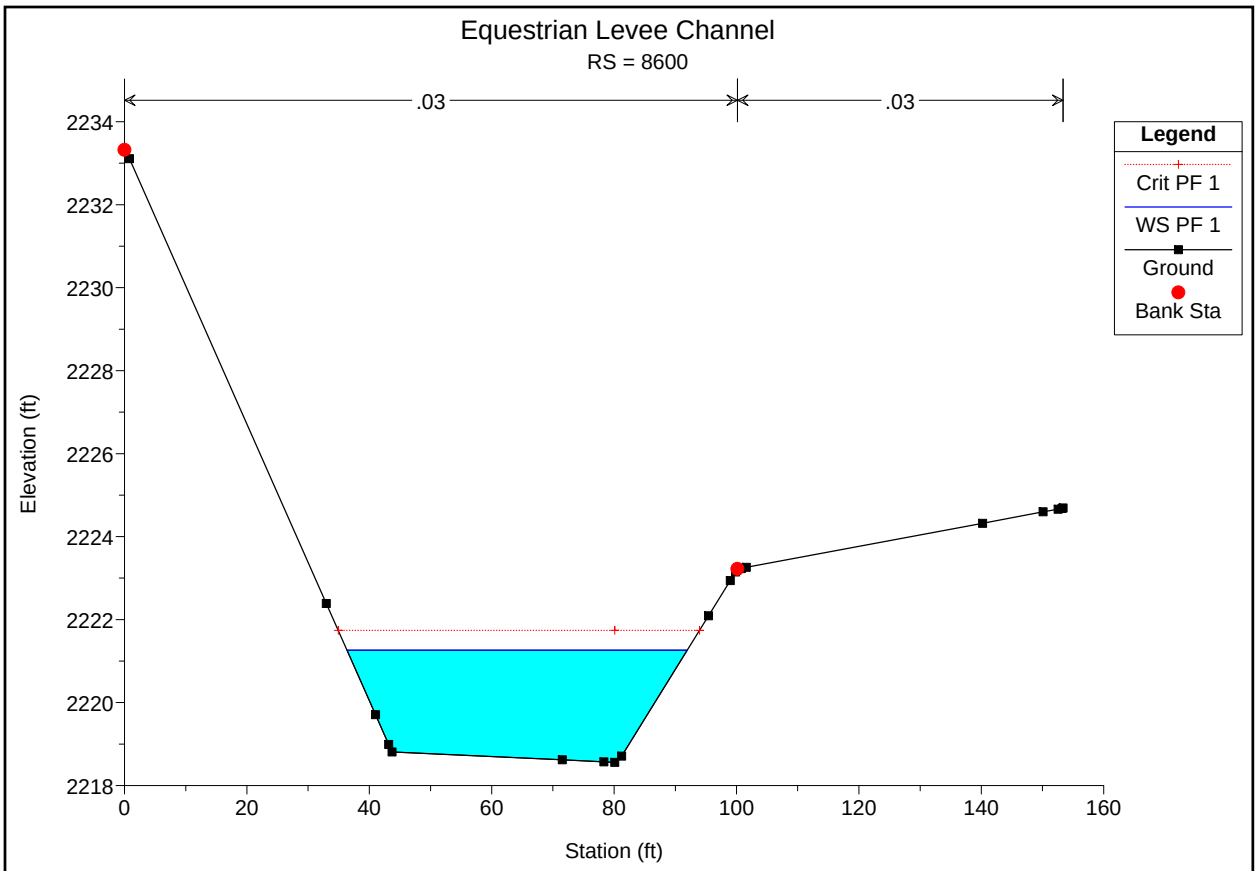

Equestrian Levee Channel
RS = 12500
.03
.03
.03
Legend
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2292
2290
2288
2286
2284
2282
2280
2278
2276
0
50
100
150
200

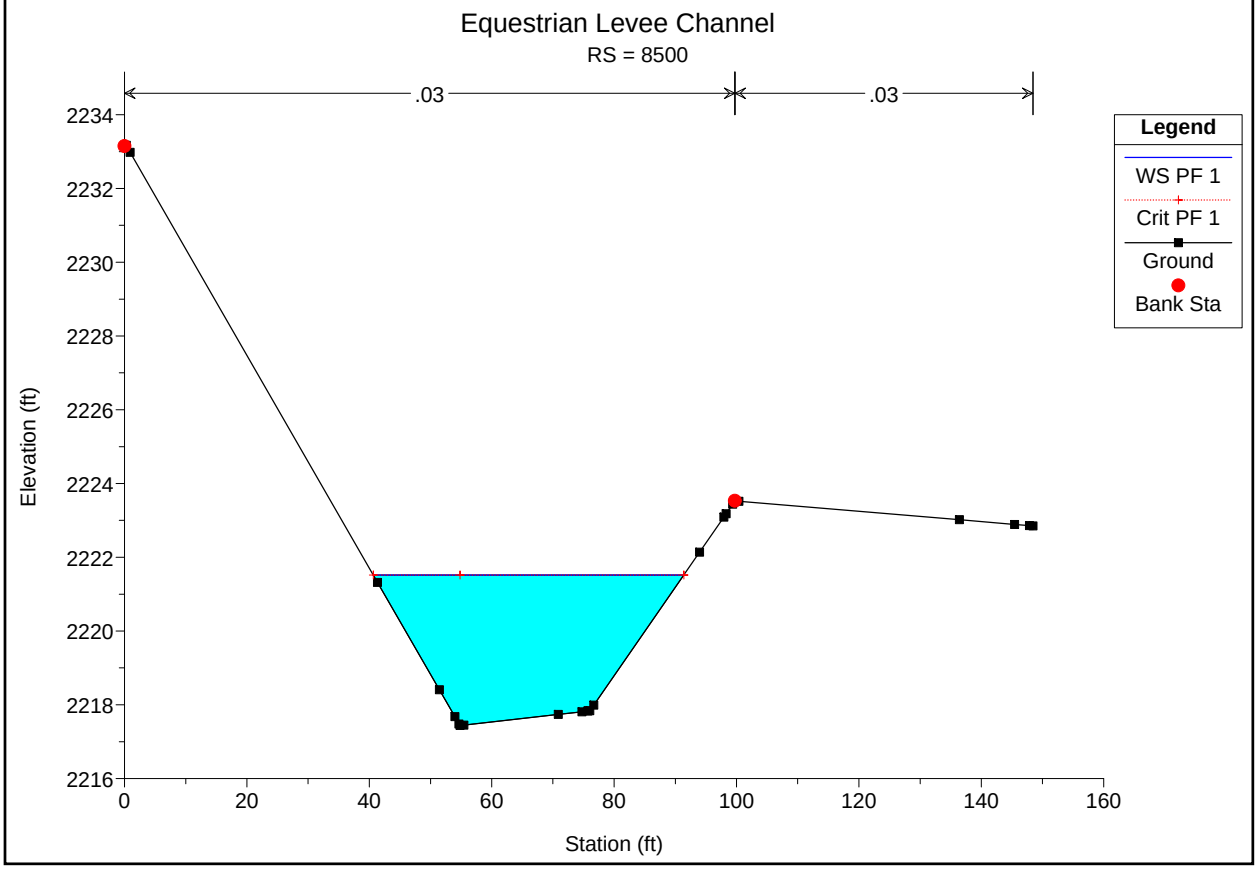

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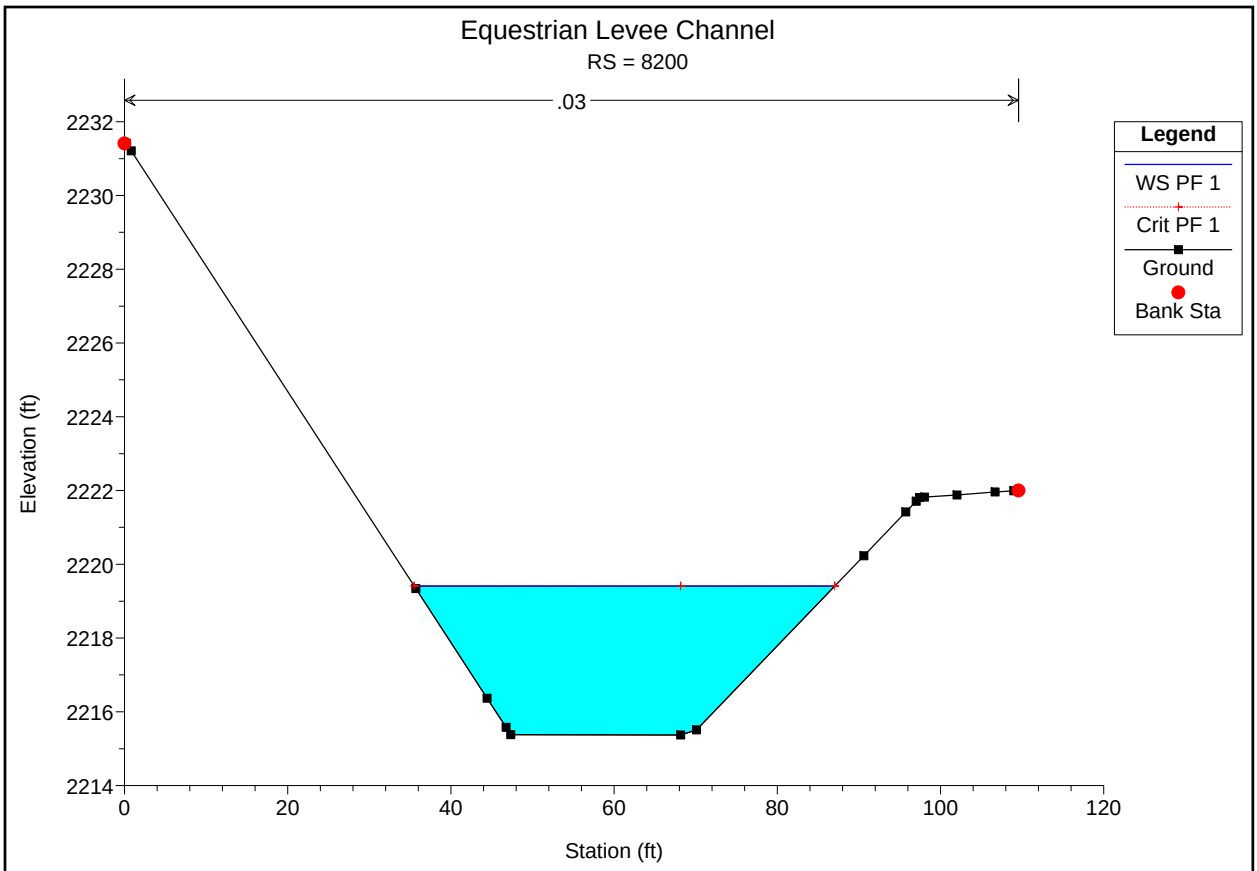

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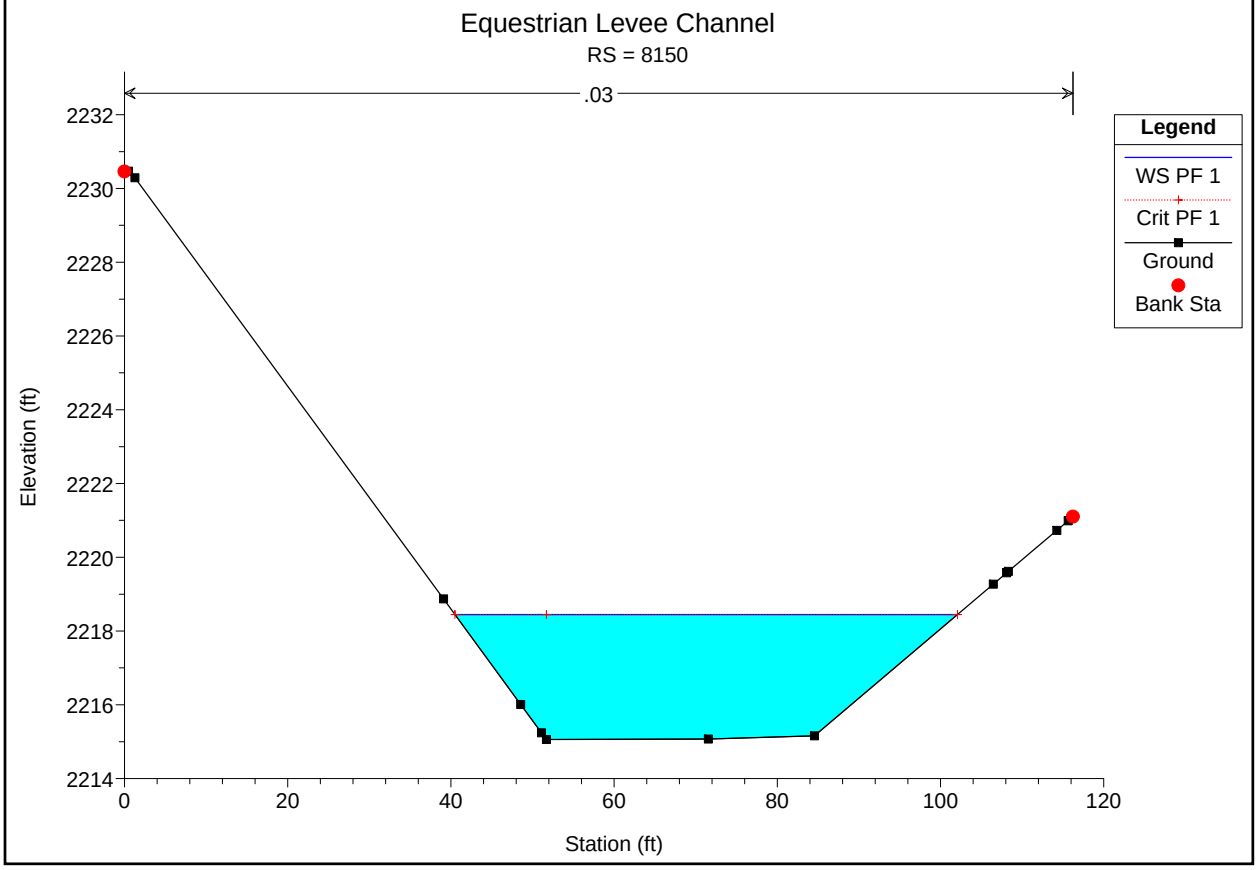

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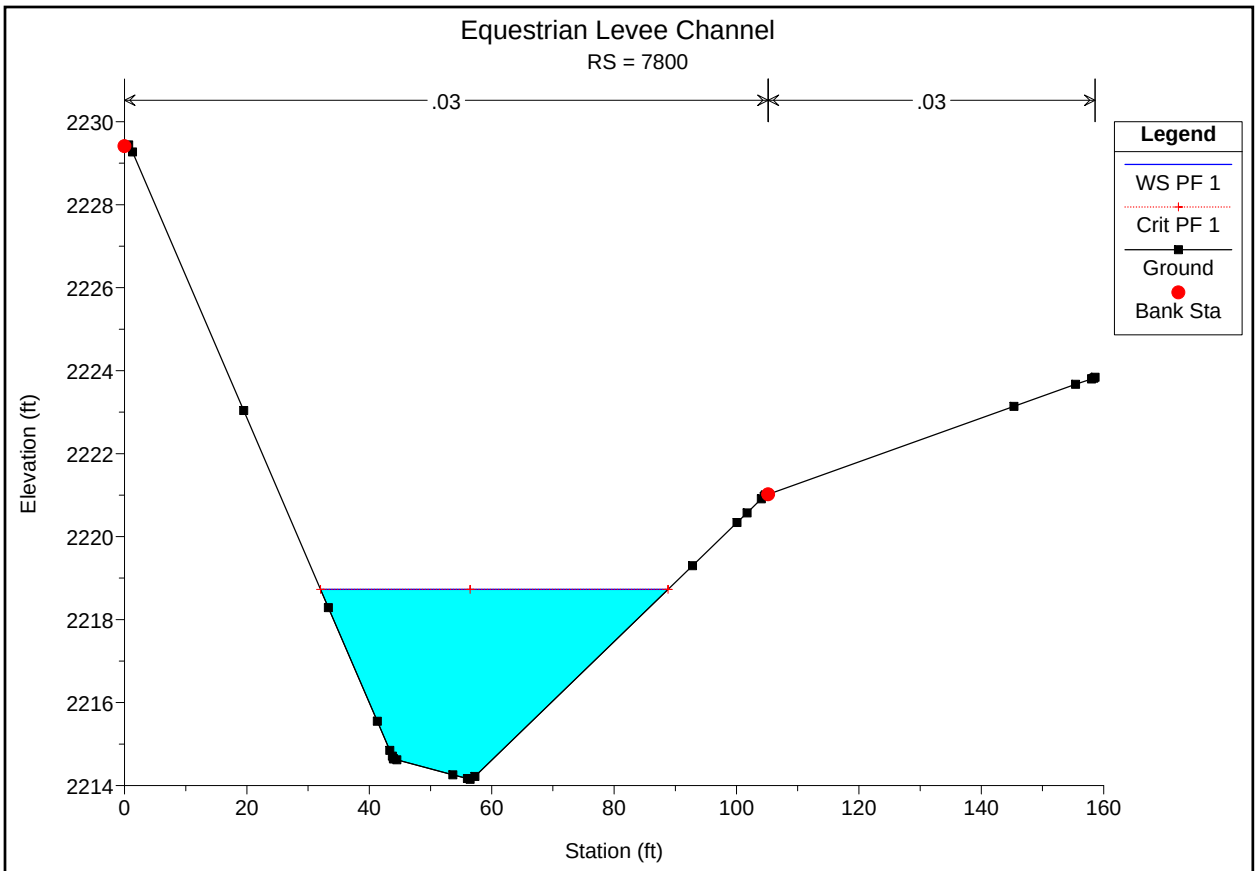

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Station (ft)
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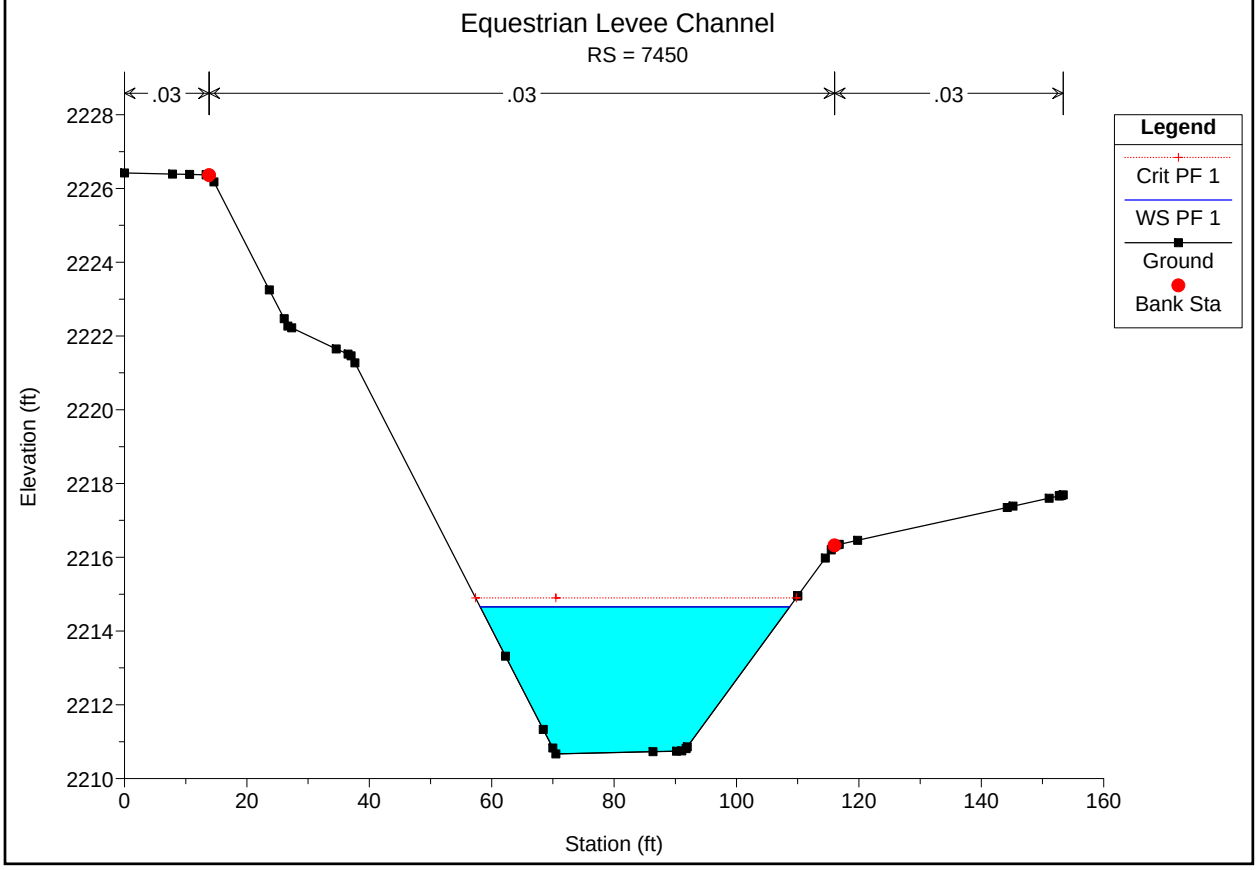

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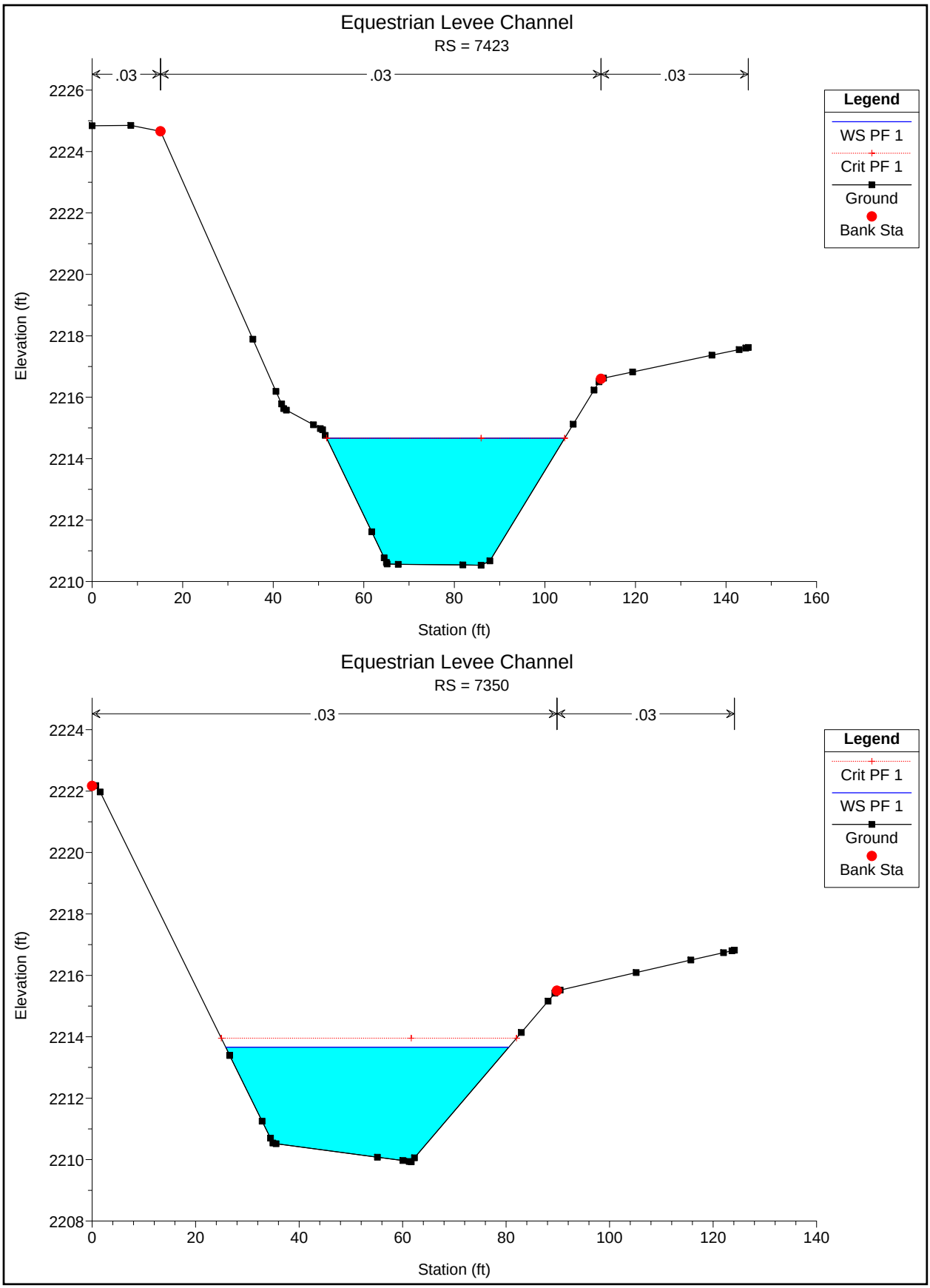

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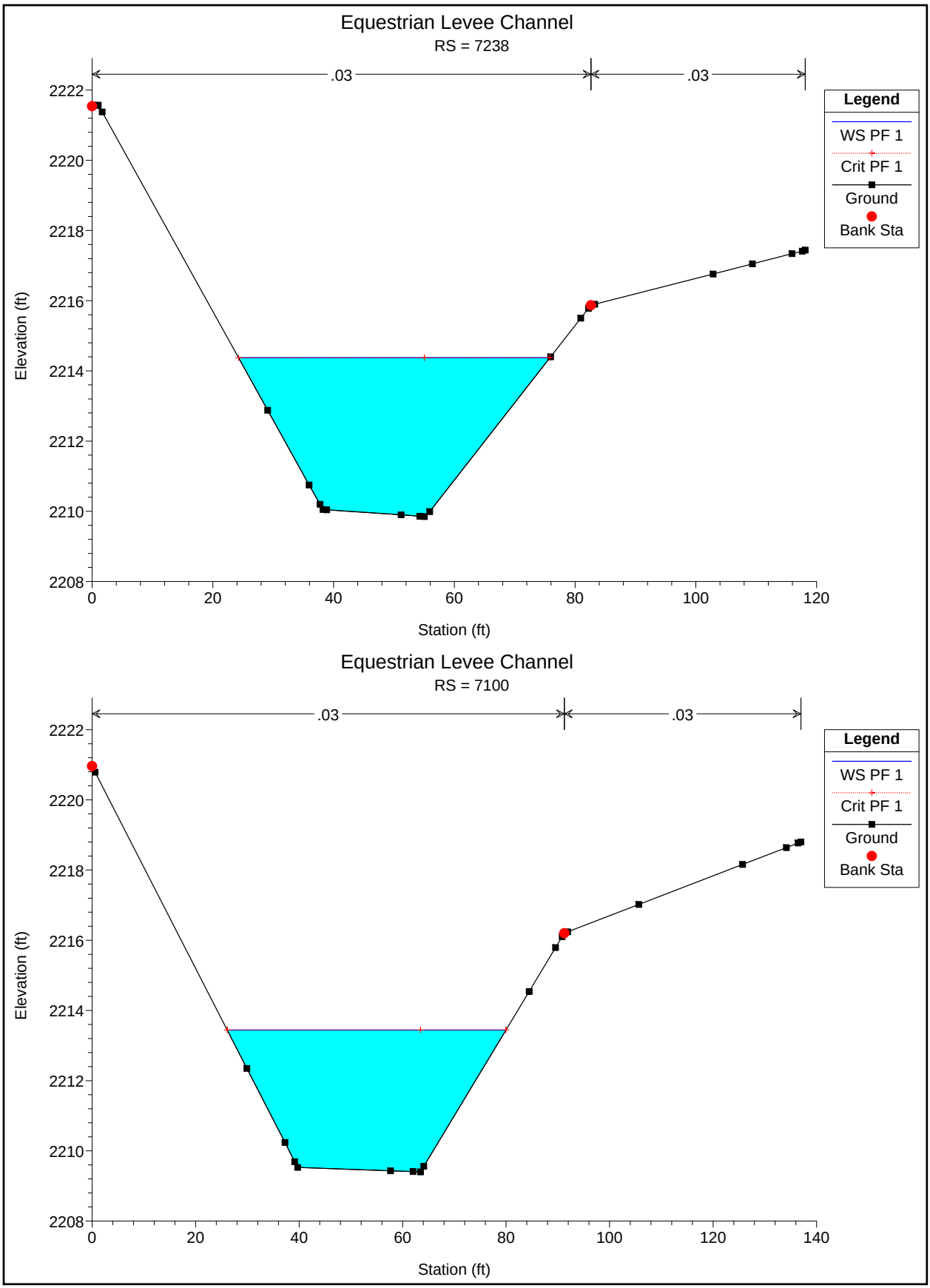

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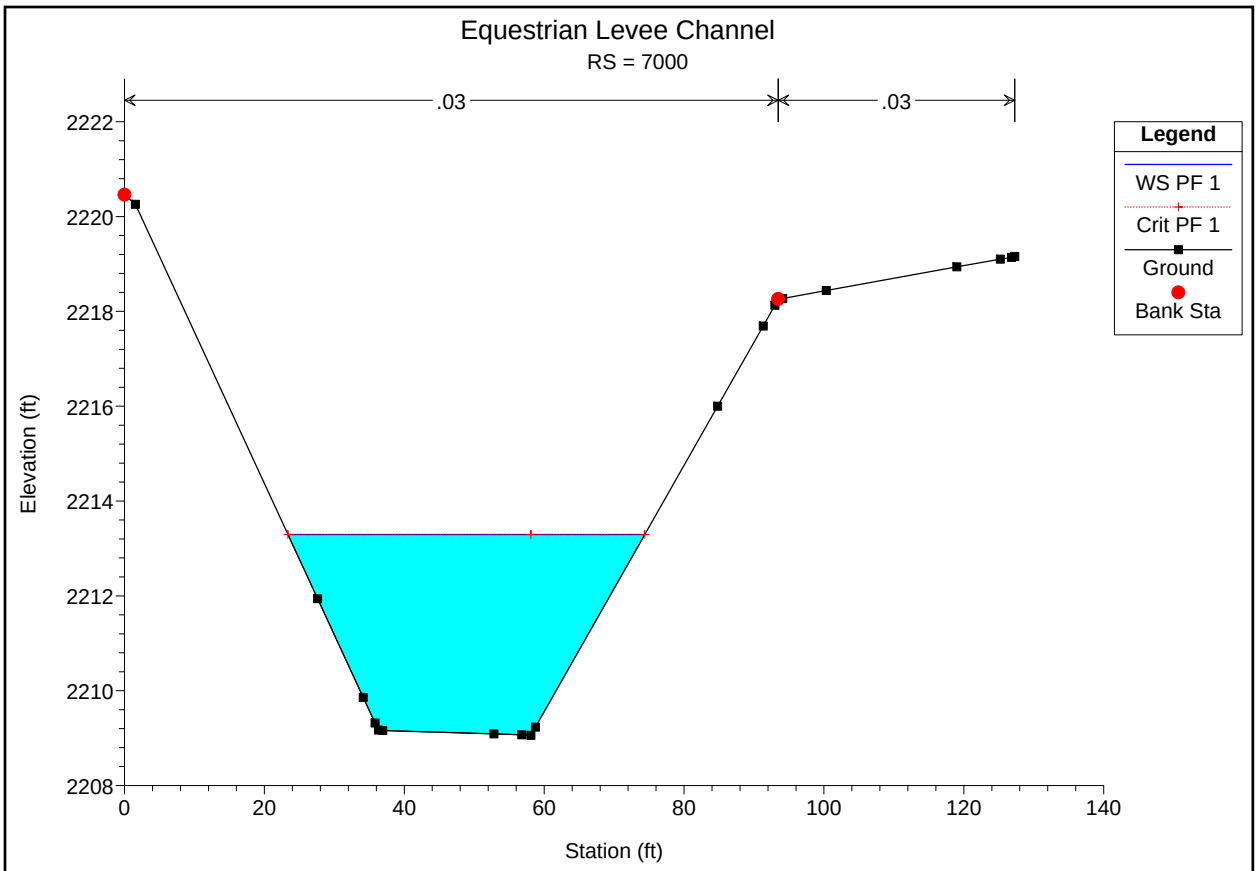

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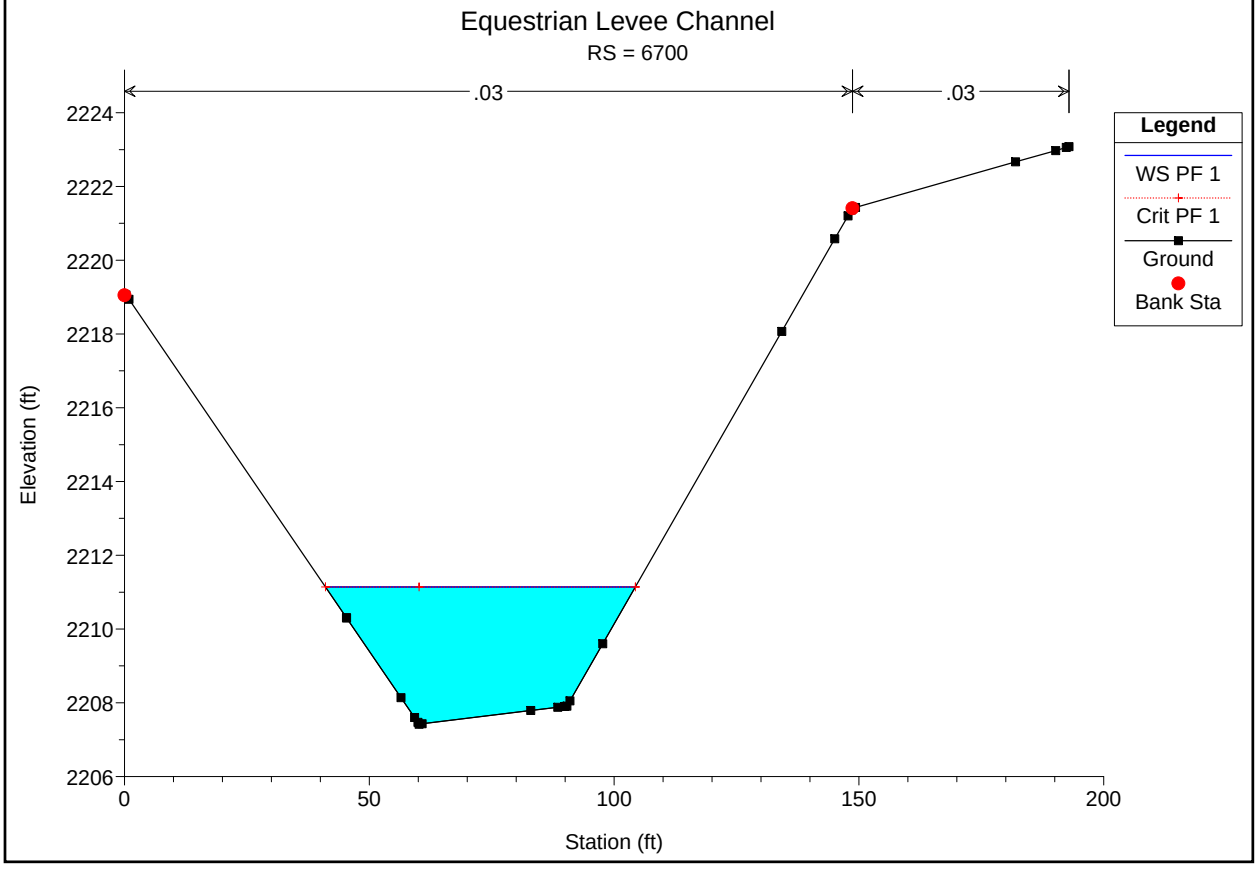

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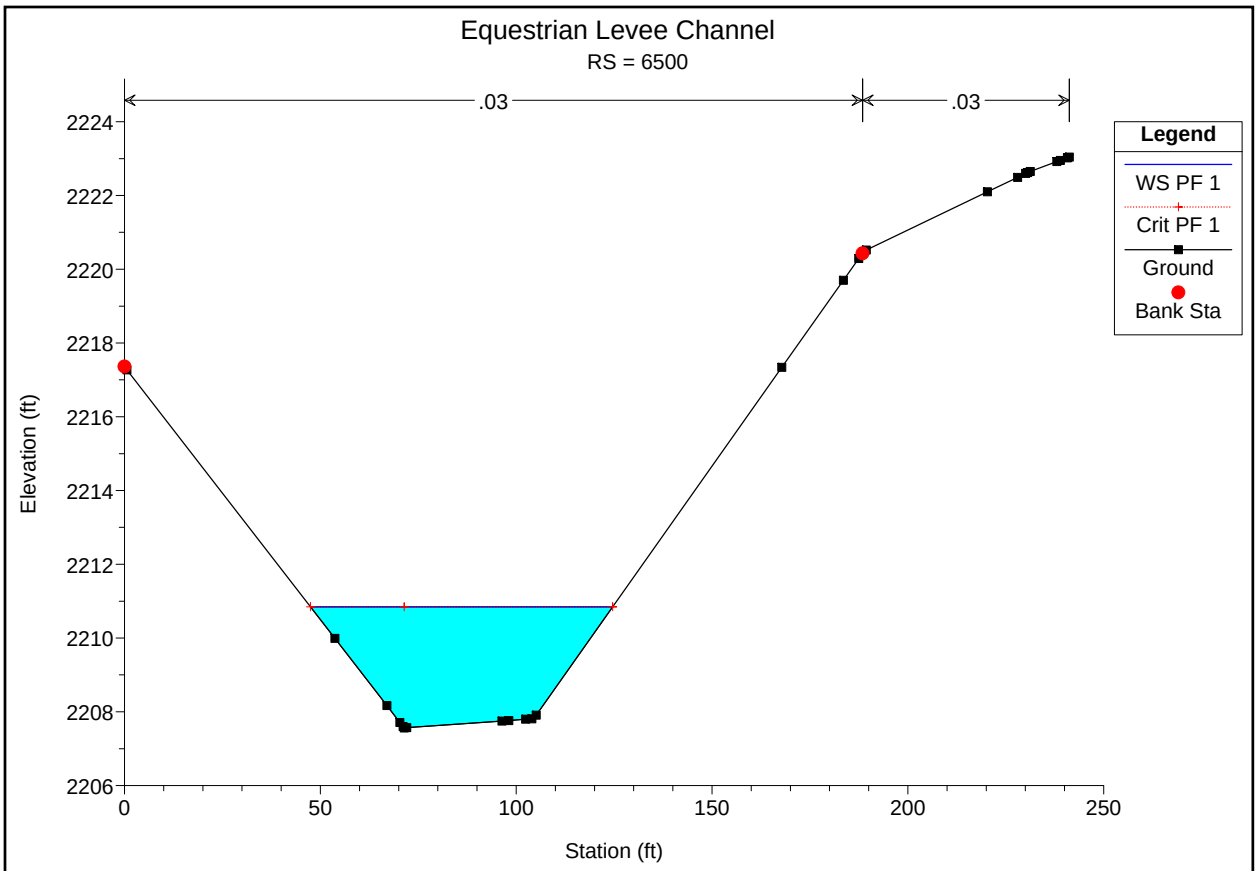

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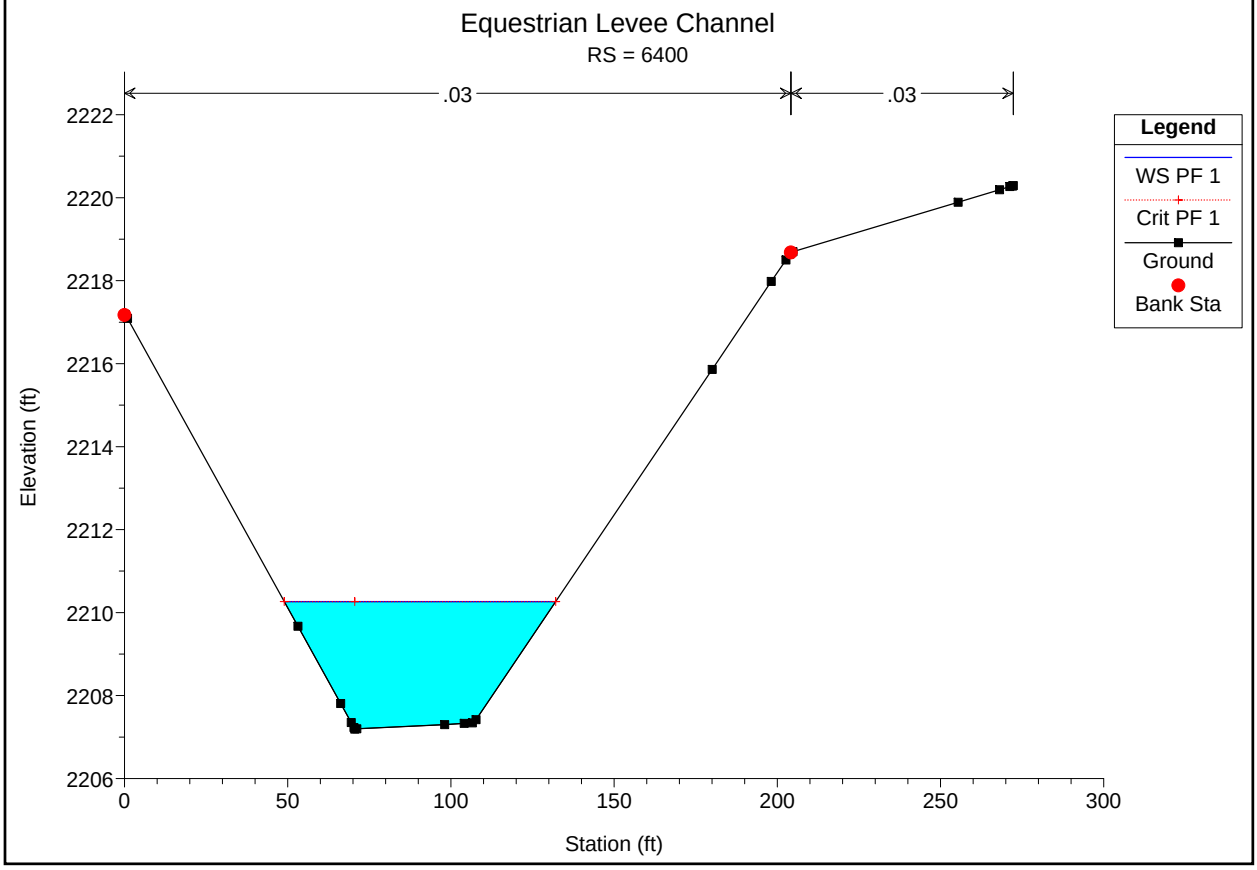

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160
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WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
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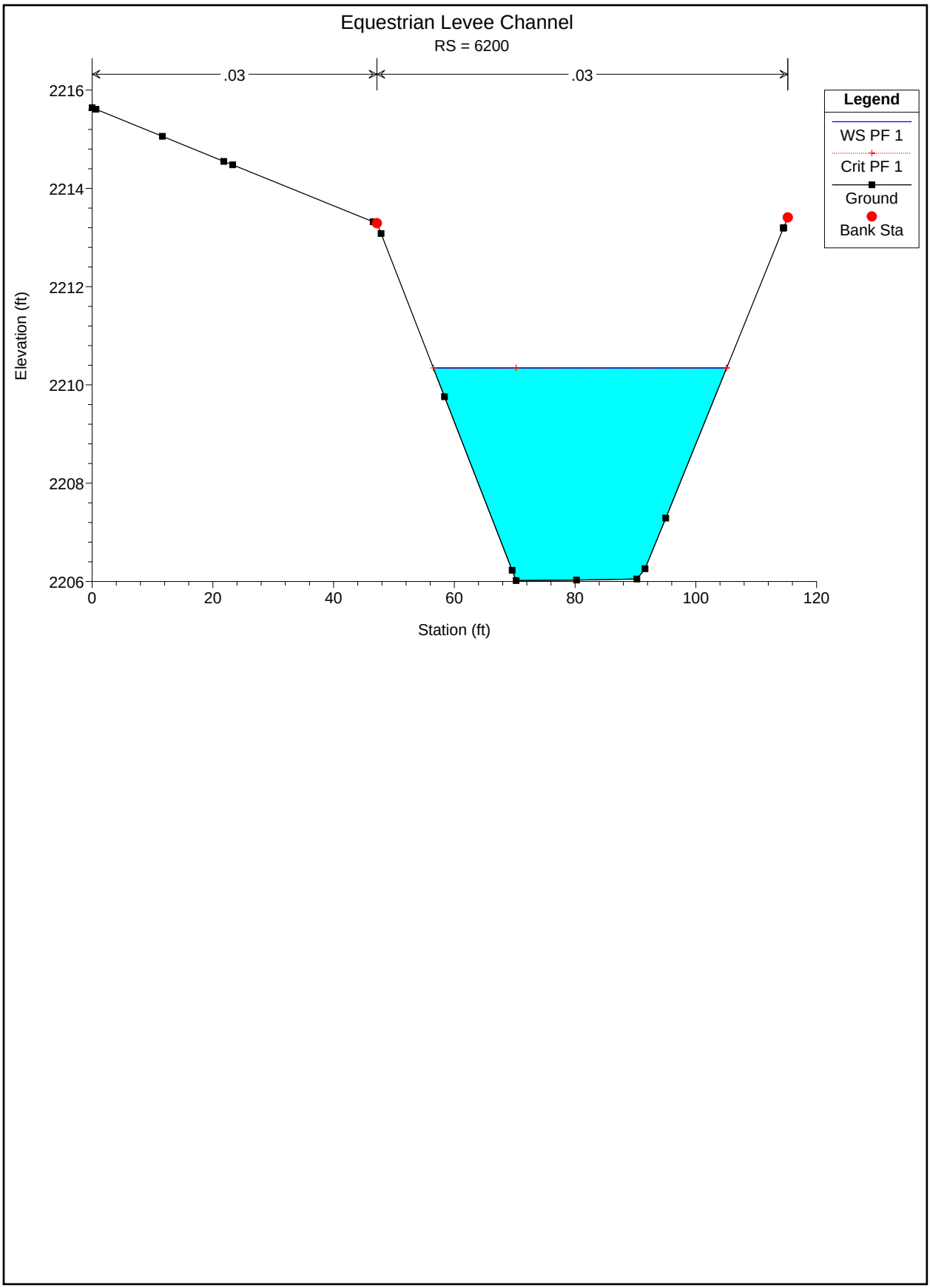

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20
40
60
80
100
120
140


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Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2222
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2218
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2208
0
20
40
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80
100
120
140


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Elevation (ft)
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100
150
200


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Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
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2218
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2210
2208
2206
0
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100
150
200
250


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Ground
Bank Sta
Elevation (ft)
Station (ft)
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2208
2206
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50
100
150
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250
300


Equestrian Levee Channel
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Legend
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Crit PF 1
Ground
Bank Sta
Elevation (ft)
2216
2214
2212
2210
2208
2206
0
20
40
60
80
100
120
Station (ft)

APPENDIX VIII

Geotechnical Summary Report (Kleinfelder)

KLEINFELDER
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GEOTECHNICAL EVALUATION REPORT
EQUESTRIAN LEVEE
CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
HENDERSON, NEVADA

Prepared for:

PBS&J
2270 Corporate Circle Suite 100
Henderson, Nevada 89074

Prepared by:

KLEINFELDER
6380 South Polaris Avenue
Las Vegas, Nevada 89118

Kleinfelder Project No. 101764

October 19, 2010

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KLEINFELDER
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October 19, 2010
Project No. 101764

Mr. Harshal Desai, PE
PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

Subject: **Geotechnical Evaluation Report**
Equestrian Levee
Clark County Regional Flood Control District
Henderson, Nevada

Dear Mr. Desai:

Kleinfelder is pleased to present this Geotechnical Evaluation Report for the Equestrian Levee located in the City of Henderson, Clark County, Nevada. The purpose of this report is to summarize levee geotechnical conditions as identified in our geotechnical exploration and analyses. This report presents our findings regarding the geotechnical aspects of FEMA levee certification for the 100-year design water surface elevation. After recommended improvements in two areas of a waterline penetration has been constructed and documented and regularly scheduled maintenance has been performed by the Owner, it is our opinion the earthen levee will be stable in accordance with geotechnical requirements as outlined in 44 CFR Section 65.10.

We appreciate the opportunity to work with you on this project. Should you wish to discuss this report or if we may be of further assistance, please contact the undersigned.

Sincerely,

KLEINFELDER

Jonathan Lehman-Svoboda, P.E.
Project Professional

PROFESSIONAL ENGINEER - STATE OF NEVADA
ANN BACKSTROM
Exp: 12/31/20
GEOLOGICAL
No. 10099

Ann L. Backstrom, P.E. 10/19/2010
Principal Professional

ALB/jrs

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Plate 9 Site Plan with Explorations and Geology
Plate 10 Interpretive Geologic Profile

APPENDICES

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Appendix B Laboratory Testing
Appendix C Seepage Analysis Results
Appendix D Slope Stability Analysis Results

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EXECUTIVE SUMMARY

This report section is an executive summary and should be read in conjunction with the following report for a more detailed description of the geotechnical evaluation performed by Kleinfelder.

The Equestrian Levee (EL) is an earthen levee approximately two miles in length located in the southeast portion of the Las Vegas Valley in the City of Henderson (COH), Clark County, Nevada. A Project Location Map is presented on Plate 1. The EL was designed and constructed in 1994 and 1996, respectively, in conjunction with the Equestrian Detention Basin (EDB) and Equestrian Drive Channel. Geotechnical exploration of the EL alignment was previously performed in 1993 by Kleinfelder as part of the geotechnical work for the overall EDB project. Observation and testing of the levee fill was performed by Kleinfelder during construction. The EL is owned, maintained and operated by COH.

In 2009 and 2010, Kleinfelder performed a geotechnical study of the EL to obtain subsurface information within the levee embankment and underlying foundation materials and to evaluate if the levee meets geotechnical requirements for FEMA levee certification as outlined in 44 CFR Section 65.10. Specifically, our study focused on assessing levee seepage and stability considering United States Army Corps of Engineers (USACE) criteria outlined in its Levee Design Manual (EM 1110-2-1913) and Design Guidance for Levee Underseepage (ETL 1110-2-569) for the 100 year[1] design water surface elevation (WSE) and flood duration, provided by the JE Fuller / Hydrology and Geomorphology, Incorporated (JE Fuller). A modified levee section due to erosion was also analyzed, along with settlement potential of the levee.

Levee performance issues not addressed by Kleinfelder include presence of sufficient freeboard, impacts of vegetation, impacts from biological activity (rodents/small animals), and impacts from encroachments. Two waterline levee penetrations are encroachments that were included in our evaluation to assess potential impacts on the levee through seepage and stability.

[1] 100-year refers to a flooding event that has a one percent chance of being equaled or exceeded in a particular location in any given year.

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The EL has a maximum height of approximately 24 feet (landside), a crown width varying from approximately 10 feet to 20 feet, and a length of approximately 10,500 lineal feet. The landside and waterside slopes have maximum inclinations that are approximately 2.2:1 and 2.9:1 (horizontal:vertical (H:V)), respectively.

Our study included:

- reviewing reports from previous geotechnical studies and construction records prepared during design and construction of the EL structure;
- reviewing construction plans and documents pertaining to a waterline penetration at two locations along the levee;
- performing a site reconnaissance and geotechnical inspection of the EL levee structure;
- drilling seven exploratory borings along the levee alignment;
- conducting laboratory testing on representative samples obtained from the borings;
- conducting seepage and slope stability analyses using SEEP/W and SLOPE/W computer programs, respectively;
- evaluating settlement potential; and
- researching past flood performance data.

The EL is an engineered structure with documentation from the construction available for review, including compaction testing during fill placement. Four critical sections were selected for analysis based on slope inclination, height and WSE relative to landside toe. A fifth analysis was performed considering erosion of the waterside slope. Steady state seepage analyses were performed in accordance with USACE EM procedures. Local vertical exit gradients at the landside toe are less than or equal to the USACE maximum criteria of 0.3 for all cases analyzed. The 100-year flood duration is 6 hours. Transient analyses were also performed to evaluate when steady state conditions would develop and these results were compared to the 100-year flood duration. The transient analyses indicate that steady state conditions do not develop for a period of more than four days.

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The slope stability analyses performed using phreatic surfaces obtained from the steady state seepage analyses indicate the slopes exceed USACE minimum factor of safety (FOS) criteria for the Steady State and Sudden Drawdown cases without erosion. Factors of Safety of 1.3 and 1.1 were calculated for the Steady State and Sudden Drawdown erosion cases, respectively. These slopes are judged to be stable for this temporary condition. The seismic stability exceeds the minimum factor of safety for Nevada Division of Water Resources (DWR) Dam Guidelines for Design (http://water.nv.gov/Engineering/Dams/design.cfm).

We recommend that reconstruction of the portions of the levee disturbed by two waterline penetrations be performed. A maintenance program is in place which includes provisions for treatment of erosion, sedimentation, animal burrows and vegetation. It is our opinion, based on the approach used in our evaluation and the findings of this study, the subject levee meets current FEMA requirements for geotechnical components of levee certification as outlined in 44 CFR Section 65.10 with regard to seepage conditions and the stability of existing slopes during the 100 year flood event, with the exception of maintenance and the two levee penetrations. Following completion of the scheduled maintenance and recommended reconstruction, the EL can be recommended for levee certification. These findings are based on the assumption that maintenance, including remediation of animal burrows, will be performed on an annual basis or more frequently, as specified in the approved Operations and Maintenance Manual.

The findings, conclusions, and recommendations presented in this report are based on the provisions and requirements outlined in the Limitations section of this report.

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1.0 INTRODUCTION

1.1 LOCATION AND DESCRIPTION

The Equestrian Levee (EL) is located within a portion of Sections 23, 26, and 35 of Township 22 South, Range 63 East, City of Henderson, Clark County, Nevada. A Project Location Map is presented on Plate 1. The EL was designed and constructed in 1994 and 1996, respectively, in conjunction with the Equestrian Levee Channel (ELC), Equestrian Detention Basin (EDB) and Equestrian Drive Channel (EDC). These flood control facilities, located within an arid geographic region that experiences an annual average precipitation of less than 4.5 inches, were built to protect development from ephemeral flows originating in the mountainous terrain to the east. Design and construction of these three facilities was authorized under the Equestrian Detention Basin Regional Flood Control Project, funded by the Clark County Regional Flood Control District (CCRFCD). The EL is owned, maintained, and operated by the City of Henderson (COH).

The EL is a trapezoidal, earthen embankment approximately 10,500 feet in length that extends in a northerly direction from high ground adjacent to US-93 to the upstream end of the EDC. The EDC is a concrete, trapezoidal channel that outfalls at the EDB. Based on information on the 1996 as-built plans and the 2009 survey data obtained by PBS&J as part of this project, the EL has a maximum landside height of approximately 24 feet and a crown width varying from approximately 10 feet to 20 feet. Landside and waterside slopes have maximum inclinations of approximately 2.2:1 and 2.9:1 horizontal:vertical (H:V), respectively. The ELC is an earthen channel that runs adjacent to the waterside toe-of-levee. The ELC is trapezoidal in shape with a bottom width in the range of 20 to 26 feet and left bank (EL waterside) slopes of approximately 2.9:1 to 5:1 (H:V). Neither the EL nor ELC was designed with embankment armoring.

A plan and profile of the EL showing EL cross-sections and the associated ELC are presented on Plates 2 through 8. Surveyed information provided by PBS&J depicting the current configuration of the levee is summarized in Table 2.2.1 and are also presented graphically on Plates 2 through 8.

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A Southern Nevada Water Authority (SNWA) waterline penetrates the EL at the south end of the alignment and at a second location approximately 1000 feet from the north end of the alignment and is described in more detail in Section 2.1.4.

1.2 PURPOSE AND SCOPE

Kleinfelder performed a geotechnical study of the EL to obtain subsurface information within the levee embankment and underlying foundation materials and to evaluate if the levee meets FEMA geotechnical requirements as outlined in 44 CFR Section 65.10. Specifically, our study focused on assessing levee seepage and stability considering United States Army Corps of Engineers (USACE) criteria outlined in its Levee Design Manual (EM 1110-2-1913) and Design Guidance for Levee Underseepage (ETL 1110-2-569) for the 100-year design water surface elevation (WSE) and flood duration, provided by the JE Fuller. Settlement potential of the levee was also evaluated.

Our study included:

- reviewing reports from previous geotechnical studies and construction records prepared during design and construction of the EL structure;
- reviewing construction plans and documents pertaining to a waterline penetration at two locations along the levee;
- performing a site reconnaissance and geotechnical inspection of the EL levee structure;
- drilling seven exploratory borings along the levee alignment;
- conducting laboratory testing on representative samples obtained from the borings;
- conducting seepage and slope stability analyses using SEEP/W and SLOPE/W computer programs, respectively;
- evaluating settlement potential; and
- researching past flood performance data.

The recommendations contained in this report are subject to the limitations presented in the 'Limitations' section of this report. In addition, a brochure prepared by ASFE (The Association of Engineering Firms Practicing the Geosciences) has been included

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behind the cover sheet of this report. We recommend that all individuals using this report read the limitations along with the attached document.

1.3 PROJECT ELEVATIONS

PBS&J performed a survey of the EL to support the hydrologic and geotechnical evaluations by JE Fuller and Kleinfelder, respectively. The survey data provided by PBS&J for Kleinfelder's use consisted of cross sections at 42 locations, including survey of landside toe and further afield; landside slope; crest width; waterside slope; waterside toe; channel and further waterside afield. Kleinfelder and JE Fuller provided input to PBS&J for survey locations. Elevation references in this report are in feet and are based on the North American Vertical Datum of 1988 (NAVD88). The 100-year water surface elevations (WSE) used in our analyses as the basis of our evaluation were provided by JE Fuller and are presented in Section 5.2, along with a tabulated summary of the surveyed existing slope configurations. A graphical depiction of the levee section at each location surveyed, including the corresponding WSE, is presented on Plates 2 through 8.

1.4 LEVEE PERFORMANCE ISSUES NOT ADDRESSED

Levee performance issues not addressed by Kleinfelder include presence of sufficient freeboard, impact of erosion, impacts of vegetation, impacts of biological activity, and impacts from encroachments. Two waterline levee penetrations are encroachments that were included in our evaluation only to assess potential impacts on levee through seepage and stability.

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2.0 BACKGROUND INFORMATION

2.1 PREVIOUS WORK

As part of the Consultant Team, Kleinfelder previously performed a background (Phase I) study for this project. The objectives for Kleinfelder in the study included:

1. Collecting and reviewing existing reference material, design/construction documentation, data, and other information pertaining to the EL, including the documents listed in Table 2.1.1.
2. Performing a geotechnical inspection of the levee.
3. Documenting compliance with the levee requirements outlined in CFR 65.10 or assessing that further study will be required.

Table 2.1.1 Equestrian Levee Documents

Document Title	Prepared By	Date
Geotechnical Investigation, Equestrian Detention Basin	Kleinfelder, Inc.	Jan. 19, 1994
Final Summary Report for Materials Testing and Observation Services	Kleinfelder, Inc.	Oct. 3, 1996
Equestrian Detention Basin Record Drawings (within DRAFT LOMR Package)	Poggemeyer Design Group	Dec. 18, 1998
Boulder City Water Delivery Improvements Record Drawings	Southern Nevada Water Authority	June 27, 2002

Prior maintenance records were not available for the EL. In addition, there were no records of previous flooding or documents available which described past performance history of levee penetrations and levee erosion during flood events.

A summary of our observations and findings during the background study are presented in the following Sections 2.1.1 through 2.1.4.

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2.1.1 Summary of 2009 Geotechnical Field Inspection

A geotechnical field inspection of the EL was performed by a senior engineer and geologist of Kleinfelder in March, 2009. Geotechnical observations made during the inspection included encroachments, waterside and landside erosion features, depressions and rutting, and evidence of animal burrows. Information presented in The United States Army Corps of Engineers Levee Owner's Manual for Non- Federal Flood Control Works, The Rehabilitation and Inspection Program Public Law 84-99, March 2006 was used as a general guideline for our inspections. A summary of the observations made are provided in the following paragraphs.

Encroachments consisting of a waterline penetration at two locations, apparent land-side ground surface modifications, and other miscellaneous, minor excavations less than a foot deep and covering an area of less than 20 square feet were observed. The penetrations consist of a Southern Nevada Water Authority (SNWA) waterline installation oriented in a north-south direction crossing the levee obliquely at the bend near approximate Station 78+10 and in an east-west direction near approximate Station 165+00. The most significant of the remaining landside encroachments consisted of an excavation approximately 50 feet in length and 6 to 8 feet in depth with 2.5:1 (horizontal:vertical) side slopes approximately 45 feet from the landside hinge near Station 71+00. The survey at Station 71+00 on Plate 2 shows the landside geometry at this location.

Erosion of the waterside levee toe was observed at several locations along the levee alignment. Typical occurrences consisted of a vertical to near vertical erosion surface approximately one to one-and-a half feet in height along a distance approximately 50 to 100 feet in length. The location of the waterside toe erosion generally corresponded to areas where natural wash confluences enter the levee channel from the east. An area of erosion or weathering of the waterside levee slope near mid-height, approximately 10 feet in length and ½ to one foot deep, was observed near the confluence with Equestrian Drive Channel.

Low areas, up to one foot deep and generally covering an area less than 15 square feet, were present on both the landside and waterside levee slopes. An elongate, low area, approximately 40 feet in length, 2 feet wide, and ½ foot deep was present on the

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landside slope within the vicinity of the northern SNWA waterline crossing. Ruts typically ½ to one foot deep impacting an area up to 5 square feet were observed on slope and crest areas. Localized steepening of the landside slope, interpreted to be the result of erosion from recreation vehicle traffic, was present near approximate Station 74+00.

Animal burrows approximately one to 2 inches in diameter were observed in the waterside slope near existing desert vegetation. The depth and extent of the burrows were not determined during the geotechnical field inspection.

2.1.2 Summary of 1994 Geotechnical Report

A geotechnical exploration for design of the EL was performed by Kleinfelder and consisted of 13 test pits excavated in November 1993 at intervals of approximately 800 feet to 1,000 feet on center. The test pits were excavated with a Case 580 backhoe to depths of 8 to 10 feet below existing grade at the time of exploration. Approximate ground surface elevations are presented on the test pit logs. The source of the elevation data is not included.

Information on the test pit logs indicate that the on-site soils consist predominantly of poorly and well-graded sand and gravel soils with less than 10% silty fines (USCS soil classifications SP-SM and SW-SM). Zones of trace to partial cementation were logged in a few areas, including one location for which backhoe refusal on partially cemented soils at a depth of 8 feet was reported. Groundwater was not encountered to the maximum depth explored.

Laboratory testing on samples obtained from the levee trench excavations included a total of six gradation analyses, three remolded direct shear strength tests, one maximum dry density-optimum moisture content curve, two laboratory falling-head permeability tests, two laboratory electrical resistivity tests, and five corrosivity tests. Gradation test results indicate gravel contents in the range of 35% to 50%, sand contents in the range of 45% to 60%, and non-plastic fines contents in the range of 4% to 7%. Coefficient of friction values (phi angles) in the range of 37 degrees to 41 degrees were reported for the direct shear strength results on samples screened over a No. 4 sieve.

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Permeability values of 4 X 10^{-5} and 6 X 10^{-5} cm/sec were reported for the laboratory falling head permeability test results. The tests were run on samples screened over a No. 4 sieve and remolded to 85% to 90% of maximum dry density based on the reported laboratory maximum dry density of 129 pcf. A test head of approximately 1,430 mm (4.7 feet) was reported.

2.1.3 Construction Observation and Materials Testing Records

Construction observation and materials testing services for the Equestrian Detention Basin were provided by Kleinfelder, including subgrade preparation observations and periodic field density testing for the EL. A total of 70 field density tests were performed on the EL and a Final Summary Report was issued (Kleinfelder Project No. 31-128842, dated October 3, 1996).

2.1.4 SNWA Waterline Penetration Plans

Construction Plans provided by SNWA dated March 2003 show details of the SNWA 30-inch diameter waterline penetration at SNWA pipeline stations 136+50 to 139+00 and 50+50 to 54+00 (approximate EL Stations 78+00 and 165+00). In both locations, the waterline penetration was oblique to the axis of the EL. The plan and profile sheets (Drawing Nos. 2-C-6 and 2-C-14) indicate the top of waterline as installed was to be between approximately 5.5 and 6.0 feet below the channel invert and landside toe.

The plan sheets provided indicate cut and cover installation of the waterline using a two phased approach. Phases 1 and 2 of the Berm Breach Plan (Drawing 2-C-39) consisted of removing the waterside and landside levee, respectively, within a construction easement 75 feet centered on the pipe alignment. The plans show a trench width of 4.5 feet at the pipe spring line. The trench width was shown to be larger at the channel invert but was not dimensioned on the plans. Upon excavation of each phase, the waterline trench was to be backfilled and the levee replaced. Pipe zone backfill is shown as Controlled Low Strength Material (CLSM), similar to a concrete slurry, to pipe spring zone and Clark County Type II aggregate base compacted to 90% of maximum dry density from spring zone to one foot above the pipe crown. Trench backfill was to consist of Selected Backfill per the waterline specifications. Pipe bedding was to consist of Clark County Type II aggregate base. Trench backfill, pipe zone backfill, and pipe bedding were to be compacted to 90% dry density as determined by

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ASTM D1557. The levee was to be replaced with Clark County Type II aggregate base compacted to 95% relative dry density as determined by ASTM D1557.

Waterline construction records documenting the waterline installation at the penetration locations were provided by SNWA subsequent to completion of the Kleinfelder Phase I study. The records pertaining to the areas of the waterline penetrations consisted of a photocopy of six photographs taken of the cut at the northern crossing; SNWA documentation of the Contractor's request to use material from the berm excavation for the berm reconstruction in place of the originally specified Type II aggregate base; SNWA documentation for an increase in compaction of trench backfill from 90% to 95% of maximum dry density (ASTM D1557) and the construction of a CLSM cut-off collar, four feet wide, to be located just upstream of the waterside levee toe extending from the bottom of pipe trench to the top of trench; construction inspection reports including equipment and personnel lists, CLSM strength reports, and seven compaction test results for the north crossing and one compaction test result for the south crossing.

The compaction test results indicate trench backfill materials at the locations tested have of a minimum dry density of 90% of the maximum dry density (ASTM D1557). Compaction data indicate that embankment fill materials at the locations tested have a dry density of 95% of maximum dry density (ASTM D1557).

2.2 LEVEE GEOMETRY

The EL is approximately 10,500 feet in length extending south of Equestrian Drive at approximate Station 62+00 to approximate Station 167+00. Graphical depictions of the levee section at each location surveyed, including the corresponding WSE, are presented on Plates 2 through 8. A tabulated comparison of the existing EL slope geometry based on survey data and the slopes as represented on the as-built plans is presented in Table 2.2.1

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Table 2.2.1 Levee Slope Geometry Summary

Levee Station	Surveyed Landside Slope (H:V)	Landside Slope per Plan (H:V)	Crest Width (feet)	Surveyed Waterside Slope (H:V)	Waterside Slope per Plan (H:V)	Landside Height (feet)	Waterside Height (feet)
62+00	3.7:1	3.0:1 to 7.0:1	47.2	3.2:1	2.0:1 to 7.0:1	9.3	7.3
64+00	11.3:1	3.0:1 to 7.0:1	18.4	7.0:1	2.0:1 to 7.0:1	5.1	10.0
65+00	7.6:1	7.0:1 to 3.0:1	17.3	7.3:1	7.0:1 to 3.0:1	3.8	9.8
67+00	5.5:1	7.0:1 to 3.0:1	18.0	5.1:1	7.0:1 to 3.0:1	4.5	11.7
70+00	2.9:1	3.0:1	15.5	3.1:1	3.0:1	7.2	11.3
71+00	2.9:1	3.0:1	14.9	3.5:1	3.0:1	6.5	11.4
72+38	2.2:1	2.5:1	17.0	3.2:1	3.0:1	7.6	11.6
73+50	2.4:1	3.0:1	15.4	2.9:1	3.0:1	10.8	11.7
74+23	3.0:1	3.0:1	14.5	3.0:1	3.0:1	15.9	14.3
74+50	2.7:1	3.0:1 to 5.0:1	14.0	3.1:1	3.0:1	17.9	15.7
78+00	4.9:1	5.0:1	16.3	2.9:1	3.0:1	18.6	14.8
81+50	4.7:1	5.0:1	14.2	3.3:1	3.0:1	21.7	15.4
82+00	2.8:1	5.0:1	14.3	2.9:1	3.0:1	23.8	16.0
85+00	5.7:1	8.0:1	18.2	3.5:1	3.0:1	19.0	15.8
86+00	6.3:1	8.0:1	14.4	3.0:1	3.0:1	17.6	14.5
90+00	6.1:1	8.0:1	18.5	3.3:1	3.0:1	15.0	12.1
95+00	6.6:1	8.0:1	15.0	3.0:1	3.0:1	13.0	12.6
100+00	6.1:1	8.0:1	15.7	3.3:1	3.0:1	13.0	11.9
105+00	6.2:1	8.0:1	16.5	3.3:1	3.0:1	12.2	12.4
110+00	6.4:1	8.0:1	16.2	3.3:1	3.0:1	5.5	11.9
115+00	5.8:1	8.0:1	18.0	3.2:1	3.0:1	11.8	12.1
120+00	6.5:1	8.0:1	19.6	3.1:1	3.0:1	12.9	11.8
125+00	5.3:1	8.0:1	16.0	4.0:1	3.0:1	9.7	11.6
127+00	6.1:1	8.0:1	16.0	4.8:1	5.0:1	9.9	10.9
130+00	6.9:1	8.0:1	16.4	5.2:1	5.0:1	13.7	11.6
132+50	7.3:1	8.0:1	16.6	4.4:1	5.0:1	13.0	10.9
138+00	7.1:1	8.0:1	12.9	4.8:1	5.0:1	13.4	11.2
140+00	7.3:1	8.0:1	13.9	5.3:1	5.0:1	13.2	11.1
145+00	8.3:1	8.0:1	14.4	5.2:1	5.0:1	11.4	11.0
147+00	8.8:1	8.0:1	17.0	5.5:1	5.0:1	9.8	9.9
150+00	8.2:1	8.0:1	16.3	4.7:1	5.0:1	4.9	11.3
160+00	6.6:1	8.0:1	19.7	5.4:1	5.0:1	6.2	8.7
161+50	5.8:1	8.0:1	20.5	5.2:1	5.0:1	6.5	8.3
162+00	6.7:1	8.0:1	20.3	5.2:1	5.0:1	4.6	7.5
163+00	6.5:1	8.0:1	15.8	5.0:1	5.0:1	6.0	6.8
164+00	5.3:1	8.0:1	14.1	4.8:1	5.0:1	5.8	6.8
165+00	6.1:1	4.0:1	16.4	5.2:1	5.0:1	6.0	7.2
165+50	5.0:1	4.0:1	15.0	6.4:1	4.0:1	6.5	4.4
166+00	4.2:1	4.0:1	10.2	5.3:1	4.0:1	7.5	4.2
167+00	3.8:1	4.0:1	13.7	3.8:1	4.0:1	6.2	3.9

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Based on the survey data, the landside height of the levee has a maximum height of approximately 24 feet. The crest width varies from 10 to greater than 20 feet, but was 12.9 feet or greater in all locations but one. The landside slope has inclinations that range from approximately 2.2:1 to greater than 8:1 (H:V). The waterside slope has inclinations that range from approximately 2.9:1 to 7.3:1 (H:V). Landside slopes over a significant portion of the levee are steeper than depicted on the as-builts. Between approximate Stations 72+00 and 74+00, the landside slopes were surveyed to be between 2.2:1 and 2.4:1 (H:V). The steepest slope in the original design is 2.5:1 (H:V).

The project plans indicate that the EL was constructed from a combination of cut and fill. Two segments of the alignment, approximately 64+00 to 70+00 and 148+00 to 159+00, were constructed primarily in native materials. The majority of the remaining portion of the alignment was a combination of cut and fill with typical cuts in the range of two to six feet and typical fills in the range of 4 to 14 feet. Localized fills in excess of 20 feet were required at the location of a major wash crossing near Station 82+00.

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3.0 REGIONAL AND SITE GEOLOGY

3.1 GEOLOGY

The EL is located within the southeastern portion of the Las Vegas Valley, a north northeast trending elongate valley characteristic of the Basin and Range physiographic province. The Las Vegas Valley is filled with Quaternary- to Tertiary-age unconsolidated sediments derived from erosion of the mountains surrounding the valley. The sediments become increasingly fine-grained with distance from the source area and are several thousand feet thick in the low-lying central portion of the valley. Progressively more steeply sloping alluvial fans composed of coarser-grained materials extend outward from the central valley.

The EL site is mapped on the Geologic Map of the Henderson Quadrangle (Bell and Smith, 1980, 1:24,000) and the Geologic Map of the Boulder City 15-Minute Quadrangle, Clark County, Nevada (Anderson, 1977; 1:62,500). The published geologic map data indicates that the site is predominantly underlain by Quaternary pediment and fan deposits of the River Mountains. The River Mountains are located within one mile east of the site and composed predominantly of volcanic rocks of varying lithologies. The levee alignment passes within approximately 300 feet of bedrock outcrops near Station 82+00. A short section of the alignment near the south end also traverses an area mapped as older, Tertiary-age basin-fill deposits (Anderson). In addition to the review of the published data, Kleinfelder obtained pairs of aerial photos of the EL site area (Continental Aerial Surveys; 1968, 1974, 1981, 1991, and 1999; scales as referenced in Section 8.0) for stereoscopic review. Surface geology in the area of the EL alignment based on the published data supplemented by our geologic site reconnaissance and the aerial photo review is presented on Plate 9, Site Plan with Explorations and Geology.

The Quaternary-age alluvial, pediment, and fan deposits shown on Plate 9 are undifferentiated for this report and are referred to as "alluvium." Bedrock consisting of volcanic rock is anticipated to underlie the subject levee at a depth of 200 or more feet. The following paragraphs provide a description of each of the geologic units mapped on Plate 9 from youngest to oldest:

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Fill (Qaf): The fill materials of the levee embankment are 1 to 20 feet thick, and generally comprised of dry to moist, medium dense to dense, brown to red-brown, fine- to medium-grained sand and gravel with silt. Specific Unified Soil Classification System (USCS) classifications are provided on the attached boring logs, Appendix A. The observed fill materials appear to be a random mix of local alluvial soils. Based on the observed fill composition, and review of the original geotechnical report for the project, the levee was likely constructed from excavation during construction of the Equestrian Detention Basin and associated channels.

Alluvium (Qa, Qr_1, Qr_2, and Qr_3): The levee embankment fill is underlain by alluvium which extends to depths greater than the depth of our borings and is estimated to extend to depths of several hundred feet in most areas of the alignment and to a depth of at least 200 feet in the area of the bedrock outcrops near Station 82+00. The alluvium encountered in our borings generally consists of dry to slightly moist, medium dense to very dense, brown to red brown, sand and gravel with cobbles and boulders, varying but typically small amounts of silt, and localized zones of calcium carbonate cementation occurring as laterally discontinuous, interfingering zones with varying proportions of sand, gravel, and silt.

Basin-fill (Tm): The basin fill deposits are mapped as consisting of cobble to boulder conglomerate with silt and sand matrix and occur at the surface in an isolated area near the south end of the alignment between approximate Stations 140+00 and 150+00.

Volcanic Bedrock (Tv): Volcanic lithologies of the River Mountains in the EL area consist of primarily dacite with lesser amounts of basalt, andesite, breccia, and tuff.

Intrusive Bedrock (Ti): Intrusive bedrock associated with the Boulder City pluton south of the site.

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3.2 GEOMORPHOLOGY

The EL is located on a west draining alluvial fan located on the east flank of the River Mountains. The alignment falls in elevation from south to north at a slope of approximately 2% from a high of approximately 2380 feet to a low of approximately 2200 feet.

3.3 FAULTING

Based on the previously referenced published map data, no Quaternary faults traverse the EL alignment. The closest Quaternary faults shown in the Nevada Bureau of Mines and Geology (NBMG) on-line database are the Black Hills Fault, inferred approximately ¾ mile southeast of the south end of the levee and an unnamed fault mapped approximately ¾ mile northeast of the north end of the levee (NBMG, 1010). The Black Hills Fault is believed to have a latest ground surface rupture of less than 15,000 years ago and the unnamed fault is believed to have a latest rupture between 15,000 and 130,000 years ago (dePolo, 2008). The Black Hills Fault is also included in the United States Geological Survey (USGS) Quaternary fault database with the mapped northern extent located approximately two miles southwest of the EL (USGS and NBMG, 2010). The faults shown on Plate 9 are not included in the Quaternary fault data base and are judged to be bedrock faults and inactive.

The latitude and longitude of the north and south ends of the EL alignment correspond to approximately 36.0134/-114.9222 degrees and 35.9858/-114.9203, respectively. A peak bedrock ground acceleration (PGA) value of 0.12 was obtained at both locations for an event with a ten percent probability of exceedance in 50 years using the USGS (2002) Seismic Hazard Curves and Uniform Hazard Response Spectra calculator v.5.0.9.

3.4 REGIONAL GROUNDWATER

Groundwater was not encountered within the borings drilled for this exploration. A search of the USGS (2001) Water Resources web site indicates the closest well in the database is located between ½ and ¾ mile southeast of EL. The available groundwater measurement from this well is dated 1973 and indicates water at an approximate depth of 800 feet below the ground surface.

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4.0 SITE CHARACTERIZATION

4.1 SITE EXPLORATION

The subsurface exploration program consisted of drilling and logging seven hollow-stem auger borings. The boring locations were selected considering site geology; levee geometry based on the results of the PBS&J survey; and the presence of features of interest such as site geology and major wash crossings.

The exploratory borings were drilled using a Diedrich truck-mounted drill rig equipped with 6-inch diameter hollow-stem augers. The borings were located using Kleinfelder's Trimble Global Positioning System (GPS) in conjunction with aerial imagery provided by PBS&J. Borings were drilled to a depth of approximately one levee height below the foundation (as measured from waterside crest to toe) or depths varying from approximately 15-½ to 33-½ feet below levee crest. The approximate locations of the borings are presented on Plate 9, Site Plan with Explorations and Geology.

The borings were logged by registered engineers or geologists from Kleinfelder in general accordance with USCS methods and general procedures established in ASTM D2488. The results of our laboratory testing were used to refine the field classifications which are presented on the logs. In-place soil samples were obtained using either a Standard Penetration (SPT) or California-type sampler driven a total of 18 inches (or until practical refusal) into the undisturbed soil at the bottom of the boring. The soil sampled by the SPT (2-inch O.D., 1.5-inch I.D.) or California sampler (3-inch O.D., 2.4-inch I.D.) was returned to our laboratory in Las Vegas, Nevada for testing. The sampler was driven using a hydraulically-actuated 140-pound "automatic" hammer falling 30 inches. The total number of hammer blows required to drive the sampler the final 12 inches is termed the blow count and is recorded on the boring logs at the respective sampling depths. Bulk samples of the soils were retrieved directly from the auger blades. Borings were backfilled with hydrated bentonite chips to within three feet of the levee crest. The remaining three feet was backfilled with the auger cuttings.

A Key to Soil Symbols and Terms used on the boring logs is presented on Plate A-1 in Appendix A. The logs of borings are presented on the Boring Log and Test Summary sheets on Plates A-2 through A-8. The calibrations of hammer energy are provided after Plate A-8. The logs of test pit excavations from the previous 1993 explorations

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and location map are presented at the end of Appendix A after the hammer energy calibrations.

4.2 LABORATORY TESTING

Geotechnical laboratory tests were performed on selected soil samples collected from the 2009 borings to evaluate the physical characteristics and engineering properties of the samples. The tests were conducted to support soil parameter selection for the geotechnical analyses. The laboratory program consisted of the following tests:

- Eleven unit weight tests (ASTM Test Method D2937) to evaluate the in-situ unit weight of various sampled soils at various depths.
- Fifteen moisture content tests (ASTM Test Method D2216) to evaluate moisture content of various sampled soils at various depths.
- Five grain size analyses (ASTM Test Method C117 and C136) to evaluate the gradation of sampled soils and to aid in soil classification.
- Two grain size with hydrometer analyses (ASTM Test Method D422) to evaluate the gradation of sampled soils and to aid in soil classification.

Results of the unit weight and moisture content tests are shown on the boring logs in Appendix A. A summary of the grain size and hydrometer analyses is presented on Plates B-1 through B-3 in Appendix B. The 1993 laboratory tests are presented following Plate B-3 in Appendix B.

4.3 SUBSURFACE CONDITIONS

The embankment soils are similar in composition to the underlying alluvium. The transition between the levee fill and the native soils was distinguished considering information presented on the project plans and observations made during drilling and should be considered approximately located. The levee embankment fill materials encountered consisted of dense to very dense, fine- to coarse-grained sand and gravel with varying amounts of silt. The USCS classifications of the levee embankment materials and native alluvial soils vary but were predominantly GM, SM, GP-GM, and SP-SM. Intermittent zones containing coarse gravel and/or cobbles were interpreted to be present by observations of the augers during drilling. Medium dense to dense zones

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in the native soils (N values of 25 to 30) were encountered in two locations, typically at or near the original ground surface. Groundwater was not encountered during our field exploration and based on our literature review of the regional groundwater conditions, it is our opinion that groundwater is in excess of 100 feet below the crest of the levee.

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5.0 GEOTECHNICAL EVALUATION

5.1 ANALYSIS CRITERIA

There are no formal published guidelines specifically for levee certification analysis in Southern Nevada. For the purposes of this evaluation the USACE levee design criteria has been considered for general guidelines in the evaluation of EL performance for the 100 year design WSE.

The project design criteria discussed in the following sections is based on the following USACE engineering manuals (EM) and engineering technical letters (ETL):

- EM 1110-2-1913 "Design and Construction of Levees," dated 30 April 2000
- ETL 1110-2-569 "Design Guidance for Levee Underseepage," dated 1 May 2005

Seepage and slope stability analyses were performed to evaluate steady-state through and underseepage, and stability of the EL embankment. The USACE criterion of allowable exit gradient ≤ 0.3 at the levee landside toe was considered in our seepage analyses. A transient analysis was also performed to estimate both maximum saturation (i.e. the maximum penetration of the phreatic surface into the embankment) during the 100-year flood duration and the time for steady state conditions to develop under a sustained WSE. Evaluation of embankment seepage and slope stability was also performed to assess the case where waterside erosion has occurred using predictions of base flood erosion impacts to levee geometry provided by JE Fuller.

The USACE Manual EM 1110-2-1913 identifies four types (Cases) of loading conditions for slope stability analyses described below. The minimum slope stability FOS against failure for each of the cases is summarized in Table 5-1.

Case I: End of Construction. This case addresses slope stability at the end of construction of the levee and is not required for longer post-construction levee evaluation.

Case II: Sudden Drawdown. This case represents a condition where the flood stage fully saturates a majority of the levee embankment, followed by a stage where the water

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falls faster than the soil can drain. A FOS of 1.0 applies to the case where pool levels prior to drawdown are unlikely to persist for long periods preceding drawdown and is judged to be applicable to the EL.

Case III: Steady State Seepage from Full Flood Stage. This condition occurs when the water remains at or near flood stage levels, thus fully saturating the embankment soils. A steady state seepage condition then occurs. The minimum required slope stability FOS against failure for this case of 1.4 has been used in our evaluation.

Case IV: Earthquake (Seismic). This case is currently under revision by the USACE and no minimum FOS is provided in the guidance documents. A seismic slope stability analysis was performed based on ½ the peak ground acceleration (PGA) of 0.12g. The seismic horizontal force coefficient used in the earthquake (seismic) analysis was taken as one-half the PGA (i.e., 0.06g). Nevada Division of Water Resources (DWR) Dam Guidelines for Design (http://water.nv.gov/Engineering/Dams/design.cfm, accessed October, 2009) minimum factor of safety for seismic stability was used as a guideline for this analysis.

Table 5-1
Minimum Required Slope Stability Factor of Safety Without Erosion

Case	Minimum Factor of Safety
Case I – End of Construction	(not applicable to this levee)
Case II – Sudden Drawdown	1.0
Case III – Steady State Seepage	1.4
Case IV – Earthquake (Seismic)	1.0

According to 44 CFR 65.10 (3), Embankment Protection, engineering analyses of levee embankment and foundation must be submitted that demonstrate that erosion of the levee embankment during the base flood will not result in embankment instability. The minimum factors of safety for Cases II and III were used to demonstrate stability of eroded levee slopes.

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5.2 SELECTION OF CROSS SECTIONS FOR ANALYSES

Ground surface and WSE used in our analyses for the EL were provided by JE Fuller. WSE range from 2380.4 at 167+00 to 2210.4 at Sta 62+00. We understand the WSE is based on 100-year hydrology combined with assumptions regarding upstream basin/levee performance. This water surface is referred to as the 100-year WSE in this report and is referenced to NAVD88 elevations. It is also our understanding the WSE and survey data were provided with the level of detail required for the evaluation of the civil engineering components of the EL. A summary of the WSE and water heights above waterside and landside toes, and surveyed embankment geometry for the EL is presented in the following Table 5-2. Graphical representations of the surveyed sections, including the WSE at each location, are presented on Plates 2 through 8.

Table 5-2
Summary of Slope Configuration for Seepage and Stability Analysis

Station No. (Appx.)	100 yr WSE (feet)	*Crest Width (feet)	Waterside					Landside				
			Crest Elev. (feet)	Toe Elev. (feet)	Height (feet)	Slope Ratio (H:V)	Water Height Above Toe (feet)	Crest Elev. (feet)	Toe Elev. (feet)	Height (feet)	Slope Ratio (H:V)	Water Height Above Toe (feet)
62+00	2210.4	47	2213.3	2206.0	7.3	3.2:1	4.4	2215.6	2206.4	9.3	3.7:1	4.0
64+00	2212.4	18	2217.2	2207.2	10.0	7.0:1	5.2	2216.7	2211.6	5.1	11.3:1	<1
65+00	2212.5	17	2217.4	2207.6	9.8	7.3:1	4.9	2216.8	2213.0	3.8	7.6:1	**N/A
67+00	2212.8	18	2219.1	2207.4	11.7	5.1:1	5.4	2218.1	2213.6	4.5	5.5:1	**N/A
70+00	2213.3	15	2220.5	2209.2	11.3	3.1:1	4.1	2220.4	2213.2	7.2	2.9:1	<1
71+00	2214.6	15	2220.9	2209.5	11.4	3.5:1	5.1	2220.9	2214.4	6.5	2.9:1	<1
72+38	2214.9	17	2221.6	2210.0	11.6	3.2:1	4.9	2221.0	2213.4	7.6	2.2:1	1.5
73+50	2215.9	15	2222.2	2210.5	11.7	2.9:1	5.4	2222.0	2211.2	10.8	2.4:1	4.7
74+23	2215.9	15	2224.9	2210.6	14.3	3.0:1	5.3	2224.9	2209.0	15.9	3.0:1	6.9
74+50	2216.1	14	2226.4	2210.7	15.7	3.1:1	5.4	2226.4	2208.5	17.9	2.7:1	7.6
78+00	2218.7	16	2229.4	2214.6	14.8	2.9:1	4.1	2228.6	2210.0	18.6	4.9:1	8.7
81+50	2220.8	14	2230.5	2215.1	15.4	3.3:1	5.7	2230.1	2208.4	21.7	4.7:1	12.4
82+00	2220.8	14	2231.4	2215.4	16.0	2.9:1	5.4	2230.7	2206.9	23.8	2.8:1	13.9
85+00	2221.5	18	2233.2	2217.4	15.8	3.5:1	4.1	2232.1	2213.1	19.0	5.7:1	8.4
86+00	2223.1	14	2233.3	2218.8	14.5	3.0:1	4.3	2233.1	2215.5	17.6	6.3:1	7.6
90+00	2227.8	18	2236.5	2224.4	12.1	3.3:1	3.4	2236.3	2221.3	15.0	6.1:1	6.5
95+00	2234.0	15	2244.3	2231.7	12.6	3.0:1	2.3	2244.0	2231.0	13.0	6.6:1	3.0
100+00	2242.7	16	2251.4	2239.5	11.9	3.3:1	3.2	2251.1	2238.1	13.0	6.1:1	4.6
105+00	2250.3	17	2259.3	2246.9	12.4	3.3:1	3.4	2258.4	2246.2	12.2	6.2:1	4.1
110+00	2257.6	16	2266.7	2254.8	11.9	3.3:1	2.8	2265.9	2260.4	5.5	6.4:1	**N/A
115+00	2264.9	18	2274.0	2261.9	12.1	3.2:1	3.0	2273.1	2261.3	11.8	5.8:1	3.6
120+00	2272.4	20	2281.3	2269.5	11.8	3.1:1	2.9	2280.4	2267.5	12.9	6.5:1	4.9

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Table 5-2
Summary of Slope Configuration for Seepage and Stability Analysis

Station No. (Appx.)	100 yr WSE (feet)	*Crest Width (feet)	Waterside					Landside				
			Crest Elev. (feet)	Toe Elev. (feet)	Height (feet)	Slope Ratio (H:V)	Water Height Above Toe (feet)	Crest Elev. (feet)	Toe Elev. (feet)	Height (feet)	Slope Ratio (H:V)	Water Height Above Toe (feet)
125+00	2281.0	16	2289.2	2277.6	11.6	4.0:1	3.4	2288.8	2279.1	9.7	5.3:1	1.9
127+00	2284.8	16	2292.4	2281.5	10.9	4.8:1	3.3	2292.4	2282.5	9.9	6.1:1	2.3
130+00	2291.6	16	2299.5	2287.9	11.6	5.2:1	3.7	2299.6	2285.9	13.7	6.9:1	5.7
132+50	2297.2	17	2304.5	2293.6	10.9	4.4:1	3.6	2304.2	2291.2	13.0	7.3:1	6.0
138+00	2310.5	13	2318.6	2307.4	11.2	4.8:1	3.1	2318.2	2304.8	13.4	7.1:1	5.7
140+00	2316.1	14	2323.9	2312.8	11.1	5.3:1	3.3	2323.4	2310.2	13.2	7.3:1	5.9
145+00	2327.9	14	2335.6	2324.6	11.0	5.2:1	3.3	2335.2	2323.8	11.4	8.3:1	4.1
147+00	2332.9	17	2340.2	2330.3	9.9	5.5:1	2.6	2339.4	2329.6	9.8	8.8:1	3.3
150+00	2339.9	16	2347.8	2336.5	11.3	4.7:1	3.4	2347.2	2342.3	4.9	8.2:1	**N/A
160+00	2364.9	20	2370.3	2361.6	8.7	5.4:1	3.3	2369.6	2363.4	6.2	6.6:1	1.5
161+50	2368.1	20	2373.2	2364.9	8.3	5.2:1	3.2	2372.7	2366.2	6.5	5.8:1	1.9
162+00	2369.4	20	2373.2	2365.7	7.5	5.2:1	3.7	2372.7	2368.1	4.6	6.7:1	1.3
163+00	2370.0	16	2375.2	2368.4	6.8	5.0:1	1.6	2375.0	2369.0	6.0	6.5:1	1.0
164+00	2372.2	14	2377.2	2370.4	6.8	4.8:1	1.8	2377.7	2371.9	5.8	5.3:1	<1
165+00	2373.8	16	2379.0	2371.8	7.2	5.2:1	2.0	2379.2	2373.2	6.0	6.1:1	<1
165+50	2376.2	15	2380.0	2375.6	4.4	6.4:1	0.6	2380.4	2373.9	6.5	5.0:1	2.3
166+00	2378.9	10	2381.7	2377.5	4.2	5.3:1	1.4	2381.7	2374.2	7.5	4.2:1	4.7
167+00	2380.4	14	2382.3	2378.4	3.9	3.8:1	2.0	2382.1	2375.9	6.2	3.8:1	4.5

Notes: Shaded Cross-Sections were Selected for Analysis.
* Crest widths are rounded to the nearest foot.
** The 100 yr WSE is lower than the landside toe elevation.

As summarized in the above table and shown graphically on Plates 2 through 8, the waterside slope heights along the alignment range from 4 to 16 feet. Landside slope heights vary from approximately 5 to 24 feet. The height of water above the landside toe elevation ranges from less than 0 to approximately 14 feet. The survey data indicates the levee cross-section at Stations 73+50, 78+00, and 82+00 have equally the steepest of the waterside slopes; Station 82+00 exhibits the tallest landside slope with the greatest height of water above the landside toe; and Stations 72+38 and 73+50 have the two steepest landside slopes. Based on the above, Stations 72+38, 73+50 and 82+00 were judged to be critical sections and therefore selected for our seepage and slope stability analyses. Although not judged to be a critical section for slope height or inclination, an additional analysis was performed at Station 167+00 to represent the southernmost end of the alignment.

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JE Fuller performed a horizontal (lateral) toe erosion study and a maximum of 24 feet was provided for the portions of the alignment coinciding with the critical sections identified. The eroded waterside slope was defined by a plane inclined approximately equal to the angle of internal friction of the embankment soils. This geometry was applied to the cross sections selected for seepage and slope stability analyses. The shortest seepage path due to erosion occurs at Station 73+50. This location also was the steepest surveyed landside slope. Seepage and slope stability analyses of the levee cross-section modified by erosion were therefore also performed at this location.

Slope angles and heights as calculated from the survey data were used in our analyses. The crest width varies from 10 to greater than 20 feet, but was 12.9 feet or greater in all locations but one. A crest width of 12 feet, the original design width, was used for all analyses. The cross-sections analyzed are shown on Plates 3, 4 and 8.

5.3 SEEPAGE AND STABILITY ANALYSES

Transient and steady state seepage analyses along with steady state, sudden drawdown, and seismic slope stability analyses were performed on four critical cross-sections of the EL as discussed in Section 5.2 and indicated on Table 5-2. JE Fuller lateral erosion estimates were applied to the critical cross sections and the section most impacted by erosion was selected for the eroded levee analysis. Seepage and slope stability estimates for the eroded levee were performed for the cross-section at Station 73+50. Slope stability was judged not to be applicable to the eroded section.

Details regarding the analyses performed, including soil models applied, material properties, seepage model boundary conditions, and the results of the analyses are presented in the following Sections 5.3.1 through 5.3.4.

5.3.1 Analyses Details

Seepage and slope stability analyses were performed to evaluate through and underseepage, and stability of the EL embankments. A transient analysis was also performed to estimate both distance of levee saturation during the 100-year flood duration and the time for steady state conditions to develop under a sustained WSE to evaluate the potential of developing steady state conditions. Design parameters input into the seepage analysis and slope stability model included the embankment geometry,

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the approximate soil unit weight and estimated hydrologic properties and strength of the native and embankment fill soils. The WSE used in our analyses was previously discussed in Section 5.2. For the Sudden Drawdown Case, the three-stage procedure required by the USACE is adopted. Pre- and post-drawdown soil strengths were computed by SLOPE/W considering pore water pressures based on the input water surface elevations as defined by the three-stage procedure.

Seepage Analyses Seepage analyses were performed using SEEP/W, a component of the GeoStudio 2007 Suite v.7.16. A zero flux (i.e. no flow) boundary condition was imposed on the landside edge and bottom edge of the model for all transient and steady state seepage analyses performed. To model maximum saturation during the 100-year flood event for the transient analysis, a zero flux boundary was also used for the waterside edge. A hydraulic filling function was conservatively estimated using the 100-year event water discharge versus time data provided by JE Fuller and applied to the channel bottom and waterside slope to estimate maximum saturation in the transient analyses. To estimate the time required to reach steady state seepage, the waterside edge boundary condition was set equal to the hydraulic filling function until the WSE was obtained. The WSE was then held constant until near steady state conditions were developed. A constant WSE was used for the waterside edge boundary condition in the steady state analysis to calculate steady state local vertical exit gradients.

An initial groundwater elevation equal to 100 feet below the modeled landside ground surface was used in all the transient analyses.

The landside of the levee and the landside ground surface were modeled as potential seepage surfaces (i.e. seepage extends to ground surface). These nodes are assigned a zero unit flux boundary condition that is automatically adjusted by SEEP/W to a constant head boundary based on the iterative results of successive finite element iterations. The calculated pressure head at each node is compared to the elevation head of each iteration. If the pressure head is positive at the node, the node becomes a constant head node with head equal to the ground surface elevation, thus allowing water to seep from the modeled surface.

A global mesh size of five feet was applied to the levee embankment and foundation soils. A mesh size constraint equal to 2.5 feet extending vertically down to the initial water table and extending laterally between the waterside model edge and

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approximately 150 to 200 feet downstream from the landside toe was applied to all seepage estimates. Secondary nodes and higher order elements were defined throughout the mesh.

To reduce the potential for numerical errors due to boundary effects, the models were extended approximately 1,000 and 2,000 feet landward from the centerline of the existing levee for the transient and steady state seepage analyses, respectively.

Slope Stability Analyses Slope stability analyses were conducted using the software program SLOPE/W, also a component of the GeoStudio 2007 suite. As described in Section 5.1, our analyses considered three types of loading conditions: Steady Seepage from Full Flood Stage (Steady State), Sudden Drawdown, and Earthquake (Seismic). As described previously, stability of the eroded section did not consider seismic loading conditions. Pore water pressure distributions as calculated by SEEP/W were used in the slope stability analyses.

The FOS against slope failure was calculated using the SLOPE/W entry/exit search routine to determine the critical failure surface by Spencer's method. Spencer's method is a two-dimensional limit-equilibrium method that satisfies force equilibrium of slices and overall moment equilibrium of the potential sliding mass. Failures originating at the crest (entry point) and exiting near the toe which were a minimum of 5 feet thick were considered in our analyses. Shallow failures or failures impacting only part of the slope were judged to be maintenance issues and not a true slope failure.

Input parameters to the slope stability analysis include the levee slope configuration, unit weight, shear strength properties of levee embankment and foundation materials, and the location of the phreatic surface for each case analyzed. After a potential failure surface has been assumed, the soil mass located above the failure surface is divided into a series of vertical slices. Forces acting on each slice include the slice weight, the pore pressure, the normal force on the base, the mobilized shear force (including both cohesion and friction), and the horizontal side forces due to earth pressures.

For the Sudden Drawdown Case, the three-stage procedure required by the USACE is adopted. Pre- and post-drawdown soil strengths were computed by SLOPE/W considering pore water pressures based on the input water surface elevations as defined by the three-stage procedure.

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The FOS is calculated by determining the ratio of the resisting force (friction and/or cohesion along the failure surface) to the driving forces about the center of the assumed failure surface. The computer program performs automatic searches of different potential failure surfaces to compute the lowest FOS corresponding to a critical failure surface for a particular analysis condition.

5.3.2 Soil Models

Soil parameters were selected for the levee cross-sections analyzed considering the results from the recent 2009 and previous 1993 field explorations, the laboratory testing programs, density test data for the embankment fill soils from the materials testing report, published geologic mapping, the results of our reconnaissance, and our experience with similar soil types.

The soils encountered in the 2009 explorations consisted of relatively homogeneous granular material. Lab test data from the 2009 explorations indicates that the embankment materials and native soils have fines contents between approximately 10 and 15% and that the fines are non-plastic. Results of explorations and lab testing from the previous 1993 explorations performed prior to construction of the EL indicate non-plastic fines contents typically less than 10% and were generally similar in the proportions of sand and gravel. The soil models applied to the cross sections consider the similarity of materials as reflected in the 2009 and 1993 gradations and our understanding of levee construction from on-site excavation.

An interpretive profile of the EL alignment incorporating pre-construction site topography, current topography, geology, and the results of explorations is presented on Plate 10, Interpretive Geologic Profile.

5.3.3 Material Properties

The results of 2009 and 1993 explorations and laboratory data, as well as the 1996 density test data from the materials testing report, were used to estimate hydraulic conductivity, unit weight and porosity for the seepage modeling. The results of explorations and laboratory data were used to estimate D_{10} values and horizontal hydraulic conductivity at saturation for the embankment and foundation soils using

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Figure 3-5 of the USACE EM 1110-2-1913. The highest correlated hydraulic conductivity value was selected for analysis to evaluate the impact of flood duration. An average of the 1996 compaction test data was used to estimate dry unit weight and porosity.

Blowcount data obtained in the 2009 explorations was corrected for measured hammer efficiencies, drill rod string, and overburden pressure. The corrected blow count data, $(N_1)_{60}$, was used to estimate the embankment and native soil strength parameters following correlations presented in Das (2006). The one-third lower bound friction angle of 40 degrees was selected for the native soils. The lower bound friction angle of 38 degrees was selected for the embankment soils. This value correlates with the average phi angle of 38 degrees obtained from remolded direct shear results performed on granular soils obtained in the 1993 explorations in the project area. The soil parameters used in our analyses are summarized in Table 5.3.

Table 5-3
Summary of Seepage Parameters and Material Properties for Slope Stability Analyses

Soil Description	Total Unit Weight (pcf)	Total and Effective Friction Angle (deg)	Horizontal Hydraulic Conductivity, Kx (ft/day)	Ratio of Vertical to Horizontal Conductivity, Ky/Kx
Embankment Fill: Sand and Gravel with Silt	130	38	170	0.25
Native Soils: GP-GM, SP-SM, GM, SM	130	40	170	0.25

The parameters summarized in Table 5-3 represent the estimated properties of the various materials under saturated flow conditions. Hydraulic functions that relate unsaturated permeability to soil moisture suction are incorporated in SEEP/W. The volumetric water content and hydraulic conductivity functions used were selected based on grain size distribution data from the laboratory tests, porosity calculated using average dry density from the compaction test data, and published coefficient of volume compressibility values for the soil types modeled (Bell, 1981).

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5.3.4 Seepage and Slope Stability Analyses Results

The results of the seepage analyses are shown on Plates C-1 through C-5 in Appendix C. Plates C-1, C-2, C-4 and C-5 presents the results without erosion and Plate C-3 presents the results considering erosion. A graph of water elevation versus time used as input for the seepage analyses is presented on Plate C-6.

The estimated wetting front, or furthest progression of the phreatic surface in the embankment during the base flood, was analyzed and is represented as the transient seepage case. In all analyses, the furthest that the wetting front progresses is the mid-point of the crest during the base flood event. These analyses are represented in the transient seepage results in the upper left diagram on Plates C-1 through C-5.

The time to steady state seepage as well as steady state seepage with the local vertical exit gradient, $(i_y)_{max}$ at the landside toe are also shown on Plates C-1 through C-5. A plot of the vertical exit gradient at nodes along the modeled land surface generated by SEEP/W was used to select the location and maximum magnitude of $(i_y)_{max}$ along the embankment. The time to steady state seepage is greater than four days for each of the cases analyzed. The seepage analyses indicate that the maximum vertical landside exit gradient is less than or equal to the USACE maximum allowable exit gradient of 0.3 for all cases analyzed.

The results of the slope stability analyses for Steady State, Sudden Drawdown and Seismic cases without erosion are shown on Plates D-1, D-2, D-4 and D-5 in Appendix D. The results of Steady State and Sudden Drawdown slope stability with erosion are presented on Plate D-3. The model geometry, material properties and the phreatic surface(s) used in the analyses are also represented on Plates D-1 through D-5. The slope stability analyses indicate the cross-sections without erosion have FOS greater than 1.4 for the Steady State Case (static stability analysis), and greater than 1.0 for the Sudden Drawdown and Seismic cases. Calculated FOS of 1.3 and 1.1 were calculated for the Steady State without erosion and Sudden Drawdown with erosion cases, respectively. These results are judged to be stable for this temporary condition. With the exception of the Sudden Drawdown analyses, waterside and landside slopes were analyzed for each case. The FOS presented for each case on Plates D-1 through D-5 represents the lowest calculated FOS for that case.

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Tables 5-5 and 5-6 summarize the results of the seepage and slope stability analyses for the cross-sections analyzed.

Table 5-5
Summary of Seepage Analyses

Erosion Case	Station	Plate No.	Nearby Boring	Surveyed Levee Crest Elevation (feet)	Surveyed Landside Toe Elevation (feet)	WSE (feet)	Estimated Time to Steady State Seepage (days)	Computed Steady State Maximum Vertical Landside Exit Gradient on Embankment
Without Erosion	72+38	C-1	B-1	2221.6	2213.4	2214.9	>4	0.3
	73+50	C-2	B-1	2222.2	2211.2	2215.9	>4	0.2
	82+00	C-4	B-2	2231.4	2215.4	2220.8	>4	0.3
	167+00	C-5	B-7	2382.3	2378.4	2380.4	>4	0.2
With Erosion	73+50	C-3	B-1	2222.2	2211.2	2215.9	>4	0.2

Table 5-6
Summary of Slope Stability Analyses

Erosion Case	Station	Plate No.	Nearby Boring	Calculated Steady State FOS	Required Steady State FOS	Calculated Sudden Drawdown FOS	Required Sudden Drawdown FOS*	Calculated Seismic FOS	Required FOS (NDWR)
Without Erosion	72+38	D-1	B-1	2.2	≥1.4	2.3	≥1.0	1.9	≥1.0
	73+50	D-2	B-1	2.0	≥1.4	2.2	≥1.0	1.9	≥1.0
	82+00	D-4	B-2	2.3	≥1.4	2.2	≥1.0	2.0	≥1.0
	167+00	D-5	B-7	2.7	≥1.4	3.7	≥1.0	3.1	≥1.0
With Erosion	73+50	D-3	B-1	1.3**	≥1.4	1.1	≥1.0	--	--

* *A minimum Factor of Safety of 1.0 applies to pool levels prior to drawdown for conditions where these water levels are unlikely to persist for long periods preceding drawdown.*

** *Erosion case represents a temporary condition.*

5.4 LIQUEFACTION POTENTIAL

Liquefaction describes a phenomenon in which saturated soil loses shear strength and deforms as a result of increased pore water pressure induced by strong ground shaking during an earthquake. Dissipation of the excess pore pressures will produce volume changes within the liquefied soil layer, which can cause settlement of the levee. Shear strength reduction combined with inertial forces from the ground motion may result in lateral migration (lateral spreading), extensional ground cracking of liquefied material, and slope failure. Factors known to influence liquefaction include soil type, structure,

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grain size, relative density, confining pressure, depth to groundwater, and the intensity and duration of ground shaking. Soils most susceptible to liquefaction are saturated, loose sandy soils and low plasticity clay and silt.

A review of the soil types and consistencies as assessed by field blow count data in the soil borings for this project indicates that the majority of the subsurface soils consist of dense to very dense, medium- to coarse-grained granular soils. In addition, the groundwater level in the project area is in excess of 100 feet below the existing ground surface. Due to the depth of groundwater and consistency of the subsurface soils, it is our opinion that the liquefaction potential for the site is very low.

5.5 SETTLEMENT

The subsurface soils at the site are granular. The majority of load-related settlement is expected to have occurred during construction of the levee or shortly thereafter.

Hydrocollapse or hydrocompaction refers to a condition where soils undergo a rapid decrease in volume upon wetting due to a collapse in soil structures. Soils that are typically associated with this condition are loess deposits and weakly cemented fine sands and silts where the cementing agent is a soluble mineral. Due to the generally coarse grained, dense to very dense nature of the on-site soils, the hydrocollapse potential for the soils underlying the levee is judged to be low.

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6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL CONCLUSIONS

The findings, conclusions, and recommendations presented in this report are integral with the provisions and requirements outlined in the Limitations section of this report.

6.1.1 Levee Characterization

The results of the explorations suggest that the EL embankment fill is composed of a relatively homogeneous mix of sand and gravel with small amounts of silt, consistent with construction from a blended mix of on-site materials. Embankment materials consist of GM, SM, SP-SM and GP-GM with fines content ranging from approximately 10% to 15% silt. Blow count data indicative of a dense to very dense consistency were encountered in the embankment fill and native soils in all cases except three zones of medium dense to dense soils (field N values of 25 to 30) approximately 2 feet thick encountered in the explorations generally near the embankment fill / native soil transition. Based on well data cited previously, groundwater is anticipated to be present at a depth of greater than 100 feet below natural grade at the site.

Interviews with representatives of Clark County Regional Flood Control District, and City of Henderson indicate that very little maintenance has been performed or required at EL since construction in 1996.

A geotechnical inspection of the EL was performed by Kleinfelder prior to conducting subsurface exploration. A waterline penetration at two locations was observed. Our conclusions and recommendations regarding the waterline penetration are presented in Sections 6.1.4 and Section 6.2. Localized steepening of the landside slope interpreted to be the result of erosion from recreation vehicle traffic was also observed, along with landside slope modifications apparently the result of utility excavations. The areas of steepened slopes and significant landside modifications are represented in the critical sections selected for the seepage and slope stability analyses and discussed in Sections 6.1.2 and 6.2. Localized erosion of the waterside toe in areas of natural wash confluences were also observed, along with evidence of small animal burrows one to two inches in diameter on the waterside slope. Remediation of the above conditions should be performed, documented, and approved by Kleinfelder.

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6.1.2 Seepage and Slope Stability

The transient seepage analyses indicate that the wetting front progresses no further than the mid-point of the crest for all cross-sections analyzed. The time to steady state seepage for all cases analyzed is greater than four days. Corresponding maximum local vertical landside toe exit gradients less than or equal to 0.3 were also obtained for all analyses.

The slope stability analyses indicate that all cases without erosion analyzed meet or exceed the minimum Factors of Safety (FOS) required for the Steady State Case and the Sudden Drawdown Cases by USACE and meet or exceed the minimum FOS for seismic stability according to Nevada Division of Water Resources (DWR) Dam Guidelines for Design (http://water.nv.gov/Engineering/Dams/design.cfm, accessed October 22, 2009). Factors of Safety of 1.3 and 1.1 were calculated for the Steady State without erosion and Sudden Drawdown with erosion, respectively. These results are judged to be stable for this temporary condition.

6.1.3 Settlement

The subsurface soils at the site are granular and therefore, the majority of settlement should have occurred during construction of the levee or shortly thereafter.

6.1.4 SNWA Waterline Penetration

Although the referenced construction details and documentation for the SNWA waterline penetration are not directly in conflict with guidelines for levee penetrations presented in USACE EM 1110-2-1913, there is no evidence on the plans or in the construction records that the reconstructed embankment was properly constructed or benched into the existing levee fill in the areas where the berm was breached to construct the penetrations. The Berm Breach Plan indicates localized cut slopes as steep as 1:1 and the photographs suggest that the cut slopes may have been locally steeper in areas. There is also no evidence that special compaction equipment or methods were utilized at the interface between the cut slope and the reconstructed embankment. As described in Section 2.1.1, a linear depression approximately 40 feet long, two feet wide, and ½ foot deep was present on the landside slope within the vicinity of the

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northern SNWA waterline crossing. This feature can be interpreted to be indicative of levee settlement at the cut slope interface. We conclude that there is a risk of a through-going, preferred seepage path at the cut slope/reconstructed embankment interface on both sides of the two waterline penetration locations. We recommend that reconstruction of the portions of the levee disturbed by two waterline penetrations be performed to reduce the potential for seepage in the areas of the waterline penetrations.

6.1.5 Other Potential Considerations

Levee performance issues not addressed by Kleinfelder include presence of sufficient freeboard, impact of erosion, impacts of vegetation, and impacts of animal burrows. The waterline penetrations and other encroachments were included in our analyses only to assess potential impacts on levee through seepage and stability. A more detailed discussion of the items not addressed is presented below.

- We understand the freeboard analysis, survey data and WSEs were provided with the level of detail required for the evaluation of the civil engineering components of the levee. Site conditions, WSEs or freeboard different than those provided may invalidate the results presented in this report.
- Our conclusions and recommendations regarding the two waterline penetrations are based on our observations and the limited construction details and documentation provided for our review. Evaluation of the proper design, construction and structural integrity of penetrations was not included as part of Kleinfelder's scope of services.
- We understand that a maintenance program is in place which includes provisions for treatment of animal burrows and vegetation. The treatment program for both conditions is based on overexcavation and replacement of the impacted levee embankment materials with either compacted fill or cementitious material.
- Operation and Maintenance, and Past Performance: Limited information regarding past performance, repairs, and maintenance was available for this levee. We understand that recommendations for an annual maintenance program have been developed as part of the overall performance assessment.

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6.2 RECOMMENDATIONS AND CERTIFICATION

Based on our evaluation and findings of this study, it is our opinion that for the 100-year WSE as previously defined, the EL meets the current FEMA requirements for geotechnical components of levee certification outlined in 44 CFR Section 65.10 with regard to seepage conditions, and the stability of the existing slopes, with the exception of maintenance and the two waterline penetrations. Following the recommended improvements in the areas of the two SNWA waterline penetrations and remediation of the maintenance conditions identified, Kleinfelder can recommend the EL for certification.

A steady state seepage analysis was performed in accordance with USACE EM procedures. Local vertical exit gradients at the landside toe are less than or equal to 0.3 for all cases analyzed. A transient analysis was performed to evaluate when steady state conditions would develop and these results were compared to the 100-year flood duration. The 100-year flood duration is approximately six hours. A transient analysis indicates that steady state conditions do not develop for a period four or more days for all cases analyzed.

The slope stability analyses performed using phreatic surfaces obtained from the steady state seepage analyses indicate the slopes meet or exceed USACE minimum criteria for the Steady State and Sudden Drawdown cases without erosion. Factors of Safety of 1.3 and 1.1 were calculated for the Steady State without erosion and Sudden Drawdown with erosion, respectively. These results are judged to be stable for this temporary condition. The seismic stability exceeds the minimum factor of safety for Nevada Division of Water Resources (DWR) Dam Guidelines for Design (http://water.nv.gov/Engineering/Dams/design.cfm). Based on this approach, the EL levee is found to be stable in accordance with 44 CFR 65.10, which allows the consideration of flood duration.

As shown on Plate 9, a combined total of 22 borings and test pits were performed along the EL alignment in the previous 1993 and recent 2009 studies. Although the distribution and depth of the explorations performed are not consistent with the requirements of USACE ETL 1110-2-569, based on the boring logs, explorations from previous Kleinfelder projects in the project area, and our understanding of the geology

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in the vicinity of the site, it is our opinion the soil characteristics observed and tested in our borings are representative of the levee embankment soils and underlying alluvium to the depths modeled.

The operation and maintenance recommendations outlined below should be included in guidelines being prepared for future satisfactory performance of the levee.

Operation and maintenance inspections should be done after a rainfall or flood event and on a time-based criteria (annually or less) to evaluate distress such as erosion, slope condition and rodent burrows. Inspections should be recorded and photographs taken to document current conditions. Additionally, we recommend inspection and any needed operation and maintenance be performed subsequent to an earthquake event with an epicenter near the vicinity of the site. We recommend the Operation and Maintenance Plan also include documentation of the lateral and vertical limits of repairs using survey as a means to further assess and document levee performance. The repair procedure should outline a plan for fixing and maintaining washout erosional areas, gullies, animal burrows, etc. Repair methods could consist of excavating and infilling erosional features with compacted soil, track walking the levee faces with heavy equipment, as determined by the type and size of repair. These repairs should be performed in a prompt manner after the occurrence. Existing slope inclinations should be maintained to the present grade or flatter, and a maintenance program should include periodic survey to identify areas where slopes begin to steepen.

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7.0 LIMITATIONS

Recommendations contained in this report are based on our limited field observations and subsurface explorations, limited laboratory tests, review of limited construction details and documentation, and our present knowledge of the subject levee. It is possible that soil conditions vary between or beyond the points explored. If soil or groundwater conditions are encountered that differ from those described, we should be notified immediately in order that a review may be made and any supplemental recommendations provided.

Kleinfelder did not provide surveying services. An opinion regarding the accuracy of the surface location or elevations with respect to the approved plans and current site surveying is not provided. We understand the survey data and WSE's were provided with the level of detail required for the evaluation of the civil engineering components of the basin. Site conditions, WSEs and/or freeboard different than those provided may invalidate the results presented in this report.

Information and recommendations presented in this report should not be extrapolated to other areas or be used for other projects without our prior review and response.

The client has the responsibility to see that all parties to the project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. This report contains information that may be useful in the preparation of contract specifications; however, the report is not designed as a specification document and may not contain sufficient information for this use without proper modification.

Our evaluation of subsurface conditions at the site has considered subgrade soil and groundwater conditions present at the time of our investigation. The influence(s) of post-construction changes to these conditions such as introduction of water into the subsurface will likely influence future performance of the proposed project. Our scope of services addresses present groundwater conditions; whereas, future irrigation, broken water pipelines, etc., may adversely influence the project and should be addressed and mitigated, as needed.

Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the authors of this report, are only mentioned in the given

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standard; they are not incorporated into it or "included by reference", as the latter term is used relative to contracts or other matters of law.

We have presented the findings, conclusions and recommendations in this report in a manner consistent with the standards of care and skill ordinarily exercised by members of Kleinfelder's profession practicing under similar conditions in Clark County, Nevada, and at the time the services were performed. No warranty, express or implied, is made.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance, but in no event later than one year from the date of the report. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party, and client agrees to defend, indemnify, and hold harmless Kleinfelder from any claim or liability associated with such unauthorized use or non-compliance.

The scope of our geotechnical services did not include any environmental site assessment for the presence or absence of hazardous/toxic materials. Kleinfelder will assume no responsibility or liability whatsoever for any claim, damage, or injury which results from pre-existing hazardous materials being encountered or present on the project site, or from the discovery of such hazardous materials.

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8.0 REFERENCES CITED

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Continental Aerial Stereoscopic Aerial Photographs:

Date	Photo Number	Scale
5/28/1968	58, 59	1:30,000
2/3/74	23-7,23-8,24-7,24-8	1:12,000
9/23/1981	7-2, 7-3	1:40,000
3/8/1991	C-6-7-17, C-6-76-18, C-6-7-19	1:24,000
10/4/99	C-138-12-113, C-138-12-114, C-138-12-115	1:24,000

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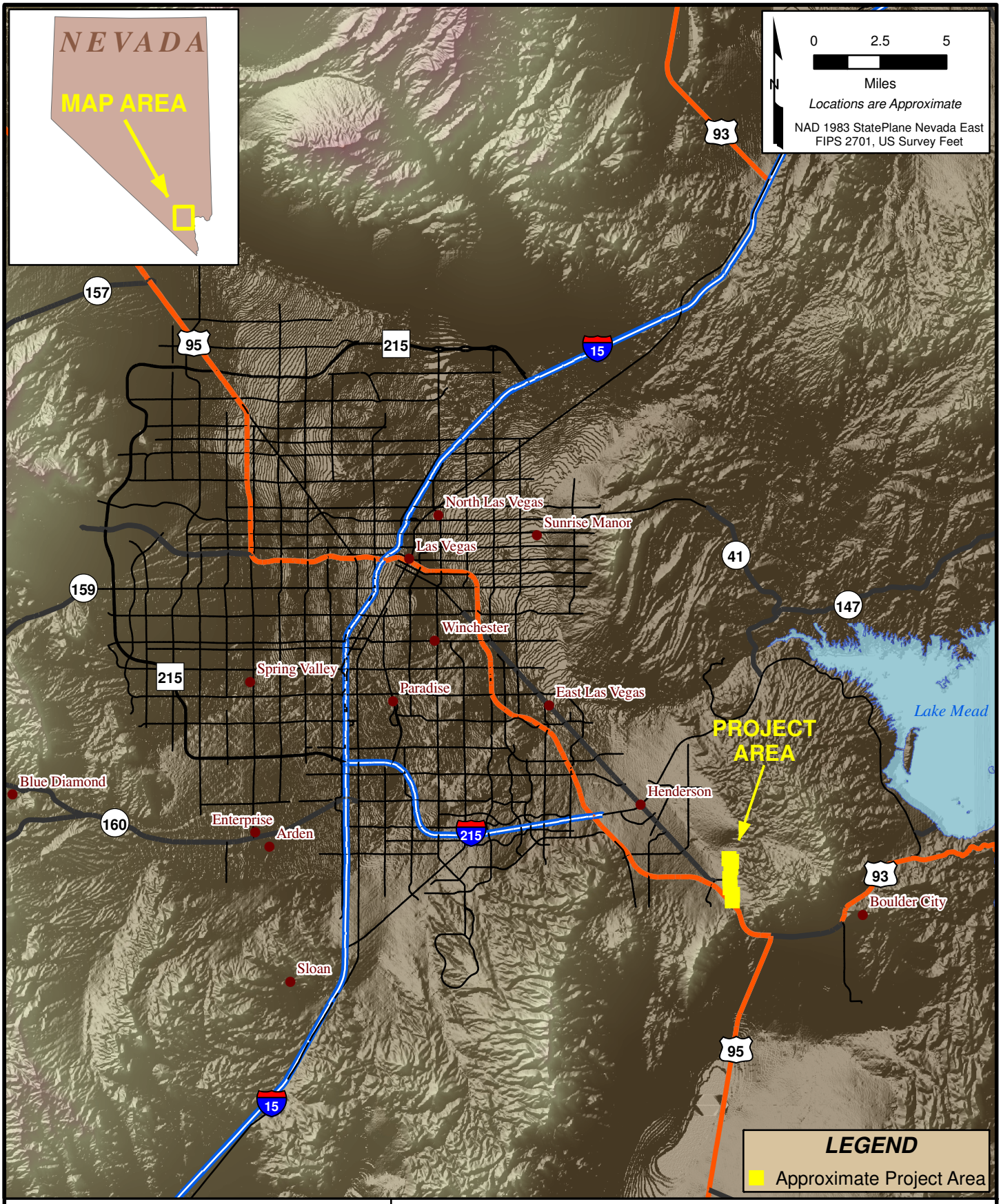
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9.0 ACRONYMS DEFINED

ASFE	Association of Engineering Firms Practicing the Geosciences
CCRFCD	Clark County Regional Flood Control District
COH	City of Henderson
DWR	Division of Water Resources
EDB	Equestrian Detention Basin
EDC	Equestrian Drive Channel
EL	Equestrian Levee
ELC	Equestrian Levee Channel
EM	United States Army Corps of Engineers Engineering Manuals
ETL	United States Army Corps of Engineers Engineering Teaching Letters
FEMA	Federal Emergency Management Agency
FOS	Factor of Safety
GPS	Global Positioning System
NBMG	Nevada Bureau of Mines and Geology
SNWA	Southern Nevada Water Authority
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USGS	United States Geological Survey
WSE	Water Surface Elevation

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PLATES



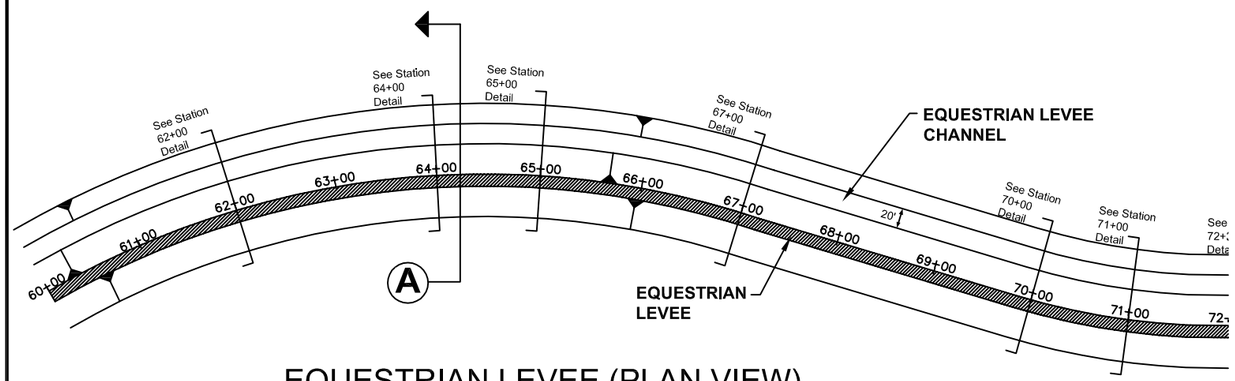
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PROJECT LOCATION MAP

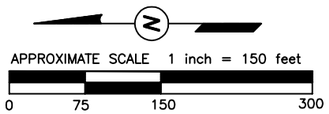
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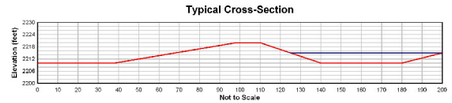
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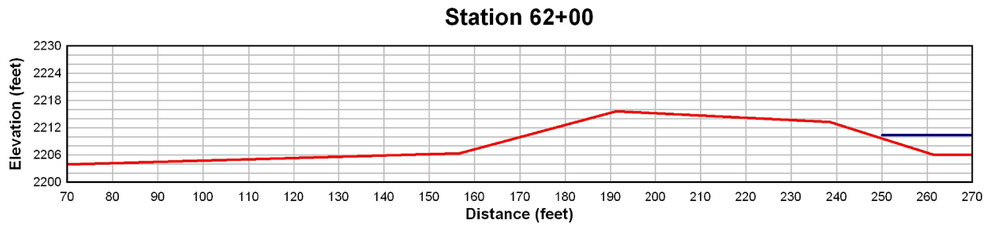


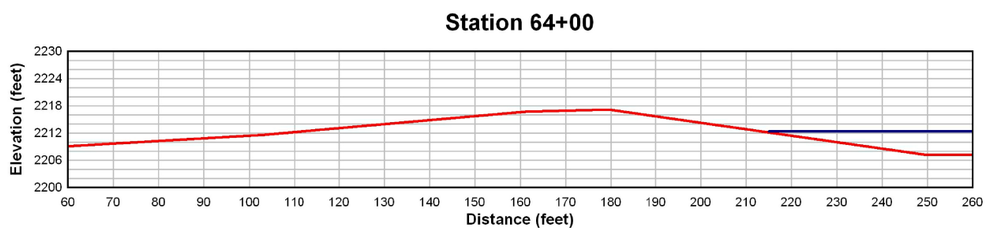
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STATION 60+00 - 72+00

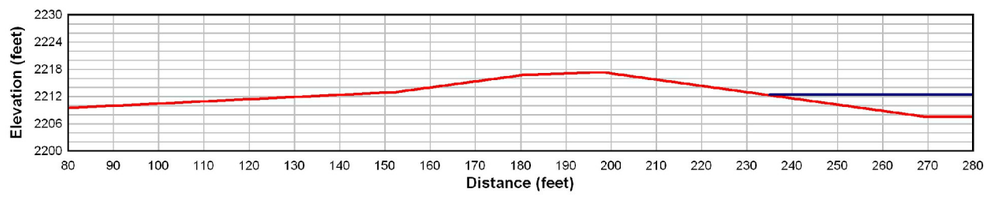


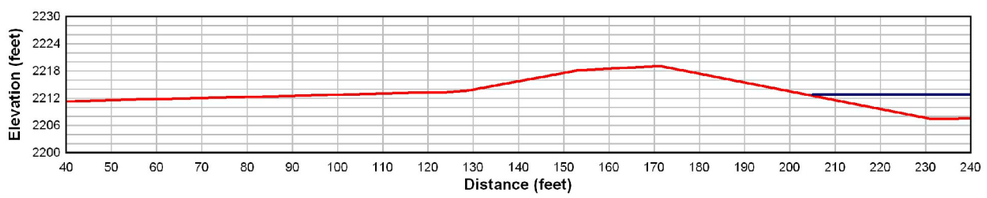


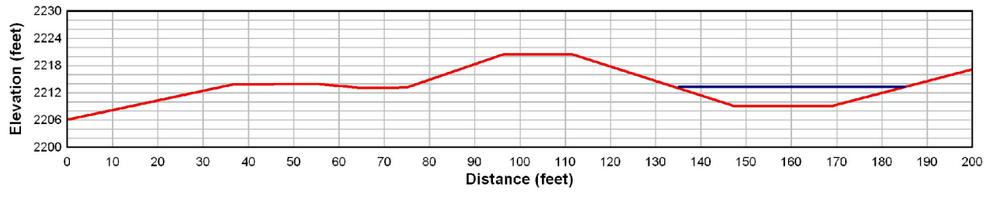
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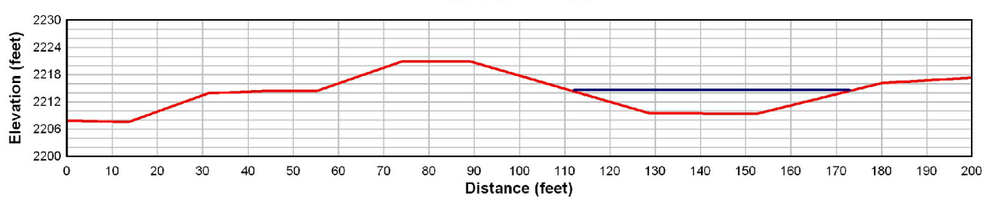












LEGEND:

— LAND SURFACE

— 100 YEAR WATER SURFACE

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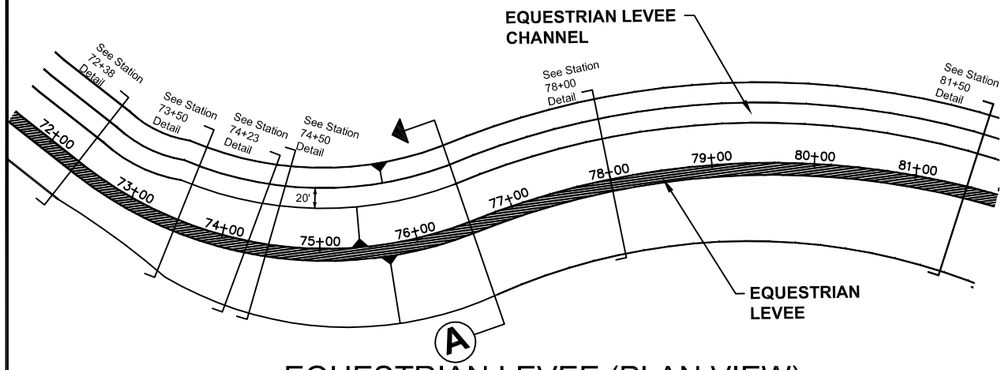
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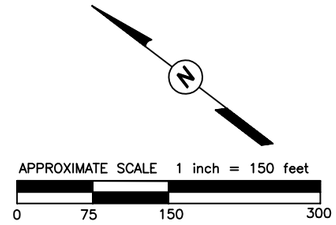
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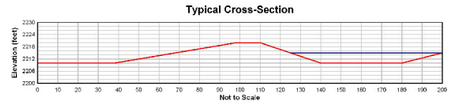
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PLATE
2

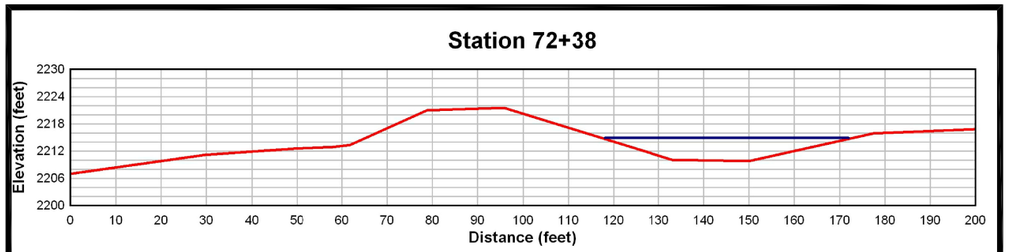


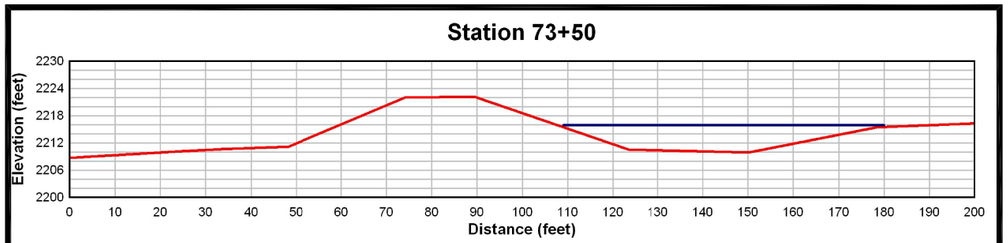
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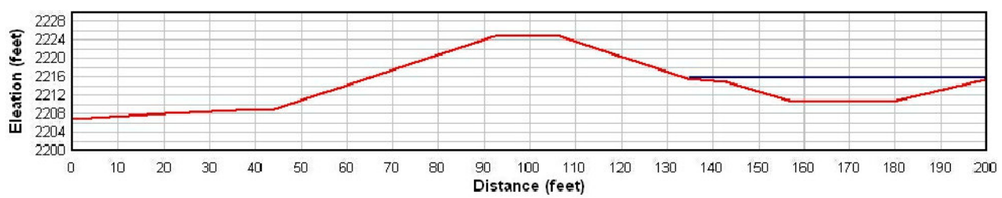


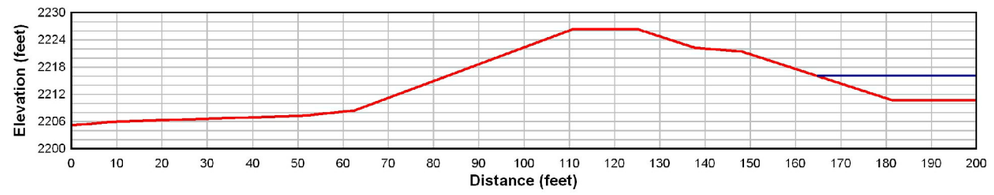


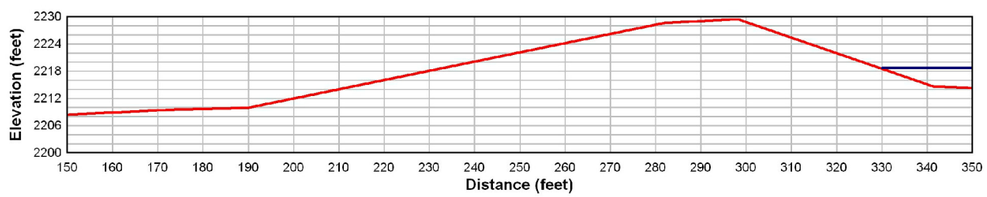
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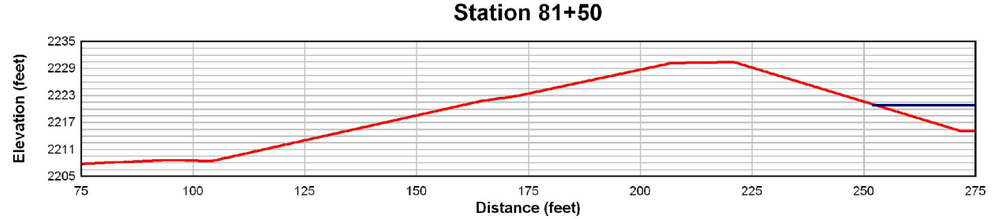












LEGEND:

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— 100 YEAR WATER SURFACE

— SELECTED CROSS-SECTION FOR STABILITY ANALYSIS (STA. 72+38 AND 73+50)

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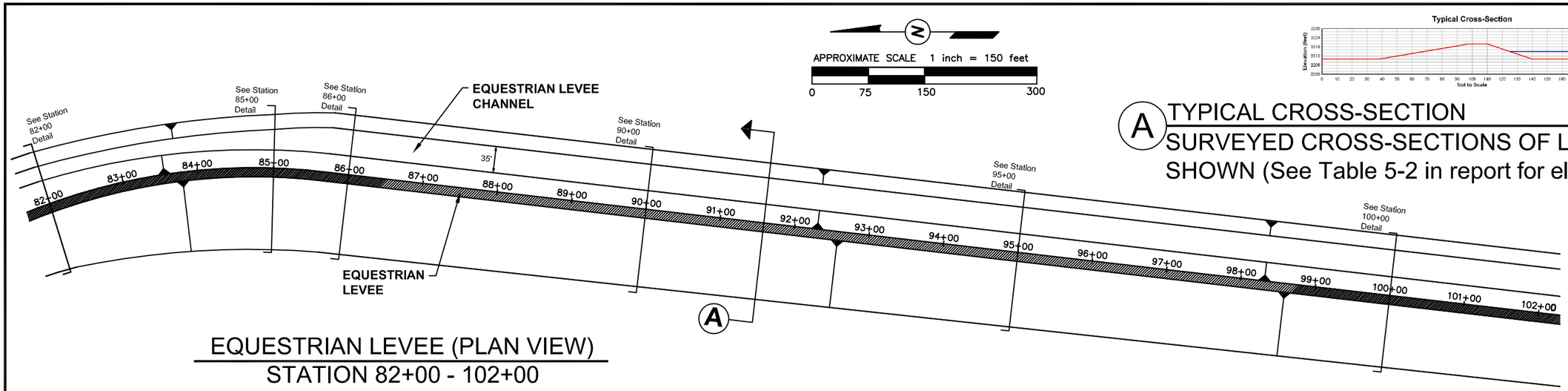
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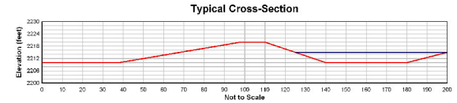
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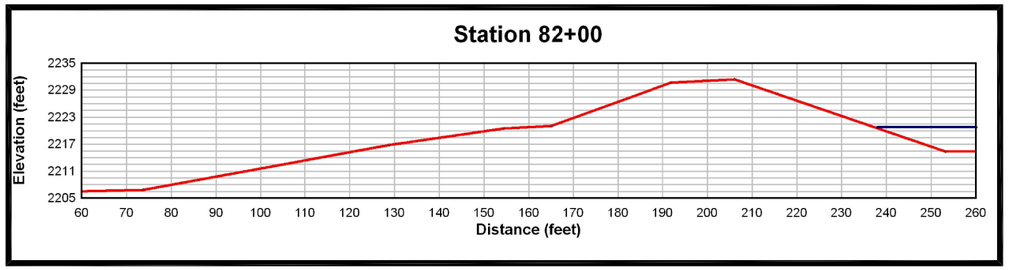
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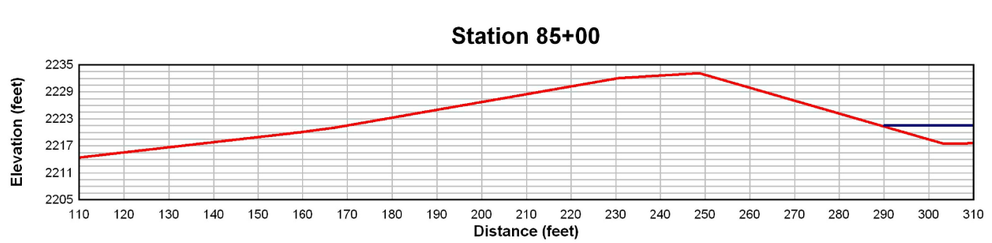


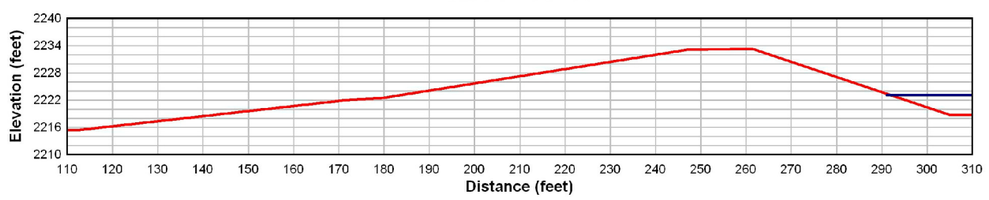
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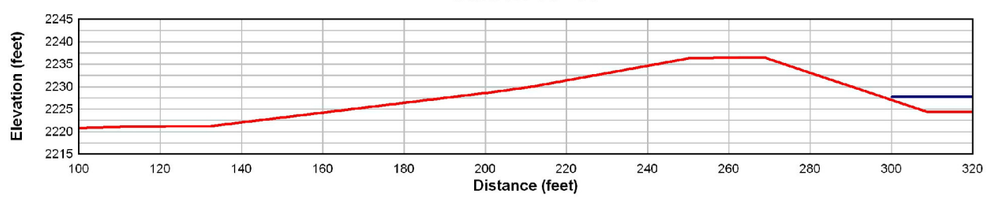


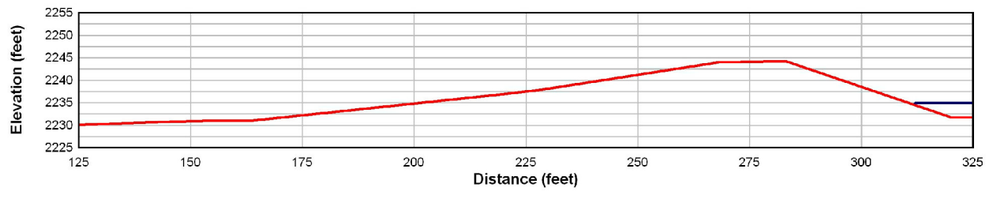
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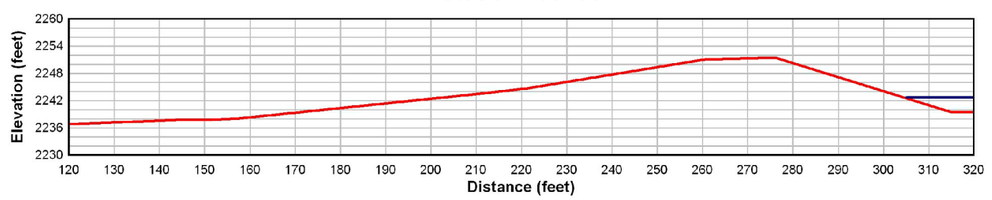












LEGEND:

— LAND SURFACE

— 100 YEAR WATER SURFACE

— SELECTED CROSS-SECTION FOR STABILITY ANALYSIS (STA. 82+00)

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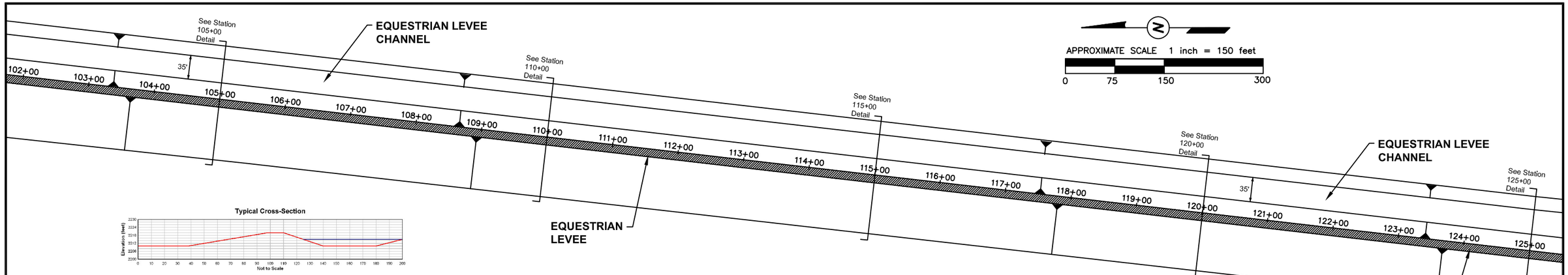
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PROJECT NO.	101764.1
DRAWN:	08/06/2010
DRAWN BY:	DFR
CHECKED BY:	ALB

Levee Survey Geometry
Station 82+00 - 102+00

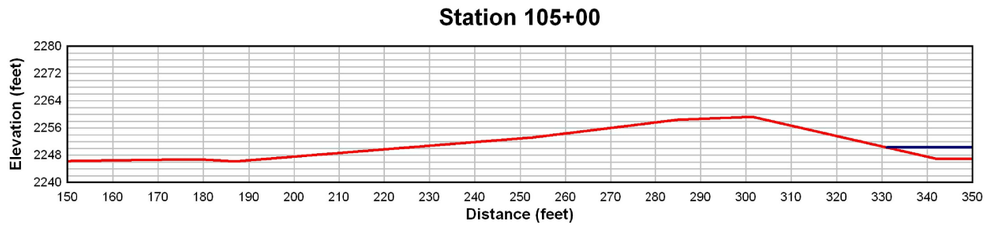
CCRFCD
Clark County Levee Certification Project
Equestrian Levee
Henderson, Nevada

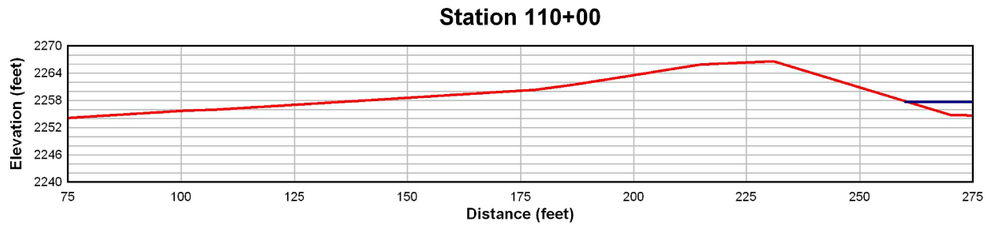
PLATE
4

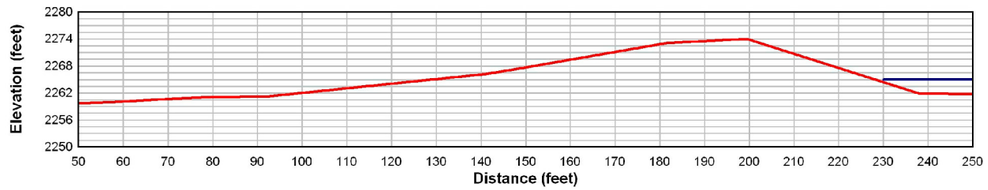


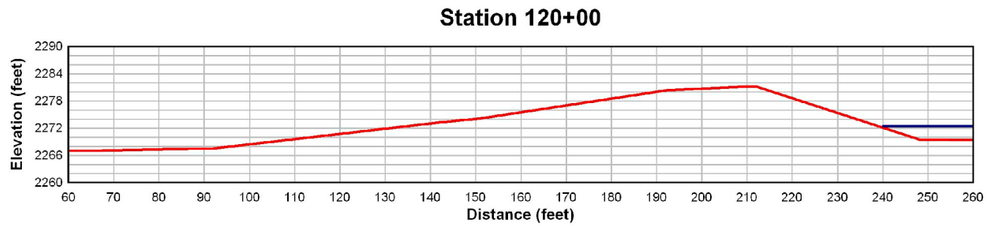
A TYPICAL CROSS-SECTION
SURVEYED CROSS-SECTIONS OF LEVEE AS SHOWN (See Table 5-2 in report for elevation summary)

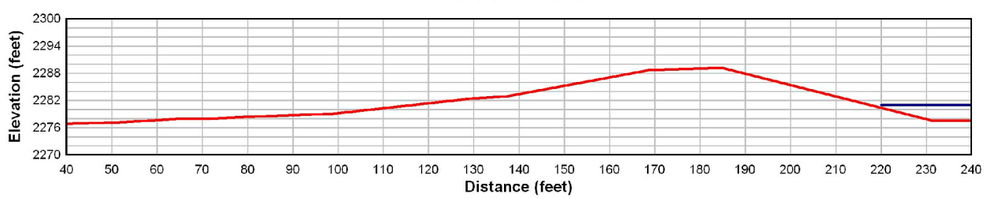
EQUESTRIAN LEVEE (PLAN VIEW)
STATION 102+00 - 125+00











LEGEND:

— LAND SURFACE

— 100 YEAR WATER SURFACE

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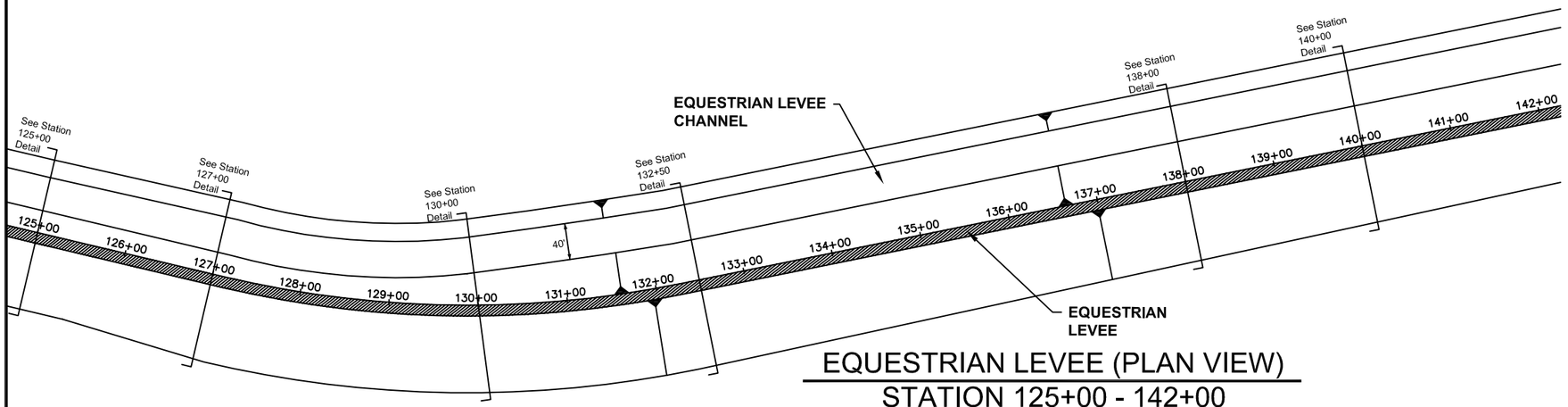
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Levee Survey Geometry
Station 102+00 - 125+00

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Equestrian Levee
Henderson, Nevada

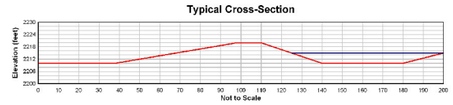
PLATE
5



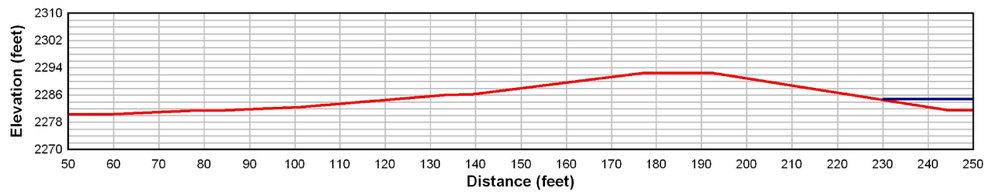
EQUESTRIAN LEVEE (PLAN VIEW)
STATION 125+00 - 142+00

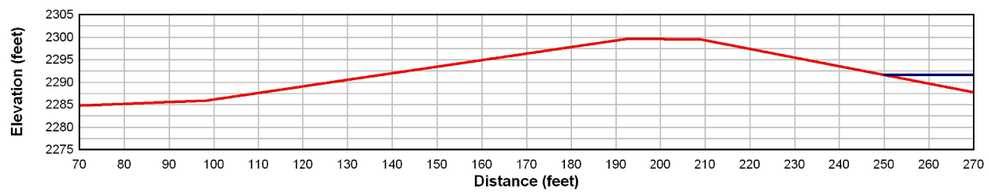
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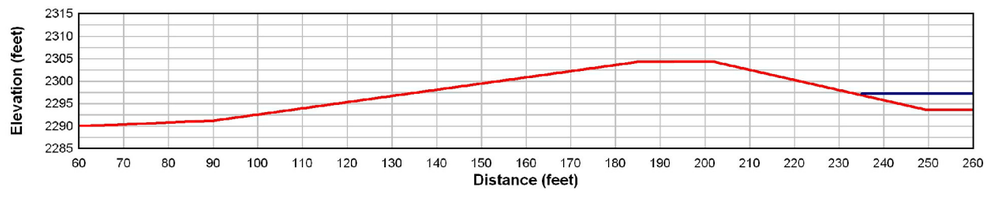
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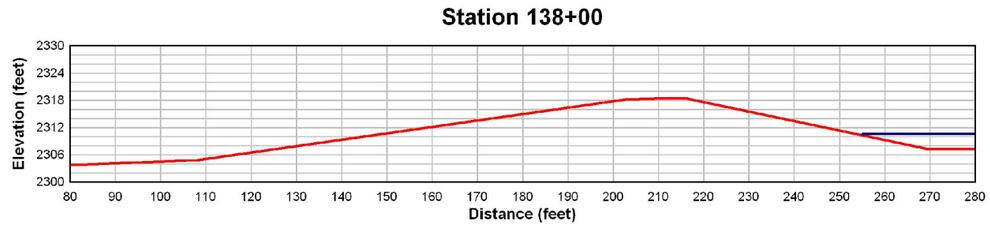


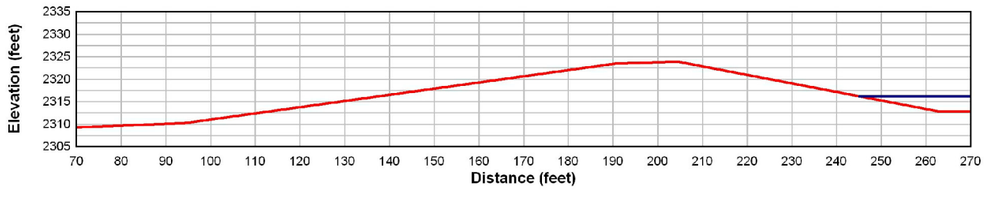
A TYPICAL CROSS-SECTION
SURVEYED CROSS-SECTIONS OF LEVEE AS SHOWN (See Table 5-2 in report for elevation summary)











LEGEND:

— LAND SURFACE

— 100 YEAR WATER SURFACE

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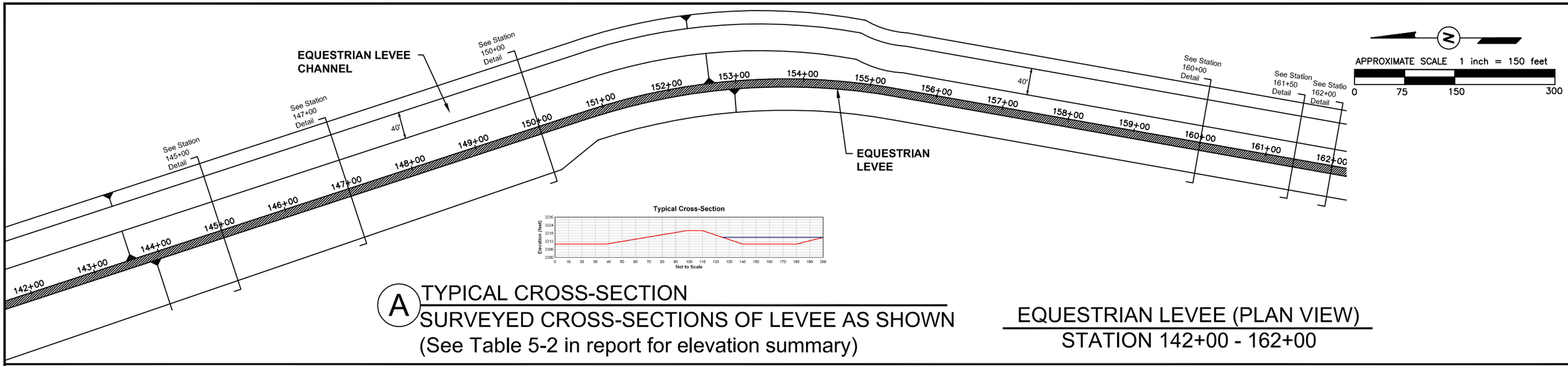
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Levee Survey Geometry
Station 125+00 - 142+00

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Equestrian Levee
Henderson, Nevada

PLATE
6



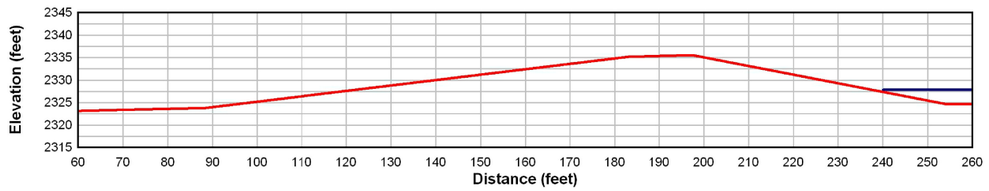
A TYPICAL CROSS-SECTION

SURVEYED CROSS-SECTIONS OF LEVEE AS SHOWN
(See Table 5-2 in report for elevation summary)

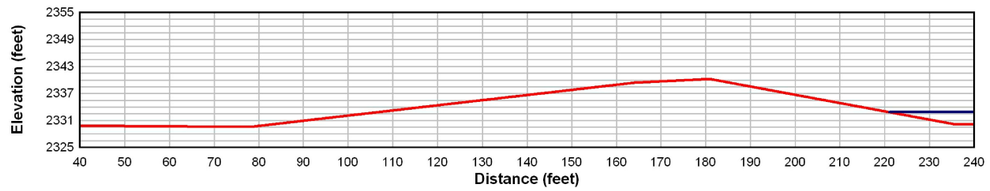
EQUESTRIAN LEVEE (PLAN VIEW)

STATION 142+00 - 162+00

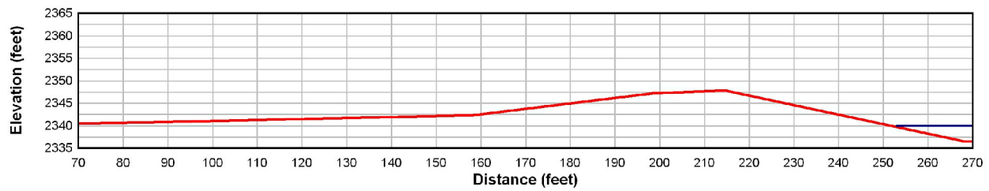
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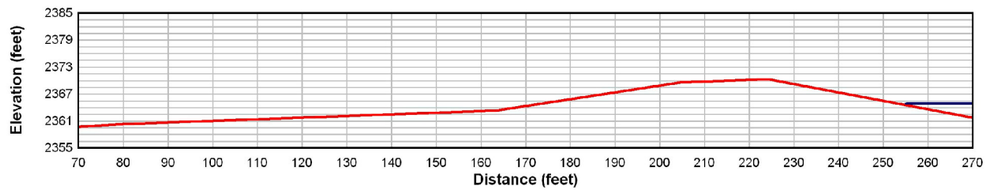
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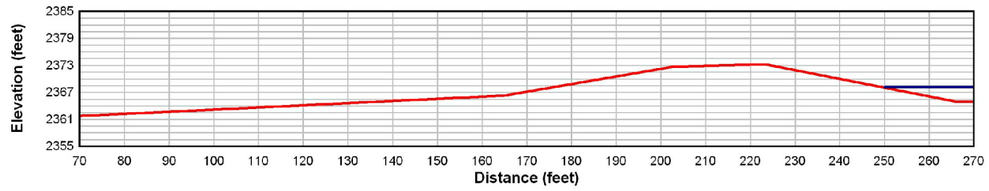
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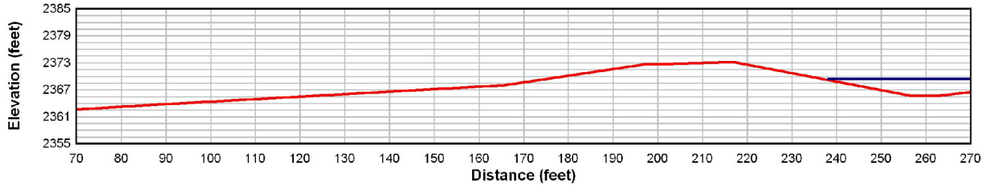
Station 160+00



Station 161+50



Station 162+00



LEGEND:

— LAND SURFACE

— 100 YEAR WATER SURFACE

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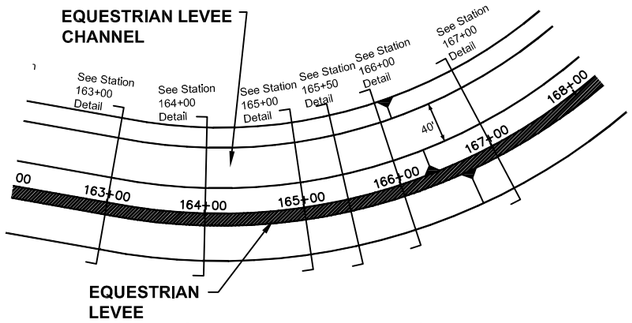
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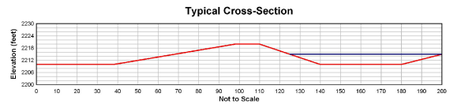
Levee Survey Geometry
Station 142+00 - 162+00

CCRFCD
Clark County Levee Certification Project
Equestrian Levee
Henderson, Nevada

PLATE
7

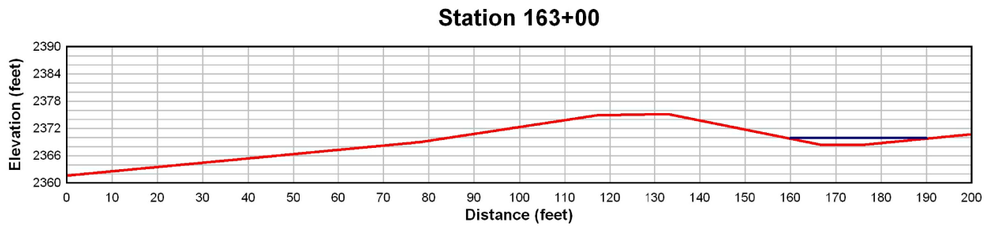


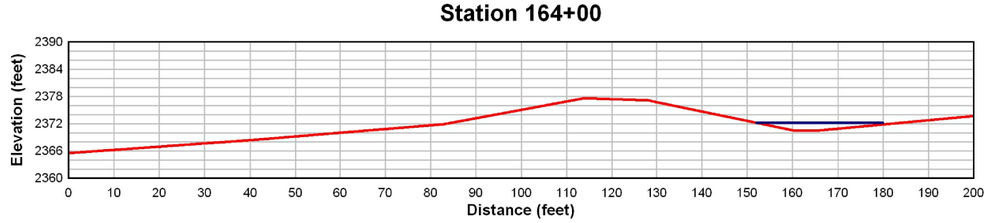
EQUESTRIAN LEVEE (PLAN VIEW)
STATION 162+00 - 168+00

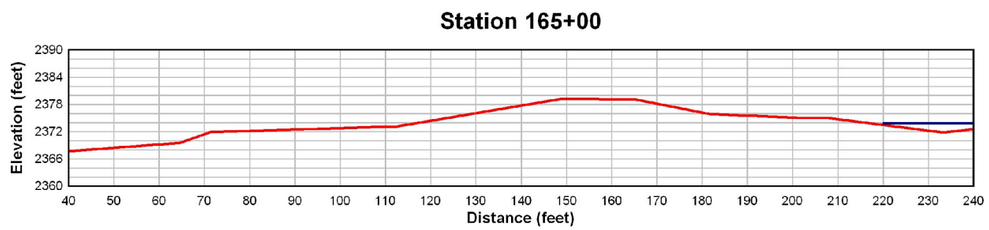


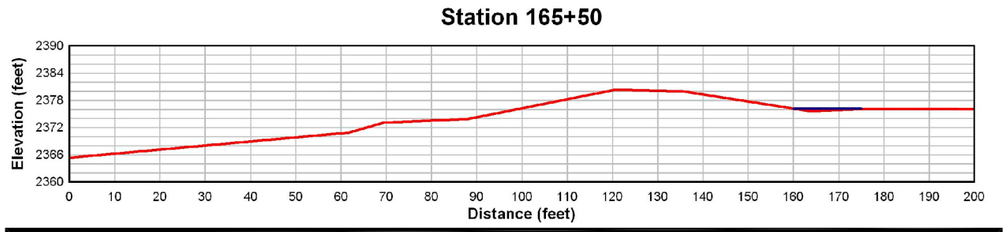
A TYPICAL CROSS-SECTION
SURVEYED CROSS-SECTIONS OF LEVEE AS SHOWN (See Table 5-2 in report for elevation summary)

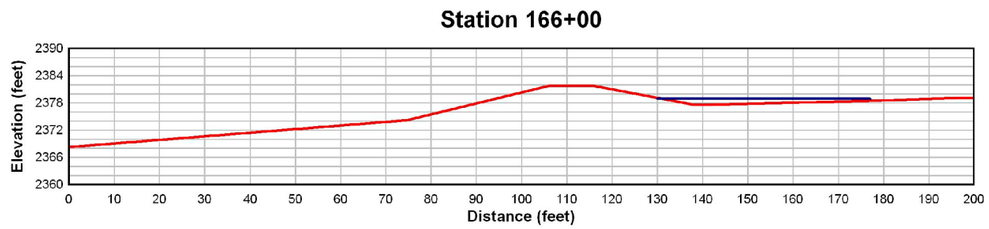
APPROXIMATE SCALE 1 inch = 150 feet
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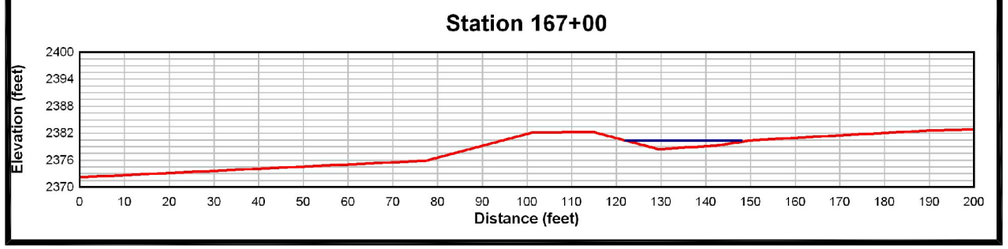












LEGEND:

— LAND SURFACE
— 100 YEAR WATER SURFACE
— SELECTED CROSS-SECTION FOR STABILITY ANALYSIS (STA. 167+00)

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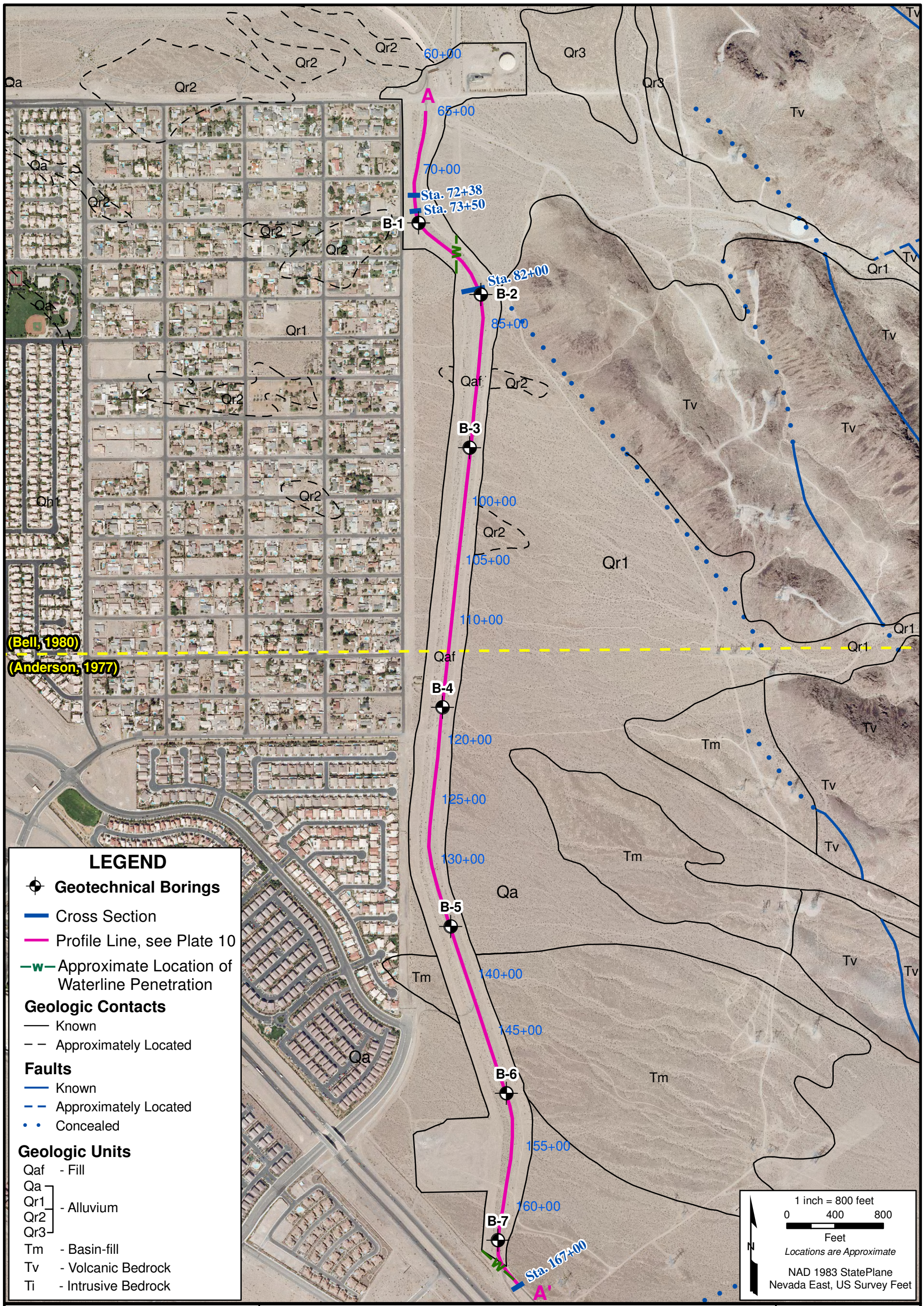
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PROJECT NO.	101764.1
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Levee Survey Geometry
Station 162+00 - 168+00

CCRFCD
Clark County Levee Certification Project
Equestrian Levee
Henderson, Nevada

PLATE
8



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SITE PLAN WITH EXPLORATIONS AND GEOLOGY

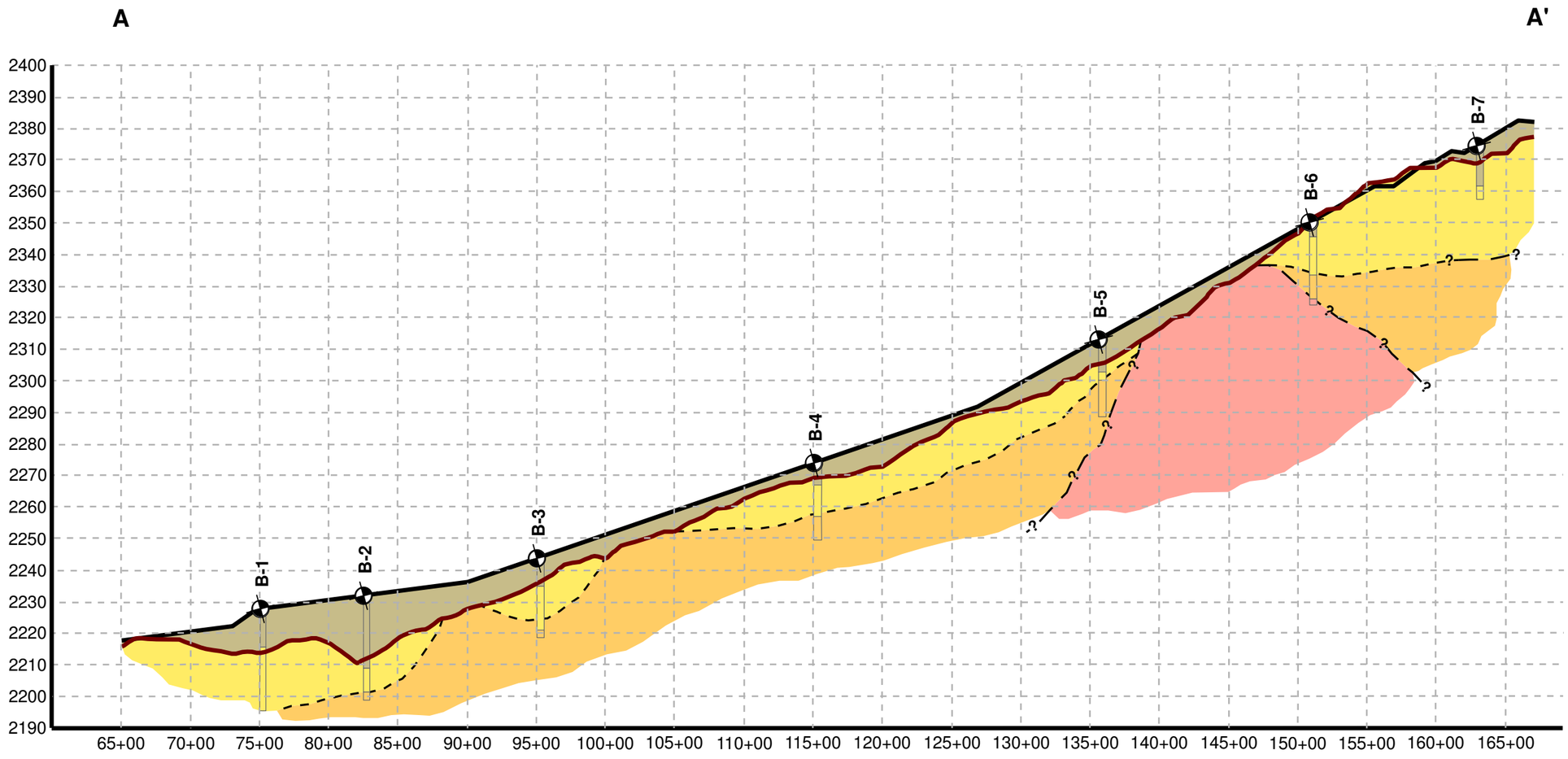
CCRFCD
Clark County Levee Certification Project
Equestrian Levee
Henderson, Nevada

Geology based on Bell (1980) and Anderson (1977).
Aerial imagery source: Project aerial.

PLATE: 9

Drawn By: KFH	Reviewed By: ALB	Date: 10/06/10	Project No.: 101764	File Name: E:\GIS\Projects\101764-CCLevee\Equestrian_geol_11x17.mxd

See Plate 9 for location of A - A'



Geology: Interpreted from Bell, 1980; Anderson, 1977; aerial photographs; and site reconnaisance

Horizontal

0 400 800

Feet

Locations are Approximate

LEGEND

- Geotechnical Borings
- Pre-Levee Ground Surface
- Equestrian Levee Crest
- Geologic Contact, Interpreted

Geology

- Qaf
- Qr1/Qa
- Qr2
- Tm

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Drawn By: KFH | Reviewed By: ALB | Date: 09/08/10

INTERPRETIVE GEOLOGIC PROFILE

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Clark County Levee Certification Project
Equestrian Levee
Las Vegas, Nevada

Project No: 101764 | File: E:\...\101764...\Equestrian_profile.mxd

Plate **10**

APPENDIX A

THE UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			Group Symbols		TYPICAL NAMES
COARSE GRAINED SOIL More than 50% of the material is LARGER than the No. 200 Sieve.	GRAVELS More than 50% of coarse part is LARGER than the No. 4 Sieve.	CLEAN GRAVELS Less than 5% finer than No. 200 Sieve.	GW		Well graded gravels, gravel - sand mixtures, little or no fines, Cu>4 & 1<Cc<3
			GP		Poorly graded gravels or gravel - sand mixtures, little or no fines Cu<4 or 1>Cc>3
		GRAVEL with fines More than 12% Finer than No. 200 Sieve. PI <4	GM		Silty gravels, gravel - sand - silt mixtures
		PI >7	GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS More than 50 % of coarse part is SMALLER than the No. 4 Sieve.	CLEAN SANDS Less than 5% Finer than No. 200 Sieve.	SW		Well graded sands, gravelly sands, little or no fines. Cu>6& 1<Cc<3
			SP		Poorly graded sands or gravelly sands, little or no fines. Cu<6 or 1>Cc>3
		SAND with fines More than 12% Finer than No. 200 Sieve. PI <5	SM		Silty sands, sand - silt mixtures
		PI >7	SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOIL More than 50 % of the material is SMALLER than the No. 200 Sieve	SILTS & CLAYS Liquid Limit LESS than 50	PI - Below A - Line	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with low plasticity
		PI - Above A - Line	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL		Organic silts and organic clays of low plasticity
	SILTS & CLAYS Liquid Limit GREATER than 50	PI - Below A - line	MH		Inorganic silts, Micaceous or diatomaceous fine sands or silty soils, elastic silts
		PI - Above A - Line	CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt		Peat and other highly organic soils

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		Fine	Medium	Coarse	Fine	Coarse		

0.002 mm #200 #40 #10 #4 3/4" 3" 12"

U. S. Standard Sieve Size

Descriptive Terms Used With Soils

CONSISTENCY			Moisture Content	
	SILTS & CLAYS	SANDS & GRAVELS		
Strongest	Very Stiff	Very Dense	Wettest	Wet
	Stiff	Dense		Very Moist
	Medium Stiff	Medium Dense		Moist
Weakest	Soft	Loose	Driest	Slightly Moist
				Dry

	CALICHE	Cemented Sand & Gravel	
Strongest	Very Hard	Very Hard	Requires many hammer blows to break.
	Hard	Hard	Breaks with few to many hammer blows
	Moderately Hard	Moderately Hard	Crumbles with few hammer blows
Weakest	Partially cemented	Partially cemented	Crumbles with hand pressure

KEY TO SOIL SYMBOLS AND TERMS

PROJECT : Equestrian Levee

PROJECT NO.: 101764

PLATE NO.: A-1

DATE DRILLED: 12/3/09
LOCATION: See Figure 2

BORING NO. B- 1

ELEVATION: 2227
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2227.0 / 0									**Levee Embankment FILL** - silty sand with gravel, cobbles up to 4 inches in diameter from 0 to 2 feet, light brown	slightly moist	
				0.5	83	18 28 32			- color change to brown below 2 feet		
2222.0 / 5				0.4	89	16 30 32			- color change to light brown below 4 feet		
				0.7	88	16 32 50/5"			- coarse gravel, cobbles or possible boulder from 7½ to 8½ feet		
				0.5	70	22 50/5"					
2217.0 / 10				0.4	100	32 42			- more gravel below 10 feet		
				0.5	73	43 42 50/5"			**Silty GRAVEL with Sand (GM)** - brown		very dense
2212.0 / 15			G, H	0.5	97	42 50 50/4"			- fine gravel layer from 15 feet to 15¼ feet		
				0.4	94	16 22 17			- 1 inch diameter gravel below 16 feet		dense
				0.4	50	9 14 20					
2207.0 / 20				0.4	0	50/5"			- gravel up to 2 inch diameter below 19½ feet		very dense
				0.3	100	50 44 50					
	4		M	0.4	83	28 39 48			- gravel up to 2 inch diameter below 23½ feet - color change to light brown with some red below 24 feet		
2202.0 / 25											
	3	114	M, D	0.3	61	16 22 23			- less gravel and color change to light brown at 26 feet		
				0.3	100	20 42 47			- 1 inch to 2 inch diameter gravel in shoe and color change to brown with pink and white below 28 feet		
2197.0 / 30 *											

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

LAB TESTS: G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 74+50. Groundwater not encountered during drilling.

+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-2a

DATE DRILLED: 12/3/09
LOCATION: See Figure 2

BORING NO. B- 1

ELEVATION: 2227
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2197.0 30				0.4	83	23 24 23			- color change to light brown with some red below 30 feet	slightly moist	dense
	3	111	M, D		67	33 44 40			- color change to light brown below 32 feet		very dense
									Bottom of boring at depth of 33.5 feet		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 74+50. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-2b

DATE DRILLED: 12/2/09
LOCATION: See Figure 2

BORING NO. B- 2

ELEVATION: 2231
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2231.0 0									**Levee Embankment FILL** - silty gravel with sand, light brown - probable cobbles or possible boulder below 1 foot	slightly moist	
				0.5	67	16 35 38					
				0.6	67	27 47 45					
2226.0 5									- cobbles or coarse gravel 4½ to 5½ feet		
				0.3	67	14 19 19			- silty sand with gravel, color change to light brown to brown below 6 feet		
				0.5	100	13 22 29			- color change to red brown to brown		
2221.0 10				0.4	89	26 50 49			- trace roots less than 1/8 inch diameter in sample at 10 feet	slightly moist to moist	
				0.5	100	34 40 45			- equal parts sand and gravel below 12 feet		
2216.0 15				0.7	100	27 54 37			- coarse gravel or cobbles 14 to 14½ feet		
				0.3	67	14 21 24			- color change to brown below 16 feet	moist	
			G, H	0.5	67	21 27 30			- poorly graded sand with silt and gravel below 18 feet		
2211.0 20				0.5	67	20 17 26					
				0.5	0	30 23 22			- coarse gravel, cobbles or possible boulder below 22 feet	slightly moist to moist	
				0.8	67	36 20 27			**Silty GRAVEL with Sand (GM)** - brown		dense to very dense
2206.0 25											
	3	115	M, D	0.5	100	32 31 55			- trace roots at 26 feet - cobbles or coarse gravel from 26 to 30 feet	slightly moist	very dense
				0.6		45 37 50/5"					
2201.0 30											

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 82+20. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-3a

DATE DRILLED: 12/2/09
LOCATION: See Figure 2

BORING NO. B- 2

ELEVATION: 2231
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2201.0											
30	2	116	M, D	0.6	100	47 48 40	S-3		**Poorly Graded SAND with Silt and Gravel (SP-SM)** - light brown	slightly moist	very dense
					78	47 36 41			**Silty SAND with Gravel (SM)** - light brown		
									Bottom of boring at depth of 33.5 feet		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 82+20. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-3b

DATE DRILLED: 12/1/09
LOCATION: See Figure 2

BORING NO. B- 3

ELEVATION: 2244
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2244.0 0									**Levee Embankment FILL** - silty sand with gravel, brown	slightly moist	
				0.4	83	18 25 44			- gravel up to 2 inches in diameter at 2 feet		
			G	0.5	65	18 27 50/5"			- well-graded gravel with silt and sand below 4 feet		
2239.0 5				0.4	89	20 40 43			- less gravel below 6 feet		
				0.5	89	16 20 28			**Silty GRAVEL with Sand (GM)** - brown		dense
2234.0 10				0.5	61	9 18 15			- less gravel and color change to light brown below 10 feet		
				0.4	50	20 15 15			- coarse gravel zone 11½ feet to 12 feet		medium dense to dense
2229.0 15	3		M		61	18 24 37					dense
				0.5	83	18 29 30					
	3	111	M, D	0.5	88	26 46 50/5"			- gravel increase up to 3 inches in diameter and color change to red brown below 18 feet		
2224.0 20				0.4	100	26 25 23			- less gravel below 20 feet - color change to light brown below 21½ feet		
	3		M	0.4	88	44 47 50/5"			- increased gravel below 23 feet		very dense
2219.0 25					100	17 37 41					
									Bottom of boring at depth of 25.5 feet		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 95+50. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-4

DATE DRILLED: 12/1/09
LOCATION: See Figure 2

BORING NO. B- 4

ELEVATION: 2277
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2277.0 / 0									**Levee Embankment FILL** - silty sand with gravel, 8 inch diameter cobbles on surface of waterside slope	slightly moist	
				0.5	89	16 24 33			- color change to light brown below 2 feet		
2272.0 / 5				0.4	89	20 23 22			- decreased gravel with color change to red brown below 4 feet		
				0.6	78	23 26 26					
			G	0.5	89	18 26 41			- coarse gravel or cobble zone 7½ to 8 feet **Silty SAND with Gravel (SM)** - gravel up to 2 inches in diameter, light brown		very dense
2267.0 / 10				0.6	89	22 26 13			- color change to red brown below 10 feet		dense
				0.4	17	12 18 16					
2262.0 / 15	3	113	M, D	0.5	83	12 18 37			- coarse gravel or cobbles at 15 feet		
				0.4	100	50/4"					very dense
				0.4	63	47 50/3"					
2257.0 / 20				0.4	89	37 29 30			- less gravel and color change to brown below 20 feet		
	3	109	M, D	0.5	100	48 50/5"					
2252.0 / 25					17	30 27 32					
									Bottom of boring at depth of 25.5 feet		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 117+50. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-5

DATE DRILLED: 12/1/09
LOCATION: See Figure 2

BORING NO. B- 5

ELEVATION: 2314
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2314.0 0									**Levee Embankment FILL** - silty sand with gravel, brown	slightly moist	
				0.6	89	11 17 20			- color change to light brown below 2 feet		
2309.0 5				0.5	100	12 17 20					
				0.4	94	13 32 40			- increased gravel and color change to red brown below 6 feet		
				0.5	72	20 19 24					
2304.0 10				0.5	83	17 23 25					dense
			G	0.5	53	28 27 50/5"			**Well-Graded GRAVEL with Silt and Sand (GW-GM)** - light brown		very dense
2299.0 15	4 3	114 113	M, D M, D	0.4		36 38 50					
				0.5	73	50/5"			- coarse gravel or cobbles at 17½ feet - color change to brown below 18 feet		
				0.5	50	21 46 37					dense
2294.0 20				0.5	85	21 46 50/1"					very dense
				0.5	0	56 50/3"					
2289.0 25					61	17 18 16					
									Bottom of boring at depth of 25.5 feet		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 135+90. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-6

DATE DRILLED: 11/30/09
LOCATION: See Figure 2

BORING NO. B- 6

ELEVATION: 2349
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2349.0 / 0									**Levee Embankment FILL** - silty sand with gravel, light brown	slightly moist	
				0.5	44	12 14 16			- probable cobbles from 2 to 4 feet		
			G	0.8	89	10 13 23			**Silty SAND with Gravel (SM)** - gravel up to 2 inches in diameter, light brown		dense
2344.0 / 5				0.3	89	26 33 34					very dense
				0.2	44	19 21 15					dense
2339.0 / 10				0.4	89	22 21 23					very dense
				0.8	78	13 30 50			- coarse gravel or cobbles zone at 13 feet		
2334.0 / 15	3 2	109	M M, D		100	45 35 45			- color change to tan/brown below 14 feet		
				1.0	86	50 50/1"			- color change to brown, decrease in gravel size below 16 feet		
				1.6	35	50 50 50/5"			- increased gravel with possible cobbles from 19 to 21 feet		
2329.0 / 20				0.4	83	28 26 20				dry	dense
	2	113	M, D	0.3	89	20 29 36			- color change to multicolored brown, red, and white below 23 feet		
2324.0 / 25					67	27 22 30				slightly moist	
									Bottom of boring at depth of 25.5 feet		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 150+50. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-7

DATE DRILLED: 11/30/09
LOCATION: See Figure 2

BORING NO. B- 7

ELEVATION: 2373
HAMMER WEIGHT: 140 lbs

ELEV. MSL / DEPTH IN FEET	FIELD MOISTURE (%)	Unit Weight (pcf)	LAB TESTS *	DRILLING RATE (min./ft)	% RECOVERED	BLOWS per 6" INCREMENT	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.
2373.0 0									**Levee Embankment FILL** - silty gravel with sand, gravel up to 3 inches in diameter, light brown to brown	dry	
			G	1.1	100	14 21 26			- silty sand with gravel, light brown		
2368.0 5				1.0	100	20 24 22					
				0.4	72	23 24 23					
				0.4	89	15 17 17			- less gravel from 8 to 11 feet		
2363.0 10				0.9	94	15 13 12			**Silty GRAVEL with Sand (GM)** - brown		medium dense
				0.4	72	9 11 25			- increased coarse gravel up to 3 inches in diameter below 13 feet		dense
2358.0 15	2		M		67	44 38 44					very dense
									Bottom of boring at depth of 15.5 feet		

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

* **LAB TESTS:** G=Grain Size Distribution, H=Hydrometer, M=Moisture Content, D=Density

NOTES: Boring drilled on levee crest near station 162+30. Groundwater not encountered during drilling.

\+ **SAMPLER TYPE:** Drive Sample 2.42" I.D. | Grab | Shelby Tube | SPT Sample 1.375" I.D. | Bulk

KLEINFELDER

BORING LOG AND TEST SUMMARY

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE A-8

Abe Construction Services, Inc.

2230 Lariat Lane, Walnut Creek, CA 94596
PHONE: 925-944-6363 FAX: 925-476-1588
EMAIL: SA.ACS@ATT.net

November 16, 2009

Eagle Drilling Services, LLC
7150 Placid Street
Las Vegas, NV 89119

Attn: Felicia Sanders

Re: SPT Hammer Energy Measurements
Las Vegas, NV
November 4-5, 2009

Job No. 9078

Dear Ms. Sanders,

This report presents the results of SPT (Standard Penetration Test) energy measurements obtained for five of Eagle Drilling's drill rigs on November 4 & 5, 2009. Dynamic measurements were made with a PDA (Pile Driving Analyzer) during SPT sampling at depths from 10 ft to 35 ft. The objective of the dynamic measurements was to determine the energy transfer ratio (ETR) or efficiency of the SPT systems, which is used to normalize the SPT N values to a standard efficiency of 60% (N_{60}).

DYNAMIC TESTING AND FIELD DETAILS

Drill Rig and SPT Hammer Description

The five drill rigs that were calibrated include Eagle Drilling's Diedrich D120, Mobile B90, Diedrich D50 Track Rig, Diedrich D50T Turbo Track Rig, and the Sonic Drill Rig. All rigs used NW rod and standard split spoon samplers for SPT sampling and all rigs were equipped with automatic hammers which have a 140 lb ram, a 30-inch nominal drop heights, and a theoretical potential energy of 350 ft-lbs. Further details regarding the SPT equipment are beyond the scope of this report and should be obtained from the driller.

Dynamic Test Instrumentation

Dynamic measurements of strain and acceleration were taken on a 2-ft long section of NW rod, which was attached to the top of the sample rod string just below the hammer. The rod section was instrumented with two strain bridges and two piezoresistive accelerometers. By averaging the measurements taken from opposite sides of the rod, the effects of non-uniform hammer impacts to the recorded signals were minimized.

Strain and acceleration signals were conditioned and converted to force and velocity records by a PAK Model, Rig Driving Analyzer® (PDA). This dynamic testing equipment is the same equipment that is routinely used for conventional Rig driving analysis. The dynamic force and velocity records were the basis of the computed energy results presented in this report. In the field the force and velocity records from the PDA were viewed on a graphic LCD screen to evaluate data quality. A representative sample of the force and velocity records was also digitally stored on disc for back up.

Calculation of Energy Transfer

The energy transferred to the instrumented rod section was computed from the dynamic force and velocity records by the EFV method, which uses both the force and velocity records to calculate the maximum transferred energy as:

$$EFV = \int F(t)\, V(t)\, dt$$

The integration is performed over the time period from which the energy transfer begins (non-zero) and terminates at the time when the energy transfer reaches a maximum value. This method is theoretically correct for all rod lengths regardless of the 2L/c stress wave travel time (L is the rod length and c is the stress wave speed in the rod) and the number of non-uniform rod corrections. This calculation is the method we use to compute the energy transfer ratio, ETR, which is computed as:

$$ETR = EFV / \text{Rated Hammer Energy}$$

Dynamic Test Results

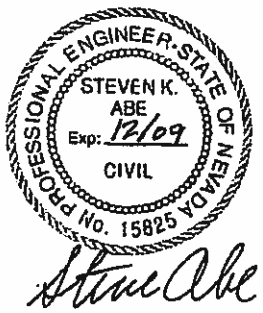
The PDA calculated results are given in Appendix A and include the energy transfer (EFV), the energy transfer ratio (ETR), the hammer blow rate (BPM), the maximum impact force (FMX), and the maximum rod velocity (VMX). For each sample depth interval, the average, maximum, minimum and standard deviation of each value are given in Appendix A. Other information includes the sample depth interval and the total number of blows for the reported depth interval. The statistical results for the five drill rigs tested are summarized in the following table.

Summary of SPT Hammer Efficiencies

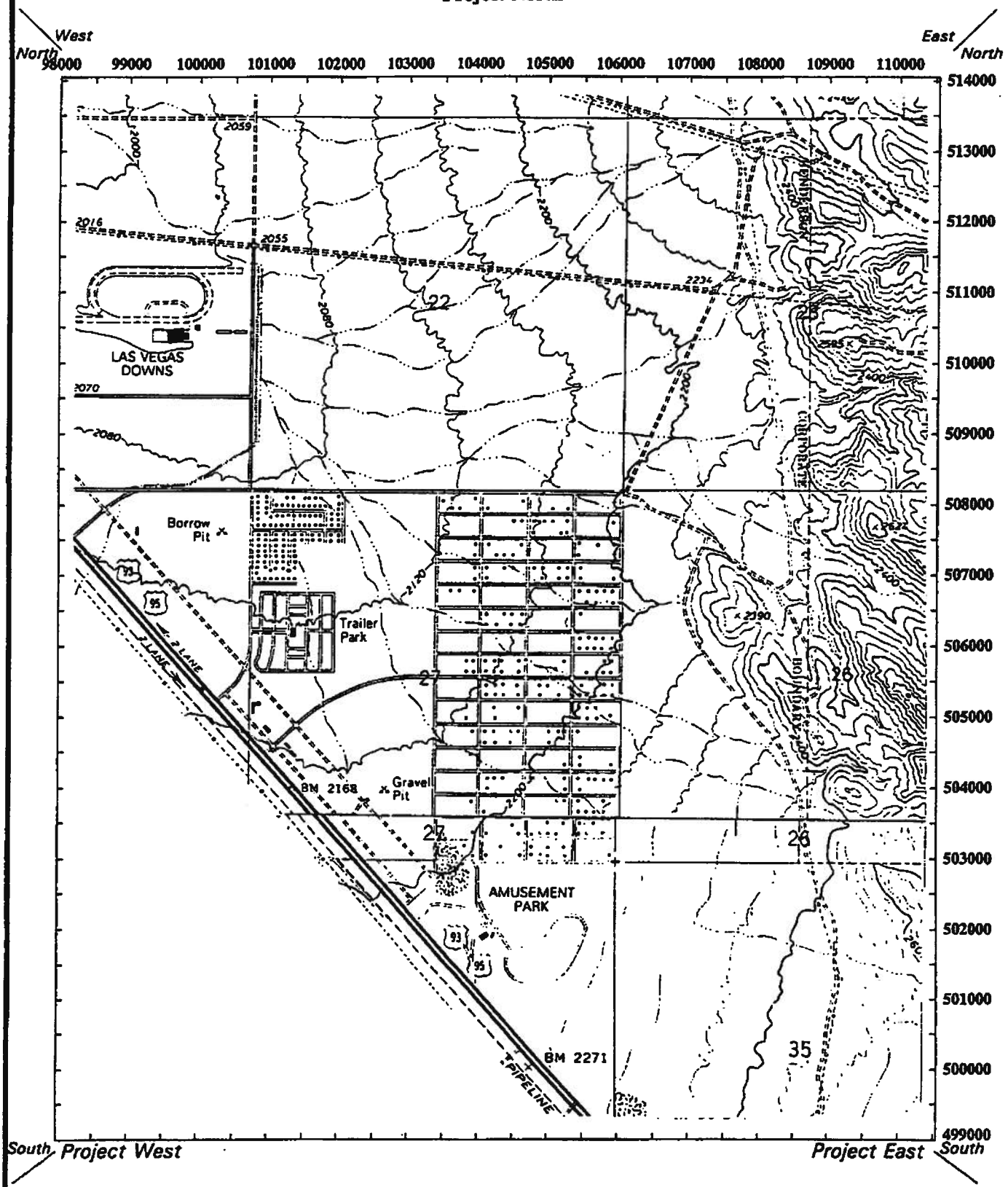
Rig	Average ETR %	Std. Dev. %	Max. ETR %	Min. ETR %	# Blows
Diedrich D120	80	3	87	73	167
Mobile B90	92	6	97	12	241
Diedrich D50 Track	75	10	86	32	191
Diedrich D50 Turbo	72	4	81	61	242
Sonic Drill	80	4	92	72	250

I appreciate the opportunity to be of assistance to you on this project. Please contact me if you have any questions regarding this report, or if I may be of further service.

Very truly yours,
ABE Engineering
Steve Abe, P.E.



PREVIOUS EXPLORATIONS



● - Approximate Exploration Location

Scale : Approximately 1" = 2000 '

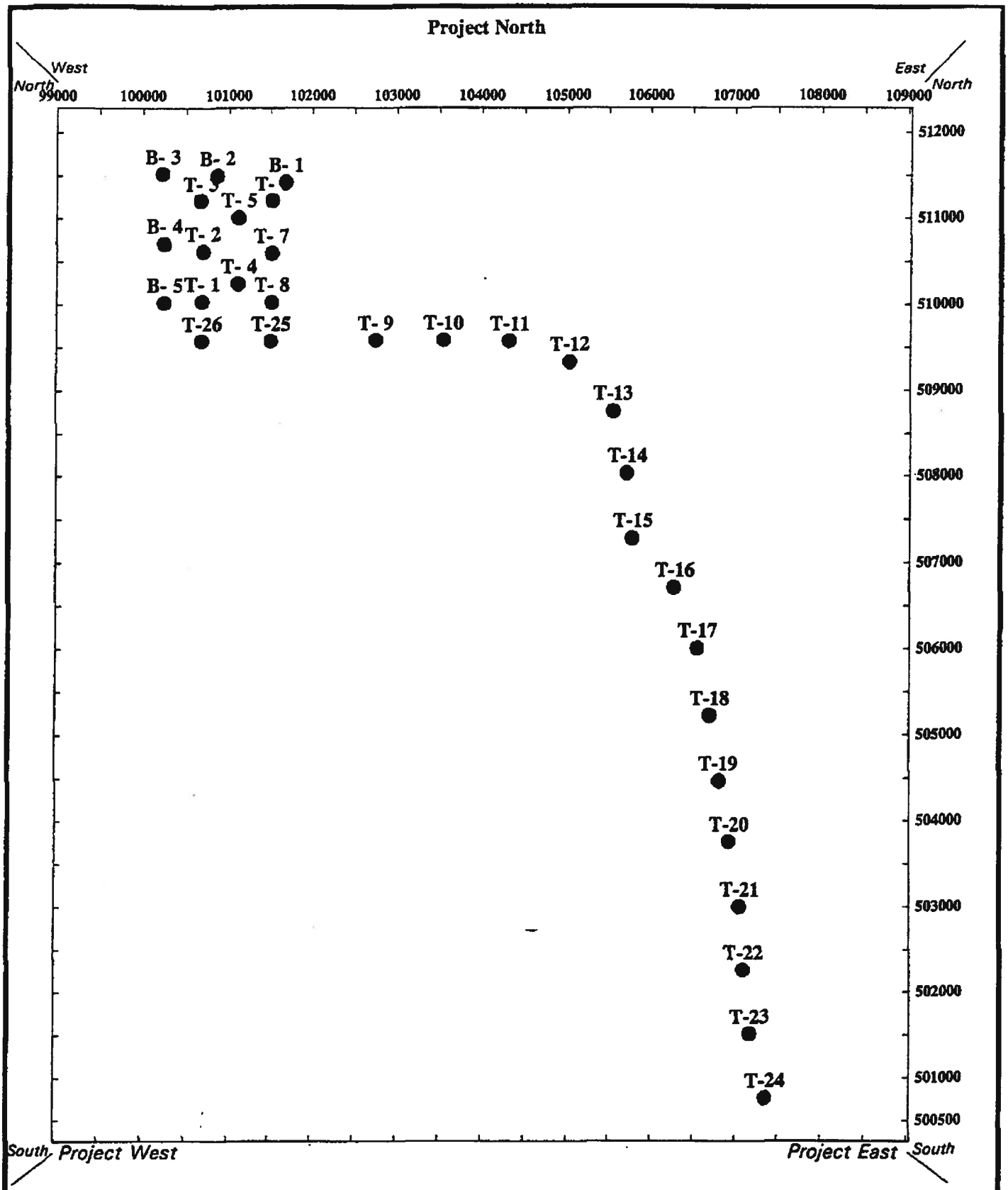
KLEINFELDER
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

GENERAL SITE LOCATION MAP

PLATE
1



● - Approximate Exploration Location

Scale : Approximately 1" = 1600 '

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

LOCATION OF EXPLORATIONS

PLATE
2

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T-12

ELEVATION: Approx. 2166 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2166.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some cobbles and boulders to 16" diameter, angular to subangular volcanic stone, light brown fine to coarse sand matrix - braided alluvial surface	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
				slightly moist		Perm.
			- alluvial sorting poorly defined		very dense	
2161.00 / 5						
2156.00 / 10			Bottom at 10 feet.			
2151.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

BY:

KLEINFELDER
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-17

DATED EXCAVATED: 11/4/93
LOCATION: See Plate 2

TRENCH NO. T-13

ELEVATION: Approx. 2189 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2189.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - desert pavement surface, angular to subangular gravel and cobbles up to 6" diameter, volcanic stone, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
			- very little caving, no cementation, tight interlocking		dense	S
				slightly moist		
			- alluvial sorting on 6" to 16" poorly defined intervals		very dense	
2184.00 / 5						
2179.00 / 10			Bottom at 10 feet.			
2174.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

APPROV:

BY:

KLEINFELDER
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-18

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-14

ELEVATION: Approx. 2215 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2215.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some cobbles and boulders up to 20" diameter, surface cleared of vegetation by wild fire, surface detritus sorted by windrows to ridges of very coarse angular cobbles and boulders, and braided alluvial rills of coarse sand and fine gravel with very little fines, gray-brown to mottled pink-black volcanic stone with light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	Res
				slightly moist		
			- alluvial sorting in 3" to 12" layers		very dense	
2210.00 / 5						
2205.00 / 10			Bottom at 10 feet.			
2200.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-19

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-15

ELEVATION: Approx. 2219 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2219.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** some boulders to 20" diameter, surface cleared of vegetation by wild fire, angular volcanic stone, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- less cobbles and boulders below 3 feet.	slightly moist		
					very dense	G,A
2214.00 / 5						
2209.00 / 10			Bottom at 10 feet.			
2204.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-20

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-16

ELEVATION: Approx. 2214 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2214.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - vegetation cover approximately 70 percent, (Creosote bush, White Bursage and Indian rice grass, some cobbles up to approximately 8" diameter, light brown - some weak to moderately hard cementation - alluvial sorting poorly defined	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
				slightly moist		
			- angular to subangular volcanic stone		very dense	D1557, Ch
2209.00 / 5			- less cementation			
			Bottom at 8 feet.			
2204.00 / 10						
2199.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-21

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-17

ELEVATION: Approx. 2235 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2235.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - angular volcanic stone up to approximately 10" diameter, light brown	dry to slightly moist	loose to medium dense	
					medium dense	
			- alluvial sorting poorly defined		dense	
			- some weak cementation in upper 3 feet	slightly moist		S
2230.00 / 5			- three well defined alluvially sorted beds approximately 6" thick between 5 and 7 feet		very dense	
			Bottom at 8 feet. Backhoe refusal in very dense, partially cemented sand and small gravel.			
2225.00 / 10						
2220.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE A-22

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-18

ELEVATION: Approx. 2261 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2261.00 / 0			**POORLY GRADED, SILTY SAND (SM)** - some gravel and cobbles up to approximately 6" diameter, angular volcanic detritus, light brown matrix - alluvial sorting in thin lenses	dry to slightly moist	loose to medium dense medium dense dense	
			- more coarse grained below 3 feet	slightly moist		
2256.00 / 5					very dense	Res
			Bottom at 8 feet.			
2251.00 / 10						
2246.00 / 15						

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NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

APPROV:

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-23

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-19

ELEVATION: Approx. 2287 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2287.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles, angular volcanic stone, light brown matrix - angular cobbles up to approximately 6" diameter	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- occasional alluvially sorted lenses of coarse sand/fine gravel	slightly moist		
					very dense	
2282.00 / 5						G,A
2277.00 / 10			Bottom at 10 feet.			
2272.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-24

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-20

ELEVATION: Approx. 2303 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2303.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles up to 6" diameter, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- occasional 4" alluvially sorted lenses	slightly moist		
					very dense	Ch
2298.00 / 5			- some fine roots to 6 feet.			
			- more coarse grained below 5 feet.			
2293.00 / 10			Bottom at 10 feet.			
2288.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-25

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-21

ELEVATION: Approx. 2320 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2320.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - angular gravel and cobbles up to 10" diameter, light brown matrix - alluvial volcanic stone detritus	dry to slightly moist	loose to medium dense	
					medium dense	
			- poorly defined alluvial sorting		dense	
				slightly moist		
2315.00 / 5					very dense	Perm.
			Bottom at 9 feet.			
2310.00 / 10						
2305.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-26

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-22

ELEVATION: Approx. 2342 feet
EQUIPMENT: Case 580 Backhoe

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2342.00 / 0			**POORLY SORTED, SILTY SAND (SP-SM)** - coarse varnished desert pavement, some gravel and cobbles up to 6" diameter, alluvial volcanic stone, light brown matrix	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			- poorly defined alluvial sorting, little change in grading with depth	slightly moist		
					very dense	Ch
2337.00 / 5						
			Bottom at 9 feet.			
2332.00 / 10						
2327.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-27

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-23

ELEVATION: Approx. 2357 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2357.00 / 0			**POORLY GRADED, SILTY SAND (SP-SM)** - some gravel and cobbles to 6" diameter, light brown	dry to slightly moist	loose to medium dense	
					medium dense	
			WELL GRADED, SILTY SAND (SW-SM) - some gravel and cobbles, angular volcanic stone, light brown matrix		dense	
				slightly moist		
			- frequent lenses of well sorted coarse sand & line gravel with little or no fines		very dense	G,A
2352.00 / 5						
			Bottom at 8 feet.			
2347.00 / 10						
2342.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

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PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-28

DATED EXCAVATED: 11/5/93
LOCATION: See Plate 2

TRENCH NO. T-24

ELEVATION: Approx. 2375 feet
EQUIPMENT: Case 580 Backhoe

ELEV. MSL / DEPTH IN FEET	SAMPLES +	SYMBOL	SOIL DESCRIPTION	MOISTURE	CONSIST.	OTHER TESTS
2375.00 / 0			**WELL GRADED, SILTY SAND (SW-SM)** - heavily varnished desert pavement, old alluvial surface, some cobbles and boulders up to 20" diameter, light brown matrix - angular volcanic detritus	dry to slightly moist	loose to medium dense	
					medium dense	
					dense	
			indistinct alluvial sorting	slightly moist		
					very dense	
2370.00 / 5						S
			- partially cemented, hard digging			
			Bottom at 9 feet.			
2365.00 / 10						
2360.00 / 15						

NR=No Recovery, C=Consolidation, A=Atterberg, Ch=Chemical test, S=Direct Shear, G=Grain-Size, E=Expansion, Sol=Solubility, Res=Resistivity, R=R-Value, ASTM D1557=Compaction test

NOTES: Groundwater not encountered during trenching.

+SAMPLER TYPE: Drive Sample 2.625" I.D. Bulk

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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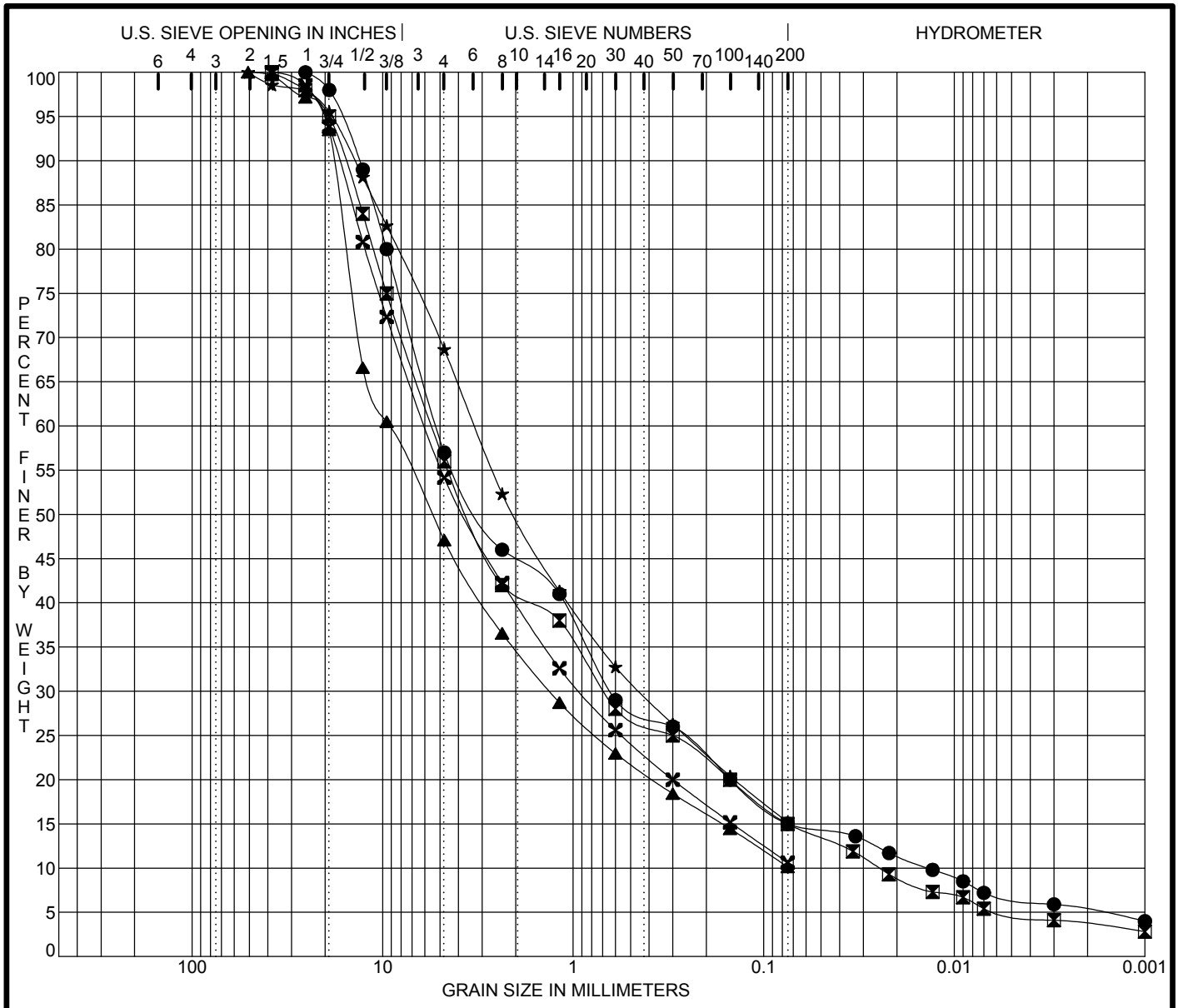
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

TRENCH LOG

PLATE
A-29

APPENDIX B



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	B- 1	14.0	SILTY GRAVEL with SAND (GM)				5.64	378.5
⊠	B- 2	18.0	PROBABLE FILL : SILTY GRAVEL with SAND				3.47	222.3
▲	B- 3	4.0	PROB. FILL : WELL-GRADED GRAVEL with SILT and SAND				2.56	126.3
★	B- 4	8.0	SILTY SAND with GRAVEL (SM)					
✕	B- 5	12.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)				2.09	87.3

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	B- 1	14.0	25.4	5.2	0.6	0.01	43	42	8	7
⊠	B- 2	18.0	38.1	5.5	0.7	0.02	44	41	10	5
▲	B- 3	4.0	50.8	9.3	1.3		53	37	10	
★	B- 4	8.0	50.8	3.3	0.4		31	53	15	
✕	B- 5	12.0	38.1	5.9	0.9		46	44	11	

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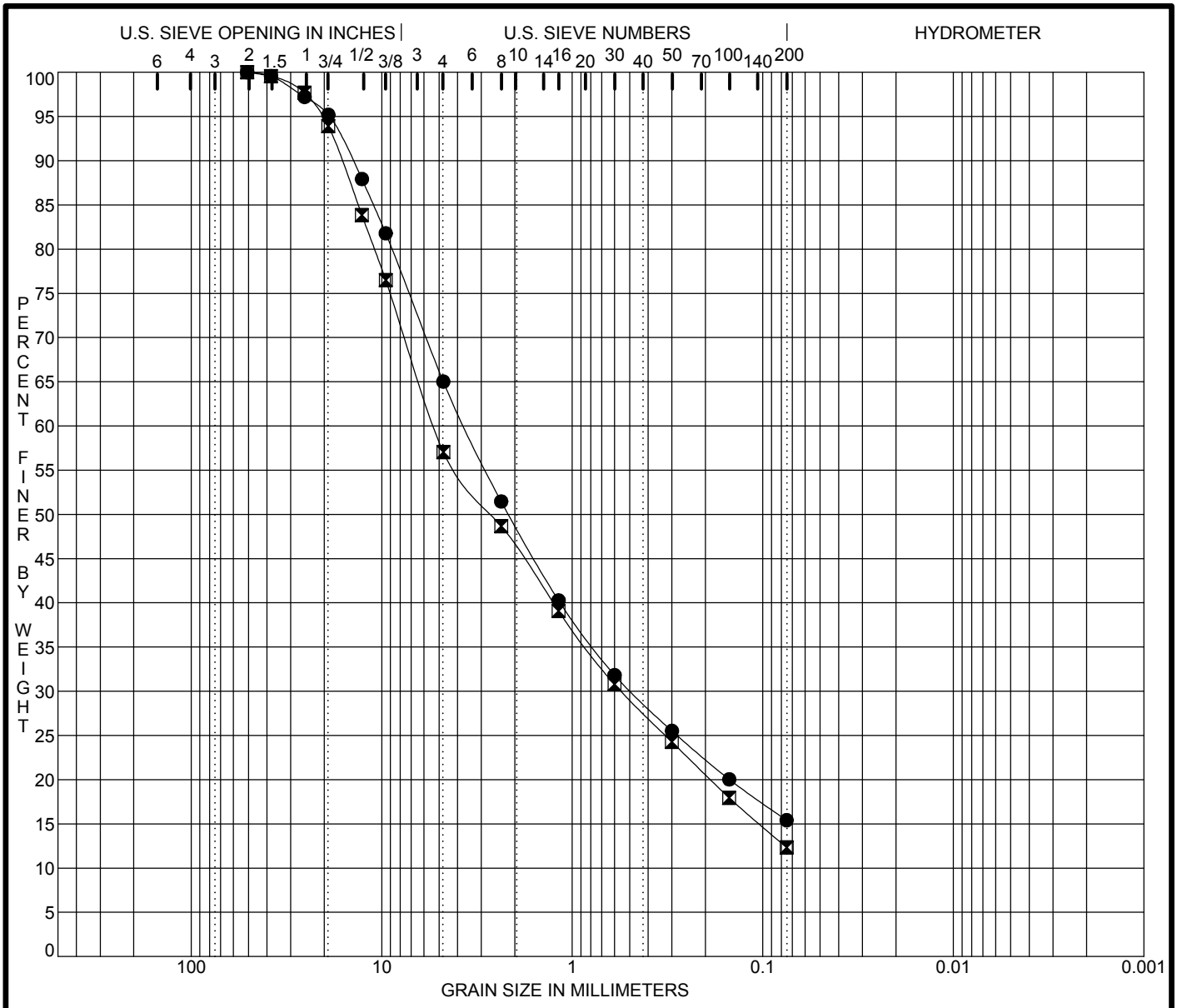
GRAIN SIZE ANALYSES

PROJECT: Equestrian Levee

PROJECT NO. 101764

PLATE

B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	B- 6	4.0	SILTY SAND with GRAVEL (SM)					
⊠	B- 7	3.0	PROBABLE FILL : SILTY SAND with GRAVEL				1.03	93.9

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	B- 6	4.0	50.8	3.7	0.5		35	50	15	
⊠	B- 7	3.0	50.8	5.3	0.6		43	45	12	

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GRAIN SIZE ANALYSES

PROJECT: Equestrian Levee

PROJECT NO. 101764

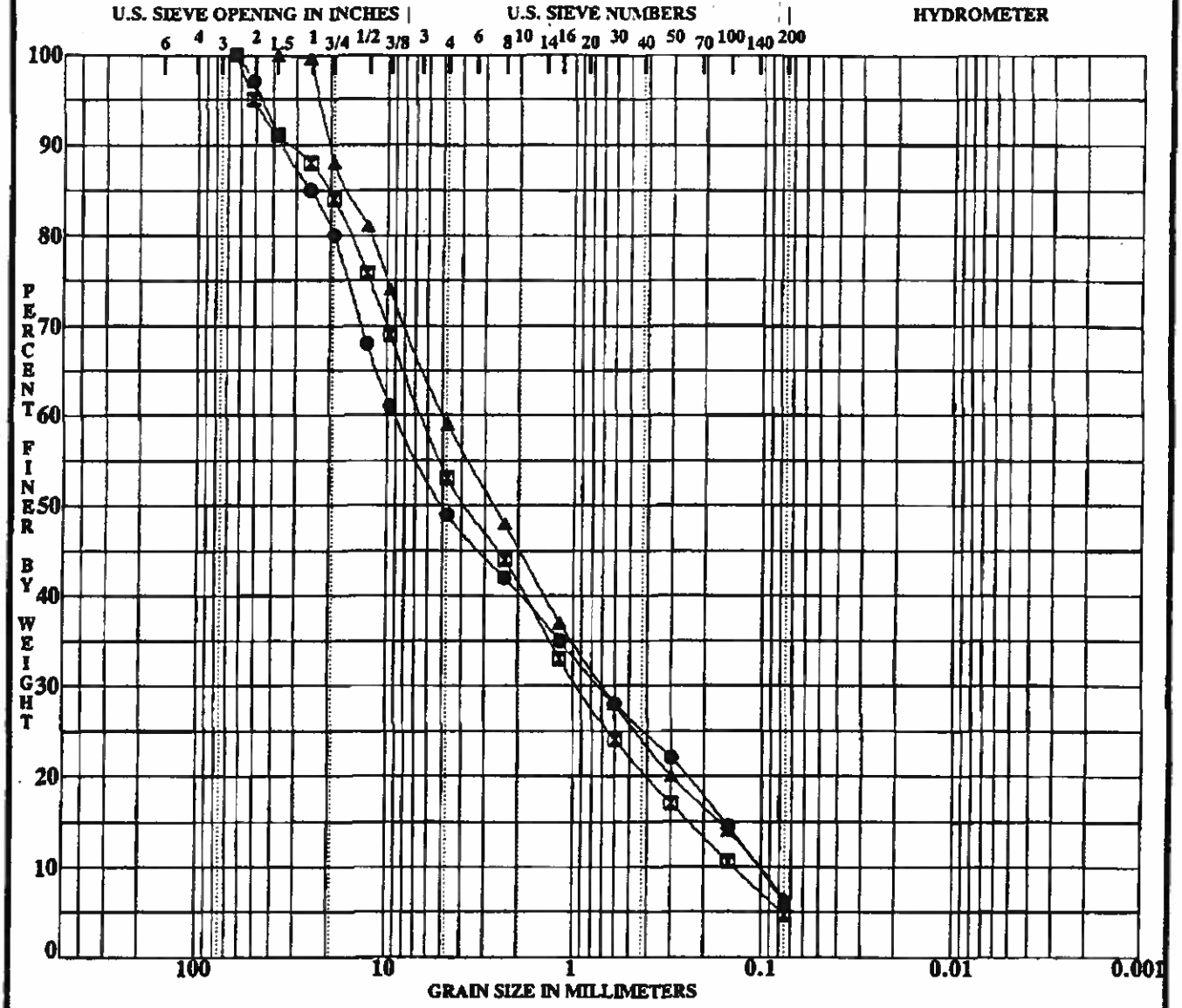
PLATE

B-2

MOISTURE / DENSITY TEST SUMMARY

Exploration No.	Sample Depth (ft)	SOIL DESCRIPTION	Water Content (%)	Dry Density (pcf)	Moist Density (pcf)
B- 1	24.0	SILTY GRAVEL with SAND (GM)	4		
B- 1	26.5	SILTY GRAVEL with SAND (GM)	3	114	117
B- 1	32.5	SILTY GRAVEL with SAND (GM)	3	111	114
B- 2	26.5	SILTY GRAVEL with SAND (GM)	3	115	118
B- 2	30.5	POORLY-GRADED SAND with SILT and GRAVEL (SP-SM)	2	116	119
B- 3	14.5	SILTY GRAVEL with SAND (GM)	3		
B- 3	18.5	SILTY GRAVEL with SAND (GM)	3	111	114
B- 3	22.5	SILTY GRAVEL with SAND (GM)	3		
B- 4	14.5	SILTY SAND with GRAVEL (SM)	3	113	116
B- 4	22.0	SILTY SAND with GRAVEL (SM)	3	109	113
B- 5	14.5	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	4	114	118
B- 5	15.0	WELL-GRADED GRAVEL with SILT and SAND (GW-GM)	3	113	116
B- 6	14.5	SILTY SAND with GRAVEL (SM)	3		
B- 6	15.0	SILTY SAND with GRAVEL (SM)	2	109	112
B- 6	22.5	SILTY SAND with GRAVEL (SM)	2	113	116
B- 7	14.0	SILTY GRAVEL with SAND (GM)	2		

PREVIOUS LABORATORY TEST RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	T-8	2.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NP	NP	NP	0.57	86.9
⊠	T-11	3.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.99	46.1
▲	T-15	4.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.94	48.0

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	T-8	2.0	63.50	8.99	0.728	0.1035	51.0	42.9	6.1	
⊠	T-11	3.0	63.50	6.44	0.942	0.1398	47.0	48.3	4.7	
▲	T-15	4.0	38.10	4.98	0.697	0.1036	41.0	52.5	6.5	

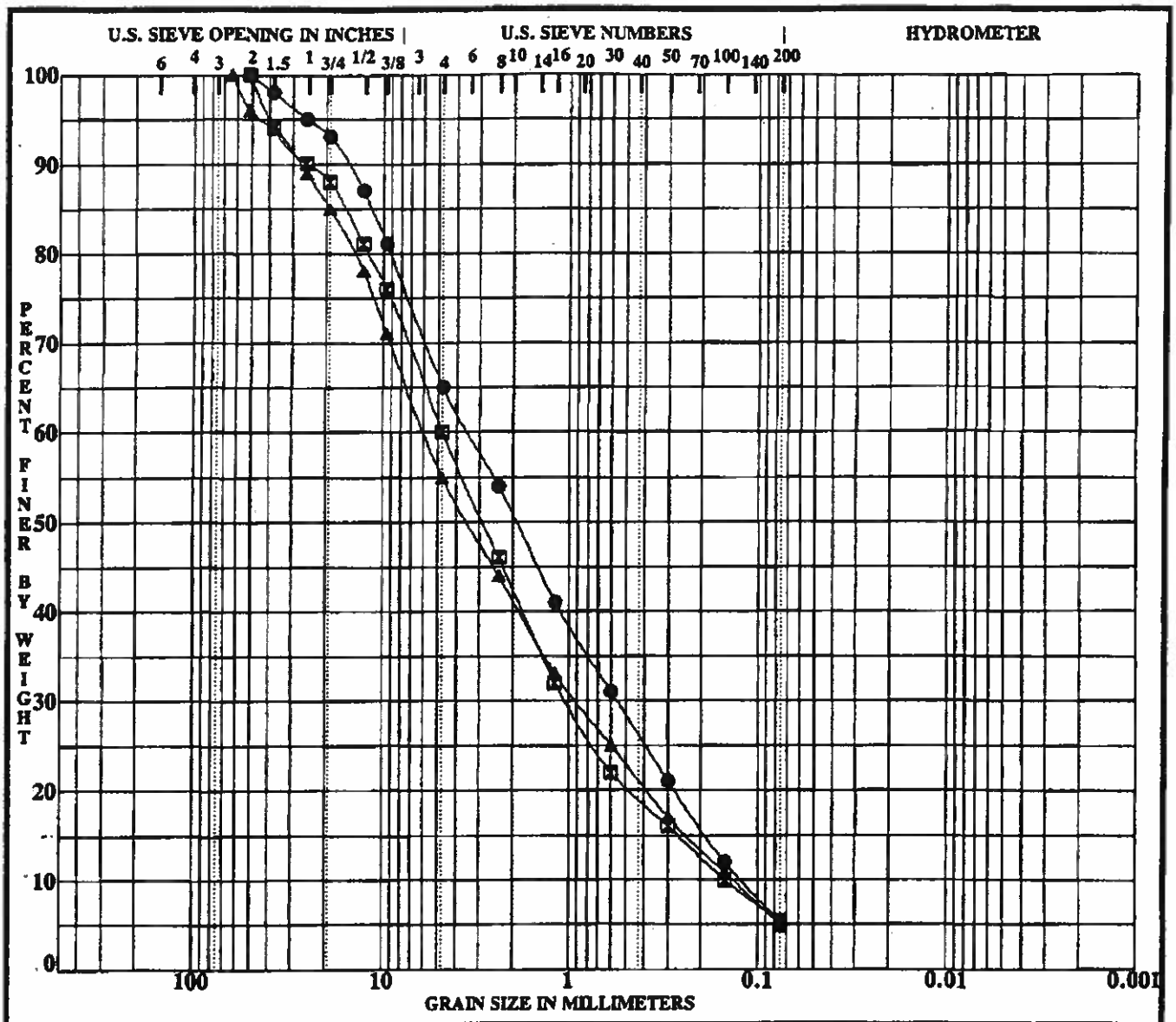
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

GRAIN SIZE ANALYSES

PLATE
B-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	T-19	8.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.74	28.3
⊠	T-23	4.0	WELL GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	1.49	31.7
▲	T-25	6.0	WELL GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	1.04	43.2

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	T-19	8.0	50.80	3.46	0.560	0.1220	35.0	59.7	5.3	
⊠	T-23	4.0	50.80	4.75	1.031	0.1500	40.0	54.6	5.4	
▲	T-25	6.0	63.50	5.91	0.916	0.1365	45.0	50.1	4.9	

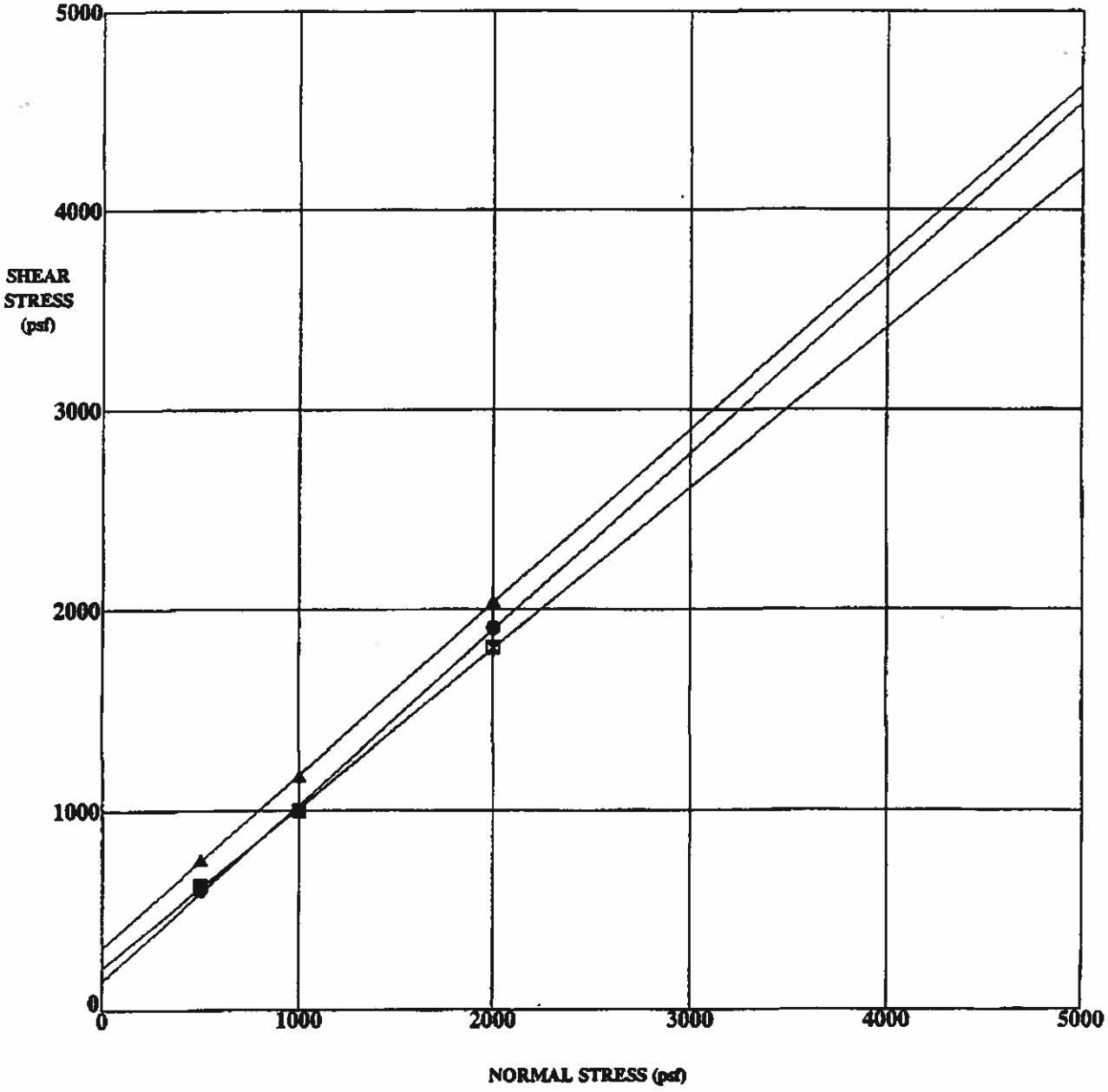
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

GRAIN SIZE ANALYSES

PLATE
B-3



Exploration No.	Depth (ft.)	Soil Description	PHI Angle Degrees	Cohesion (psf)
● T-9	3.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	41	145
⊠ T-13	2.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	39	213
▲ T-17	3.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	41	315

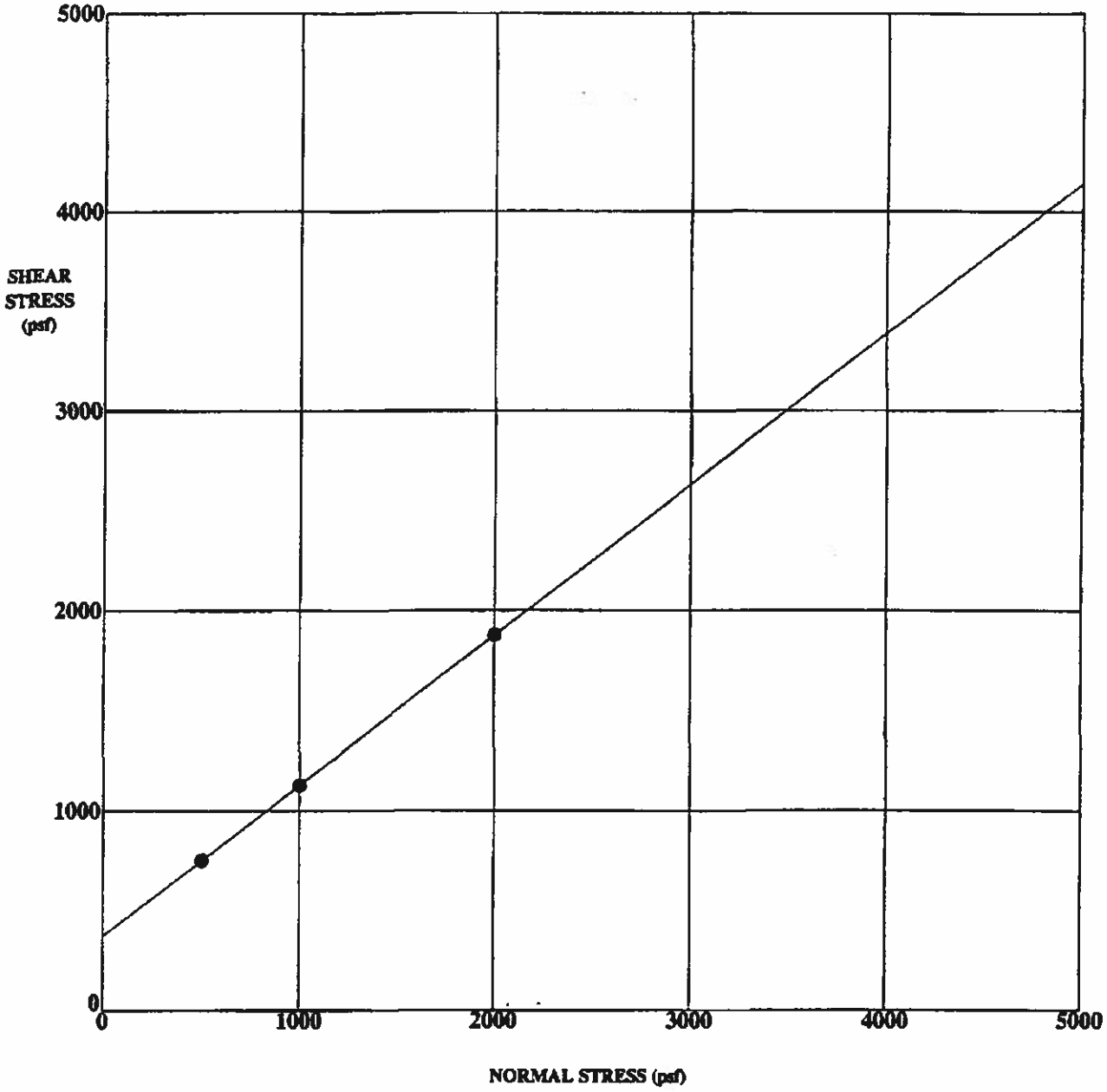
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

DIRECT SHEAR TEST RESULTS

PLATE
B-5



Exploration No.	Depth (ft.)	Soil Description	PHI Angle Degrees	Cohesion (psf)
● T-24	5.0	POORLY GRADED, SILTY SAND (SP-SM) - remolded	37	373

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

DIRECT SHEAR TEST RESULTS

PLATE
B-6

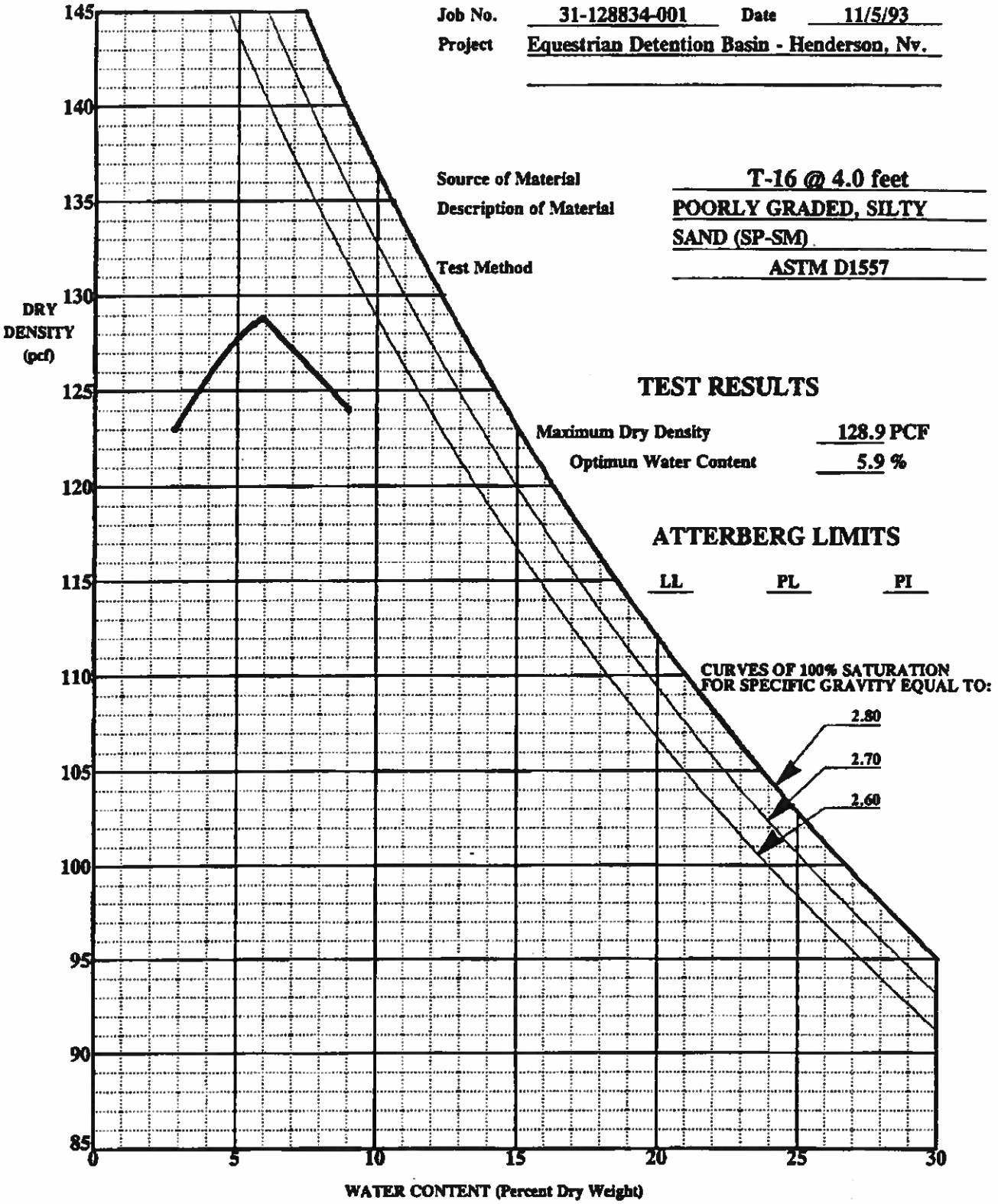
Job No. 31-128834-001 Date 11/5/93

Project Equestrian Detention Basin - Henderson, Nv.

Source of Material T-16 @ 4.0 feet

Description of Material POORLY GRADED, SILTY SAND (SP-SM)

Test Method ASTM D1557



TEST RESULTS

Maximum Dry Density 128.9 PCF

Optimun Water Content 5.9 %

ATTERBERG LIMITS

LL PL PI

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

MOISTURE-DENSITY RELATIONSHIP

PLATE B-8

Table No. : 1

PERMEABILITY TEST RESULTS

Project : Equestrian Detention Basin, Henderson, Nv.

Exploration Point	Sample Depth (ft.)	SOIL DESCRIPTION	Permeability K (cm/sec)	Moist. (%)	Density (PCF)	Sat. %	Test Head (mm)
T- 5	2.00	POORLY GRADED, SILTY SAND (SP-SM)	4.8E-5	16.5	113	98	1343
T-12	3.00	POORLY GRADED, SILTY SAND (SP-SM)	5.7E-5	15.8	115	100	1428
T-21	4.00	POORLY GRADED, SILTY SAND (SP-SM)	4.3E-5	17.7	111	99	1436

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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

Project: Equestrian Detention Basin

PERMEABILITY TEST RESULTS

PLATE
B-9

Table No. : 2

RESISTIVITY TEST RESULTS

Project : **Equestrian Detention Basin**

Exploration Point	Sample Depth (ft.)	SOIL DESCRIPTION	RESISTIVITY Nat. Moisture ohm-cm	RESISTIVITY Saturated ohm-cm
T-14	2.0	SILTY SAND (SP-SM)	583000	13970
T-18	4.0	SILTY SAND (SP-SM)	2499250	10350

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PROJECT NO 31-128834-001

Project: Equestrian Detention Basin

RESISTIVITY TEST RESULTS

PLATE
B-10

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(702) 383-1199 • Fax (702) 383-4983

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FORENSIC

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TESTING MATERIALS

LABORATORY NO: 5810(b) DATE: November 10, 1993

SAMPLE: Soil

MARKED: 31-128834

DATE RECEIVED: 11/9/93

SUBMITTED BY: Kleinfelder, Inc.
6850 South Paradise Rd.
Las Vegas, NV 89119

REPORT OF DETERMINATION

BORING NUMBER	T-1	T-4	T-7	T-10	T-16	T-20
DEPTH (feet)	2	4	4	2	4	4
pH VALUE	8.64	9.20	9.32	9.23	9.59	9.16
RED-OX (MV)	+454	+440	+442	+446	+431	+442
SULFATE (ppm)	75	25	10	25	100	25
SULFIDE (ppm)	Nil	Nil	Nil	Nil	Nil	Nil
TOTAL SALTS (ppm)	447	66	80	50	168	60
CHLORIDE (ppm)	80	10	10	5	15	10

Respectfully submitted,
ATLAS CHEMICAL TESTING LABORATORIES

Robert L. Summers
Analytical Chemist

NOTES: 1. The soil water extract ratio was 5:1, therefore, to convert a solution ppm (or mg/l) to a soil ppm (or mg/kg) for this extract ratio multiply by five(5). To convert soil ppm to a weight percent divide by ten thousand(10,000).

2. The standard methods used for the determination above are the glass electrode/silver-silver chloride, ASTM D 1498, Turbidimetric/Std. Meth. 426C, Methylene Blue/Std. Meth. 427C, Electrical Conductivity, factor empirically determined/Std. Meth. 205 and Argentometric/Std. Meth. 407A respectively.

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LABORATORY NO: 5810(b) - Continued DATE: November 10, 1993

SAMPLE: Soil

MARKED: 31-128834

DATE RECEIVED: 11/9/93

SUBMITTED BY: Kleinfelder, Inc.
6850 South Paradise Rd.
Las Vegas, NV 89119

REPORT OF DETERMINATION

BORING NUMBER	T-22	T-25				
DEPTH (feet)	4	6				
pH VALUE	8.72	8.74				
RED-OX (MV)	+457	+456				
SULFATE (ppm)	160	100				
SULFIDE (ppm)	Nil	Nil				
TOTAL SALTS (ppm)	248	186				
CHLORIDE (ppm)	15	15				

Respectfully submitted,
ATLAS CHEMICAL TESTING LABORATORIES

Robert L. Summers
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SULFATE (ppm)	75	25	10	25	100	25
SULFIDE (ppm)	Nil	Nil	Nil	Nil	Nil	Nil
TOTAL SALTS (ppm)	447	66	80	50	168	60
CHLORIDE (ppm)	80	10	10	5	15	10

Respectfully submitted,
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LABORATORY NO: 5810(b) - Continued DATE: November 10, 1993

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MARKED: 31-128834

DATE RECEIVED: 11/9/93

SUBMITTED BY: Kleinfelder, Inc.
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REPORT OF DETERMINATION

BORING NUMBER	T-22	T-25				
DEPTH (feet)	4	6				
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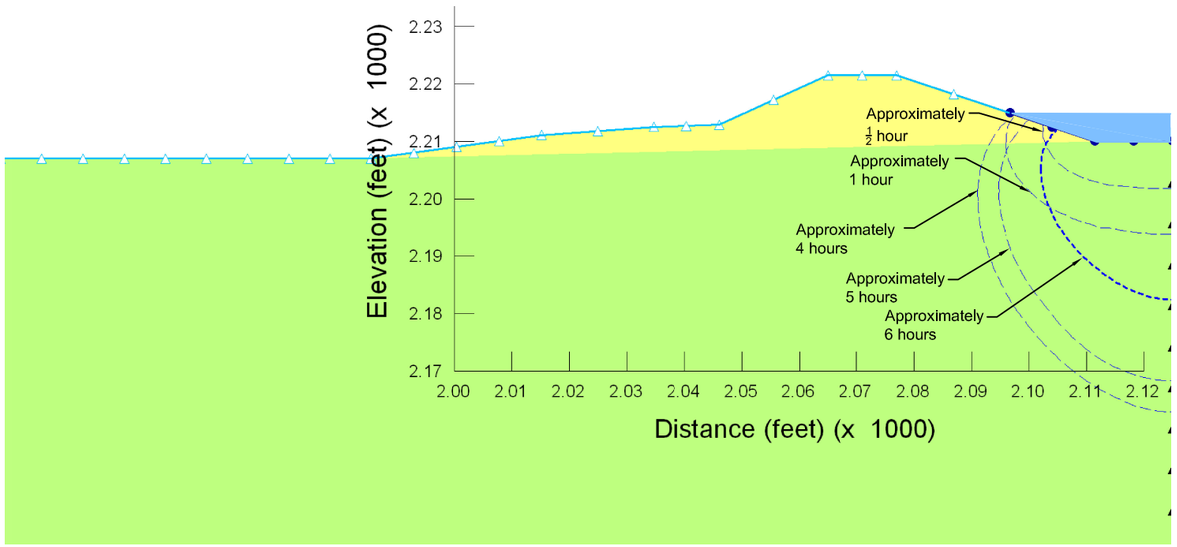
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Analytical Chemist

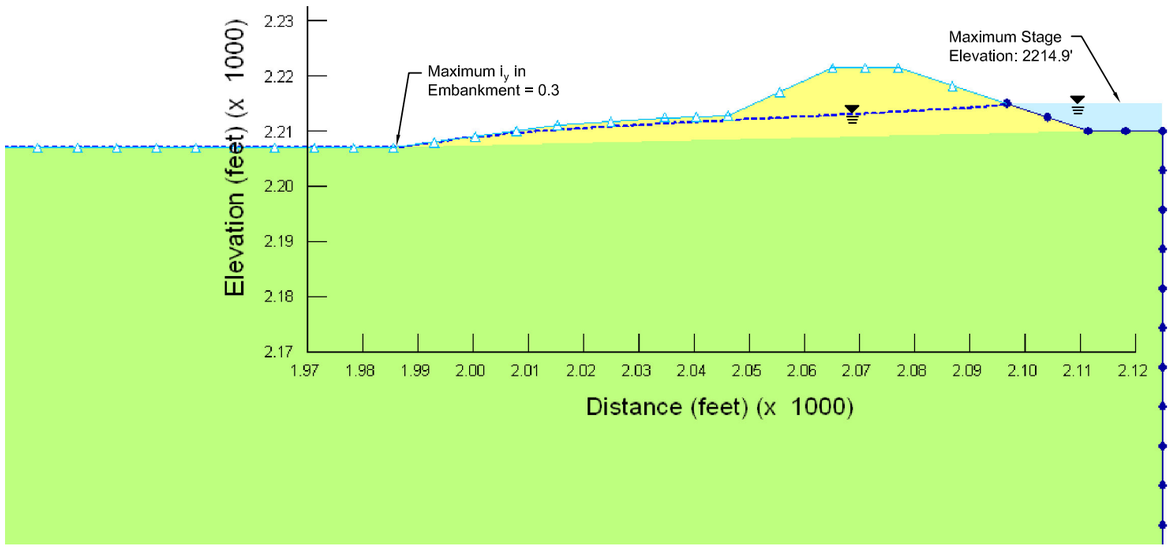
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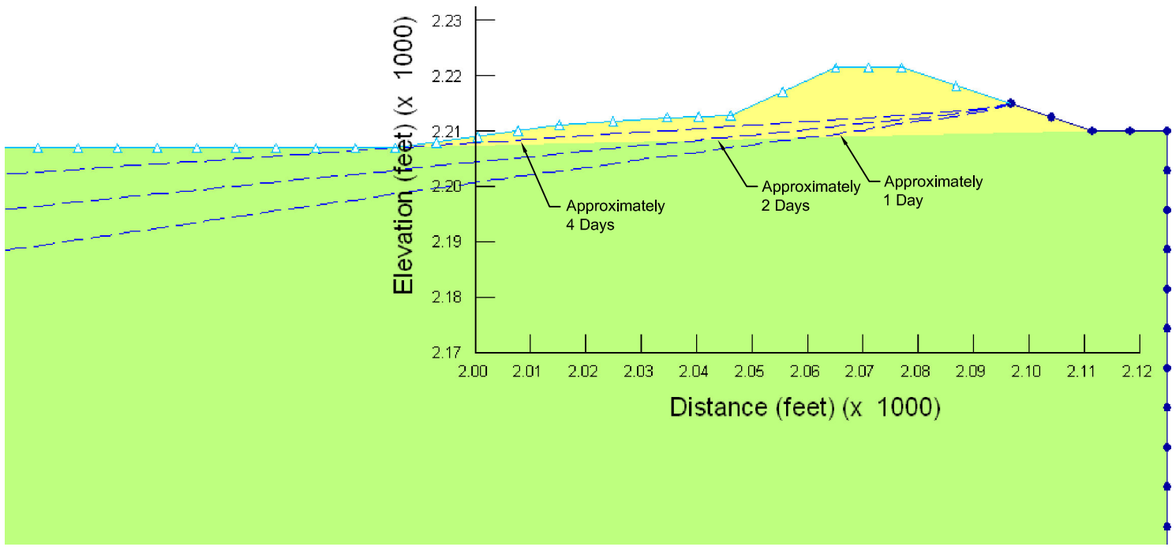
APPENDIX C



TRANSIENT SEEPAGE
APPROXIMATE STATION 72+38



STEADY-STATE SEEPAGE
APPROXIMATE STATION 72+38



TIME TO STEADY STATE SEEPAGE
APPROXIMATE STATION 72+38

LEGEND:

- SEEP\W PHREATIC SURFACE

- SEEP\W WETTING FRONT

Hydraulic Properties

Material Type	Color	K_H (ft/day)	K_H/K_V
LEVEE EMBANKMENT		170	4
NATIVE FOUNDATION		170	4

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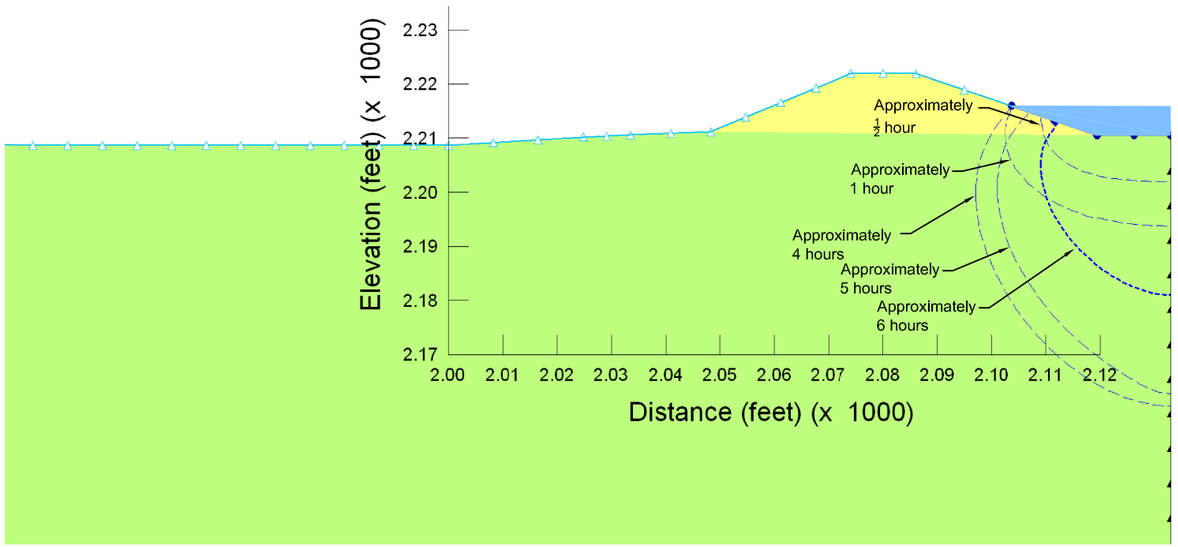
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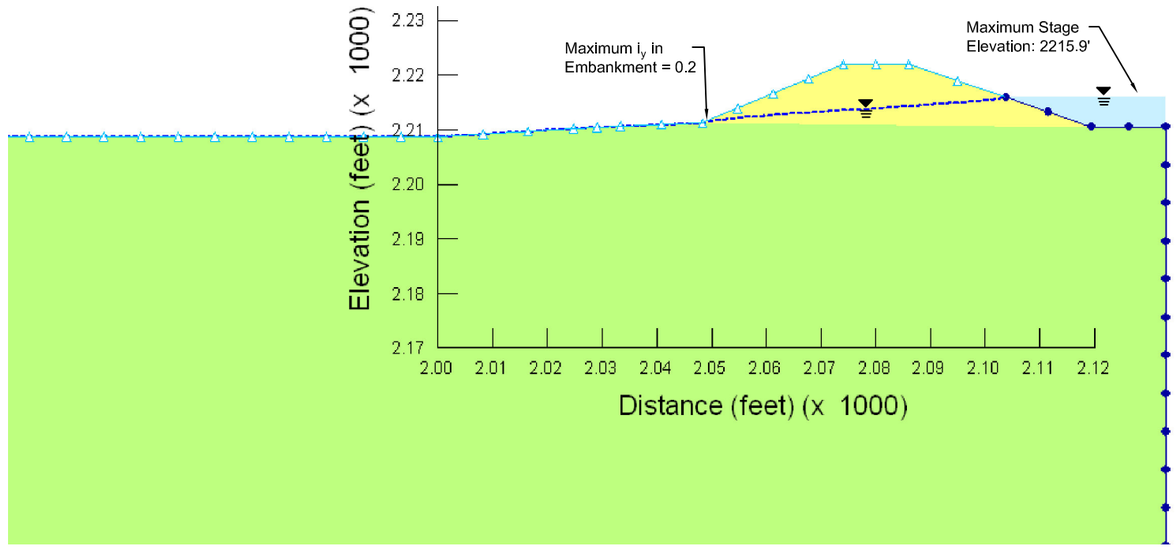
Seepage Analyses Without Erosion Station 72+38

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Clark County Levee Certification Project
Equestrian Levee
Henderson, Nevada

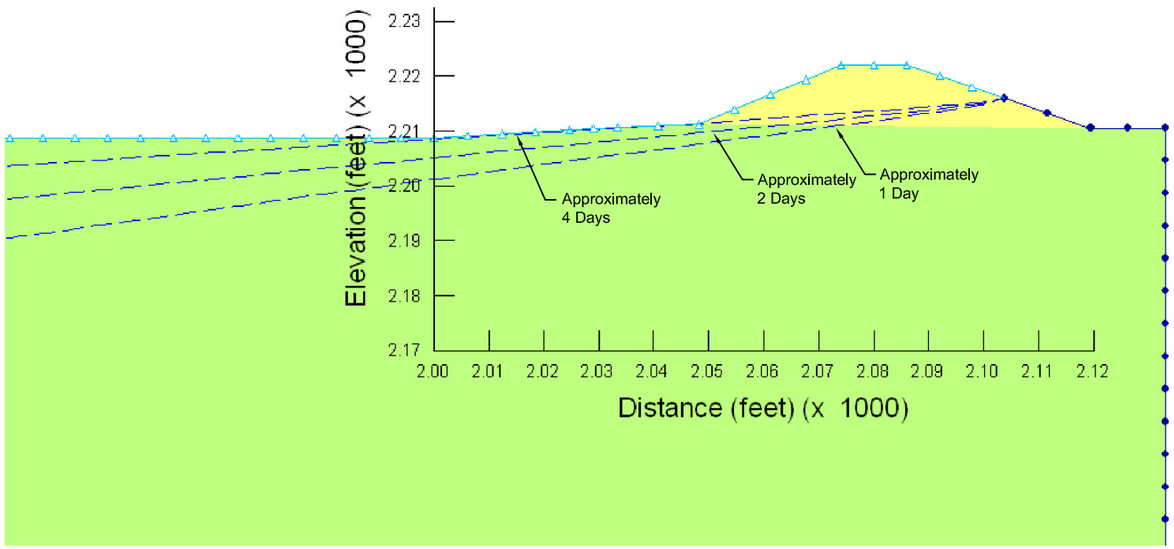
PLATE
C-1



TRANSIENT SEEPAGE
APPROXIMATE STATION 73+50



STEADY-STATE SEEPAGE
APPROXIMATE STATION 73+50



TIME TO STEADY STATE SEEPAGE
APPROXIMATE STATION 73+50

LEGEND:

- SEEP\W PHREATIC SURFACE
- SEEP\W WETTING FRONT

Hydraulic Properties

Material Type	Color	K_H (ft/day)	K_H/K_V
LEVEE EMBANKMENT		170	4
NATIVE FOUNDATION		170	4

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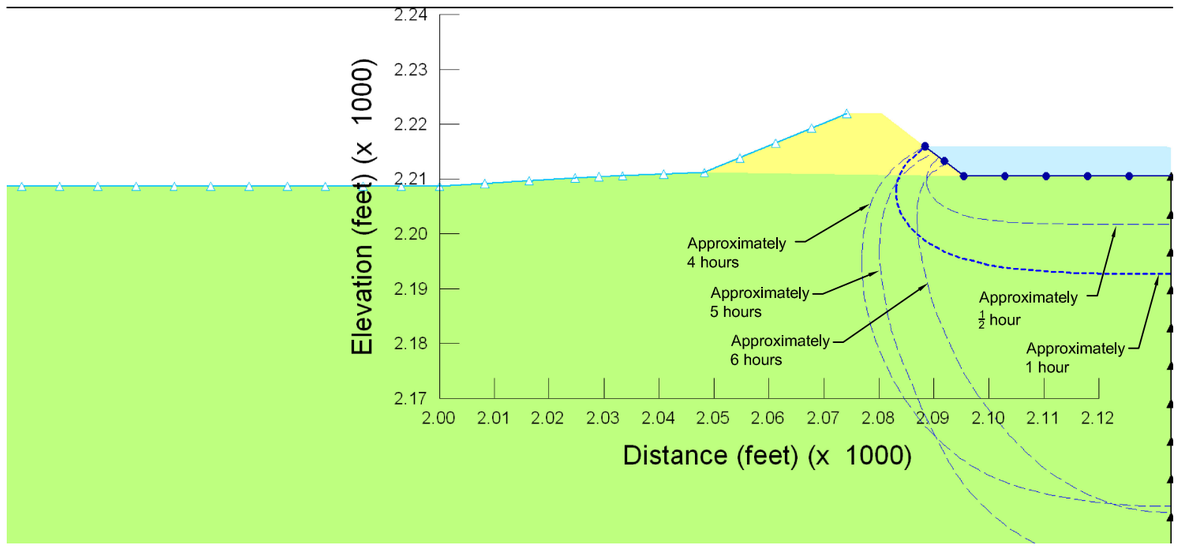
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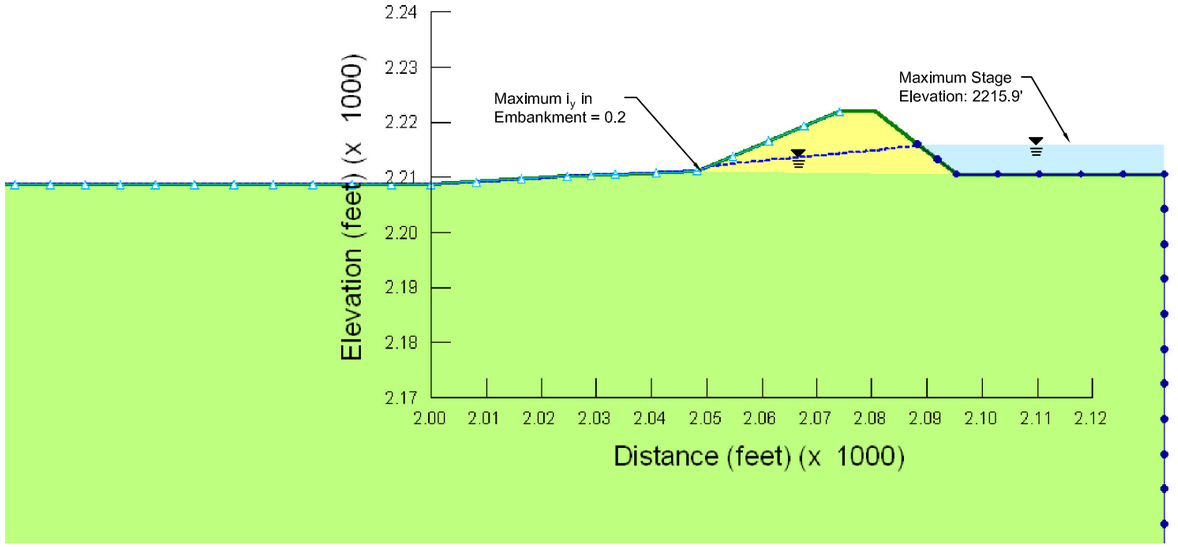
Seepage Analyses Without Erosion Station 73+50

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Henderson, Nevada

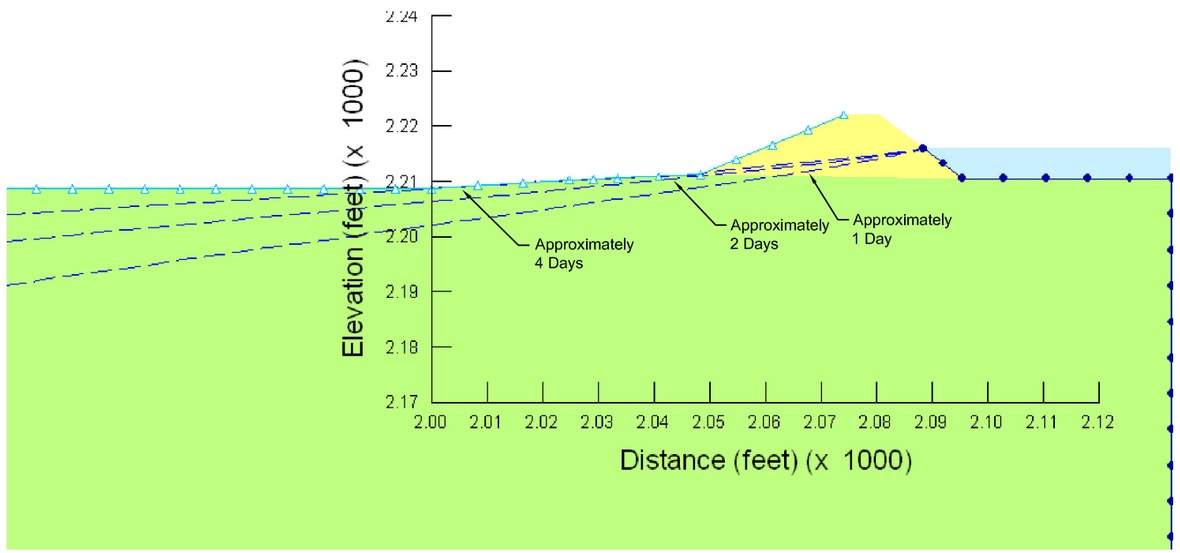
PLATE
C-2



TRANSIENT SEEPAGE
APPROXIMATE STATION 73+50



STEADY-STATE SEEPAGE
APPROXIMATE STATION 73+50



TIME TO STEADY STATE SEEPAGE
APPROXIMATE STATION 73+50

LEGEND:

- SEEP\W PHREATIC SURFACE
- SEEP\W WETTING FRONT

Hydraulic Properties

Material Type	Color	K_H (ft/day)	K_H/K_V
LEVEE EMBANKMENT		170	4
NATIVE FOUNDATION		170	4

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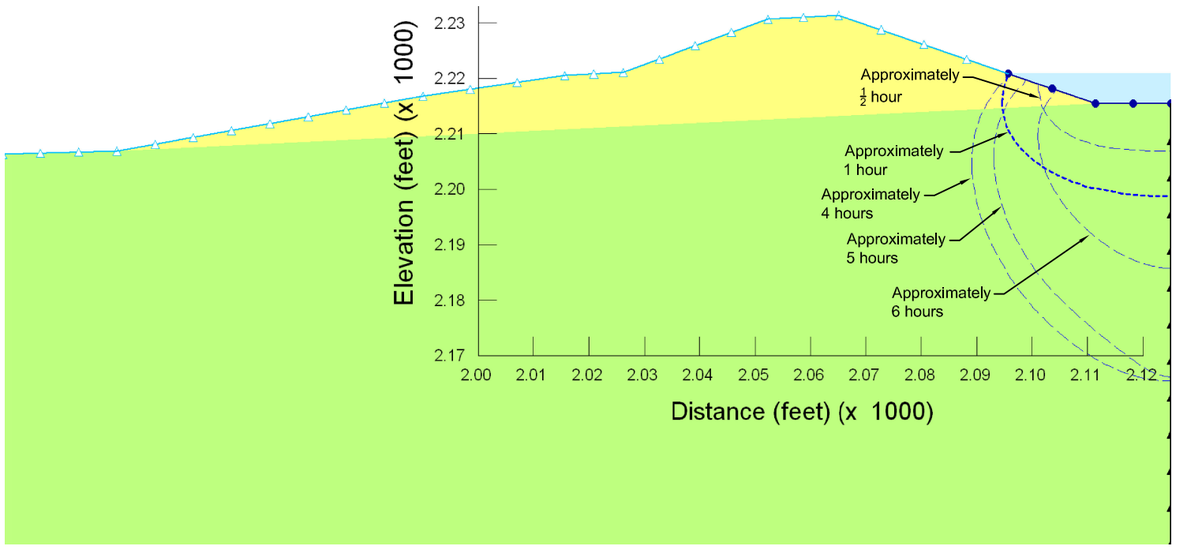
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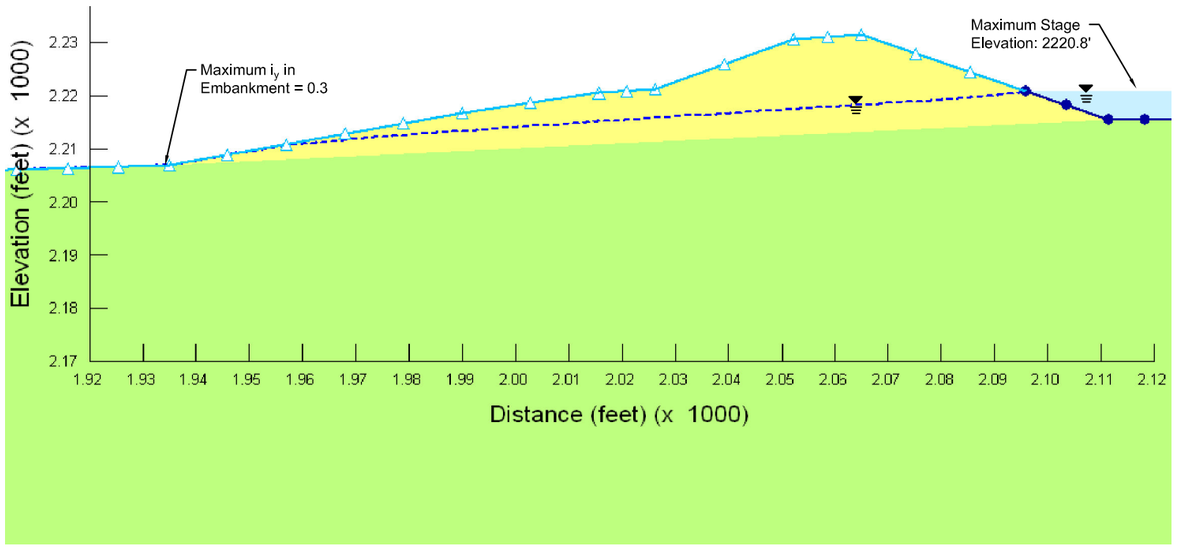
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Equestrian Levee
Henderson, Nevada

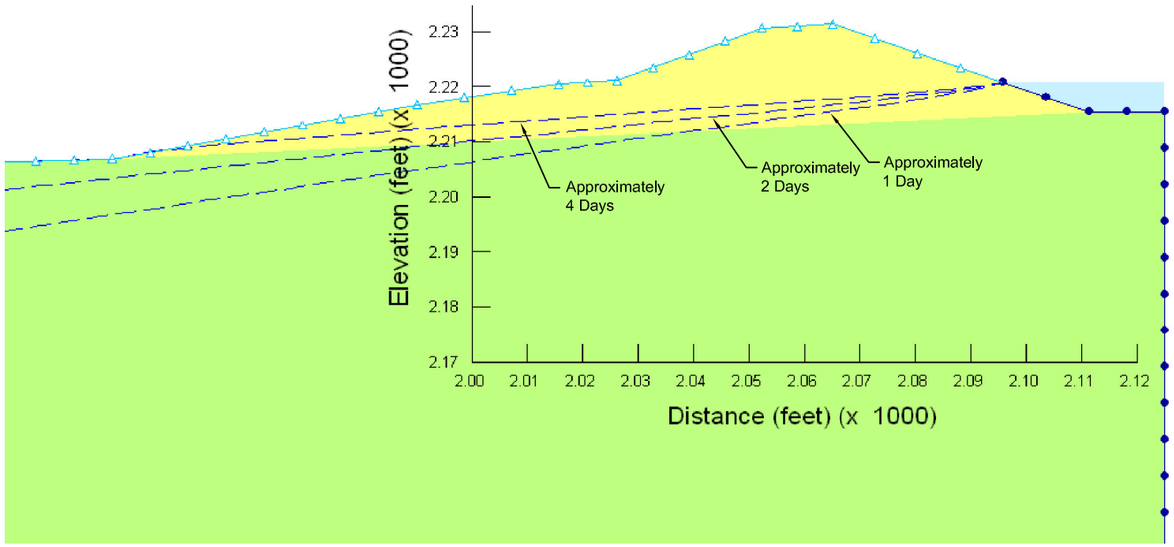
PLATE
C-3



TRANSIENT SEEPAGE
APPROXIMATE STATION 82+00



STEADY-STATE SEEPAGE
APPROXIMATE STATION 82+00



TIME TO STEADY STATE SEEPAGE
APPROXIMATE STATION 82+00

LEGEND:

- SEEP\W PHREATIC SURFACE
- SEEP\W WETTING FRONT

Hydraulic Properties

Material Type	Color	K_H (ft/day)	K_H/K_V
LEVEE EMBANKMENT		170	4
NATIVE FOUNDATION		170	4

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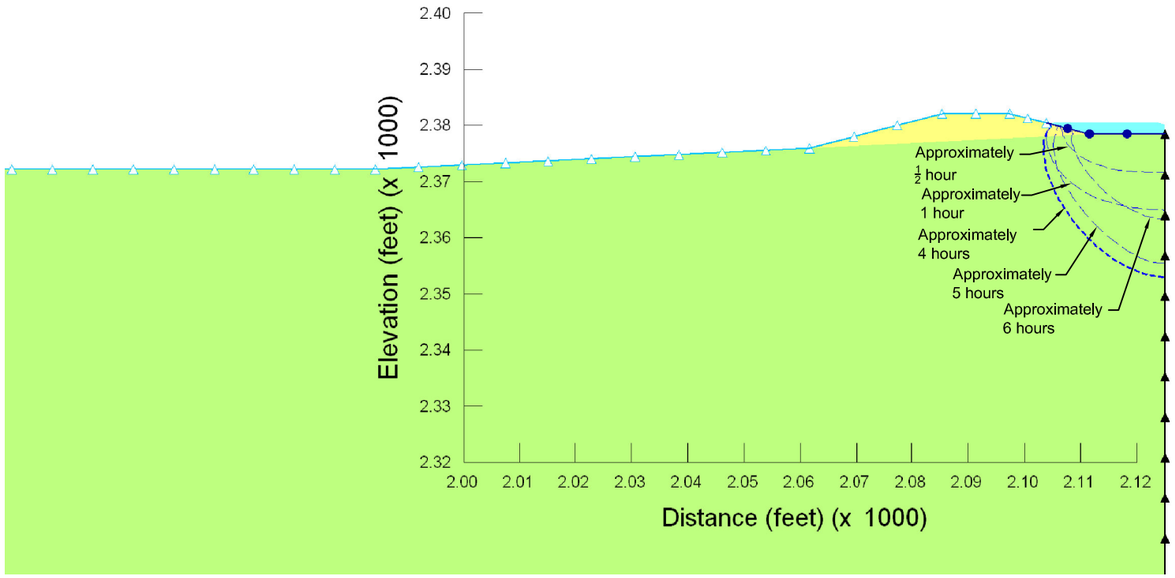
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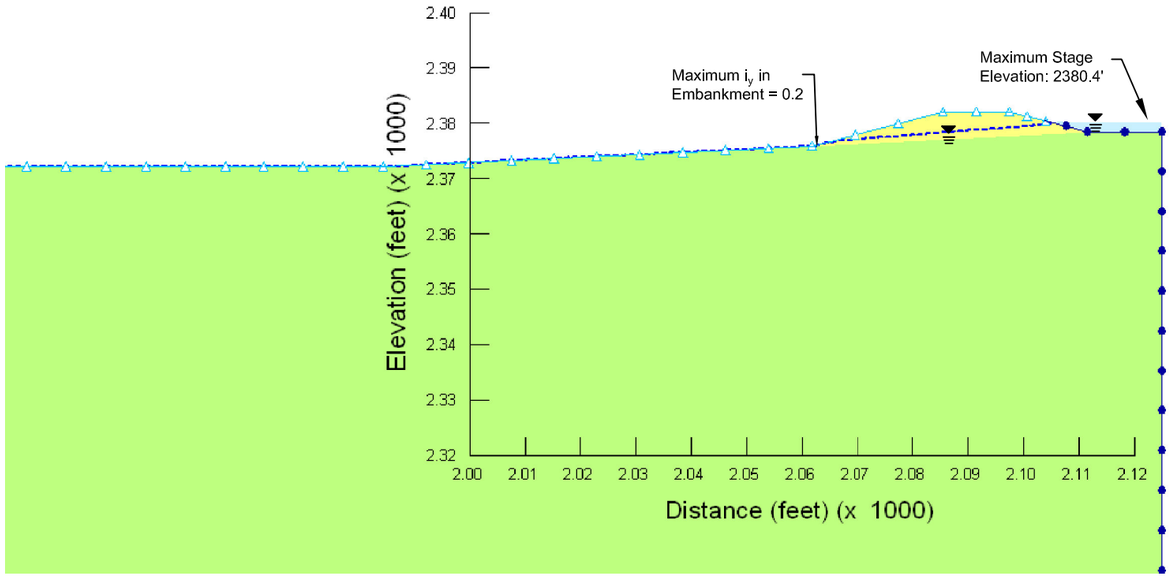
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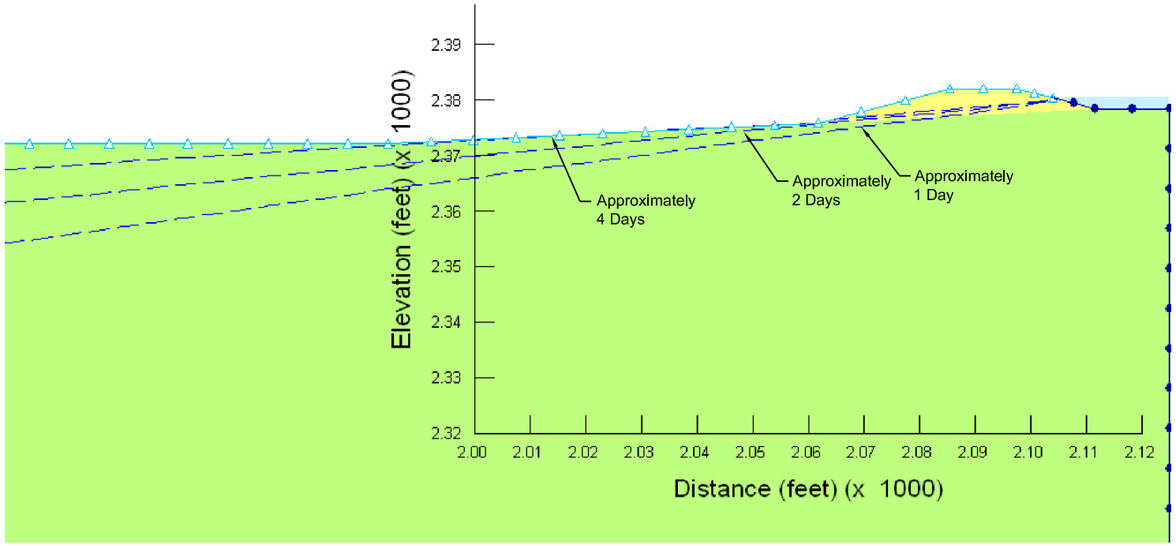
PLATE
C-4



TRANSIENT SEEPAGE
APPROXIMATE STATION 167+00



STEADY-STATE SEEPAGE
APPROXIMATE STATION 167+00



TIME TO STEADY STATE SEEPAGE
APPROXIMATE STATION 167+00

LEGEND:

- SEEP\W PHREATIC SURFACE
- SEEP\W WETTING FRONT

Hydraulic Properties

Material Type	Color	K_H (ft/day)	K_H/K_V
LEVEE EMBANKMENT		170	4
NATIVE FOUNDATION		170	4

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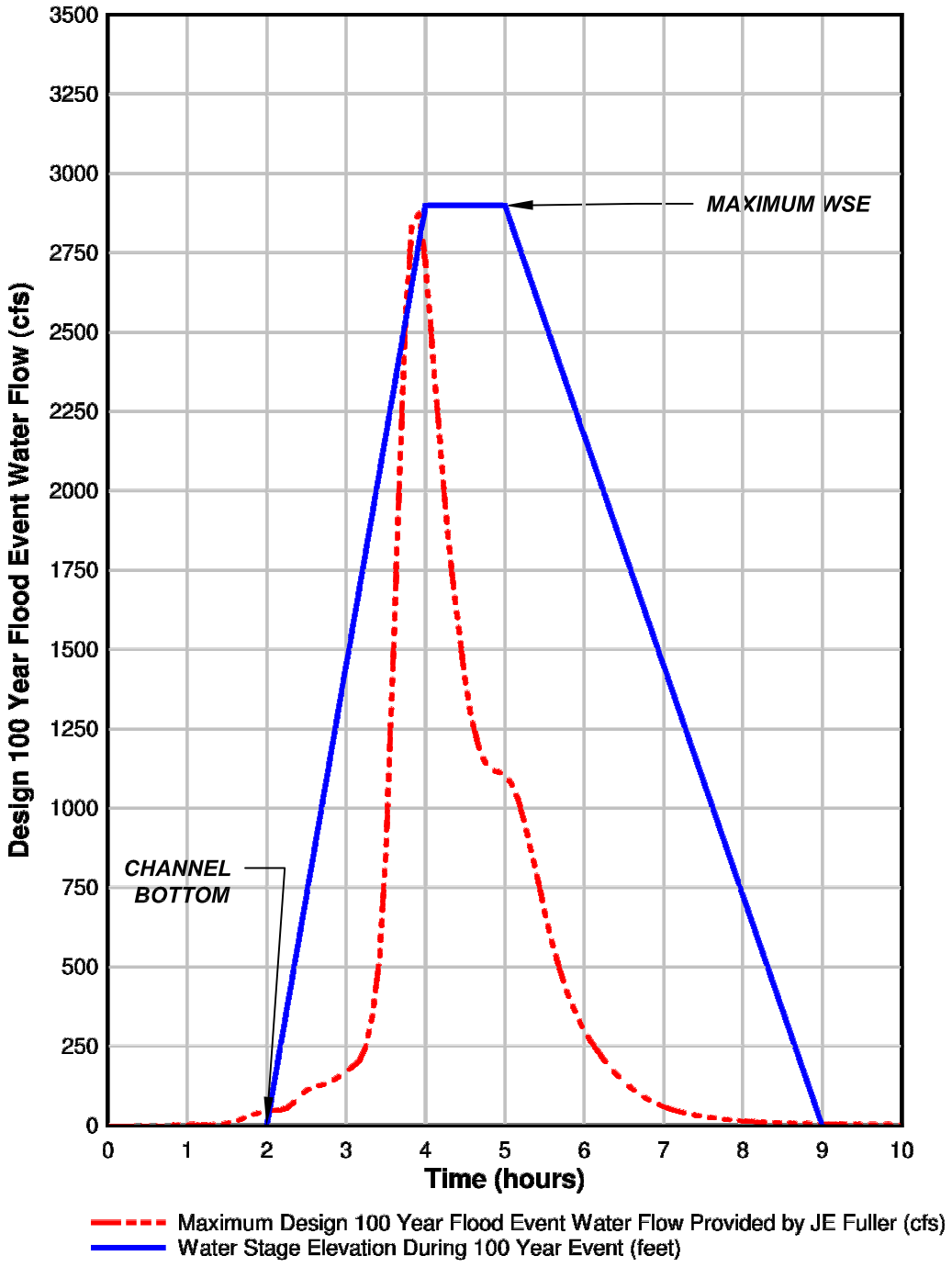
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PLATE
C-5



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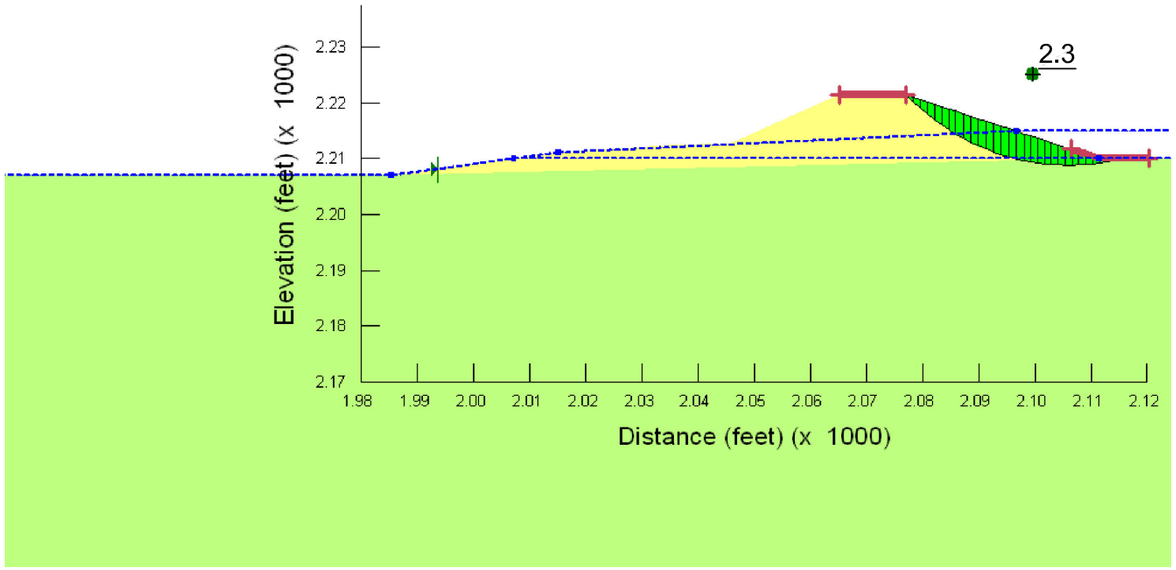
PBS&J Hydrograph with Simplified Water Stage vs Time

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Henderson, Nevada

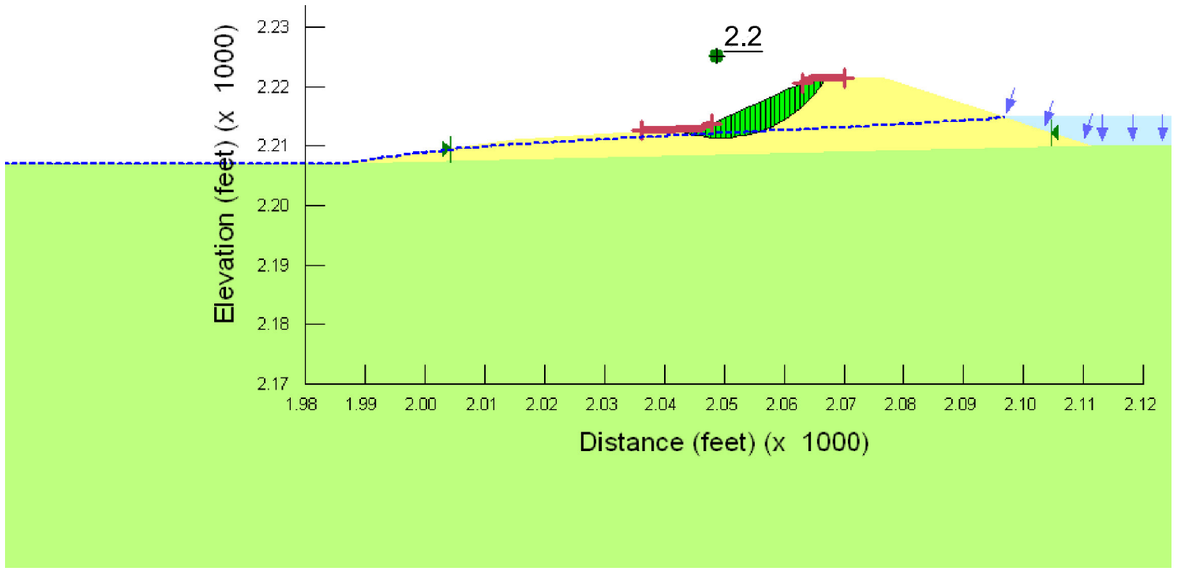
PLATE

C-6

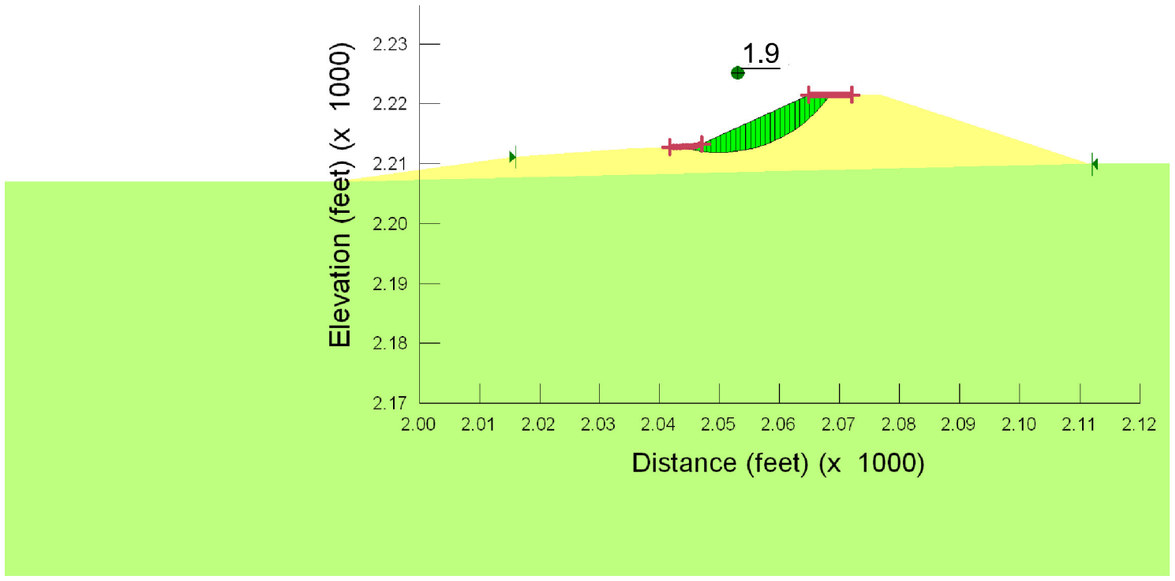
APPENDIX D



SUDDEN DRAWDOWN SLOPE STABILITY
APPROXIMATE STATION 72+38



STEADY STATE SLOPE STABILITY
APPROXIMATE STATION 72+38



SEISMIC SLOPE STABILITY
APPROXIMATE STATION 72+38

LEGEND:

1.9 - ESTIMATED FACTOR OF SAFETY

\- FAILURE SURFACE

\- MODELED PHREATIC SURFACE(S)

Strength Properties						
Material Type	Color	Unit Weight (pcf)	Effective Stress		Total Stress	
			Friction Angle (deg.)	Apparent Cohesion (psf)	Friction Angle (deg.)	Apparent Cohesion (psf)
LEVEE EMBANKMENT		130	38	0	38	0
NATIVE FOUNDATION		130	40	0	40	0

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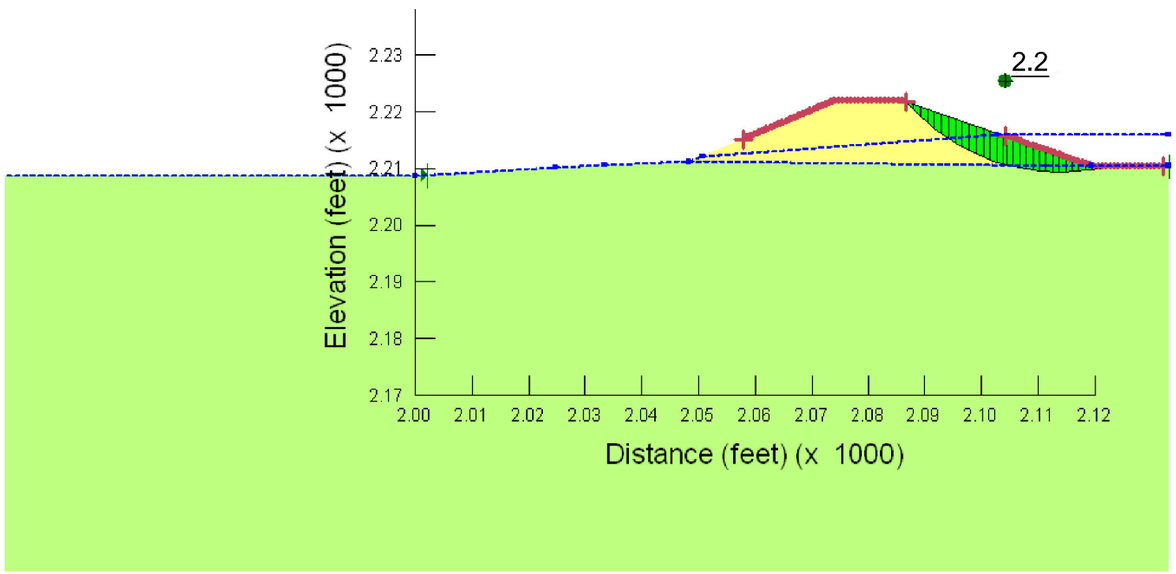
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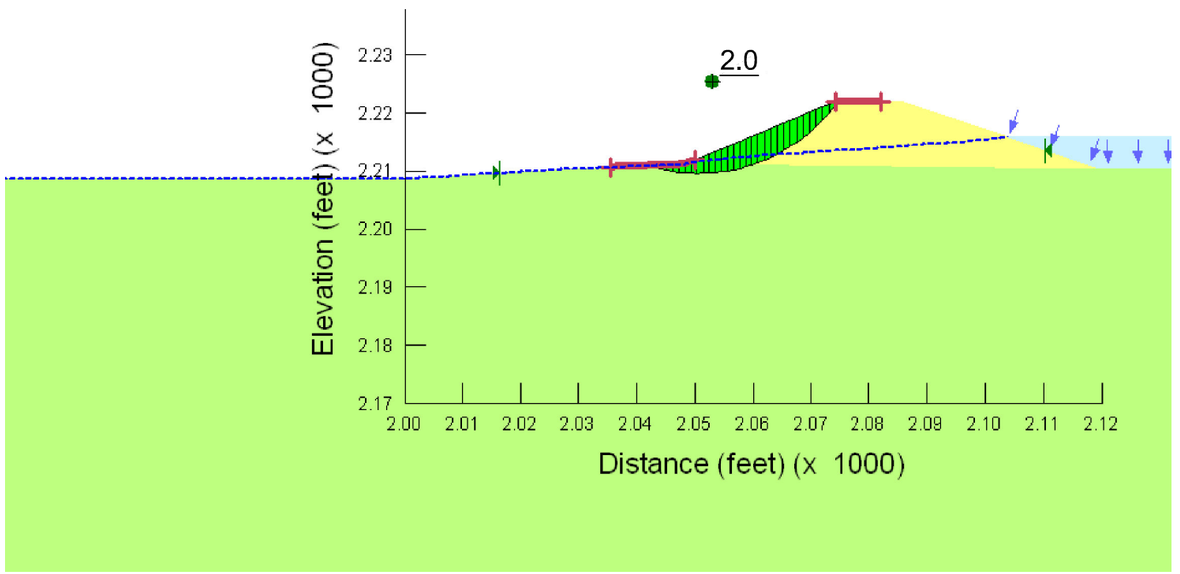
Slope Stability Analyses
Without Erosion
Station 72+38

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Equestrian Levee
Henderson, Nevada

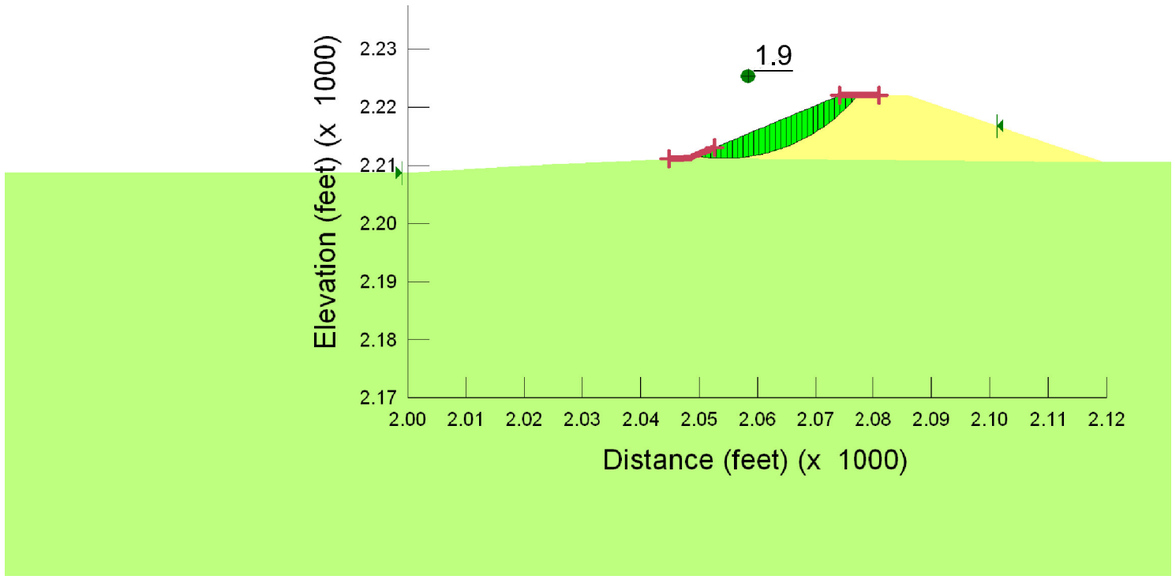
PLATE
D-1



SUDDEN DRAWDOWN SLOPE STABILITY
APPROXIMATE STATION 73+50



STEADY STATE SLOPE STABILITY
APPROXIMATE STATION 73+50



SEISMIC SLOPE STABILITY
APPROXIMATE STATION 73+50

LEGEND:

1.9 - ESTIMATED FACTOR OF SAFETY

\- FAILURE SURFACE

\- MODELED PHREATIC SURFACE(S)

Strength Properties						
Material Type	Color	Unit Weight (pcf)	Effective Stress		Total Stress	
			Friction Angle (deg.)	Apparent Cohesion (psf)	Friction Angle (deg.)	Apparent Cohesion (psf)
LEVEE EMBANKMENT		130	38	0	38	0
NATIVE FOUNDATION		130	40	0	40	0

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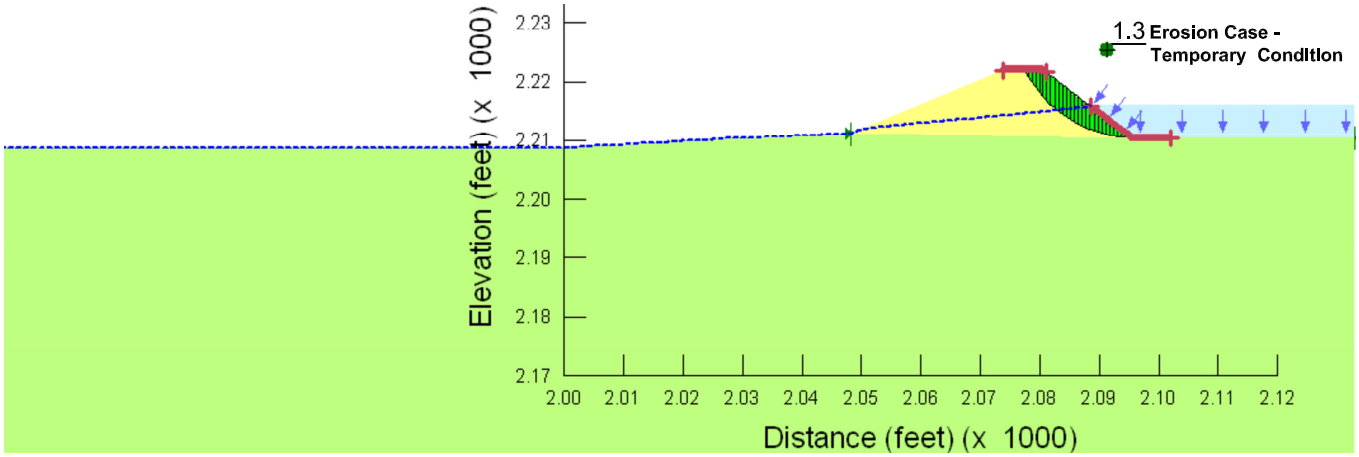
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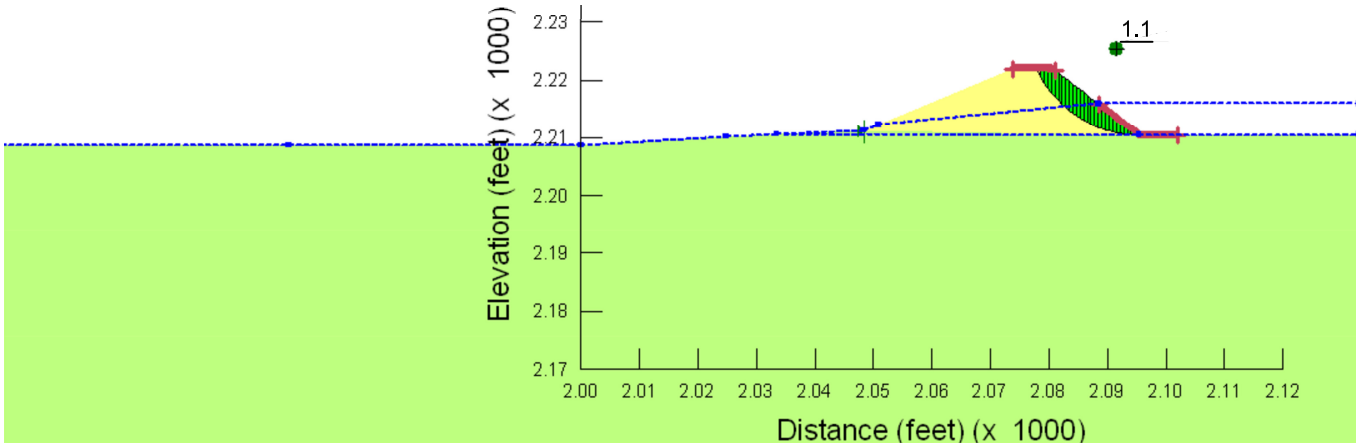
Slope Stability Analyses
Without Erosion
Station 73+50

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Henderson, Nevada

PLATE
D-2

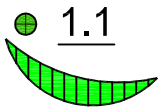


STEADY STATE SLOPE STABILITY
APPROXIMATE STATION 73+50



SUDDEN DRAWDOWN SLOPE STABILITY
APPROXIMATE STATION 73+50

LEGEND:



- ESTIMATED FACTOR OF SAFETY
- FAILURE SURFACE
- MODELED PHREATIC SURFACE(S)

Strength Properties

Material Type	Color	Unit Weight (pcf)	Effective Stress		Total Stress	
			Friction Angle (deg.)	Apparent Cohesion (psf)	Friction Angle (deg.)	Apparent Cohesion (psf)
LEVEE EMBANKMENT		130	38	0	38	0
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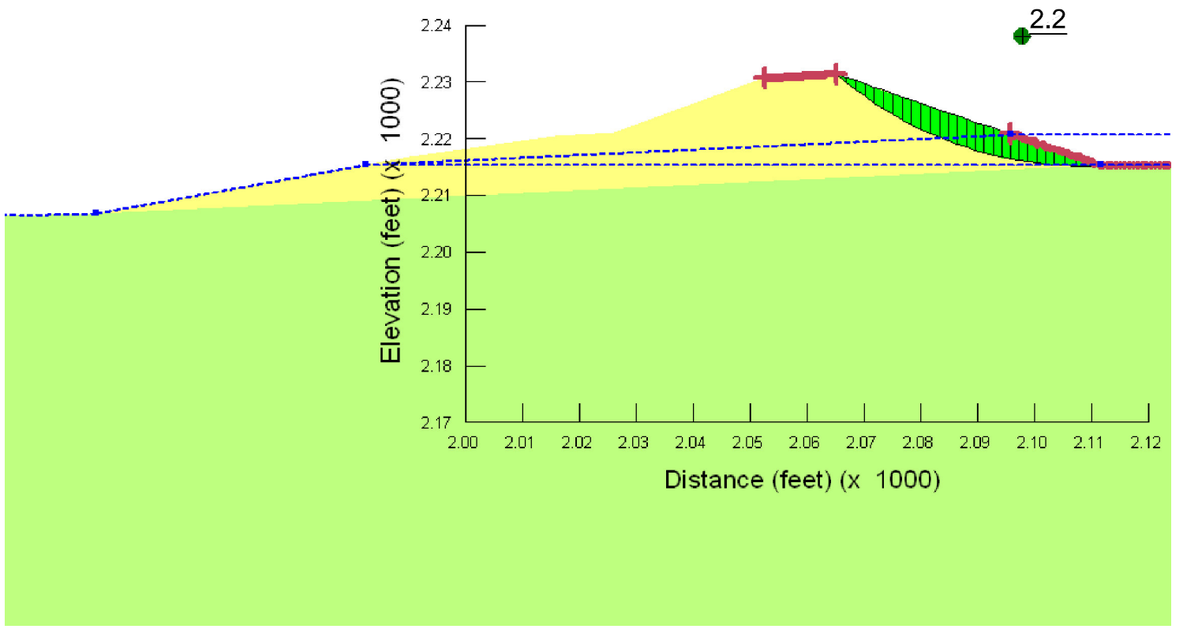
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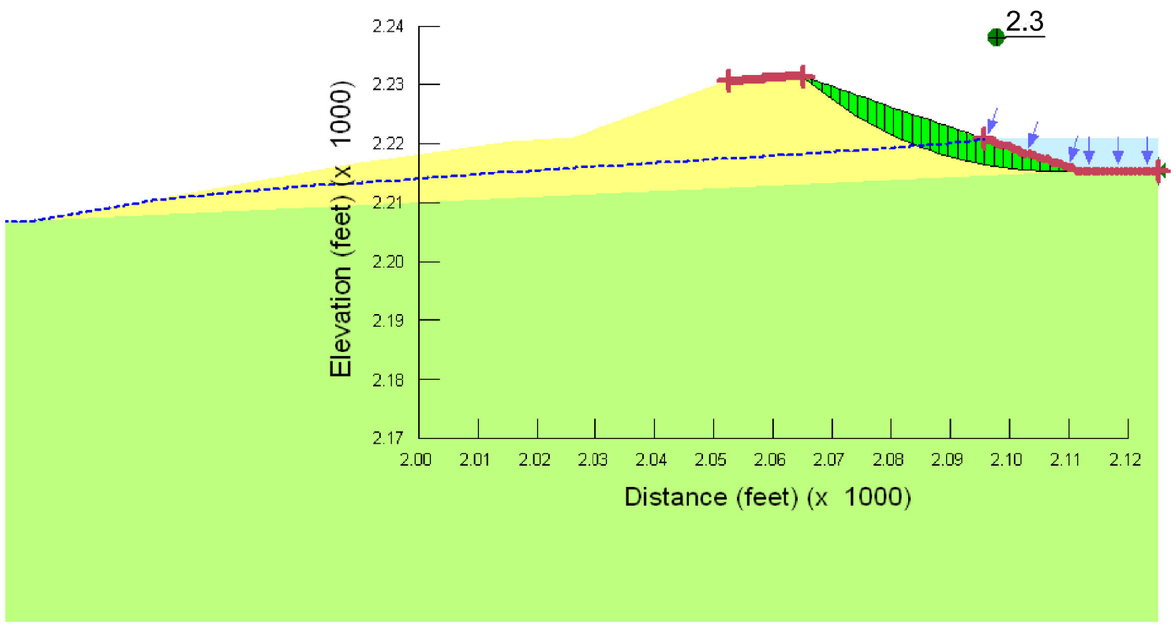
Slop Stability Analyses With Erosion Station 73+50

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Equestrian Levee
Henderson, Nevada

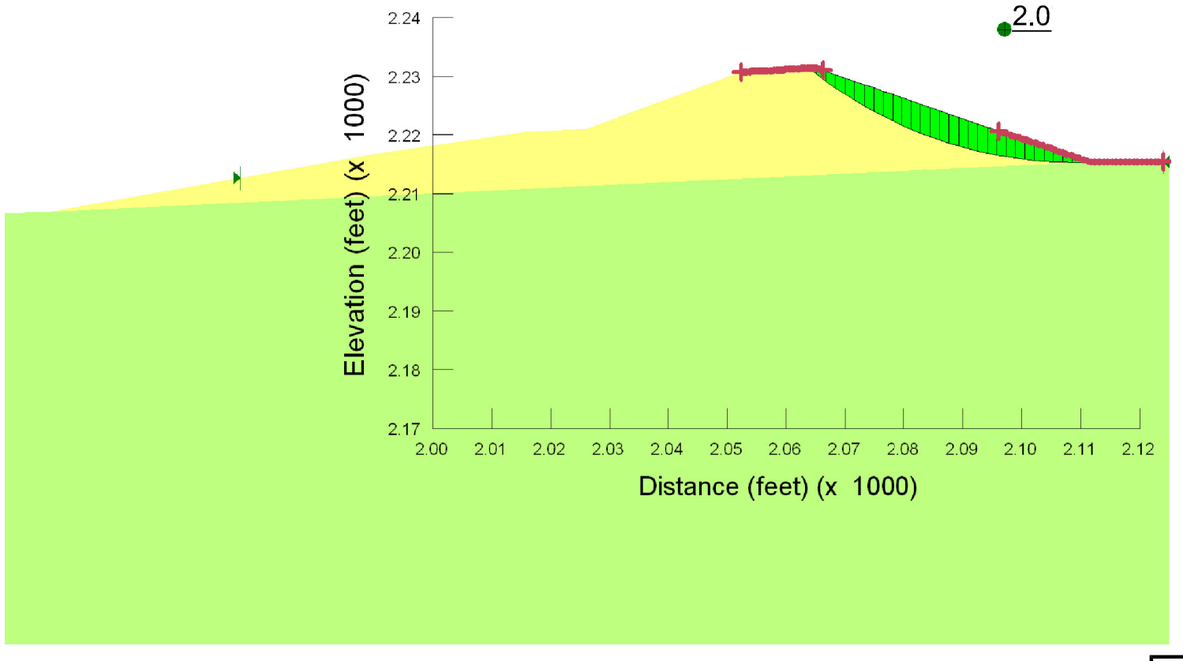
PLATE
D-3



SUDDEN DRAWDOWN SLOPE STABILITY
APPROXIMATE STATION 82+00



STEADY STATE SLOPE STABILITY
APPROXIMATE STATION 82+00



SEISMIC SLOPE STABILITY
APPROXIMATE STATION 82+00

LEGEND:

2.0 - ESTIMATED FACTOR OF SAFETY

\- FAILURE SURFACE

\- MODELED PHREATIC SURFACE(S)

Strength Properties

Material Type	Color	Unit Weight (pcf)	Effective Stress		Total Stress	
			Friction Angle (deg.)	Apparent Cohesion (psf)	Friction Angle (deg.)	Apparent Cohesion (psf)
LEVEE EMBANKMENT		130	38	0	38	0
NATIVE FOUNDATION		130	40	0	40	0

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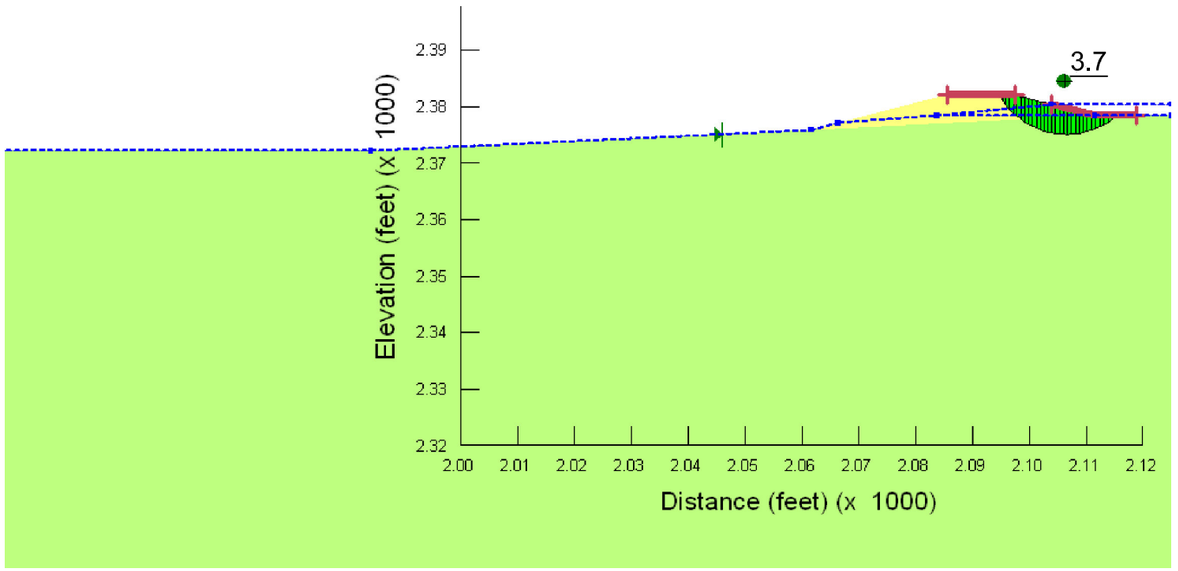
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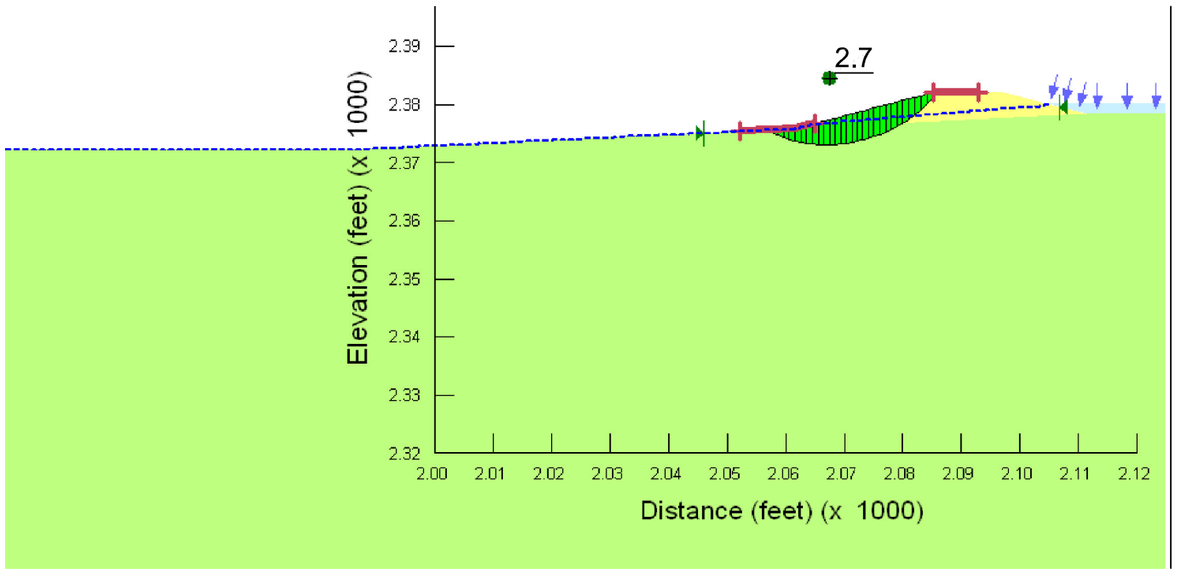
Slope Stability Analyses Without Erosion Station 82+00

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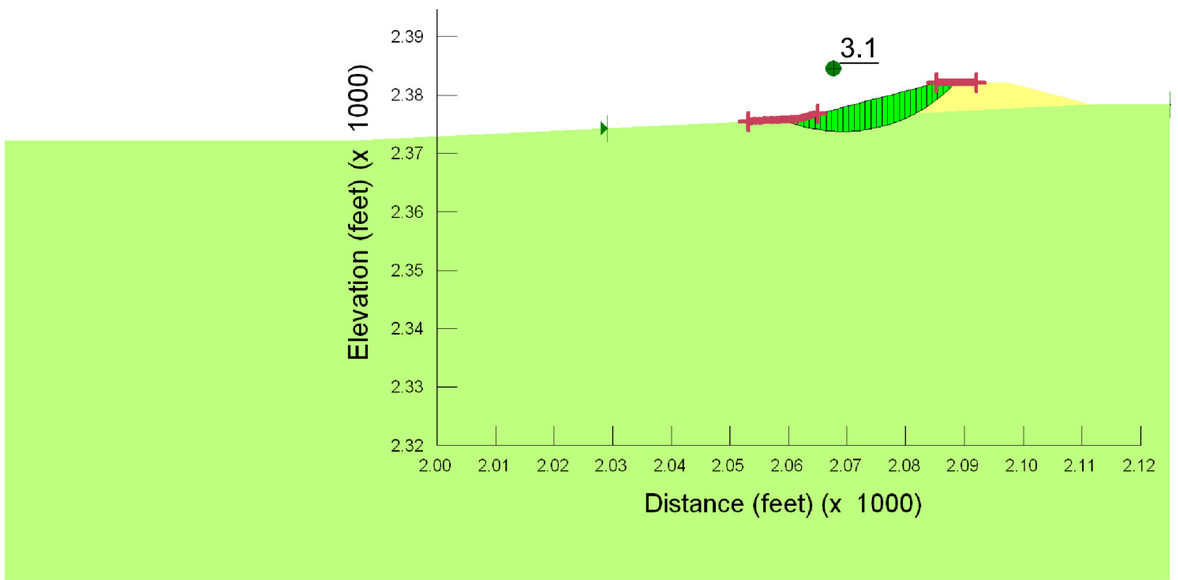
PLATE
D-4



SUDDEN DRAWDOWN SLOPE STABILITY
APPROXIMATE STATION 167+00



STEADY STATE SLOPE STABILITY
APPROXIMATE STATION 167+00



SEISMIC SLOPE STABILITY
APPROXIMATE STATION 167+00

LEGEND:

2.7 - ESTIMATED FACTOR OF SAFETY

\- FAILURE SURFACE

\- MODELED PHREATIC SURFACE(S)

Strength Properties

Material Type	Color	Unit Weight (pcf)	Effective Stress		Total Stress	
			Friction Angle (deg.)	Apparent Cohesion (psf)	Friction Angle (deg.)	Apparent Cohesion (psf)
LEVEE EMBANKMENT		130	38	0	38	0
NATIVE FOUNDATION		130	40	0	40	0

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Slope Stability Analyses
Without Erosion
Station 167+00

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Henderson, Nevada

PLATE
D-5

APPENDIX IX

CCRFCD Operations and Maintenance Manual

REGIONAL FLOOD CONTROL DISTRICT



OPERATIONS AND MAINTENANCE MANUAL

Adopted
September 9, 2010

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

OPERATIONS AND MAINTENANCE MANUAL

GALE WM. FRASER, II, P.E.
GENERAL MANAGER / CHIEF ENGINEER

www.regionalflood.org

The Operations and Maintenance Manual has been updated in accordance with Regional Flood Control District Board action on September 9, 2010. The Board adopted amendments to Chapter 1, Section 1.10 – Executive Summary: Maintenance Procedures and Inventory Procedures, Chapter 2, Section 2.20 – Authority, Section 2.30 – Responsibility, and Section 2.50 – Definitions, Chapter 3, Section 3.20 – Policies, Chapter 4, Section 4.25 – Certification of Compliance, 4.32 – Activities, Section 4.42 – Physical System, Performance Standards, Forms, and Appendix A and Appendix B.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

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CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

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CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

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CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 1
EXECUTIVE SUMMARY

1.10 EXECUTIVE SUMMARY

The Clark County Regional Flood Control District (District) was created under NRS 543 with responsibility to plan, construct and maintain drainage and flood control facilities throughout Clark County. In order to comply with NRS 543.340(4), this **Operations and Maintenance Manual** has been prepared through the cooperation and support of all of the affected member entities, which include Clark County and the incorporated cities within Clark County. The document sets forth both policies and procedures by which the maintenance of the drainage and flood control facilities will be achieved to assure their proper working order at the time of need. The overall goal of the maintenance program as adopted by the District Board is as follows:

> COMPLY WITH THE PROVISIONS OF NRS 543.340(4) AND ASSURE THAT FACILITIES IN THE MASTER PLAN ARE MAINTAINED IN A MANNER THAT MAXIMIZES THEIR USEFUL LIFE AND ENSURES THEIR OPERATION AT DESIGN CAPACITY DURING A STORM EVENT.

Nineteen policy statements have been adopted to support the above goal.

In order to achieve the goal, and to comply with the adopted policies, the following procedures have been developed in an open and very participatory manner.

Funding Procedure – Provides for a means by which the member entities can be paid for activities associated with maintenance of drainage and flood control facilities on the Master Plan provided they meet criteria as set forth in the manual.

Administrative Procedure – Provides for establishing standards and levels of service by which maintenance will be achieved. This procedure includes the steps and schedule by which an annual work plan is established and adopted by the District Board. It also provides for the certification of performance by each member entity in accordance with the annual interlocal contract. The ability for the member entity to contract maintenance activities to private contractors is also authorized under this procedure.

Maintenance Procedures – This procedure provides the specific activities under which the maintenance program is to be carried out as listed below:

ACTIVITY NUMBER	ACTIVITY NAME	WORK MEASURE UNIT
03	Facility Assessment and Inventory	Labor Hours
05	Inspect Channels	Miles
06	Inspect Levees/Detention and Debris Basins	Miles/Each
08	Species Survey and Removal	Labor Hours
10	Clean and Reshape Channels/Levees	Cubic Yards
15	Repair Lined Channel	Each
20	Erosion Control and Repair	Square Feet
21	Provide/Maintain Dust Control	Acres
25	Clean Detention/Debris Basins	Cubic Yards
35	Fence Repair	Linear Feet
40	Vegetation Control – Chemical	Acres
45	Vegetation Control – Mechanical	Acres
50	Maintain Access Road	Miles
55	Clean and Inspect Inlet/Outlet Structures	Each
60	Repair Inlet/Outlet Structures	Each
65	Clean Storm Sewer Lines	Linear Feet
70	Storm Sewer Repair	Repairs
75	Clean/Flush Culverts & Bridges	Each
80	Miscellaneous Work Activities	Labor Hours
85	Engineering	Labor Hours

A specific performance standard has been developed for each activity setting forth the following elements:

- The most effective crew size.
- The kinds and number of equipment required.
- The major types of material that should be used.
- Recommended procedures for performing the work.
- An estimate of expected average daily accomplishment with standard crew size, equipment, and procedures.
- Authorization and scheduling criteria.

Inventory Procedures – A critical element of any maintenance program is the identification and condition of the overall drainage and flood control system. In the case of this program, the inventory also identifies those facilities that are "eligible" for payment of maintenance activities, provided the work is a part of the annual plan.

Maintenance is an ongoing and very dynamic function of a successful drainage and flood control program. This **Operations and Maintenance Manual** sets forth an initial set of policies and procedures, including the various actions required to achieve the maintenance goal. The manual will need to be updated on a regular basis to reflect fiscal implications and the experience gained as the District continues to grow and to serve the citizens and taxpayers of Clark County.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 2
INTRODUCTION

2.10 BACKGROUND

The Clark County Regional Flood Control District (District) was established in 1986 to plan, construct, and maintain drainage and flood control facilities throughout Clark County. These responsibilities focus on alleviating the potential for flooding and protecting the lives and property of existing residents**,** future residents and visitors within the District's Service Area. The initial phases of the District's program succeeded in preparing a Master Plan, uniform design criteria, regulatory standards, and constructing facilities. As these areas have progressed, the District, along with other agencies and member entities in the County, has oriented its efforts towards assuring adequate maintenance of flood control facilities and conveyance systems. This orientation is consistent with the vital role maintenance plays in all comprehensive flood control programs. This **Operations and Maintenance Manual** has been prepared through the District with the support and cooperation of each affected member entity. It represents a commitment to uniform flood control system standards and establishes a blueprint for a cost effective and consistent maintenance program throughout the District's service area.

2.20 AUTHORITY

Nevada Revised Statute (NRS) 543 mandates that the District shall undertake programs for both construction and maintenance of flood control facilities. A commitment to building and maintaining flood control facilities within Clark County is reiterated in the District's **Uniform Regulations for the Control of Drainage** (Uniform Regulations) which states that capital improvements, operation, and maintenance are all interrelated parts of the District's overall flood control program. In accordance with NRS 543.340(4) and the Uniform Regulations, the District prepared an **Operations and Maintenance Manual**, which was adopted by the District Board on November 8, 1990. To reflect fiscal implications and experience gained, the manual was updated in 1995, 1999, 2003, 2005, 2007, and 2010.

2.30 RESPONSIBILITY

The District was formed, in part, to fund and coordinate the construction and maintenance of facilities to alleviate flooding and protect the life and property of citizens within the boundaries of the District. It is the responsibility of the District to prepare and update the Master Plan for the control of floods, and manage the District funds for the Control of Floods in a manner consistent with NRS 543.

2.40 APPROACH

The maintenance program must assure that the flood control projects funded by the District are maintained at a level which maximizes their useful life and assures that facilities operate to design capacity. As an interconnected network of conveyances and structures, failure of any flood control facility to operate properly may affect the performance of the overall system within a specific watershed.

Flood control facilities require regular maintenance if they are to be functional, visually attractive, and last through their design life. Accordingly, the development of a maintenance program is just as critical to the overall success of a comprehensive flood control effort as basin planning and regulation enforcement. As stormwater and flood control programs begin to address nonpoint pollution/water quality issues, the maintenance program will play an even greater role by enabling cost effective reductions in pollutant loadings to receiving waters. Finally, visibility of the program to the public, which a comprehensive maintenance program affords, is an important factor in demonstrating that flood control management is truly a full-time commitment and not simply a priority only after a storm event. The primary objectives of the District's maintenance program are:

- To develop a complete physical feature inventory for the system.
- To establish overall policies and levels of service.
- To develop operating procedures.

It is also critical that ongoing inspection and reporting procedures continue to assure all systems are ready when needed.

Due to the multiple jurisdictions involved with maintenance of the flood control system, a commitment to this program from all member entities within the service area of the Regional Flood Control District was essential. This commitment was made through the Maintenance Technical Committee during the development of the manual in 1990. It was also recognized that coordination of this maintenance program with state transportation programs was critical. The level and consistency of the long range commitment has a direct impact on how effective the resulting maintenance system becomes. This commitment begins with a credible **Operations and Maintenance Manual**.

An essential building block for a successful flood control maintenance program in Clark County is a complete physical feature inventory of the system. It is also important to note that no maintenance program is ever truly "complete". Rather, these programs are constantly evolving as inventories are defined and standards/costs are further refined. A similar evolution is anticipated for this program. The flexibility to adjust to this evolutionary process has been built into this manual.

2.50 DEFINITIONS

In addition to the definitions of terms and phrases set forth in other District documents, the following apply to operation and maintenance:

Acceptance for Maintenance: "Acceptance for Maintenance" means that a project funded by the District, member entity, or other public/private funds is a part of the Master Plan and has been constructed in accordance with District standards and therefore eligible for maintenance funding by the District.

Annual Budget: "Annual Budget" means the anticipated costs associated with completion of each activity outlined within the annual work plan submitted by each of the member entities, and ultimately approved by the District Board of Directors prior to the start of each fiscal year.

Annual Work Plan: "Annual Work Plan" means a plan submitted by each of the member entities setting forth the type and quantity of maintenance to be performed during the ensuing budget year in a form prescribed by the District specifically requesting funds for budgeting purposes.

Certification: "Certification" means the documentation which evidences that required maintenance by a member entity has been completed in accordance with established standards.

Funding Eligibility: Projects eligible for District maintenance funding are those identified in the Regional Flood Control District's Master Plan and any revisions, amendments, and/or changes subsequently approved. Only those facilities that exist as Master Plan Facilities or exist in the same alignment as a proposed Master Plan facility, and appurtenant facilities constructed as part of a regional facility within one-quarter mile of a Master Plan facility are eligible.

Maintenance Program: The "Maintenance Program" has been established by the Board to provide funding of, and establish performance standards and guidelines for, the maintenance of flood control facilities located throughout Clark County and the incorporated areas. The Program provides funding to member entities to perform maintenance of eligible flood control facilities. Subsequently, the District works with the member entities annually to develop Maintenance Work Plans. The work plans undertaken through the Maintenance Program and budgets are funded through the annual interlocal contracts between each member entity and the District. No matching funds are required, except in those cases where an arrangement has been made to cooperatively fund a particular field activity. Work is performed using a combination of private contractors and member entity maintenance staff. The Maintenance Program contains three broad categories of work:

1. Routine and/or Preventive Maintenance: "Routine and/or Preventive Maintenance" means work on existing facilities to keep them in proper working condition, including but not limited to, debris/sedimentation removal, vegetative control, and reshaping.

2. Restoration: "Restoration" means the repair to existing facilities after a storm event including erosion repair, fence replacement, repairing/replacing trash racks, inlets, storm sewer systems, major debris removal, and similar "one time" work activities.

3. Rehabilitation: "Rehabilitation" means rebuilding a facility and/or conveyance system after it is destroyed by an event or it has been determined that it is not operating according to the intent of the design documents on file at the District causing a safety or maintenance problem or it has deteriorated to the extent that it must be replaced "in kind" including replacing or modifying drop structures, reshaping channels, bank protection restoration, inlets, etc. In general, the rehabilitative projects are designed by consultants and the construction contracts are awarded through a bid process.

Maintenance Program Exclusions: "Exclusions" typically include local drainageway maintenance such as curb and gutter work, inlet maintenance, and repairs to small piped storm sewer systems, unless otherwise constructed as part of a regional facility and landscaping, irrigation systems, trails, bike paths, and other recreational or multi-use features that do not have a direct flood control or drainage function. Maintenance work exclusions also include repair or replacement of existing flood control Master Plan facilities which undergo catastrophic damage of more than one-half (1/2) mile. These types of catastrophic damages will generally be classified as capital improvements, and requests for capital improvement funds must be reprogrammed as a capital improvement project in accordance with District Policies and Procedures.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 3
POLICY STATEMENT

It is important that a maintenance policy statement be adopted which reflects the objectives of both the elected officials and the operations staff charged with its implementation. The initial policy document was prepared and reviewed by District staff and the Maintenance Committee. Following input from the group, it was reviewed by the respective Public Works Directors of all member entities and further revised to reflect their input. The document was then reviewed by the Technical Advisory Committee (TAC) and the Citizens Advisory Committee (CAC) before final adoption by the Board on November 8, 1990. To reflect fiscal implications and experience gained, the document is updated on a regular basis. The final adopted policy statement is as follows:

3.10 GOAL

Comply with the provisions of NRS 543.340 (4) and assure that facilities in the Master Plan are maintained in a manner that maximizes their useful life and ensures their operation at design capacity during a storm event.

3.20 POLICIES

1. Facilities eligible for maintenance funding shall be inspected on an annual basis, as a minimum, to assure proper maintenance has been provided.

2. In cases where funded maintenance by the lead member entity is not performed to the standards specified, the District shall perform or cause to be performed the maintenance necessary to assure proper operations of the facility. Costs incurred by the District shall be deducted from the amount authorized in the maintenance agreement between the lead member entity and the District.

3. Flood control facilities improved or constructed after adoption of this policy, must be designed in accordance with District criteria and standards to be eligible for maintenance funding.

4. Access to the facility must be guaranteed to the lead member entity and the District in order to be eligible for maintenance funding.

5. Maintenance and repairs to flood control facilities will be performed in a manner that will minimize the degradation of water quality.

6. The maintenance requirements applied to these facilities shall be based on the standards contained in the District's **Operations and Maintenance Manual**.

7. The lead member entity must develop an annual work plan to be eligible for maintenance funds. Upon completion of the work, the member entity must certify that the work was completed in accordance with the standards contained in the District's **Operations and Maintenance Manual**.

8. Maintenance funding is available only for repair, restoration, rehabilitation, or maintenance of existing facilities and is not intended to supplement the District's capital improvement program. For example, if the intent of the field activity is to increase the designed capacity of a facility or conveyance, then that function is capital in nature.

9. Copies of plans and specifications must be furnished to the District for review and approval prior to finalizing design when maintenance projects are awarded through a bid process or when maintenance projects will be to a design different from its original design. This review will be for the purpose of ensuring compliance with the District's Master Plan and regional objectives and will be used to update the inventory of existing facilities. As-built plans or record drawings will be provided to the District upon project completion and prior to project closeout.

10. Expenditures for repair and replacement of existing flood control Master Plan facilities which undergo catastrophic damage of one-half (1/2) mile or less will be classified as maintenance. These expenditures will be made from budgeted maintenance funds.

11. Expenditures for repair and replacement of existing flood control Master Plan facilities which undergo catastrophic damage of more than one-half (1/2) mile will generally be classified as capital improvements. Requests for capital improvement funds must be programmed as a capital improvement project in accordance with District Policies and Procedures.

12. Expenditures for removal of debris and sediment captured or deposited in a debris basin, detention basin or a linear flood control facility will be classified as maintenance. Necessary repairs to a debris or detention basin will also be classified as maintenance. These expenditures will be made from budgeted maintenance funds.

13. Expenditures for repair and replacement of non-improved or "earth lined" flood control facilities and features will be classified as maintenance. These expenditures will be made from budgeted maintenance funds.

14. A member entity may consider another option in lieu of repairing or rehabilitating facilities that have not been improved to Master Plan design specifications. This option is to build/implement the long-term solution for the damaged facility. Expediting the

implementation of the Master Plan may be a viable alternative that maximizes the use of available resources. This should be considered as an alternative if the long-term solution can be implemented in a timely manner. Requests for capital improvement funds to implement a Master Plan project must be programmed as a capital improvement project in accordance with District Policies and Procedures.

15. District funds may be provided for maintenance of Master Plan facilities by outside contractors under conditions when the use of such an approach is deemed the most efficient and cost effective by the lead member entity.

16. If a member entity receives funds from other sources for maintenance and repair of drainage and flood control facilities paid for by the District, the funds will be paid to the District. Examples of other sources include, but are not limited to, Federal Emergency Management Agency (FEMA) funds for repairs resulting from a designated disaster, and funding from developers for maintenance and repair of District facilities.

17. Member entities and their contractors are responsible for compliance with all local, state and federal laws in the execution of maintenance activities. The District will not be responsible for any fines and/or penalties caused by the actions or inactions of the member entity's employees, consultants, contractors, or agents.

18. Bridge structures, generally speaking, are not eligible for District funding unless it can be shown that the flood carrying aspects of the regional facility causes a safety or maintenance problem.

19. Member entities are responsible for maintenance of documentation demonstrating effective and diligent maintenance of levees accredited by FEMA as providing protection from a base flood in accordance with Title 44 Code of Federal Regulations (44CFR) part 65.10 and to make that documentation available to FEMA upon request should the levees need to be reaccredited.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 4
PROCEDURES

4.10 FUNDING PROCEDURES

4.11 Purpose

This element of the **Operations and Maintenance Manual** provides the member entities with procedures for the appropriation, expenditure and payment of funds to perform maintenance activities. A principle role of the District shall be to manage and disburse payments to the member entities for maintenance that is performed in compliance with the approved plans. (See Funding Flow Diagram.)

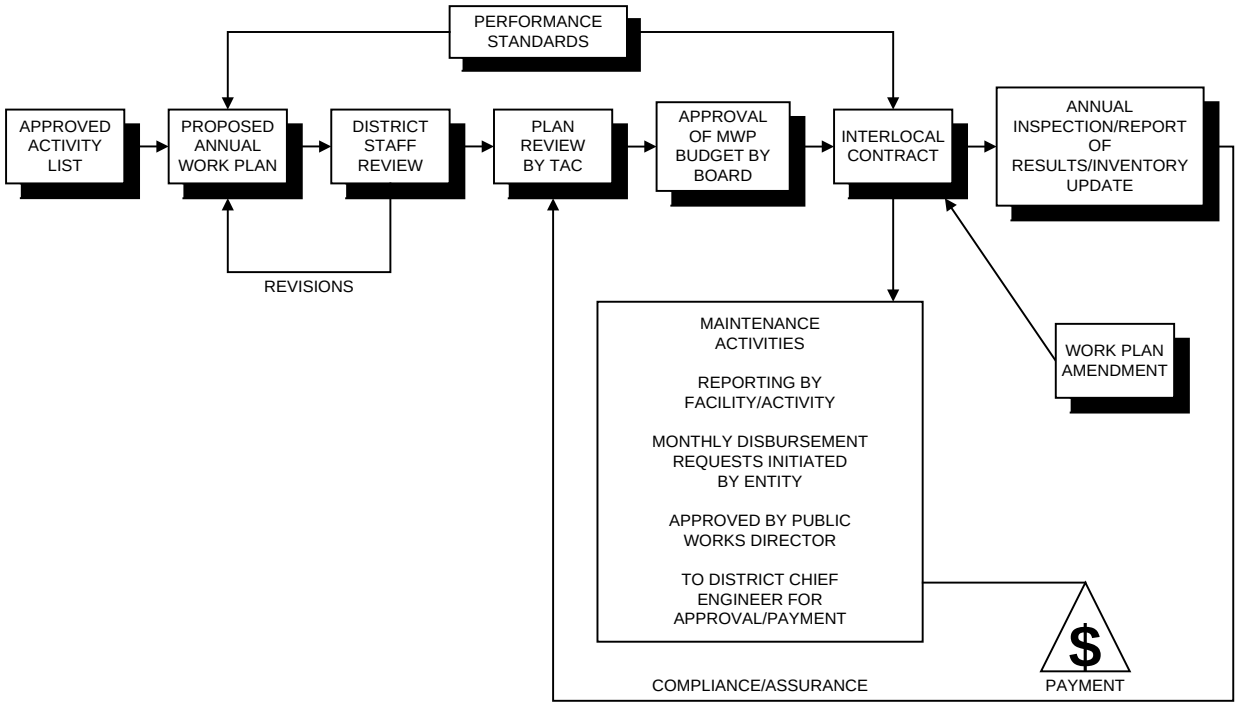
The District has authorized funding to assist the member entities with major drainageway maintenance in accordance with the priorities listed below:

- First priority: District owned facilities.
- Second priority: Facilities owned by member entities.
- Third priority: Facilities owned by other public agencies.
- Fourth priority: Facilities owned by others in which access has been guaranteed to the lead member entity and the District.
- Fifth priority: Unimproved drainageways.

4.12 Payment Procedures

Payment for work performed will be made in accordance with the annual interlocal contract executed as part of the approved work plan and the payment procedures outlined herein. The primary mechanism for payments shall occur through a purchase order established between the District and each member entity. In cases where the member entity directs the District to make payments to a contractor or supplier directly, the purchase orders will be established between the District and the contractor, consultant, or supplier, at the member entity's request. Unless otherwise contained within this manual, all District Policies and Procedures relating to disbursement of funds and payment to member entities apply.

Funding Flow Diagram



Disbursement requests (invoices) must be accompanied by a verification statement from the member entity that the work for which payment is due has been completed in accordance with the standards contained in this manual. The disbursement request must identify the Master Plan facility maintained, specific plan activity or activities for which payment is sought, and separately identify personnel, equipment, and other related costs. (See Disbursement / Amended Annual Budget Request Form, which can be obtained electronically from the District.) Administrative costs incurred by the member entity in the management of the interlocal contract are not payable to the member entity. Examples include cost accounting work, secretarial/clerical work, the preparation of requests for payment, and certification statements for work performed under the contract.

All invoices from the member entity requesting payment to the member entity or direct payment to the member entity contractor or vendor must first be submitted to and approved by the member entity's Public Works Director or other designated responsible person in charge of the project. The Chief Engineer or designated District staff will process and approve such payments within 30 days providing all invoices have appropriate backup, and the required approval has been obtained and terms of the interlocal contract have been satisfied.

Direct payments to contractors must originate from the member entity and include the following:

1. Invoice to the member entity from the contractor.
2. Certification of work performed by the contractor signed by the member entity, if applicable.
3. Disbursement / Amended Annual Budget Request Form.

Monthly and annual summaries of purchase order balances, budget status, and facility expenditures shall be prepared by the District as a part of the routine financial reporting procedures to the Board.

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM - FISCAL YEAR 20XX-XX

ENTITY: _____

[ ] Disbursement Request

Vendor Name: _____

Invoice Number: _____

Amount Requested: _____

RFCD Purchase Order #: _____

[ ] Amended Annual Budget Request

Approved: _____

General Manager/Chief Engineer Date

Clark County Regional Flood Control District

MWP Facility #:											
Facility Name:											
Master Plan Facility ID:											**ACTIVITY TOTAL**
03-Facility Assessment & Inv.											**0.00**
05-Chnl Insp											**0.00**
06-Levee/DB/Debris Insp.											**0.00**
08-Species Survey and Removal											**0.00**
10-Reshape Chnl/Levees											**0.00**
15-Chnl Repair											**0.00**
20-Erosion Control and Repair											**0.00**
21-Dust Control											**0.00**
25-Clean DB											**0.00**
35-Fence Repair											**0.00**
40-Vege Control - C											**0.00**
45-Vege Control - M											**0.00**
50-Access Rd											**0.00**
55-Clean In/Outlet											**0.00**
60-Repair In/Out											**0.00**
65-Clean Storm Drn											**0.00**
70-Sewer Repair											**0.00**
75-Clean Culverts											**0.00**
80-Misc Maint											**0.00**
85-Engr											**0.00**
Facility Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

I certify that the above described maintenance was/will be performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further, the information contained in this Request accurately reflects those costs incurred/to be incurred during the performance of this work.

_____

Project Manager Date

4.20 ADMINISTRATIVE PROCEDURES

4.21 Purpose

The purpose of this element of the **Operations and Maintenance Manual** is to provide specific procedures for establishing standards and levels of service, preparing the annual work plan, administrating the planning, approval and enforcement elements, and updating the manual over time. The principal role of the District shall be to review and approve annual maintenance work plans and monitor the performance of work activities. The principal role of the member entities shall be development of annual work plans that are consistent with the District's approved maintenance activity list; performance of the maintenance work set forth in the approved work plans; and the submittal of quarterly reports that summarize work performance while certifying compliance with maintenance activity performance standards as set forth in the **Operations and Maintenance Manual.**

4.22 Annual Work Plans

In accordance with the schedule on the following page, each member entity shall submit a proposed annual maintenance work plan to the Chief Engineer containing the following components:

Part I:	Maintenance Work Plan Summary – Summary of overall work plan listing specific projects (physical system inventory) and associated costs attributable to each. (See Appendix B, Exhibit A.)
Part II:	Facility map(s) which identify location of projects (physical system inventory) and planned maintenance work by project.
Part III:	Maintenance Work Program Annual Budget – Individual maintenance projects (physical system inventory) broken into maintenance activities to be completed, including narrative, and associated budgeted costs for all projects identified in Part I. (See Appendix B, Exhibit A.)

District staff shall review the proposed plans and work with the member entities to resolve any discrepancies found with District maintenance standards and policy objectives. After the initial staff review, the plans shall be forwarded to the Technical Advisory Committee (TAC) and Citizens Advisory Committee (CAC). Lastly, the plans will be submitted to the Board for final approval.

The activities in the work plan shall be consistent with the District's approved activity list for maintenance of flood control and drainage facilities. Work plans should also describe locally funded work activities that may be linked to the District maintenance work activities to show overlapping areas of responsibility for personnel and equipment. Where local personnel and equipment are going to be used to perform both District funded activities and locally funded

activities, the member entity will describe how these resources are to be managed and the procedures for tracking costs related to both sets of activities.

Member entities may contract for the performance of maintenance work activities. The proposed work plan must specify that a contractor is to be utilized and the time frame for selection of a contractor. In the event that maintenance work is performed under contract, the contract must specify that the District has the authority to inspect all work performed under the contract and approve or deny payments to contractors based on inspection findings.

All work performed must comply with District approved maintenance activity performance standards as set forth in subsequent sections of this Manual. The member entity is required, as a minimum, to inspect Master Plan facilities annually; including any maintenance work performed by member entities on Master Plan Facilities, and shall notify the District prior to the annual inspection of completed maintenance work. Member entities shall facilitate the inspection of maintenance work by the District. The District may withhold funding, require additional maintenance work, or seek repayment of disbursed funds when an inspection reveals that work activities were not performed in conformance with activity performance standards. The annual maintenance work plan schedule follows:

February 1	-	Submittal of preliminary work plan proposal and tentative budget to District staff for review, recommendations, and coordination with member entities. This is important for the following reasons: 1) Fiscal Year Budget Authority submittal and approval. 2) Prioritization of maintenance funding activities.
April 1	-	Submittal of tentative annual work plans, budgets, and interlocal contracts to District staff for review, recommendations, and coordination with member entities.
May (TAC deadline)	-	Submittal of the member entity's final annual work plans, budgets, and interlocal contracts to the TAC and CAC for approval.
June (Board meeting)	-	After receiving approval from the TAC and CAC, member entities' final annual work plans, budgets, and interlocal contracts are submitted to the Board of Directors for approval.
July 1	-	Beginning of maintenance plan contract period, which ends June 30.

Each member entity will submit quarterly reports indicating the status of the work completed under the current fiscal year's program. (See Quarterly Status Report Form.) The reports are due 30 days after the close of the quarter, and will be submitted to the Board for review. Also, each member entity shall submit an annual certification to the District stating that all work contained in the work plan and paid through the interlocal contract has been performed to the specifications established in this manual.

Quarterly Status Report

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
QUARTERLY STATUS REPORT - FY 20XX-XX

MWP Facility #: _____ Entity: _____

Facility Name: _____ Date Prepared: _____

MP Facility ID: _____ Quarter: _____

Force Account/ Contract	Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Expended To Date ($)	Percent Complete	Scheduled Completion Date
	03 Facility Assessment and Inventory					
	05 Inspect Channels					
	06 Inspect Levees/Detention and Debris Basins					
	08 Species Survey and Removal					
	10 Clean and Reshape Channels/Levees					
	15 Repair Lined Channel					
	20 Erosion Control and Repair					
	21 Provide/Maintain Dust Control					
	25 Clean Detention Debris Basins					
	35 Fence Repair					
	40 Vegetation Control – Chemical					
	45 Vegetation Control – Mechanical					
	50 Maintain Access Road					
	55 Clean & Inspect Inlet/Outlet Structures					
	60 Repair Inlet/Outlet Structures					
	65 Clean Storm Sewer Lines					
	70 Storm Sewer Repair					
	75 Clean/Flush Culverts & Bridges					
	80 Miscellaneous Work Activities					
	85 Engineering					
	TOTALS	$0.00	$0.00	$0.00	0%	
Delays or problem areas:						
Work completed during current quarter:						
Work to be completed during next quarter:						

Consultant/
Contractor: _____

Project
Manager: _____ Phone Number: _____

4.23 Approval of Annual Work Plan

The work plans received by the District will be reviewed and budget requests compiled into a summary showing the dollar amount by member entity for each of the priority areas set forth in Section 4.11. The Chief Engineer shall review the total maintenance budget requests against the District's proposed annual total budget for facility maintenance and make a recommendation to the District Board as to the amount of maintenance funds to be disbursed to each respective member entity based upon equity and need.

Once the Technical Advisory Committee has reviewed the maintenance work plans and budget appropriation recommendation, the Chief Engineer will forward the compiled summary to the Board for consideration and approval as a key element of the Annual District Budget.

The Chief Engineer's report to the District Board shall show both the budget requested by the member entity and the recommended amount to be appropriated, the report will also make comments on any adjustments made to the initial request.

4.24 Work Plan and Budget Amendments

Requests for amendments to approved work plans and budgets must be submitted to the Chief Engineer in writing. The amendment request must specify the work elements affected, describe the reasons for the amendment request, and describe the impact of the proposed amendment on the affected work plan objectives.

Formal approval of work plan and/or budget amendments requiring a reallocation of funds between facilities must be obtained from the Chief Engineer prior to submittal of payment requests. (See Disbursement / Amended Annual Budget Request Form.) The member entity shall also notify District staff of work plan and/or budget amendments within a facility. Requests requiring an increase in the overall work plan budget must be submitted to the Board for approval with a supplemental interlocal contract for the amended work in accordance with Chapter VI.A.2 of the District's **Policies and Procedures Manual**.

Amendment requests shall be reviewed by District staff and responded to in writing within 15 days of receipt of the original request.

4.25 Certification of Compliance

It is the intent of the District to rely to the maximum extent possible on the member entities to carry out the maintenance activities and comply with the procedures and standards set forth in this manual. The District shall from time to time inspect facilities funded by the District or those on the Master Plan to assure compliance with the interlocal contract. Each member entity shall submit an annual certification to the District stating that all work contained in the work plan and paid through the interlocal contract has been performed to the specifications established in this manual. This certification shall be signed by the person executing the interlocal contract or their designee. The certification should summarize proposed and actual plan accomplishments. It should also describe any major maintenance problems that have implications for the District as a whole, such as significant deterioration of major conveyance system components or the failure of system components to perform as intended, and suggest revisions to the activity list provisions. In addition, the certification will include a detailed maintenance report for debris basins, detention basins and levees (high hazard structures). The report will list all conditions requiring maintenance and how each was addressed accompanied by before and after photo documentation. For maintenance of levees accredited by FEMA as providing protection from the base flood, annual levee maintenance reports will be kept on file by the affected entity and made available to FEMA upon request demonstrating compliance with 44CFR part 65.10.

The certification and final payment requests shall be submitted to the District within 30 calendar days of the termination of the annual interlocal contract for maintenance funding.

Final Accounting Report

(ENTITY)
MAINTENANCE WORK PROGRAM
FINAL ACCOUNTING REPORT - FY 20XX-XX
As of (Current Date)

VENDOR	P.O. NUMBER	P.O. AMOUNT	TOTAL EXPENDED	P.O. BALANCE
Sample Vendor 1	1234567890 10	1,000.00	1,000.00	0.00
Sample Vendor 2	1234567890 20	1,000.00	500.00	500.00
Sample Vendor 3	1234567890 30	1,000.00	200.00	800.00
	Total	$3,000	$1,700	$1,300

FY XX-XX INTERLOCAL AMOUNT/BUDGET	4,000.00	Total Encumbered	3,000.00
Total Encumbered	3,000.00	Total Expended	1,700.00
Total Unencumbered	$1,000.00	Total Unexpended	$1,300.00

Total Authorized	**$4,000.00**
Expended	**$1,700.00**
REPROGRAM FOR MWP	**$2,300.00**

Regional Flood Control District **(Entity)**

RFCD Date Project Manager Date

I certify that the above described maintenance was performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further, the information contained in this Final Accounting Report accurately reflects those costs incurred during the performance of this work. If there are any maintenance problems that have implications for the District as a whole, such as significant deterioration of major conveyance system components or failure of system components to perform as intended, a detailed description will accompany this report as an attachment.

4.26 Interlocal Contract Document

The performance of work outlined in the approved maintenance plan shall be guided by an interlocal contract entered into annually between the District and each member entity. A sample contract is contained in Appendix B. Major provisions of the contract include: the adoption of the Board approved work plan as the document outlining the work to be performed; references to the performance standards, payment procedures, and plan amendment procedures outlined in this manual for governing maintenance work performance evaluations, and contract amendments; and a requirement for submittal of an annual certification of results.

4.27 Contract for Maintenance Performance

If, in the opinion of the member entity, it appears to be most cost effective (or due to an emergency) to utilize the services of private contractors to perform maintenance functions, the member entity shall solicit bids from qualified contractors in compliance with their statutory procedures for the necessary work. All contracts for maintenance services shall be bid on an annual basis or for a specific project location. The member entity will provide the District with copies of bid specifications and bid tabulations as well as copies of the respective contract documents. The member entity shall advise the District in advance that they intend to utilize a private contractor (may be included as part of annual work plan). They shall also provide a summary of work performed and a statement of inspection as part of the request for payment to the member entity or directly by the District to the contractor. All expenditures must comply with NRS 332, Local Government Purchasing Act, NRS 338, the Public Works Act, and all relevant statutes, rules, regulations, and policies.

4.30 MAINTENANCE PROCEDURES

4.31 Purpose

As a part of the overall operations and maintenance procedures adopted by the District, an outline for specific maintenance procedures has been developed. The accepted maintenance procedures are centered around specific elements of a management system for field maintenance, and include defined maintenance activities, standards, scheduling, and reporting procedures.

Due to the diversity in physical features among the various agencies involved, and the varied resources employed in maintenance activities, it is essential to treat these procedures as general guidelines which must be tailored to meet the situation at hand. It is also essential that these procedures remain dynamic, be actively reviewed, and periodically updated. An annual review is recommended.

4.32 Activities

Maintenance work activities identify all major maintenance work and include all activities which are performed frequently and in amounts that make them a significant part of the total work program. Each activity must be clearly defined so maintenance personnel at all levels of management uniformly understand the operation to be performed and the type of deficiency to be corrected.

Personnel who plan, schedule, perform, report, or evaluate maintenance work must know what each work activity means. Work activities are used for the following purposes:

- Planned maintenance work is identified in the annual maintenance work plan by activity name and number.
- Activity names and numbers are used for authorizing, assigning, and reporting work.
- Activity names and numbers are used on work scheduling guides and work performance summaries.

Work measurement units are established for the major maintenance activities. For example, "Acres Covered" is the work measurement unit for vegetation control while "Cubic Yards Removed" is the work unit for cleaning and reshaping channels. These measurement units are used to describe how much work is planned and to report how much work is accomplished for each activity.

For some activities, specific work measurement units--other than labor hours--would not be meaningful. For example, the miscellaneous maintenance activity includes a number of different operations. This activity cannot be measured by a common unit other than labor hours.

Following is the accepted maintenance Activity List for the District including work measure units.

ACTIVITY NUMBER	ACTIVITY NAME	WORK MEASURE UNIT
03	Facility Assessment and Inventory	Labor Hours
05	Inspect Channels	Miles
06	Inspect Levees/Detention and Debris Basins	Miles/Each
08	Species Survey and Removal	Labor Hours
10	Clean and Reshape Channels/Levees	Cubic Yards
15	Repair Lined Channel	Each
20	Erosion Control and Repair	Square Feet
21	Provide/Maintain Dust Control	Acres
25	Clean Detention/Debris Basins	Cubic Yards
35	Fence Repair	Linear Feet
40	Vegetation Control – Chemical	Acres
45	Vegetation Control – Mechanical	Acres
50	Maintain Access Road	Miles
55	Clean and Inspect Inlet/Outlet Structures	Each
60	Repair Inlet/Outlet Structures	Each
65	Clean Storm Sewer Lines	Linear Feet
70	Storm Sewer Repair	Repairs
75	Clean/Flush Culverts & Bridges	Each
80	Miscellaneous Work Activities	Labor Hours
85	Engineering	Labor Hours

4.33 Standards

"Performance Standards" have been established for each of the major maintenance work activities. These performance standards specify:

- The most effective crew size.
- The kinds and number of equipment required.
- The major types of material that should be used.
- Recommended procedures for performing the work.
- An estimate of expected average daily accomplishment with standard crew size, equipment and procedures.
- Authorization and scheduling criteria.

Following is an item-by-item description of the format of the performance standards.

1. Activity Identification/Date – The activity number and name are shown as well as the "effective date" of the performance standard--to be used when updating or replacing performance standards.

2. Description and Purpose – The Description and Purpose section of the performance standard explains the work activity and the kinds of defects to be corrected or reasons for doing the work.

3. Authorized By and Work Control Category – The level of management responsible for authorizing the work is identified. Certain activities requiring special equipment, coordination, or expertise are Engineer-authorized activities and should not be scheduled or performed without the Engineer's approval. The type of control to be placed on the quantity of work performed is identified. This control is unlimited or limited in terms of the amount of work done (accomplishment) or the amount of labor input (crew-day).

4. Performance Criteria – This section includes important information for the "scheduler" about when to schedule the work and for the crew leader to identify the work to be done.

5. Crew Size – The crew size outlines the numbers of personnel needed to do the work. The crew size is based on average conditions. Sometimes, there will be a need to add or delete people to satisfy special traffic safety conditions or hauling requirements.

6. Equipment – The basic requirements for major pieces of equipment are listed. Situations such as the breakdown or unavailability of equipment or special materials hauling requirements may require the addition, deletion or substitution of equipment.

7. Materials – The materials section includes a list of the major materials to be used for the activity.

8. Work Method – The work method outlines, step-by-step, the recommended procedures for performing the work. Each step should be performed in order to correctly maintain the feature as well as provide the quality of work desired.

9. Average Daily Production – The average daily production is an estimate of the amount of work a crew can accomplish during a day using the recommended crew size, equipment, materials and work method. This estimate is shown as a range and should be attainable over a period of time. Some days the accomplishment may be more or less than the estimate, but eventually, the average should fall in line.

10. Notes – Any other relevant, helpful information or instructions.

Use of Performance Standards

Maintenance supervisory personnel should become thoroughly familiar with these performance standards. It is important that the performance standards be used when making assignments and performing work. Some situations will require deviation from the performance standards--such as more or less flagmen or additional haul trucks. These situations are recognized, and crew leaders are expected to consider such situations when organizing and managing their activities.

Haul truck needs should be determined using factors such as haul distance and time estimates (spot, dump, load, and cycle times).

The performance standards also provide guidance and a measure for supervisors to use when evaluating work in progress and completed.

Field personnel are in the best position to identify new or better work methods or difficulties with the current performance standards. These suggestions for improvements or questions should be directed to the crew leader or supervisor.

The performance standards should be reviewed and updated annually. If other changes occur that require more frequent review and update or development, the performance standards can be changed to suit these needs.

4.34 Scheduling

The objectives of work scheduling are:

- To do the planned amount of work.
- To perform the work when it should be done.
- To do the work where it should be done.
- To use the proper people, equipment and supplies to do the work.
- To ensure to the extent possible that all flood control facilities are functioning at design capacity during a storm event, noting that Flash Flood Season is July through September.

Three tools are available to help supervisors meet these objectives. The WORK PROGRAM defines the estimated amount of work and the estimated labor-days required for each activity to provide the desired levels of service; a WORK CALENDAR helps to establish when the various activities should be done; and the PERFORMANCE STANDARDS provide information about quantity standards, personnel requirements and how much work can be done in a given time.

The annual work program establishes the kinds and amount of work to be done during the year and the resources that will be required to do that work. This annual plan needs to be broken into a monthly plan for effective scheduling of work and to permit timely evaluations of work program performance.

The process of "distributing" the annual work load throughout the year is done by allocating a part of the work (in labor-hours, by activity) to specific months. Some types of work -- emergency or service activities -- must be done throughout the year as the need arises. Other types of work must be done on a regularly scheduled basis -- such as preventive maintenance work. Finally, some types of work can be done during certain periods but can be shifted from one month to the other, and still other work can be done almost any time during the year.

These factors must be considered when distributing the different types of work. Preventive maintenance and other types of work which must be performed on a regularly scheduled basis are distributed so as to level labor power needs as much as possible. Finally, work which can be performed any time is distributed to those months with the fewest labor-days. In this way, staffing needs are kept as uniform as possible resulting in more efficient use of available labor power.

A work calendar lists -- activity by activity -- the labor-hours for each month. These labor-hours are used in conjunction with the work program annual work quantities for work scheduling and the preparation of periodic Activity Status Reports. (See Work Calendar Form.)

Once the work program and staffing levels have been set, the work load distribution can be finalized and the calendar prepared to summarize/communicate the planned monthly distribution of the work program.

Work scheduling is the process of using the work calendar and specific scheduling procedures to plan ahead, establish work priorities and accomplish the work.

The performance standards outlined in the previous sections apply to corrective and preventive maintenance activities. These procedures are not as rigid or foolproof as implied by the description. Equipment breakdowns, emergencies, or bad weather will disrupt a schedule -- but part of the scheduling process is to be aware that these situations will occur and to be prepared to respond with little or no difficulty. Because of these situations, supervisors should not expect to accomplish all of the work as scheduled. Generally, a supervisor can consider his/her scheduling efforts to be successful if 75 to 80 percent of the scheduled work is completed as planned.

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
WORK CALENDAR

MWP Facility #: _____ Entity: _____
Facility Name: _____ Fiscal Year: _____
MP Facility ID: _____ Date Prepared: _____

ACTIVITY		Monthly Distribution of Time (in hours)												Total Per
No.	Description	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Activity
03	Facility Assessment and Inventory													-
05	Inspect Channels													-
06	Inspect Levees/Detention and Debris Basins													-
08	Species Survey and Removel													-
10	Clean and Reshape Channels/Levees													-
15	Repair Lined Channel													-
20	Erosion Control and Repair													-
21	Provide/Maintain Dust Control													-
25	Clean Detention/Debris Basins													-
35	Fence Repair													-
40	Vegetation Control - Chemical													-
45	Vegetation Control - Mechanical													-
50	Maintain Access Road													-
55	Clean & Inspect Inlet/Outlet Structures													-
60	Repair Inlet/Outlet Structures													-
65	Clean Storm Sewer Lines													-
70	Storm Sewer Repair													-
75	Clean/Flush Culverts & Bridges													-
80	Miscellaneous Work Activities													-
85	Engineering													-
	Total Per Month	-	-	-	-	-	-	-	-	-	-	-	-	-

I certify that the above described maintenance will be performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further the information contained in this Work Calendar accurately reflects the time expected to be incurred during the performance of this work.

_____
Project Manager Date

Following are some additional hints or techniques to consider:

- It is not necessary to "formally schedule" the daily, routine activities. It is necessary, however, to regularly check the work reports and accomplishments to verify the distribution of work assignments. A periodic review and adjustment of the work assignments may be necessary to maintain a "balanced work load".
- It is usually best to prepare a schedule (and work assignments) assuming everything will work as planned -- no equipment breakdowns, no emergencies, etc. But make sure a backlog of "alternate" work is available so that little time is wasted when adjustments to the schedule must be made.
- Some guidelines for identifying alternate work:
    - Low priority work that needs to be done, but not necessarily during the next week or so.
    - Work that does not require special equipment or a lot of preparation time.
    - Preventive maintenance on light equipment.

Take time to estimate the amount of work needed and the number of hours required to do the work. Good estimates will improve the scheduling process significantly. The performance standards, inspections and sound judgment based on experience all help the estimating process.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
03	**FACILITY ASSESSMENT AND INVENTORY**	**09/09/10**

DESCRIPTION & PURPOSE

Assessment and inventory program to catalog existing facilities, assess condition of those facilities, and prioritize repairs.

AUTHORIZED BY	LIMITS ON WORK
Director of Public Works or designee	

PERFORMANCE CRITERIA

After completion of initial inventory, maintenance of database will be ongoing to keep records up to date and accurate. Continually assess system condition and maintenance priorities.

CREW SIZE	WORK METHOD
• Project Manager • Project Engineer • Survey Crew • CADD/GIS	1. Field locate existing RFCD facilities. 2. Assess condition and maintenance needs. 3. Catalog findings in a database. 4. Prioritize repairs based on assessment of needs.
EQUIPMENT	
• 1 Pickup • GPS Equipment • Traffic Control • Computer w/software • Video Inspection	
MATERIAL	**AVERAGE DAILY PRODUCTION**

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
05	**INSPECT CHANNELS**	**09/09/10**

DESCRIPTION & PURPOSE

Inspect both improved and unimproved flood channels for proper cross-section, sedimentation, debris accumulation and erosion damage, in order to schedule cleaning or repairs as needed.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Perform complete inspection of channels on an annual basis and after major storm events.

CREW SIZE	WORK METHOD
• 1 Crew Supervisor 1 **TOTAL**	1. Use safety devices, as required. 2. Visually inspect channels for cross-section, sediment, debris, erosion, and vegetation. 3. Prioritize a list of channels requiring maintenance. 4. Schedule cleaning of channels referring to prioritized list.
EQUIPMENT	
• 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
	8 miles/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
06	**INSPECT LEVEES, DETENTION AND DEBRIS BASINS**	**09/09/10**

DESCRIPTION & PURPOSE

Inspect for proper cross-section, sedimentation, debris accumulation, erosion damage including piping, unwanted vegetation growth, depressions/rutting, bank caving, slope stability, and/or steepened slopes, cracking, animal burrowing, encroachments, and condition of erosion control measures in order to schedule cleaning or repairs as needed. Also perform post maintenance inspection to ensure all recommended maintenance was completed properly.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Perform complete inspection after major storm and earthquake events. Prepare complete findings and recommendations report, including characterization of all animal burrows found and supported by photographs of areas requiring maintenance. Report should also include results of post maintenance inspection.

CREW SIZE	WORK METHOD
• 1 Crew Supervisor 1 **TOTAL**	1. Use safety devices, as required. 2. Visually inspect for proper cross-section, sedimentation, debris accumulation, erosion damage including piping, unwanted vegetation growth, depressions/rutting, bank caving, slope stability, and/or steepened slopes, cracking, animal burrowing, encroachments, and condition of erosion control measures. 3. Photograph areas of distress identified in Part 2 with notation describing location on levee (e.g. stationing). 4. Prioritize a list of facilities requiring maintenance. 5. Schedule maintenance of levees referring to prioritized list.
EQUIPMENT	
• 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
	8 miles/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
08	**SPECIES SURVEY AND REMOVAL**	**09/09/10**

DESCRIPTION & PURPOSE

In situations where maintenance activities could impact the desert tortoise or other protected species, a USFWS approved biologist will survey the work zone and recommend appropriate action for compliance with Biological Opinion 1-5-93-F-67R and all applicable laws.

Provides mitigation for potential embankment failure by piping through animal burrows.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Perform surveys/removals within 30 days prior to ground-disturbing activities. Burrows should be inspected by a qualified biologist to ensure that the burrow is not occupied, and then collapsed or filled in. Animal burrows that are identified should be thoroughly excavated and inspected, backfilled with compacted fill similar to material of the levee or other similar means (e.g.: pumped with flowable fill).

CREW SIZE	WORK METHOD
• 1 USFWS-approved biologist 1 **TOTAL**	1. Use safety devices, as required. 2. Visually inspect work areas for signs of protected species and burrows. 3. Ensure that burrows are not occupied then collapse or fill in burrow. 4. Tortoises shall be relocated to suitable habitat in accordance with Biological Opinion 1-5-93-F-67R and all applicable laws. 5. A brief report documenting the activities of the biologist will be prepared and submitted to RFCD with photo documentation.
EQUIPMENT	
• 1 Pickup • 1 fiber-optic scope	
MATERIAL	AVERAGE DAILY PRODUCTION
	1 work area/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
10	**CLEAN & RESHAPE CHANNELS/LEVEES**	**09/09/10**

DESCRIPTION & PURPOSE

Sediment and debris removal, and reshaping of unlined channels to restore adequate capacity. Reshaping of levee crests to eliminate depressions and rutting to eliminate potential to pond water and associated seepage damage. Reconstruction of areas where cracking of the embankment is evident and/or slope stability has been compromised.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Improved earth channels and levees should be scheduled for cleaning and re-profiling on an annual schedule, or as appropriate following a flood event. Natural channels on a 3-year cycle.

CREW SIZE	WORK METHOD
• 2 Equipment Operators • 1 Truck Driver • .5 Foreman 3.5 **TOTAL**	1. Set up safety devices as required. 2. Remove sediment and vegetation. 3. Load and haul removed material to proper disposal site. 4. Reshape channel/levee. 5. All fill should be compacted to a minimum of 95% of maximum dry density per ASTM D1557. Perform compaction tests following frequency guidelines in uniform Standard Specifications. 6. Clean up work site as necessary. 7. Remove safety devices.
EQUIPMENT	
• 1* 10 Wheel Dump Truck • 1 Scraper • 1 Gradall	
MATERIAL	AVERAGE DAILY PRODUCTION
• Disposal Fees	300 Cubic Yards/day

NOTES:

*Schedule sufficient trucks to insure maximum utilization of excavation equipment.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
15	**REPAIR LINED CHANNEL**	**09/09/10**

DESCRIPTION & PURPOSE

Repair of damaged concrete, rip rap, gabion, or other channel linings, retaining walls, etc., to restore to original condition and prevent further deterioration.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Repairs of channel linings, retaining walls, and other structures critical to the protection of a facility are to be scheduled immediately upon detection of damage.

CREW SIZE	WORK METHOD
• 1 Maintenance Foreman • 2 Maintenance Workers 3 **TOTAL**	1. Obtain safety equipment, materials, and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Clean and prepare damaged area. 4. Build and place forms as necessary. 5. Place and finish concrete. 6. Remove forms and back fill. 7. Clean up work site as necessary.
EQUIPMENT	
• Pickup • Flatbed Dump • Concrete Mixer	
MATERIAL	AVERAGE DAILY PRODUCTION
• Assorted lumber • 6-30 bags sacked concrete • 3-15 tons concrete gravel mix • 2-10 CY ready-mix concrete	1 Each/Day

NOTES:

Crew size and equipment may vary significantly depending on urgency, extent and complexity of repair.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
20	**EROSION CONTROL AND REPAIR**	**09/09/10**

DESCRIPTION & PURPOSE

Placement of rip rap, sand bags, or other erosion control materials and repair of damaged areas of erosion protection. The replacement and compaction of material removed by erosion, using hand tools or other methods, to restore flood control channels, supporting embankments, levees or access roads. This work is done to prevent further deterioration and eliminate potential erosion problems.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Work is to be scheduled when damage or deterioration is severe enough to present potential erosion problems and when damage has occurred which has affected or will affect the structural integrity of a channel embankment, levee, or access road. Erosion undercutting roadways, sidewalks, or prepared embankments/improvements shall be repaired immediately. Repair of undermined stabilizers shall be scheduled immediately.

CREW SIZE

- 2 Foreman
- 2 Equipment Operators
- 4 Maintenance Workers

8 **TOTAL**

EQUIPMENT

- 1 Truck Crane or Backhoe
- 1 Air Compressor w/compactor
- 1 1-Ton Dump Truck or Flatbed Truck
- 1 Pickup w/Water Tank or Auxiliary Spray Truck

WORK METHOD

1. Obtain safety equipment, materials and tools necessary for the day's work.
2. Begin applicable safety procedures and/or traffic control.
3. Shape work area to receive riprap, or other erosion control materials. Shape repair area to conform to adjacent areas.
4. Place material and grout where applicable. Place and compact fill material in lifts to a minimum of 95% of maximum dry density per ASTM D1557. Perform compaction tests following frequency guidelines in Uniform Standard Specifications.
5. Haul fill material from pre-determined source.
6. Remove debris and growth from damage location.
7. Back fill as necessary.
8. Clean up work site as necessary.

MATERIAL

- 20-50 Tons Rock for riprap (delivered)
- 5-12 yards ready mix concrete (if needed)
- 5,000-15,000 gal Water
- 15-30 Tons Select Fill Material

AVERAGE DAILY PRODUCTION

1,300 Square Feet/day
15 Cubic Yards

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
21	**PROVIDE / MAINTAIN DUST CONTROL**	**09/09/10**

DESCRIPTION & PURPOSE

Uniform application and maintenance of surface gravel, dust palliatives, or other alternative dust control measures to limit the emission of particulate matter into the ambient air.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Work is to be scheduled when loose sand, dust, or dust particles are found to exist in excess of acceptable limits. Select and apply approved dust control measure in a manner that will minimize the degradation of water quality.

CREW SIZE

- 1 Foreman – Part-time
- 1 Driver
- 1 Nozzle operator
- 1 – 2 laborers to protect surrounding area from overspray

4 – 5 **TOTAL**

EQUIPMENT

- 1 Spray Truck
- 1 Flatbed truck for delivery of bulk materials
- 1 Forklift to load bulk materials into tank on spray truck
- 1 Motor grader
- 1 Compactor

WORK METHOD

1. Obtain safety equipment, materials and tools necessary for the day's work.
2. Begin applicable safety procedures and/or traffic control.
3. Prepare surface area to receive palliative or other dust control measures with motor grader and compactor if required.
4. Palliative with pre-emergent herbicide requires preparation of soil surface.
5. Apply dust palliative to prepared surface.
6. Clean up work site as necessary.

MATERIAL

- Gravel
- Dust palliative (i.e. gypsum, fiber mulch)
- Water source
- Other alternative dust control measure

AVERAGE DAILY PRODUCTION

6 acres/day – open areas (i.e. detention basin)
3 acres/day – strip areas with fence (i.e. channel)

NOTES:

Control measures shall be implemented to limit the disturbance of open areas.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
25	**CLEAN DETENTION/DEBRIS BASINS**	**09/09/10**

DESCRIPTION & PURPOSE

Inspection and removal, by loader (including hauling and disposal), of sediment and debris deposited in detention and debris basins to restore full capacity and original shape.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Remove sediment when debris basins or dams detention capacity is reduced. Clean out is normally justified when the sedimentation reaches 1 to 2 feet in depth or as established by the design.

CREW SIZE	WORK METHOD
• 1 Foreman • 3 Equipment Operators • 1 Maintenance Worker 5 **TOTAL**	1. Obtain safety equipment, materials and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Prepare removal and disposal sites for access. 4. Stockpile material for removal. 5. Load material and haul to proper disposal site. 6. Shape dam or basin to desired line and grade. 7. Grade disposal site as necessary. 8. Clean up work site as necessary.
EQUIPMENT	
• 1 Pickup • 1 Loader • 2* Dump Trucks	
MATERIAL	AVERAGE DAILY PRODUCTION
• Disposal Fees	1,000 Cubic Yards/day

NOTES:

*Schedule sufficient trucks to insure maximum utilization of excavation equipment.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
35	**FENCE REPAIR**	**09/09/10**

DESCRIPTION & PURPOSE

The repair and/or re-establishment of downed or damaged fences to restore fence to proper condition and to provide right-of-way control.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Repair of downed or open fence areas to be performed upon detection. Repairs to damaged locations that remain partially functional are to be scheduled in priority with other work.

CREW SIZE	WORK METHOD
• 2 Maintenance Workers 2 **TOTAL**	1. Obtain safety equipment, materials and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Perform necessary repairs to: • Posts • Fabric • Top rail 4. Clean up work site as necessary.
EQUIPMENT	
• 1 Fence Truck • 1 Concrete Mixer (if needed)	
MATERIAL	AVERAGE DAILY PRODUCTION
• 40-50 Linear Ft Fence Fabric • Miscellaneous Hardware • 5 bags "Ready Crete"	100 Linear Feet/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
40	**VEGETATION CONTROL – CHEMICAL**	**09/09/10**

DESCRIPTION & PURPOSE

The application of herbicides, to designated areas, with a boom-mounted spray bar to prevent new growth and/or control existing vegetation, for the purpose of insuring the capacity and integrity of flood control facilities.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Spray pre-emergent herbicide and post-emergent herbicide annually to designated areas combining applications where possible. Select and apply herbicides in a manner to minimize the degradation of water quality.

CREW SIZE	WORK METHOD
• 2 Maintenance Workers 2 **TOTAL**	1. Set up safety devices as required. 2. Treat channel areas as required. 3. Remove safety devices. 4. Clean up work site as necessary.
EQUIPMENT	
• 1 Truck-mounted chemical tank with spray bar and hand sprayer.	
MATERIAL	**AVERAGE DAILY PRODUCTION**
• Pre 12.5-25 lb/Ac • Emerge Contact: 12.5-25 lb/Ac • Post Brush: 120 lb/Ac • Emerge Grass: 30 lb/Ac • Waterweed: 1 gal/Ac • Spreader: 1 gal/Ac • Water 200 gal/Ac	Acres

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
45	**VEGETATION CONTROL – MECHANICAL**	**09/09/10**

DESCRIPTION & PURPOSE

The mechanical removal of undesirable vegetation such as trees, brush and weeds to maintain detention, debris basins, levees and channels for the purpose of insuring the capacity and integrity of flood control facilities.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Work to be scheduled when vegetation growth is too high for effective spraying. All trees, located in riprapped areas, drainage channels and on or within 15 feet of the toe of a levee must be cut down, the root ball removed, the voids filled and compacted to original construction specifications unless specifically accounted for in the design. Tree growth in natural conveyance areas may be acceptable. Removal of vegetation in natural areas should be considered on a case by case basis in accordance with the purpose stated above and the character of the natural area.

CREW SIZE	WORK METHOD
• 1 Equipment Operator 1 **TOTAL**	1. Obtain safety equipment, materials, and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Mow, blade down, or turn under unwanted vegetation. 4. Clean up work site as necessary.
EQUIPMENT	
• 1 Mower or Grader • 1 Tilt Trailer (if needed) • 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
	4 Acres/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
50	**MAINTAIN ACCESS ROADS**	**09/09/10**

DESCRIPTION & PURPOSE

Mechanical grading of access roads to remove minor ruts and erosion, and restore normal shape and cross slope, for access to flood control facilities.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

As needed prior to rainy season, or when the weather affects the road condition.

CREW SIZE	WORK METHOD
• 2 Equipment Operators • 1 Maintenance Workers 3 **TOTAL**	1. Obtain equipment and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Grade access roads: • Restoring X-section shape • Filling potholes • Grading out ruts • Restoring ditches and drainage. 4. Roll and compact regraded. 5. Clean up work site as necessary.
EQUIPMENT	
• 1 Grader • 0-1 Water Truck • 0-1 Roller • 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
• 10,000 Gal Water (if needed)	.5 Mile/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
55	**CLEAN & INSPECT INLET/OUTLET STRUCTURES**	**09/09/10**

DESCRIPTION & PURPOSE

Cleaning and inspection of catch basins, inlets, sumps, grates, outflow and other structures to remove sediment and debris and to inspect for structural integrity and proper functioning.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan for structures to be inspected and cleaned a minimum of once per year. Annual cleaning shall be the major effort to allow thorough inspection of structure in order to schedule repairs.

CREW SIZE	WORK METHOD
• .25 Foreman • 2 Maintenance Workers 2.25 **TOTAL**	1. Perform daily vehicle P.M. check and check equipment. 2. Place signs/traffic control devices as required. 3. Locate truck in the best working position and as far off roadway as practical. 4. Remove grate. Then remove debris, trash & sediment from grate. 5. Loosen solids with spade if necessary. 6. Flush/vacuum basin. 7. Inspect structure visually to determine if further cleaning or repair is necessary. 8. Dispose of debris at proper disposal site. 9. Check and clean equipment after use. 10. Clean up work site as necessary.
EQUIPMENT	
• 1 1-Ton Truck • 1 Water Tanker (1500 gal) • -or- High Pressure Vacuum (Vactor) • Appropriate Hand Tools	
MATERIAL	AVERAGE DAILY PRODUCTION
• Water	15 Each/day

NOTES:

Structures that cannot be cleaned shall be reported to the Maintenance Supervisor for initiation of corrective action.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
60	**REPAIR INLET / OUTLET STRUCTURES**	**09/09/10**

DESCRIPTION & PURPOSE

Repair of catch basins, grates, inlets, control gates, outfalls, weirs, manholes, sumps, and other spot structures to restore elements to their original operational condition.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Based on detailed inspection of repair, replace components, or entire structure as conditions warrant. Plan repair of five percent (5%) of system structures per year.

CREW SIZE	WORK METHOD
• 1 Foreman • 2 Maintenance Workers 3 **TOTAL**	1. Obtain necessary safety equipment, tools, and materials. 2. Initiate applicable safety procedures and traffic control. 3. Remove and clean area of damage/failure. 4. Repair as necessary to original condition and test operation as appropriate. 5. Clean up work site as necessary.
EQUIPMENT	
• 1 Pickup • 1 Compressor w/accessories	
MATERIAL	AVERAGE DAILY PRODUCTION
• Concrete • Aggregates • Miscellaneous parts, as required	1 Each/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
65	**CLEAN STORM SEWER LINES**	**09/09/10**

DESCRIPTION & PURPOSE

The removal of debris of any type from within conduits by: flushing with water; the use of a sewer cleaning machine; or by physically entering the conduit and manually removing debris, to restore full capacity.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan cleaning of storm sewer lines on an average 5-year cycle. Specific areas may require annual cleaning while others will require less than 5-year cleaning.

CREW SIZE	WORK METHOD
• 1 Maintenance Foreman • 2 Maintenance Workers 3 **TOTAL**	1. Obtain safety equipment and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Remove debris from conduit. 4. Load debris and haul to designated disposal site if necessary. 5. Clean up work area as necessary.
EQUIPMENT	
• 1 Sewer Cleaner	
MATERIAL	AVERAGE DAILY PRODUCTION
• 0-5,000 Gallons Water	1,500 linear feet/day

NOTES:

Work should be scheduled whenever possible, in conjunction with annual cleaning of adjacent structures.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
70	**STORM SEWER LINE REPAIR**	**09/09/10**

DESCRIPTION & PURPOSE

Excavation and repair of storm sewer lines to eliminate blockages and repair failed pipes.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Priority of repairs:
1. Eliminate blockages and hazards to public safety;
2. Remove flow restrictions and repair damaged/failed pipe sections.

CREW SIZE	WORK METHOD
• 1 Foreman • 1 Equipment Operator • 2 Maintenance Workers 4 **TOTAL**	1. Set up warning signs and traffic control devices. 2. Take necessary measures to control flow -- providing uninterrupted service whenever possible. 3. Cut pavement and/or excavate to the extent required to determine necessary scope of repairs. 4. Remove flow restrictions, as necessary. 5. Back fill and compact in lifts to within 10 inches of surface. 6. Place select material (rock or shell) and compact to within 2 inches of surface* (See Note below.) 7. Coordinate density test and request repaving as required. 8. Remove signs and warning devices. 9. Clean up work site as necessary. 10. Record work accomplishment.
EQUIPMENT	
• 1 Dump Truck • 1 Backhoe/Util Tractor • Air Compressor w/accessories • Appropriate Hand Tools	
MATERIAL	AVERAGE DAILY PRODUCTION
• Pipe/fittings • Sand • Cement • Rock • Asphalt, as required	1 Repair/day

NOTES:

Verify location of other utilities prior to excavation. *Back fill specifications apply to paved areas. In easements and other unpaved areas, back fill and compact in 2-foot lifts to grade; re-sod as necessary. Install safety fence and secure job site at end of workday as required.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
75	**CLEAN / FLUSH CULVERTS & BRIDGES**	**09/09/10**

DESCRIPTION & PURPOSE

Cleaning/flushing of culverts and bridges to remove sediment and debris, and eliminate restriction to flow.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan for all culverts to be cleaned/flushed annually.

CREW SIZE

- 1 Maintenance Supervisor
- 1 Maintenance Worker

2 **TOTAL**

EQUIPMENT

- 1 1-Ton Dump Truck
- 1 Water Tanker (1500 gal)
- -or- High Pressure/Vacuum cleaner/Vactor
- Safety Equipment
- Appropriate Hand Tools

WORK METHOD

1. Place signs and safety devices.
2. Locate truck in best working position and as far off roadway as possible.
3. Clean out ends of culvert.
4. Flush culverts until flow is unrestricted.
5. Load excess material/debris into truck for disposal at proper disposal site.
6. Pick up signs and safety devices.
7. Clean up work site as necessary.

MATERIAL

- Water

AVERAGE DAILY PRODUCTION

5-7 Each/Day

NOTES:

1. Inform Maintenance Supervisor of any non-cleanable culverts or those that can only be partially cleaned.
2. Avoid damaging downstream property when flushing culverts.
3. Work should be scheduled, whenever possible, in conjunction with annual cleaning of adjacent structures.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
80	**MISCELLANEOUS WORK ACTIVITIES**	**09/09/10**

DESCRIPTION & PURPOSE

All work performed that is not described in previous activities. This includes, among others, activities such as catwalk repair, rodent control, pump maintenance, concrete spalled area repair, painting, trash pickup*, graffiti abatement, sign installation and maintenance.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan 8 labor hours per channel mile per year for miscellaneous maintenance work.

CREW SIZE	WORK METHOD
• 1 Maintenance Worker 1 **TOTAL**	1. Obtain safety equipment, materials, and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Clean up work site as necessary.
EQUIPMENT	
• 1 Pickup • Hand tools	
MATERIAL	**AVERAGE DAILY PRODUCTION**
• As required	8 Labor Hours

NOTES:

*Includes appliances, tires, car bodies, and other large objects dumped in channels/basins.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
85	**ENGINEERING**	09/09/10

DESCRIPTION & PURPOSE

All work that is by nature engineering. This includes, among others, surveying, preparation of plans and specifications, as well as preparing and updating Emergency Action Plans.

AUTHORIZED BY	LIMITS ON WORK
Director of Public Works or designee	

PERFORMANCE CRITERIA

CREW SIZE	WORK METHOD
• N/A	1. As deemed most cost effective.
EQUIPMENT	
• N/A	
MATERIAL	**AVERAGE DAILY PRODUCTION**
• N/A	8 Hours/Day

NOTES:

4.35 Reporting

Comprehensive maintenance programs include procedures for reporting and summarizing work accomplished and labor-hours used for maintenance activities. This information enables managers and supervisors to compare actual performance with the planned work program. These planned-actual comparisons -- on a regular basis -- are essential for effective management and control of the work program.

The reporting procedures provide specific information:

- What Master Plan facility required work.
- What work was done by activity.
- How much of each activity was done.
- The labor-hours used to accomplish the work.

This information is used by managers in their effort to:

- Make sure the right kinds and amounts of maintenance work are done.
- Identify the problem areas and related corrective actions.
- Develop future work programs and budgets.
- Identify opportunities for improved productivity.

The work reporting process can consist of a simple form as outlined in the following section.

Daily Work Activity Report

The Daily Work Activity Report may be used to record and summarize: (1) the kinds and amounts of work performed by maintenance personnel, and (2) the number of labor-hours used to do that work. The report can be used to summarize all work activities. Each member entity may use its standard accounting/reporting procedures for the Daily Work Activity Report.

The Maintenance Supervisor or crew leader usually prepares the Daily Work Activity Report. The following are instructions for the completion of the sample report. (See Daily Work Activity Report Form.)

1. Identification Data – Fill in all blanks: the member entity, date, name of person preparing the report, and the names and employee numbers of all persons to perform work to be reported for the day. (The form provides for several combinations of activities and employees. If additional pages are needed, number the pages accordingly).

2. Master Plan Facility ID/Name – Enter the specific 4 letter-4 digit Master Plan Facility number and reach, which indicates the "from" and "to", if applicable. This number directly corresponds to the specific Master Plan location as identified on current Master Plan maps. Also, indicate the Facility Name.

3. MWP Facility Number – Enter the identifying Maintenance Work Plan facility number. (This number directly corresponds to the budget approved for the facility and will typically include a range of Master Plan facilities and reach.)

4. Activity Number – Enter the number of each activity performed. Use the Work Activity Directory or Performance Standards to complete the blank.

5. Employee Number – Enter the employee number of the person working a specific activity at the specific facility.

6. Hours Worked by Each Employee – Record the number of hours worked by each employee, by the appropriate activity. Record the time spent to the nearest quarter-hour. For example, record 1 hour and 45 minutes as 1.75 hours and 3 hours and 20 minutes as 3.25 hours.

7. Equipment Number – Enter the assigned equipment number for any mechanical equipment on which work was performed for preventive and corrective maintenance only.

8. Work Performed – Enter the location and a brief description of the work performed.

9. Accomplishment – Measure and record the amount of work done for each activity. Use the correct measurement unit for each activity. (See the Activity List in Section 4.32.) Record the amount of work done to the nearest whole unit. Record labor-hours to the nearest hour. For activities with labor-hours as the unit of measure, the "quantity" will be exactly the same as "total hours" for the activity.

10. Notes/Comments – Record any additional relevant information that may be of use in summarizing and analyzing work activity data.

The completed reports can be used for monthly summarization and report preparation, and serve as completion certification backup for the monthly force account payment billings.

REGIONAL FLOOD CONTROL DISTRICT
DAILY WORK ACTIVITY REPORT

ENTITY: _____

Employee Name:_____No._____

Date Work Performed:_____ 20____

Employee Name:_____No._____

Supervisor Name:_____

Employee Name:_____No._____

Employee Name:_____No._____

							Accomplishment	
MWP Facility Number	Master Plan Facility ID/Facility Name	Activity Number Worked	Employee Number	Hours Worked by Activity	Equip. Number Used	Work Performance (Location, Brief Description, Materials Used, Etc.)	Amount	Unit of Measure

NOTES/COMMENTS:_____
_____

The undersigned hereby certifies that the above described maintenance was performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further, the information contained herein accurately reflects the tiime and accomplishments reported during the performance of this work.

_____ _____ _____

Superivsor's Signature Date Title

Page ____ of ____

4.40 INVENTORY PROCEDURES

4.41 Purpose

The purpose of this element of the **Operations and Maintenance Manual** is to provide a record of the existing physical flood control system that is eligible for maintenance funding assistance by the District. The physical facilities that make up the collection and conveyance system have in many instances been paid for in whole or in part by the District, however, they are not owned, operated, or maintained by the District. If, however, the total flood control system does not function properly when needed, it is ultimately the responsibility of the District to determine why and to take corrective action. A critical key in assuring the system functions properly is an up-to-date inventory of the physical system.

4.42 Physical System

The member entities shall submit annual updates of the physical system inventory on the forms required by the District (See Appendix B, Exhibit A – Maintenance Work Plan Summary and Maintenance Work Program Annual Budget Form.)

4.43 Physical System Maps

The individual member entities shall submit to the District a physical system map(s) as part of the Annual Work Plan as discussed in Section 4.22, or more frequently as project completion dictates, reflecting the size, location and material elements of their drainage and flood control system. The map(s) shall reflect that portion that is on the Master Plan and also those systems that are eligible for Regional Flood Control District funding under the categories shown in Section 4.11 of this manual. Physical system maps shall be provided to the District in a form that is readily reproducible.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 5
EMERGENCY FUNDING PROCEDURES

5.10 EMERGENCY FUNDING PROCEDURES

5.11 Purpose

This element of the **Operations and Maintenance Manual** provides the member entities with procedures to perform emergency restoration and rehabilitation immediately following a flood event. A principal role of the District shall be to support the member entities efforts to: (1) secure funding from state, federal, member entity reserves and private sources; and (2) facilitate required immediate repairs to regional flood control facilities without delay.

Projects eligible for District emergency restoration and rehabilitation funding are those included in the member entity's approved or amended Maintenance Work Program.

5.12 Procedures

If the governing body elects to declare an emergency, then the District, in accordance with NRS 332.112 (Emergency Contracts) will authorize and process emergency purchase orders to the maximum limit of unexpended funds upon written request by the member entity.

APPENDIX A

KEY STATUTORY, REGULATORY AND POLICY REFERENCES

NEVADA REVISED STATUTES

1. CHAPTER 332 – PURCHASING: LOCAL GOVERNMENTS
2. CHAPTER 338 – PUBLIC WORKS
3. CHAPTER 543 – CONTROL OF FLOODS

UNIFORM REGULATIONS FOR THE CONTROL OF DRAINAGE

1. SECTION 12 – DESIGN/IMPROVEMENT STANDARDS
   a. 12.050 – Construction/Operation/Maintenance

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

1. SECTION 300 – DRAINAGE POLICY
   a. 303.10 – Drainage Facilities Maintenance
   b. 304.8 – Multiple Use Facilities

REGIONAL FLOOD CONTROL DISTRICT POLICIES AND PROCEDURES MANUAL

1. CHAPTER XI – FACILITY MAINTENANCE

REGIONAL FLOOD CONTROL DISTRICT BIOLOGICAL OPINION

1. Biological Opinion 1-5-93-F-67R

APPENDIX B

INTERLOCAL CONTRACT
ANNUAL MAINTENANCE WORK PROGRAM

THIS CONTRACT, made and entered into this ___ day of _____, 20____, by and between the [legal name of CITY or COUNTY], a political subdivision of the State of Nevada, hereinafter referred to as "CITY" (or "COUNTY"), and the CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT, hereinafter referred to as "DISTRICT".

W I T N E S S E T H:

WHEREAS, pursuant to Chapter 543 of the Nevada Revised Statutes, the DISTRICT may approve and fund projects to maintain flood control improvements; and

WHEREAS, pursuant to NRS 277.180 any one or more public agencies may contract with one or more other public agencies to perform any governmental service, activity or undertaking which any of the public agencies is authorized by law to perform; and

WHEREAS, the CITY (or COUNTY) desires to maintain flood control improvements within the CITY (or COUNTY) in accordance with the maintenance program set forth herein, and hereinafter referred to as "Project"; and

WHEREAS, the facilities upon which maintenance will be performed are facilities described in the DISTRICT'S Master Plan.

NOW, THEREFORE, in consideration of the covenants, conditions, agreements, and promises of the parties hereto, the DISTRICT authorizes the Project as it is mutually understood and agreed as follows:

SECTION I - SCOPE OF PROJECT

This Interlocal Contract applies to the maintenance of flood control facilities, which are identified in the DISTRICT'S Master Plan facilities including updates and amendments subsequently approved. The basic maintenance of the facilities will be in accordance with performance standards set forth in the current DISTRICT *Operations and Maintenance Manual*.

The Project is more specifically described in Exhibit "A" which is attached hereto and by this reference incorporated herein.

SECTION II - PROJECT COSTS

The DISTRICT agrees to make payment for Project costs within the limits specified below:

1. The Project costs shall not exceed $_____.

The amounts allocated to each individual facility within the Project must be specified in Exhibit "A". Any changes to said allocated amounts must be approved by the DISTRICT'S Chief Engineer in accordance with Section 4.24 of the DISTRICT *Operations and Maintenance Manual.*

A written request must be made to the DISTRICT and a Supplemental Interlocal Contract approved to increase the amount noted above prior to payment of any additional funds.

2. The CITY (or COUNTY) and DISTRICT will comply with Section 4.12 of the *Operations and Maintenance Manual.* In accordance with said manual the CITY (or COUNTY) shall submit invoices together with a detailed summary report of the maintenance service performed. The CITY (or COUNTY) shall submit an invoice voucher in the manner prescribed by the DISTRICT. The vouchers shall include such information as is necessary for the DISTRICT to determine the nature of all expenditures. Each voucher will clearly indicate that it is for services rendered in performance under this contract. Each voucher will also be accompanied by a written certification from the CITY (or COUNTY) stating that it is for performance of maintenance activities under this contract and is composed of completed elements set forth in the annual work program.

All invoices must be submitted for payment to:

Clark County Regional Flood Control District
Accounts Payable
600 S. Grand Central Parkway, Suite 300
Las Vegas, Nevada 89106-4511

Payment shall be considered timely if made by the DISTRICT within 30 days of receipt of the invoice. Pursuant to Section IV, Paragraph 8, the DISTRICT may, in its sole discretion, withhold payments to the CITY (or COUNTY) for services rendered if the CITY (or COUNTY)

fails to satisfactorily comply with any term or condition of this contract and/or the DISTRICT *Operations and Maintenance Manual.*

SECTION III - PROJECT TIME

The CITY (or COUNTY) agrees to perform the Project to the satisfaction of the DISTRICT between July 1, 20_____ and June 30, 20_____. The DISTRICT may grant extensions or terminate this contract and require all sums advanced to the CITY (or COUNTY) to be repaid if the CITY (or COUNTY) fails to perform by said date.

SECTION IV - GENERAL

1. The CITY (or COUNTY) will complete the Project as set forth in Exhibit "A". The CITY (or COUNTY) staff personnel responsible for coordination of work under this contract are as listed below:

(list names and titles of CITY or COUNTY staff)

It is understood that staff named above will be responsible for work coordination throughout the period of this contract unless the DISTRICT is informed in writing of changes in these personnel assignments.

2. The CITY (or COUNTY) will comply with the applicable provisions of the Local Government Purchasing Act, Chapter 332 and Public Works, Chapter 338, of the Nevada Revised Statutes.

3. Applicable portions of the current editions of the *Operations and Maintenance Manual*, *Policies and Procedures Manual*, *Hydrologic Criteria and Drainage Design Manual*, and *Uniform Regulations for the Control of Drainage* adopted by the DISTRICT will apply unless specifically superseded by this CONTRACT.

4. It is the intent of the DISTRICT that scheduling of maintenance and repair of drainage and flood control facilities in general and Master Plan Facilities specifically be coordinated among member entities. Therefore, in those cases where Master Plan approved, and DISTRICT-funded projects have regional flood control significance impacting more than one

member entity, the CITY (or COUNTY) will allow all impacted member entities an opportunity to review the maintenance schedule in order to coordinate maintenance efforts.

5. The Chief Engineer or designee of the DISTRICT shall be responsible for monitoring the performance of the CITY (or COUNTY), approval for payment of billings and expenses submitted by the CITY (or COUNTY) and the acceptance of any report provided by the CITY (or COUNTY). The CITY (or COUNTY) shall be responsible for monitoring performance of CITY (or COUNTY) staff or private contractors.

6. Accurate documentation of all work performed and payments made shall be maintained by the CITY (or COUNTY) for a period of three (3) years in hard copy form after final project approval and payments. Following the three year period, the CITY (or COUNTY) shall keep records for permanent storage in original form, in microfilm/fiche media, or an electronic format in accordance with the CITY (or COUNTY) Record Retention Schedule.

7. The CITY (or COUNTY) shall provide right of access to its facilities to the DISTRICT or Chief Engineer at all reasonable times, in order to monitor and evaluate performance, compliance, and/or quality assurance under this contract.

8. In the event the CITY (or COUNTY) fails to perform the maintenance according to the standards specified in this contract and the DISTRICT *Operations and Maintenance Manual*, the DISTRICT may perform or cause to be performed the maintenance necessary to assure proper operation of the facility. Costs incurred by the DISTRICT shall be reimbursed by the CITY (or COUNTY) or be deducted from the amount authorized by this contract. The DISTRICT may not exercise this right without giving the CITY (or COUNTY) specific written notice of the maintenance required and allowing the CITY (or COUNTY) 60 days within which to perform said maintenance. The notice required by this provision must be sent to:

insert name of City or County staff)
(insert title)
(insert title)

9. The records of the CITY (or COUNTY) and/or private contractors pertaining to the subject matter of this contract shall at all reasonable times be subject to inspection and audit by the DISTRICT or an Agent of the DISTRICT.

10. If any provision of this contract shall be deemed in conflict with any statute or rule of law, such provision shall be deemed modified to be in conformance with said statute or rule of law.

11. The CITY (or COUNTY), its employees, and representative shall at all times comply with all applicable laws, ordinances, statutes, rules, and regulations in effect at the time work is performed.

12. The CITY (or COUNTY) hereby agrees to reimburse the DISTRICT if funds are received from other sources for maintenance and repair of drainage and flood control facilities paid for by the DISTRICT.

13. The DISTRICT will not be responsible for any fines and/or penalties caused by the actions or inactions of CITY (or COUNTY) employees, consultants, contractors, or agents.

14. Any costs found to be improperly allocated to the Project will be refunded by the CITY (or COUNTY) to the DISTRICT.

15. It is specifically understood and agreed to by and between the parties hereto that it is not intended by any of the provisions of any part of this contract to create in the public or any member thereof a third party beneficiary hereunder, or to authorize anyone not a party to this contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of this contract.

16. Up to the limits set forth in NRS Chapter 41, the CITY (or COUNTY) will indemnify and defend the DISTRICT against and from any and all claims and demands of whatsoever nature which arises out of allegations of negligence or misconduct of CITY (or COUNTY) officers, employees or agents, related to or under this Contract which results from injury to or death of any persons whomsoever, or against and from damage to or loss or destruction of property.

17. This agreement shall be construed and interpreted in accordance with the laws of the State of Nevada.

/

/

/

IN WITNESS WHEREOF, the parties have caused this contract to be executed the day and year first above written.

Date of District Action: REGIONAL FLOOD CONTROL DISTRICT

_____ BY:_____
(Insert Chairman's Name), Chairman

ATTEST:

_____
(Insert Board Secretary's Name)
Secretary to the Board

Approved as to Form:

BY:_____
(Insert Chief Deputy District Attorney's Name)
Chief Deputy District Attorney

****

Date of Council Action: (CITY or COUNTY) OF _____
(or Commission Action)

BY:_____
ATTEST: (Insert Mayor/Board Chairman's Name), Title

_____
(Insert Name), (City or County Clerk)

EXHIBIT A

PART I

Maintenance Work Plan Summary – Summary of overall work plan listing specific projects (physical system inventory) and associated costs attributable to each. (See Maintenance Work Plan Summary.)

PART II

Facility map(s) which identify location of projects (physical system inventory) and planned maintenance work by project.

PART III

Maintenance Work Program Annual Budget – Individual maintenance projects (physical system inventory) broken into maintenance activities to be completed, including narrative and associated budgeted costs for all projects identified in Part I. (See Maintenance Work Program Annual Budget.)

(MEMBER ENTITY)
MAINTENANCE WORK PLAN SUMMARY
FISCAL YEAR 20XX-XX

Master Plan Facility ID	MWP Facility Number	Facility Description	Cost
		TOTAL	$ 0.00

Maintenance Work Program Annual Budget

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET - FY 20XX-XX

MWP Facility #: _____ Entity: _____

Facility Name: _____ Date Prepared: _____

MP Facility ID: _____

Force Account/ Contract	Activity	Requested Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	03 Facility Assessment and Inventory				
	05 Inspect Channels				
	06 Inspect Levees/Detention and Debris Basins				
	08 Species Survey and Removal				
	10 Clean and Reshape Channels/Levees				
	15 Repair Lined Channel				
	20 Erosion Control and Repair				
	21 Provide/Maintain Dust Control				
	25 Clean Detention Debris Basins				
	35 Fence Repair				
	40 Vegetation Control - Chemical				
	45 Vegetation Control - Mechanical				
	50 Maintain Access Road				
	55 Clean & Inspect Inlet/Outlet Structures				
	60 Repair Inlet/Outlet Structures				
	65 Clean Storm Sewer Lines				
	70 Storm Sewer Repair				
	75 Clean/Flush Culverts & Bridges				
	80 Miscellaneous Work Activities				
	85 Engineering				
	TOTALS	$0.00	$0.00	0%	
Delays or problem areas:					
Work completed during prior fiscal year:					
Work to be completed during current fiscal year:					

Consultant/
Contractor: _____

Project
Manager: _____ Phone Number: _____

APPENDIX X

CCRFCD and COH Maintenance Work Program

INTERLOCAL CONTRACT

ANNUAL FLOOD CONTROL FACILITIES

MAINTENANCE WORK PROGRAM

THIS CONTRACT, made and entered into this 10th day of June, 2010, by and between the CITY OF HENDERSON, a political subdivision of the State of Nevada, hereinafter referred to as "CITY", and the CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT, hereinafter referred to as "DISTRICT".

W I T N E S S E T H:

WHEREAS, pursuant to Chapter 543 of the Nevada Revised Statutes, the DISTRICT may approve and fund projects to maintain flood control improvements; and

WHEREAS, pursuant to NRS 277.180 any one or more public agencies may contract with one or more other public agencies to perform any governmental service, activity or undertaking which any of the public agencies is authorized by law to perform; and

WHEREAS, the CITY desires to maintain flood control improvements within the CITY in accordance with the maintenance program set forth herein, and hereinafter referred to as "Project"; and

WHEREAS, the facilities upon which maintenance will be performed are facilities described in the DISTRICT'S Master Plan.

NOW, THEREFORE, in consideration of the covenants, conditions, agreements, and promises of the parties hereto, the DISTRICT authorizes the Project as it is mutually understood and agreed as follows:

SECTION I - SCOPE OF PROJECT

This Interlocal Contract applies to the maintenance of flood control facilities, which are identified in the DISTRICT'S Master Plan facilities including updates and amendments subsequently approved. The basic maintenance of the facilities will be in accordance with performance standards set forth in the current DISTRICT *Operations and Maintenance Manual.*

The Project is more specifically described in Exhibit "A" which is attached hereto and by this reference incorporated herein.

SECTION II - PROJECT COSTS

The DISTRICT agrees to make payment for Project costs within the limits specified below:

1. The Project costs shall not exceed $718,250.00.

The amounts allocated to each individual facility within the Project must be specified in Exhibit "A". Any changes to said allocated amounts must be approved by the DISTRICT'S Chief Engineer in accordance with Section 4.24 of the District *Operations and Maintenance Manual.*

A written request must be made to the DISTRICT and a Supplemental Interlocal Contract approved to increase the amount noted above prior to payment of any additional funds.

2. The CITY and DISTRICT will comply with Section 4.12 of the *Operations and Maintenance Manual.* In accordance with said manual the CITY shall submit invoices together with a detailed summary report of the maintenance service performed. The CITY shall submit an invoice voucher in the manner prescribed by the DISTRICT. The vouchers shall include such information as is necessary for the DISTRICT to determine the nature of all expenditures. Each voucher will clearly indicate that it is for services rendered in performance under this contract. Each voucher will also be accompanied by a written certification from the CITY stating that it is for performance of maintenance activities under this contract and is composed of completed elements set forth in the annual work program.

All invoices must be submitted for payment to:

Clark County Regional Flood Control District
Accounts Payable
600 South Grand Central Pkwy. Suite 300
Las Vegas, NV 89106-4511

Payment shall be considered timely if made by the DISTRICT within 30 days of receipt of the invoice. Pursuant to Section IV, Paragraph 8, the DISTRICT may, in its sole discretion, withhold payments to the CITY for services rendered if the CITY fails to satisfactorily comply with any term or condition of this contract and/or the DISTRICT *Operations and Maintenance Manual.*

SECTION III - PROJECT TIME

The CITY agrees to perform the Project to the satisfaction of the DISTRICT between July 1, 2010 and June 30, 2011. The DISTRICT may grant extensions or terminate this contract and require all sums advanced to the CITY to be repaid if the CITY fails to perform by said date.

SECTION IV - GENERAL

1. The CITY will complete the Project as set forth in Exhibit "A". The CITY staff personnel responsible for coordination of work under this contract are as listed below:

Robert Murnane, P.E., Director of Public Works
Albert J. Jankowiak, P.E., CFM, Project Engineer II-Public Works

It is understood that staff named above will be responsible for work coordination throughout the period of this contract unless the DISTRICT is informed in writing of changes in these personnel assignments.

2. The CITY will comply with the applicable provisions of the Local Government Purchasing Act, Chapter 332 and Public Works, Chapter 338, of the Nevada Revised Statutes.

3. Applicable portions of the current editions of the *Operations and Maintenance Manual, Policies and Procedures Manual, Hydrologic Criteria and Drainage Design Manual,* and *Uniform Regulations for the Control of Drainage* adopted by the DISTRICT will apply unless specifically superseded by this CONTRACT.

4. It is the intent of the DISTRICT that scheduling of maintenance and repair of drainage and flood control facilities in general and Master Plan Facilities specifically be coordinated among member entities. Therefore, in those cases where Master Plan approved, and DISTRICT-funded projects have regional flood control significance impacting more than one member entity, the CITY will allow all impacted member entities an opportunity to review the maintenance schedule in order to coordinate maintenance efforts.

5. The Chief Engineer or designee of the DISTRICT shall be responsible for monitoring the performance of the CITY, approval for payment of billings and expenses submitted by the CITY and the acceptance of any report provided by the CITY. The CITY shall be responsible for monitoring performance of CITY staff or private contractors.

6. Accurate documentation of all work performed and payments made shall be maintained by the CITY for the period of three (3) years in hard copy form after final project approval and payments. Following the three year period, the CITY shall keep records for permanent storage in original form, in microfilm/fiche media, or an electronic format in accordance with the City's Record Retention Schedule.

7. The CITY shall provide right of access to its facilities to the DISTRICT or Chief Engineer at all reasonable times, in order to monitor and evaluate performance, compliance, and/or quality assurance under this contract.

8. In the event the CITY fails to perform the maintenance according to the standards specified in this contract and the DISTRICT *Operations and Maintenance Manual*, the DISTRICT may perform or cause to be performed the maintenance necessary to assure proper operation of the facility. Costs incurred by the DISTRICT shall be reimbursed by the CITY or be deducted from the amount authorized by this contract. The DISTRICT may not exercise this right without giving the CITY specific written notice of the maintenance required and allowing the CITY 60 days within which to perform said maintenance. The notice required by this provision must be sent to:

Robert Murnane, P.E.
Director of Public Works
240 Water Street
P.O. Box 95050
Henderson, NV 89009-5050

9. The records of the CITY and/or private contractors pertaining to the subject matter of this contract shall at all reasonable times be subject to inspection and audit by the DISTRICT or an Agent of the DISTRICT.

10. If any provision of this contract shall be deemed in conflict with any statute or rule of law, such provision shall be deemed modified to be in conformance with said statute or rule of law.

11. The CITY, its employees, and representative shall at all times comply with all applicable laws, ordinances, statutes, rules, and regulations in effect at the time work is performed.

12. The CITY hereby agrees to reimburse the DISTRICT if funds are received from other sources for maintenance and repair of drainage and flood control facilities paid for by the DISTRICT.

13. The DISTRICT will not be responsible for any fines and/or penalties caused by the actions or inactions of CITY employees, consultants, contractors, or agents.

14. Any costs found to be improperly allocated to the Project will be refunded by the CITY to the DISTRICT.

15. It is specifically understood and agreed to by and between the parties hereto that it is not intended by any of the provisions of any part of this contract to create in the public or any member thereof a third party beneficiary hereunder, or to authorize anyone not a party to this contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of this contract.

16. Up to the limits set forth in NRS Chapter 41, the CITY will indemnify and defend the DISTRICT against and from any and all claims and demands of whatsoever nature which arises out of allegations of negligence or misconduct of CITY officers, employees or agents, related to or under this Contract which results from injury to or death of any persons whomsoever, or against and from damage to or loss or destruction of property.

17. This agreement shall be construed and interpreted in accordance with the law of the State of Nevada.

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IN WITNESS WHEREOF, the parties have caused this contract to be executed the day and year first above written.

Date of District Action:

June 1, 2010

REGIONAL FLOOD CONTROL DISTRICT

BY Lawrence L. Brown III
Lawrence L. Brown III, Chairman

ATTEST:

Carolyn Frazier, Secretary of the Board

Approved as to Form:

BY
Christopher Figgins, Chief Deputy District Attorney

****

Date of Council Action: COUNCIL ACTION
JUN - 1 2010

CITY OF HENDERSON

BY:
Andy A. Hafen, Mayor

ATTEST:

Sabrina Mercadante
Sabrina Mercadante,CMC
Acting City Clerk

Approved as to Form:

By:
Elizabeth Macias Quillin, City Attorney

CITY OF HENDERSON
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

Master Plan Facility ID	MWP Facility Number	Facility Description	Cost
C1CH 0000-0674	HEN 01	C-1 CHANNEL	$32,100
C1GW 0000-0081	HEN 02	GREENWAY CHANNEL	$8,100
PTVW 0010-0180	HEN 03	VAN WAGENEN CHANNEL	$1,100
PTGB 0058-0249	HEN 04	GIBSON CHANNEL	$30,100
PTDC 0013-0237	HEN 05	LOWER PITTMAN CHANNEL	$37,000
PTWA 0000-0047 & 0055-0476	HEN 06	UPPER PITTMAN WASH	$52,000
PTRW 0000-0131	HEN 07	UPRR CHANNEL	$29,500
PTSW 0000-0129	HEN 08	SANDWEDGE CHANNEL	$18,000
WWDC 0000-0098	HEN 09	WHITNEY RANCH CHANNEL	$17,000
DCWA 0646-0669	HEN 10	DUCK CREEK CHANNEL	$31,000
C1CH 0686-0854 & 0882	HEN 11	MISSION HILLS DETENTION BASIN	$4,100
PTRE 0000-0246	HEN 12	RAILROAD EAST CHANNEL	$25,000
PTMR 0000-0399	HEN 13	MACDONALD RANCH CHANNEL	$41,000
C1DC 0000-0101	HEN 14	DRAKE CHANNEL	$16,600
PTIS 0000-0258	HEN 15	I-515 CHANNEL	$2,100
PTEA 0000-0210, 0291, & 0500-0755	HEN 16	EASTERN CHANNEL	$3,100
C1CH 0871-0972	HEN 17	WESTERN INTERCEPTOR	$3,100
C1EQ 0152-0297, C1E1 0000-0002	HEN 18	EQUESTRIAN DETENTION BASIN	$190,850
PTPW 0000-0262	HEN 19	SUNRIDGE CHANNEL	$9,600
PTRR 0000-0135	HEN 20	PITTMAN WASH RAILROAD CHANNEL	$3,600
PTWA 0048 - 0050	HEN 21	PITTMAN PARK DETENTION BASIN	$5,000
PTBR 0020-0175	HEN 22	PITTMAN WASH BURNS	$6,600
PTPE 0000-0166	HEN 24	PITTMAN PECOS CHANNEL	$30,000
C1CH 1012-1138	HEN 25	BLACK MOUNTAIN DETENTION BASIN	$4,100
C1DC 0298-0303, C1HV 0000-0300	HEN 26	EAST C-1 DB & BERM, C1-HAVRE	$4,100
PTPW 0307-0309	HEN 27	McCULLOUGH HILLS DETENTION BASIN	$3,100
PTVW 0183 - 0187	HEN 28	PIONEER DETENTION BASIN	$7,100
PTEA 0437-0493	HEN 29	PITTMAN EAST DETENTION BASIN	$3,100
C1EQ 0000-0151	HEN 30	SAGUARO PARK/DOWNS CHANNEL	$600
		SUBTOTAL	**$618,650**

EXHIBIT "A"

Albert J. Jankowiak — **Project Manager**

04/01/10 — **Date**

CITY OF HENDERSON
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

Master Plan Facility ID	MWP Facility Number	Facility Description	Cost
C1US 0000-0078	HEN 31	C-1 CHANNEL - US 95	$1,100
C1BH 0000-0302	HEN 32	C-1 CHANNEL BOULDER HIGHWAY	$2,600
PTWA 0815-0983	HEN 33	UPPER PITTMAN WASH SOUTH	$1,100
PTST 0000-0170	HEN 34	PITTMAN STEPHANIE	$16,000
PTDW 0000-0069	HEN 35	PITTMAN DESERT WILLOW	$9,000
PTFD 0000-0111	HEN 36	PITTMAN FOOTHILLS DRIVE	$17,000
PTLM 0000-0078	HEN 37	PITTMAN LAKE MEAD	$20,000
PTVV 0000-0005	HEN 38	PITTMAN VALLE VERDE	$4,600
PTPD 0010-0063	HEN 40	PITTMAN PIONEER DETENTION	$1,100
PTWH 0000-0116	HEN 41	PITTMAN WEST HORIZON	$1,100
PTAP 0000-0191	HEN 42	PITTMAN/ANTHEM PARKWAY	$1,100
PTHR 0000-0067, 0139 - 0140	HEN 43	PITTMAN HORIZON RIDGE	$1,100
PTAN 0000-0280, PTCR 0000-0036, PTOG 0000-0016, PTAT 0000-0007	HEN 45	PITTMAN ANTHEM CHANNEL & DETENTION BASIN	$4,100
PTRD 0000-0055	HEN 46	PITTMAN REUNION DRIVE	$1,100
PTGV 0028-0073	HEN 47	PITTMAN GREEN VALLEY	$2,100
PTSH 0011 - 0084	HEN 48	PITTMAN SEVEN HILLS	$800
C1U1 0000-0062	HEN 49	C-1 CHANNEL US 95 TRIB 1	$1,100
C1FK 0000-0073	HEN 50	C-1 CHANNEL FOUR KIDS	$600
LLMW 0129, 0203	HEN 53	LAKE LAS VEGAS MAGIC WAY CHANNEL	$1,100
PTHD 0000-0020	HEN 54	PITTMAN HAMPTON ROAD	$600
PTAD 0000-0070	HEN 55	PITTMAN ANTHEM DRIVE	$1,100
PTSE 0000-0346, PTPN 0000-0039	HEN 56	PITTMAN WASH SOUTHEAST	$3,100
PTWS 0000 - 0063 and PTDY 0000	HEN 57	PITTMAN WASH WILDERNESS STUDY	$1,100
PTSN 0000-0063	HEN 58	PITTMAN SOUTHEDGE-NORTH	$600
PTSS 0000-0012	HEN 59	PITTMAN SOUTHEDGE-SOUTH	$600
PTSA 0000-0091	HEN 60	PITTMAN SOUTHEDGE-ANTHEM	$1,600
		SUBTOTAL	**$95,400**

EXHIBIT "A"

Albert J. Jankowiak — **Project Manager**

04/01/10 — **Date**

CITY OF HENDERSON
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

Master Plan Facility ID	MWP Facility Number	Facility Description	Cost
PTEA 0760-0773	HEN 61	PITTMAN EAST HEADWORKS DB	$3,100
C1RT 0001-0040	HEN 62	C1 CHANNEL-RACETRACK	$1,100

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 01 **Entity:** CITY OF HENDERSON

Facility Name: C-1 CHANNEL **Date Prepared:** APRIL 12, 2010

MP Facility ID: C1CH 0000-0674

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$16,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$10,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$6,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$32,100			Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed asset management inspections. Completed programmed maintenance. Closed out construction contract for Pueblo drop inlet project.

Work to be completed during current fiscal year:

Act 10 - Clean channel and dispose material at confluences and energy dissipators. Act 45 - Remove and dispose of vegetation along unlined banks of channel, at riprap lined sections, and at joints. General maintenance activities.

Consultant/ Contractor:

Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 02 **Entity:** CITY OF HENDERSON
Facility Name: GREENWAY CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: C1GW 0000-0081

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$3,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$5,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$8,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed asset management inspections. Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 10 - Clean channel and dispose of material. General maintenance activities.

Consultant/ Contractor:

Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 03 **Entity:** CITY OF HENDERSON
Facility Name: VAN WAGENEN CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTVW 0010-0180

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$500			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed asset management inspections. Completed programmed maintenance.

Work to be completed during current fiscal year:

Remove sediment, debris, and vegetation in open channel and dispose of material. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 04 **Entity:** CITY OF HENDERSON
Facility Name: GIBSON CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTGB 0058-0249

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$15,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$15,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$30,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 10 - Clean and Reshape channel in ID Miles 0210 - 0150. Act 45 - Remove and dispose of vegetation in ID mile 0210. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 05 **Entity:** CITY OF HENDERSON
Facility Name: LOWER PITTMAN CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTDC 0013-0237

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$23,000			
	10	Clean and Reshape Channels	$11,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$2,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$37,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. Act 10 - Clean channel and dispose of material. General maintenance.activities

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 06 **Entity:** CITY OF HENDERSON

Facility Name: UPPER PITTMAN WASH **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTWA 0000-0047 & 0055-0476

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$35,000			
	10	Clean and Reshape Channels	$11,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$6,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$52,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. Act 10 - Clean channel and dispose of material. Act 45 - Remove vegetation and dispose of material. General maintenance activities.

Consultant/ Contractor:

Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 07 **Entity:** CITY OF HENDERSON
Facility Name: UPRR CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTRW 0000-0131

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	**Inspect Channels**	$20,000			
	10	**Clean and Reshape Channels**	$5,000			
	15	**Repair Lined Channel**				
	20	**Provide/Maintain Erosion Control**				
	21	**Provide/Maintain Dust Control**				
	25	**Clean & Inspect Detention/Debris Basins**				
	30	**Erosion Repair**				
	35	**Fence Repair**	$2,500			
	40	**Vegetation Control - Chemical**	$1,000			
	45	**Vegetation Control - Mechanical**	$1,000			
	50	**Maintain Access Road**				
	55	**Clean & Inspect Inlet/Outlet Structures**				
	60	**Repair Inlet/Outlet Structures**				
	65	**Clean Storm Sewer Lines**				
	70	**Storm Sewer Repair**				
	75	**Clean/Flush Culverts & Bridges**				
	80	**Miscellaneous Work Activities**				
	85	**Engineering**				
		TOTALS	$29,500	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance. Closed out construction contract for UPRR Channel Ramp project.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. Act 10 - Clean channel and dispose of material. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 08 **Entity:** CITY OF HENDERSON
Facility Name: SANDWEDGE CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTSW 0000-0129

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$13,500			
	10	Clean and Reshape Channels	$2,500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$2,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$18,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 09 **Entity:** CITY OF HENDERSON

Facility Name: WHITNEY RANCH CHANNEL **Date Prepared:** APRIL 12, 2010

MP Facility ID: WWDC 0000-0098

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	**Inspect Channels**	$6,500			
	10	**Clean and Reshape Channels**	$5,500			
	15	**Repair Lined Channel**				
	20	**Provide/Maintain Erosion Control**				
	21	**Provide/Maintain Dust Control**				
	25	**Clean & Inspect Detention/Debris Basins**				
	30	**Erosion Repair**				
	35	**Fence Repair**				
	40	**Vegetation Control - Chemical**				
	45	**Vegetation Control - Mechanical**	$5,000			
	50	**Maintain Access Road**				
	55	**Clean & Inspect Inlet/Outlet Structures**				
	60	**Repair Inlet/Outlet Structures**				
	65	**Clean Storm Sewer Lines**				
	70	**Storm Sewer Repair**				
	75	**Clean/Flush Culverts & Bridges**				
	80	**Miscellaneous Work Activities**				
	85	**Engineering**				
		TOTALS	$17,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. Act 10 - Clean channel and dispose of material. Act 45 - Remove vegetation and dispose of material. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 10 **Entity:** CITY OF HENDERSON

Facility Name: DUCK CREEK CHANNEL **Date Prepared:** APRIL 12, 2010

MP Facility ID: DCWA 0646-0669

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$5,000			
	10	Clean and Reshape Channels	$11,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$15,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$31,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. Act 10 - Clean channel and dispose of material. Act 45 - Remove vegetation and dispose of material. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 11 **Entity:** CITY OF HENDERSON

Facility Name: MISSION HILLS DETENTION BASIN **Date Prepared:** APRIL 12, 2010

MP Facility ID: C1CH 0686-0854 & 0882

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures	$1,000			
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering	$1,000			
		TOTALS	$4,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 12 **Entity:** CITY OF HENDERSON
Facility Name: RAILROAD EAST CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTRE 0000-0246

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$21,000			
	10	Clean and Reshape Channels	$3,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$25,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. Act 10 - Clean channel and dispose of material. Act 45 - Remove vegetation and dispose of material. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 13 **Entity:** CITY OF HENDERSON
Facility Name: MACDONALD RANCH CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTMR 0000-0399

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$39,000			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$41,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 14 **Entity:** CITY OF HENDERSON
Facility Name: DRAKE CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: C1DC 0000-0101

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$1,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$5,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities	$10,000			
	85	Engineering	$500			
		TOTALS	$16,600	$0		Jun-2011

Delays or Problem Areas:
Hydraulic analysis showed that the energy dissipator is needed for the confluence with C-1 Channel to function as designed. Worked with RFCD to identify alternative access ramp location.

Work completed during prior fiscal year:
Prepared construction documents and advertised construction project. Complete programmed maintenance. Completed asset management inspections.

Work to be completed during current fiscal year:
Act 10 - Clean channel and dispose of material. Act 45 - Remove vegetation and dispose of material. Act 80-Complete construction of access ramp. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 15 **Entity:** CITY OF HENDERSON
Facility Name: I-515 CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTIS 0000-0258

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$1,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$2,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 16 **Entity:** CITY OF HENDERSON
Facility Name: EASTERN CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTEA 0000-0210, 0291, & 0500-0755

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$1,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$2,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$3,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 17
Facility Name: WESTERN INTERCEPTOR
MP Facility ID: C1CH 0871-0972

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$2,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$3,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance. Completed asset management inspections.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 18 **Entity:** CITY OF HENDERSON

Facility Name: EQUESTRIAN DETENTION BASIN **Date Prepared:** APRIL 12, 2010

MP Facility ID: C1EQ 0152-0297, C1E1 0000-0002

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures	$1,000			
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities	$163,750			
	85	Engineering	$24,000			
		TOTALS	$190,850	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed asset management activities. Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 80 - Construction of slope paving identified by levee certification project Act 85-Plans and specifcations to be prepared for slope paving project; Construction management for slope paving project; Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 19 **Entity:** CITY OF HENDERSON
Facility Name: SUNRIDGE CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTPW 0000-0262

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$5,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$3,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$9,600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 20 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN WASH RAILROAD CHANNEL **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTRR 0000-0135

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$2,500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$3,600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 21 **Entity:** CITY OF HENDERSON
Facility Name: PITTMAN PARK DETENTION BASIN **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTWA 0048 - 0050

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$3,000			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering	$1,000			
		TOTALS	$5,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance. Completed repairs to the groundwater system.

Work to be completed during current fiscal year:

Act 5 - Conduct asset management activities. Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 22 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN WASH BURNS **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTBR 0020-0175

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$3,500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$3,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$6,600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 24 **Entity:** CITY OF HENDERSON
Facility Name: PITTMAN PECOS CHANNEL **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTPE 0000-0166

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$16,000			
	10	Clean and Reshape Channels	$3,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$10,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$30,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct Asset Management Activities. Act 10 - Clean channel and dispose of material. Act 45 - Remove vegetation and dispose of material. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 25 **Entity:** CITY OF HENDERSON

Facility Name: BLACK MOUNTAIN DETENTION BASIN **Date Prepared:** APRIL 12, 2010

MP Facility ID: C1CH 1012-1138

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures	$1,000			
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering	$1,000			
		TOTALS	$4,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed construction of gates limiting public access from public roads. Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 26 **Entity:** CITY OF HENDERSON

Facility Name: EAST C-1 DB & BERM, C-1 CHANNEL-HAVRE **Date Prepared:** APRIL 12, 2010

MP Facility ID: C1DC 0298-0303, C1HV 0000-0300

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	**Inspect Channels**	$100			
	10	**Clean and Reshape Channels**				
	15	**Repair Lined Channel**				
	20	**Provide/Maintain Erosion Control**				
	21	**Provide/Maintain Dust Control**				
	25	**Clean & Inspect Detention/Debris Basins**				
	30	**Erosion Repair**				
	35	**Fence Repair**				
	40	**Vegetation Control - Chemical**				
	45	**Vegetation Control - Mechanical**	$1,000			
	50	**Maintain Access Road**				
	55	**Clean & Inspect Inlet/Outlet Structures**	$1,000			
	60	**Repair Inlet/Outlet Structures**	$1,000			
	65	**Clean Storm Sewer Lines**				
	70	**Storm Sewer Repair**				
	75	**Clean/Flush Culverts & Bridges**				
	80	**Miscellaneous Work Activities**				
	85	**Engineering**	$1,000			
		TOTALS	$4,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 27
Facility Name: McCULLOUGH HILLS DETENTION BASIN
MP Facility ID: PTPW 0307-0309

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures	$1,000			
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering	$1,000			
		TOTALS	$3,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 28 **Entity:** CITY OF HENDERSON

Facility Name: PIONEER DETENTION BASIN **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTVW 0183 - 0187

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	**Inspect Channels**	$100			
	10	**Clean and Reshape Channels**				
	15	**Repair Lined Channel**				
	20	**Provide/Maintain Erosion Control**				
	21	**Provide/Maintain Dust Control**				
	25	**Clean & Inspect Detention/Debris Basins**	$3,000			
	30	**Erosion Repair**				
	35	**Fence Repair**	$1,000			
	40	**Vegetation Control - Chemical**				
	45	**Vegetation Control - Mechanical**				
	50	**Maintain Access Road**				
	55	**Clean & Inspect Inlet/Outlet Structures**	$2,000			
	60	**Repair Inlet/Outlet Structures**				
	65	**Clean Storm Sewer Lines**				
	70	**Storm Sewer Repair**				
	75	**Clean/Flush Culverts & Bridges**				
	80	**Miscellaneous Work Activities**				
	85	**Engineering**	$1,000			
		TOTALS	$7,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 29 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN EAST DETENTION BASIN **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTEA 0437-0493

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures	$1,000			
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering	$1,000			
		TOTALS	$3,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 30
Facility Name: SAGUARO PARK/DOWNS CHANNEL
MP Facility ID: C1EQ 0000-0151

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 31 **Entity:** CITY OF HENDERSON

Facility Name: C-1 CHANNEL - US 95 **Date Prepared:** APRIL 12, 2010

MP Facility ID: C1US 0000-0078

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities	$500			
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 32 **Entity:** CITY OF HENDERSON
Facility Name: C-1 CHANNEL BOULDER HIGHWAY **Date Prepared:** APRIL 12, 2010
MP Facility ID: C1BH 0000-0302

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$1,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$500			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$2,600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 33 **Entity:** CITY OF HENDERSON
Facility Name: UPPER PITTMAN WASH SOUTH **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTWA 0815-0983

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities	$500			
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 34 **Entity:** CITY OF HENDERSON
Facility Name: PITTMAN STEPHANIE **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTST 0000-0170

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$15,000			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$500			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$16,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct asset management activities. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 35
Facility Name: PITTMAN DESERT WILLOW
MP Facility ID: PTDW 0000-0069

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$8,000			
	10	Clean and Reshape Channels	$1,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$9,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct asset management activities. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 36 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN FOOTHILLS DRIVE **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTFD 0000-0111

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$16,000			
	10	Clean and Reshape Channels	$1,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$17,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct asset management activities. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 37 **Entity:** CITY OF HENDERSON
Facility Name: PITTMAN LAKE MEAD **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTLM 0000-0078

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$19,000			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$20,000	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct asset management activities. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 38 **Entity:** CITY OF HENDERSON
Facility Name: PITTMAN VALLE VERDE **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTVV 0000-0005

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$3,600			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$4,600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 5 - Conduct asset management activities. General maintenance activities.

Consultant/ Contractor:
Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 40 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN PIONEER DETENTION **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTPD 0010-0063

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$500			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 41 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN WEST HORIZON **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTWH 0000-0116

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 42 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN/ANTHEM PARKWAY **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTAP 0000-0191

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 43 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN HORIZON RIDGE **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTHR 0000-0067, 0139 - 0140

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$500			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 45 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN ANTHEM CHANNEL & DETENTION BASIN **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTAN 0000-0280, PTCR 0000-0036, PTOG 0000-0016, PTAT 0000-0007

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	**Clean and Reshape Channels**				
	15	Repair Lined Channel				
	20	**Provide/Maintain Erosion Control**				
	21	Provide/Maintain Dust Control				
	25	**Clean & Inspect Detention/Debris Basins**				
	30	Erosion Repair				
	35	**Fence Repair**				
	40	Vegetation Control - Chemical				
	45	**Vegetation Control - Mechanical**	$1,500			
	50	Maintain Access Road				
	55	**Clean & Inspect Inlet/Outlet Structures**	$1,500			
	60	Repair Inlet/Outlet Structures				
	65	**Clean Storm Sewer Lines**				
	70	Storm Sewer Repair				
	75	**Clean/Flush Culverts & Bridges**				
	80	Miscellaneous Work Activities				
	85	**Engineering**	$1,000			
		TOTALS	$4,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP information. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
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MWP Facility#: HEN 46 **Entity:** CITY OF HENDERSON
Facility Name: PITTMAN REUNION DRIVE **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTRD 0000-0055

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 47
Facility Name: PITTMAN GREEN VALLEY
MP Facility ID: PTGV 0028-0073

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$2,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$2,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 48 **Entity:** CITY OF HENDERSON
Facility Name: PITTMAN SEVEN HILLS **Date Prepared:** APRIL 12, 2010
MP Facility ID: PTSH 0011 - 0084

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities	$200			
	85	Engineering				
		TOTALS	$800	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 49 **Entity:** CITY OF HENDERSON
Facility Name: C-1 CHANNEL US 95 TRIB 1 **Date Prepared:** APRIL 12, 2010
MP Facility ID: C1U1 0000-0062

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$500			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 50 **Entity:** CITY OF HENDERSON
Facility Name: C-1 CHANNEL FOUR KIDS **Date Prepared:** APRIL 12, 2010
MP Facility ID: C1FK 0000-0073

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 53 **Entity:** CITY OF HENDERSON

Facility Name: LAKE LAS VEGAS MAGIC WAY CHANNEL **Date Prepared:** APRIL 12, 2010

MP Facility ID: LLMW 0129, 0203

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges	$500			
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance. Combined HEN 52 (LLMW 0129) into HEN 53. (2008 MPU Page F-40)

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

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MWP Facility#: HEN 54 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN HAMPTON ROAD **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTHD 0000-0020

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

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MWP Facility#: HEN 55
Facility Name: PITTMAN ANTHEM DRIVE
MP Facility ID: PTAD 0000-0070

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines	$500			
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 56 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN WASH SOUTHEAST **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTSE 0000-0346, PTPN 0000-0039

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$1,000			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair	$1,000			
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$3,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor:

Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
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MWP Facility#: HEN 57
Facility Name: PITTMAN WASH WILDERNESS STUDY
MP Facility ID: PTWS 0000 - 0063 and PTDY 0000

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$500			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 58 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN SOUTHEDGE-NORTH **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTSN 0000-0063

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	**Inspect Channels**	$100			
	10	**Clean and Reshape Channels**	$500			
	15	Repair Lined Channel				
	20	**Provide/Maintain Erosion Control**				
	21	Provide/Maintain Dust Control				
	25	**Clean & Inspect Detention/Debris Basins**				
	30	Erosion Repair				
	35	**Fence Repair**				
	40	Vegetation Control - Chemical				
	45	**Vegetation Control - Mechanical**				
	50	Maintain Access Road				
	55	**Clean & Inspect Inlet/Outlet Structures**				
	60	Repair Inlet/Outlet Structures				
	65	**Clean Storm Sewer Lines**				
	70	Storm Sewer Repair				
	75	**Clean/Flush Culverts & Bridges**				
	80	Miscellaneous Work Activities				
	85	**Engineering**				
		TOTALS	$600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 59
Facility Name: PITTMAN SOUTHEDGE-SOUTH
MP Facility ID: PTSS 0000-0012

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical				
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 60
Facility Name: PITTMAN SOUTHEDGE-ANTHEM
MP Facility ID: PTSA 0000-0091

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,600	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 61 **Entity:** CITY OF HENDERSON

Facility Name: PITTMAN EAST HEADWORKS DB **Date Prepared:** APRIL 12, 2010

MP Facility ID: PTEA 0760-0773

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels				
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$1,000			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures	$1,000			
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering	$1,000			
		TOTALS	$3,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

Completed programmed maintenance.

Work to be completed during current fiscal year:

Act 85 - Verify and update EAP. General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET-FY 2010-11

MWP Facility#: HEN 62
Facility Name: C-1 CHANNEL-RACETRACK
MP Facility ID: C1RT 0001-0040

Entity: CITY OF HENDERSON
Date Prepared: APRIL 12, 2010

Force Account/ Contract		Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	5	Inspect Channels	$100			
	10	Clean and Reshape Channels	$500			
	15	Repair Lined Channel				
	20	Provide/Maintain Erosion Control				
	21	Provide/Maintain Dust Control				
	25	Clean & Inspect Detention/Debris Basins				
	30	Erosion Repair				
	35	Fence Repair				
	40	Vegetation Control - Chemical				
	45	Vegetation Control - Mechanical	$500			
	50	Maintain Access Road				
	55	Clean & Inspect Inlet/Outlet Structures				
	60	Repair Inlet/Outlet Structures				
	65	Clean Storm Sewer Lines				
	70	Storm Sewer Repair				
	75	Clean/Flush Culverts & Bridges				
	80	Miscellaneous Work Activities				
	85	Engineering				
		TOTALS	$1,100	$0		Jun-2011

Delays or Problem Areas:

Work completed during prior fiscal year:

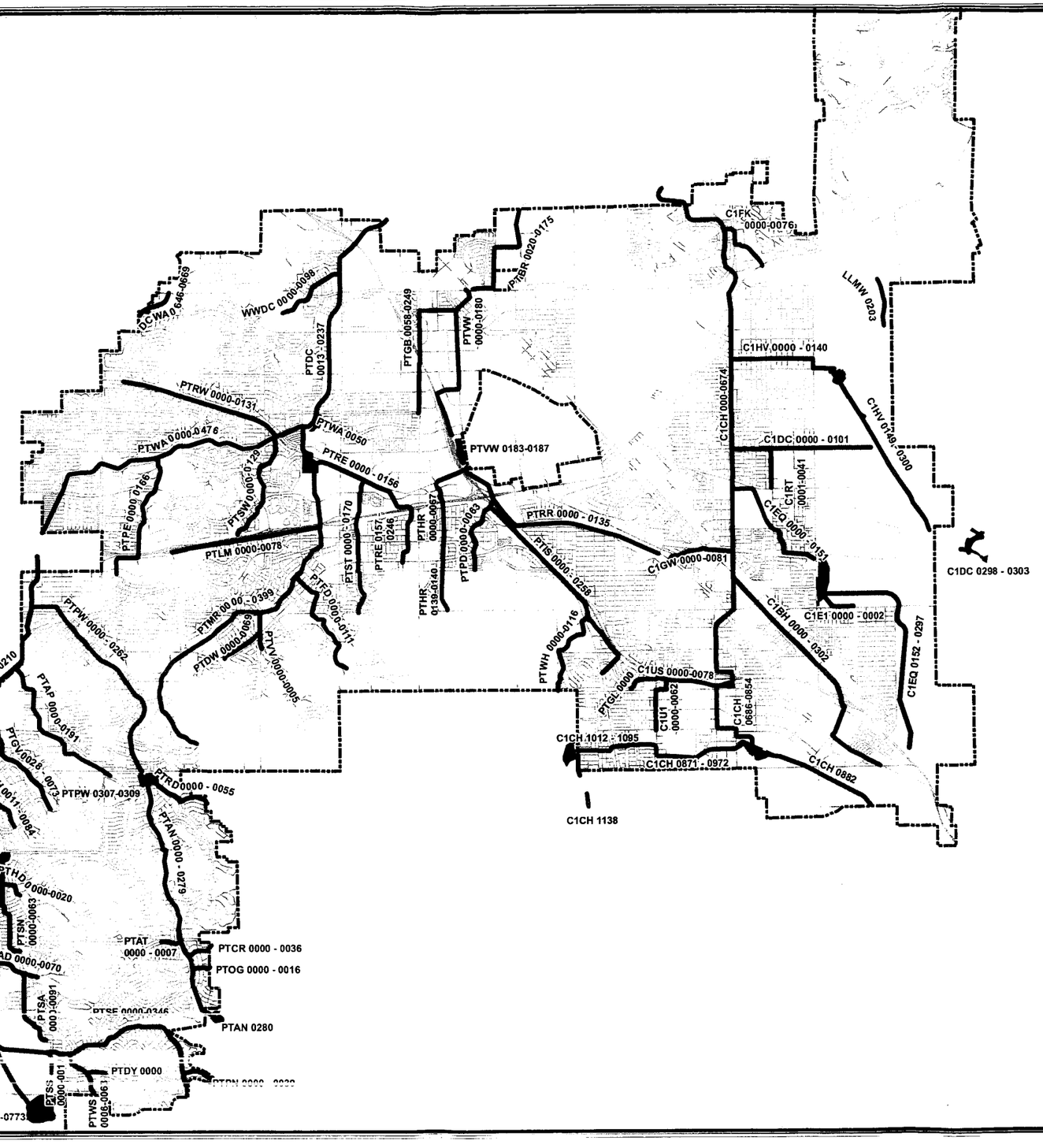
Completed programmed maintenance.

Work to be completed during current fiscal year:

General maintenance activities.

Consultant/ Contractor: Project Manager: Albert J. Jankowiak (702) 267-3024

EXHIBIT A



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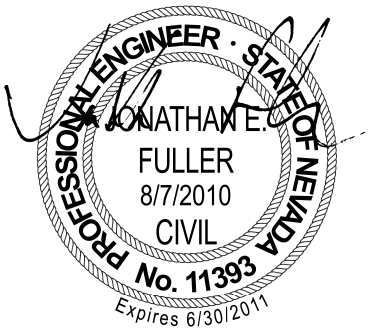
APPENDIX XI

Lateral Erosion Analysis (JE Fuller)

August 7, 2010

To: PBS&J
c/o Harshal Desai, P.E.
2270 Corporate Circle, Suite 100
Henderson, NV 89074

From: JE Fuller Hydrology & Geomorphology, Inc. (JEF)
c/o Brian Schalk, P.E.
1 West Deer Valley Road, Suite 101
Phoenix, AZ 85027



RE: Lateral Erosion Estimate for Equestrian Levee

Mr. Desai:

An Equestrian Levee lateral erosion estimate was performed in support of embankment protection assessment per the requirements found in of Title 44, Chapter 1 of the Code of Federal Regulations, Section 65.10 (44CFR65.10), paragraph (b)(3) Embankment Protection. This Technical Letter has been prepared to present the lateral erosion estimate approach, assumptions, results and supporting calculations.

1 Equestrian Levee System Description

FEMA has indicated that the Equestrian Levee (EL) in Henderson, Nevada is one of the levees in Clark County which they believe warrants accreditation. FEMA has assigned a Levee Identification Number of 2100 to the EL. The EL is owned, maintained, and operated by the City of Henderson (COH), Nevada and is located within a portion of Sections 23, 26, and 35 of T22S, R63E, City of Henderson, Clark County, Nevada (see Figure 1, provided below).

In a letter dated September 17, 2008, FEMA gave the COH the opportunity to receive PAL designation for the EL. COH signed the PAL agreement for this levee and submitted it to FEMA with the required documentation. FEMA accepted the agreement and confirmed PAL status for this levee.

The EL was designed and constructed (1994 and 1996, respectively) in conjunction with the Equestrian Detention Basin (EDB) and Equestrian Drive Channel (EDC). These flood control facilities, located within an arid geographic region that experiences an annual average precipitation of less than 4.5 inches, were built to protect development from ephemeral flows originating in the mountainous terrain to the east. Design and construction of these three facilities was authorized under the EDB Regional Flood Control Project, funded by the Clark County Regional Flood Control District (CCRFCD).

The EL is an un-armored, earthen embankment that extends in a northerly direction from high ground adjacent to US-93 to the upstream end of the EDC (the EDC is a concrete, trapezoidal channel that outfalls at the EDB). Typical levee characteristics, based on as-built plans and geotechnical testing, are provided below in Table 1.

The Equestrian Levee Channel (ELC) was constructed in conjunction with the EL. The ELC is an earthen channel that runs adjacent to the waterside toe-of-levee; therefore, the levee embankment also serves as the channel's left bank while looking in the downstream direction. Flow within the ELC is conveyed to the Equestrian Drive Channel (a concrete channel immediately downstream of the EL), which outfalls at the Equestrian Detention Basin. Typical ELC characteristics, based on as-built plans, are provided below in Table 2.

Revised FEMA FIRM Panels (32003C2615D, 32003C2620D and 32003C2975D) reflecting the EDB Regional Flood Control Project were accepted by FEMA July 18, 2001 per LOMR Case Number 99-09-623P. Currently, effective FIRM Panels reflecting the EL alignment are shown on FIRM Panels 32003C2620E and 32003C2975E, both having a map revision date of September 27, 2002. It should be noted that the levee structure alignment, shown on both the 2001 and 2002 revised FIRM Panels, is not designated as a "Levee". Rather, the levee structure alignment has been designated as a "Diversion Channel". As shown on the FIRM Panels, the "Diversion Channel" provides protection from a relatively small Zone A flood hazard approximately located between as-built Levee Stations 080+00 and 085+00. The Zone A area indicates a one percent annual chance of flooding; however, flood depths or elevations from a detailed hydraulic analysis are not provided.

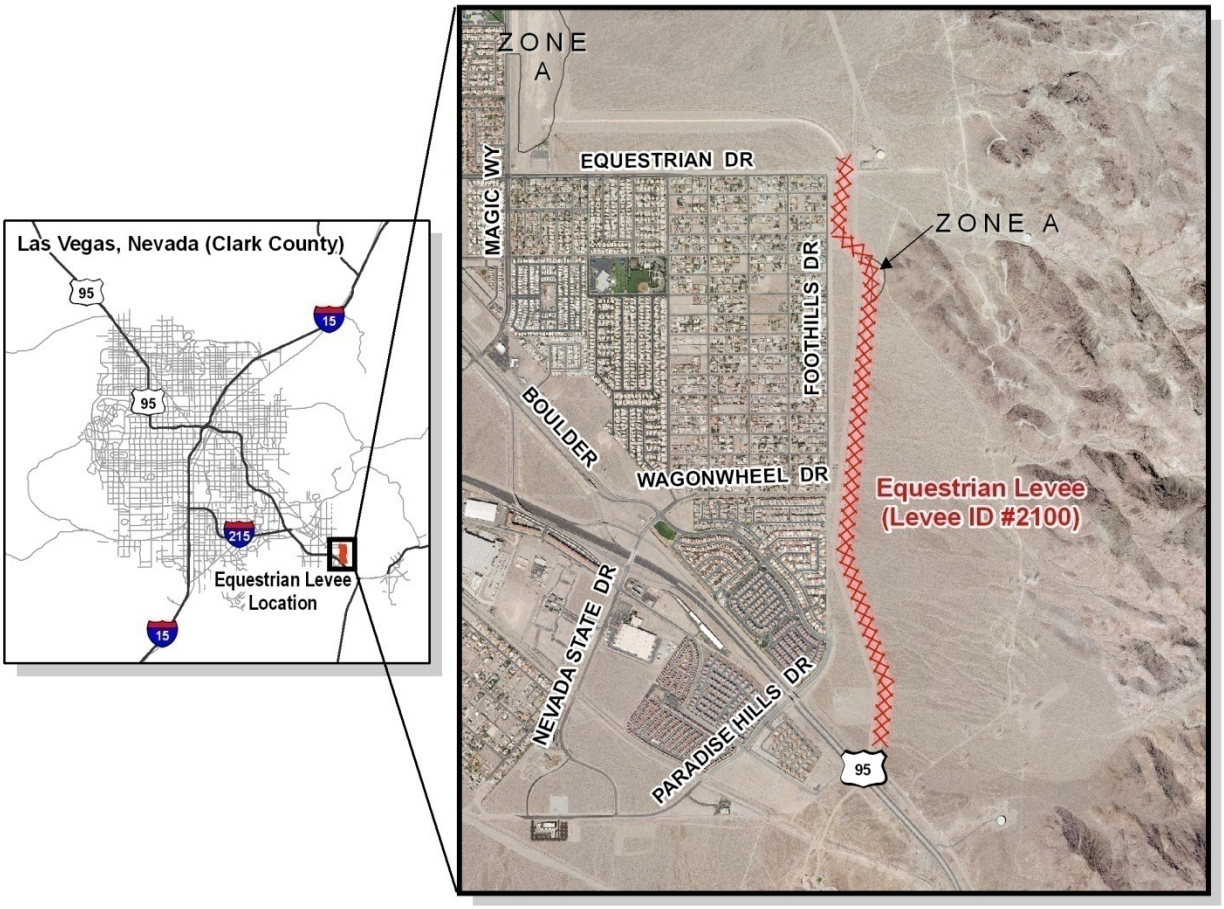


Figure 1. Equestrian Levee Location and Vicinity.

Table 1. Typical Equestrian Levee Characteristics.

Levee Characteristic	Description
Cross-Section	Trapezoidal
Length	Approximately 1.9 miles
Height	Approx. 7 to 16 feet (upstream to downstream end, respectively)
Levee Top Width	Approximately 12 feet (includes approximate 5-foot asphalt path)
Side Slope (landside)	2.5H:1V to 20H:1V
Side Slope (waterside)	3H:1V to 5H:1V
Embankment Armoring	None
D_{50}	Medium Sized Sand Material (2 – 3 mm)

Table 2. Typical Equestrian Levee Channel Characteristics

Channel Characteristic	Description
Cross-Section	Trapezoidal
Bottom Width	Approximately 20 feet
Side Slope (left bank)	3H:1V to 5H:1V
Side Slope (right bank)	4H:1V
Channel Bottom Lateral Slope	Flat to 5%
Longitudinal Slope	0.55% to 2.45%
Embankment Armoring	None
Bed Material	Typically Ranging Between Sand and Cobbles

2 44CFR65.10, Paragraph (b)(3) Embankment Protection

According to 44CFR65.10, paragraph (b)(3) Embankment Protection:

> *"Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment foundation materials; levee alignment, bends, and transition; and levee side slopes."*

3 Anticipated Flow Velocities and Potential for Levee Embankment Erosion

As part of the EL assessment to determine if the structure meets criteria set forth in 44CRF65.10, a HEC-RAS model (EquestrianLeveeChan.prj, **see attached output table**) was developed to reflect the existing condition of the EL and ELC. Present condition levee and channel geometries were obtained from supplemental survey of the structures. To determine anticipated flow velocities within the ELC, which will impact the un-armored embankment, a mixed flow regime HEC-RAS model was run with a channel n-value of 0.03 at each cross-section. The computed hydraulic characteristics of the EL-ELC System are provided below in Table 3.

Table 3. Existing Condition, HEC-RAS Computed Hydraulic Characteristics of the EL-ELC System.

HEC-RAS Station	100-Yr Q (cfs)	WSEL (ft)	Max Flow Depth (ft)	Avg. Channel Flow Velocity (ft/s)	Froude #
16700	188.96	2379.99	1.54	8.85	1.64
16550	188.96	2375.99	2.49	6.18	1.32
16500	188.96	2373.46	1.66	8.3	1.61
16400	188.96	2372.08	1.66	6.65	1.21
16300	188.96	2369.75	1.35	7.09	1.32
16200	188.96	2369.27	3.57	1.7	0.21
16150	914.8	2368.14	3.24	7.98	1.01
16000	914.8	2364.48	2.88	10.1	1.39
15950	914.8	2362.95	2.65	11.25	1.52
15500	914.8	2351.33	2.83	11.24	1.52
15000	1045.6	2339.47	3.09	10.7	1.31
14700	1045.6	2332.36	2.60	10.96	1.5
14500	1045.6	2327.22	2.61	11.79	1.53
14000	1045.6	2315.46	2.68	11.4	1.49
13800	1045.6	2309.83	2.59	11.87	1.58
13250	1314.9	2296.91	3.26	9.82	1.2
13000	1314.9	2290.8	3.05	12.91	1.59
12700	1314.9	2284.13	2.64	12.14	1.52
12500	1314.9	2280.46	2.90	11.3	1.33
12000	1314.9	2271.87	2.80	11.57	1.4
11500	1314.9	2264.58	3.09	10.46	1.21
11000	1314.9	2257.3	3.29	10.39	1.19
10500	1314.9	2249.74	2.81	11.34	1.37
10000	1314.9	2242.21	2.78	11.31	1.35
9500	1314.9	2234.59	2.88	10.61	1.23
9000	1314.9	2227.29	2.94	11.26	1.32
8600	1314.9	2223.43	4.87	5.12	0.47
8500	1314.9	2222.13	4.69	7.65	0.77
8200	1438	2220.91	5.54	6.14	0.56
8150	1438	2220.77	5.71	4.43	0.39
7800	1438	2218.74	4.59	9.33	1
7450	1494.4	2216.29	5.62	6.4	0.58
7423	1494.4	2215.92	5.39	6.52	0.63
7350	1494.4	2215.92	5.99	5.25	0.46
7238	1494.4	2214.92	5.07	8.24	0.81
7100	1494.4	2214.61	5.21	6.73	0.63
7000	1494.4	2213.91	4.85	8.08	0.78
6700	1494.4	2212.72	5.30	5.44	0.51
6500	1494.4	2212.33	4.77	4.92	0.49
6400	1494.4	2212.26	5.07	3.97	0.39
6200	1494.4	2210.35	4.33	10.01	1.01

As seen in Table 3 above, average flow velocities within the ELC are typically in excess of 5 feet per second. Velocities in excess of 5 feet per second are likely erosive to the un-armored levee embankment, which according to geotechnical testing of the embankment (**see attached**), has been constructed primarily of medium sized sand material (D50 of 2 – 3 mm). In addition, per the *Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual*, Table 703-Maximum Permissible Mean Channel Velocities (**see attached**), embankments constructed of this type of material, and experiencing the computed flow velocities reported above in Table 3, would typically require an armoring layer (such as riprap) to prevent lateral erosion of the structure. Additional discussion regarding HEC-RAS modeling is provided below in Section 5.

4 Additional Factors Affecting Potential Levee Embankment Erosion

Erosion resulting from expected wind and wave action, ice loading and debris impact is not expected.

Large flood events occurring within the arid southwest are typically short in duration. For example, the Base Flood hydrology shows the 100-year flood having flows in excess of 100 cfs for only approximately 3.5 hours. A prolonged, multi-day flood scenario impacting the EL is not anticipated.

The EL-ELC System's alignment is relatively straight, with no curves substantial enough to induce significant local erosion as a result of flow around a bend. According to the Arizona Department of Water Resources Sate Standard for Watercourse System Sediment Balance (SS 5-96, September 1996, **see attached excerpt**), additional lateral erosion setback distance is required for curves having a radius of curvature less than five times the channel width (r_c < 5W). The tightest ELC bend occurs approximately at Levee Station 073+50, with a radius of curvature of about 750 feet. At this location the computed top width of the flow is approximately 85 feet. Five times this computed top width of flow is 425 feet, which is well below the SS 5-96 requirement to include additional, local erosion at the bend.

The ELC has a relatively uniform channel geometry with no significant channel transitions; and therefore, local erosion resulting from increased flow velocities at channel transitions is not anticipated.

5 Methodology and Assumptions for Levee Embankment Erosion Estimate

As discussed above, the flow velocities within the ELC are likely to be somewhat erosive to the EL embankment. To estimate the potential embankment erosion, a sediment budget analysis was performed. The analysis was based on a levee embankment section per as-built drawings (**see attached**), ELC hydraulics, design hydrology and the Yang sediment transport equation. The procedure and assumptions used for the embankment erosion analysis are as follows:

1. HEC-RAS modeling reflecting the EL and ELC existing conditions was developed to determine hydraulic parameters (see Section 3 above) used in the embankment erosion estimate. Discharges used in the HEC-RAS model were obtained from the design hydrology previously submitted to, and approved by, FEMA per LOMR submittal dated December 21, 1998 (**see attached HEC-1 model and workmap**, EQUOAL4.HC1). The highest discharges per hour duration defining HEC-1 hydrographs at key concentration points were input into the HEC-RAS Steady Flow Data table (8 Flow Profiles total to reflect discharges throughout storm duration) to reflect the hydrograph time component in the HEC-RAS model. (**see attached HEC-RAS output table and HEC-1 tabulated hydrographs**).

2. Using the HEC-RAS computed hydraulic characteristics at each River Station (for the purpose of this Technical Letter, the River Station also refers to HEC-RAS cross-section and as-built Levee Station), the maximum sediment transport capacity of each cross-section, for each of the

highest discharges per hydrograph hour duration (8 Flow Profiles total), was estimated based on Yang's Sediment Transport Equation ("tons-per-day" of sediment at each cross-section for each discharge, see Section 5.1). Then, the total sediment volume throughput capacity at each cross-section ("cubic feet" of sediment at each cross-section for the storm duration) was determined based on these sediment transport capacity maximums (**see attached Equestrian Levee Sediment Volume Calculations**). Yang's Sediment Transport Equation requires the input of the median grain size diameter (D50), which was taken as 2 mm based on available geotechnical data (**see attached**).

3. By comparing each cross-section's sediment volume throughput capacity to the sediment volume throughput capacity at the upstream cross-section, it is possible to determine sediment deficit or surplus at each cross-section. For example, the sediment volume throughput capacities at River Stations 16550 (downstream cross-section) and 16700 (upstream cross-section) are 9,391 cu. ft. and 9,610 cu. ft., respectively. Given that the sediment throughput capacity at River Station 16550 is 219 cu. ft. less than that at River Station 16700, this 219 cu. ft. of excess sediment at River Station 16550 could deposit as it is conveyed downstream from River Station 16700. At cross-sections where deposition was calculated, no erosion of the levee embankment was assumed. Conversely, at cross-sections where erosion was calculated (cross-section has more sediment throughput capacity than sediment volume conveyed from upstream cross-section), erosion of the levee embankment was assumed.

4. At cross-sections where erosion of the levee embankment was assumed, embankment erosion was estimated based on available sediment volume throughput capacity, HEC-RAS reach length between cross-sections, levee embankment height and slope, and angle of repose for levee embankment material. Angle of repose of embankment material was obtained from geotechnical information (**attached**). In addition, given that it is unlikely that the entire flow conveyance area at a cross-section would directly impact the erosion of the levee embankment, it was assumed that only one-half of the conveyance area was available to remove and convey sediment; and therefore, only half of the sediment volume throughput capacity at a cross-section was used to estimate the potential volume of erodible material. It was also assumed that this erosion of material would come directly from the levee; however, in actuality it is likely that some portion of material would be removed from the channel bed, which would reduce the volume of material eroded from the embankment. The estimated embankment erosion at River Station 7238 is provided below as an example:

    - One-half of sediment volume throughput capacity at River Station 7238 = 20,138 cu. ft.
    - One-half of sediment volume throughput capacity at River Station 7350 (just upstream of River Station 7238) = 4,996 cu. ft.
    - Sediment volume throughput capacity difference = 15,142 cu. ft. Therefore, 15,142 cu. ft. of levee embankment could be eroded between River Stations 7238 and 7350.
    - Downstream reach length from River Station 7350 to 7238 = 101.8 ft.
    - The cross-sectional area of the material available for erosion and conveyance, at any given location between the two cross-sections, is based on the sediment volume throughput capacity between the cross-sections and the associated reach length: Cross-sectional area of available erodible material = 15,142 cu. ft. / 101.8 ft. = 149 sq. ft.
      It was assumed that erosion of the levee embankment would progress laterally through the levee at the embankment material angle of repose. Therefore, the lateral distance of erosion from the toe- and top-of-levee is dependent on the following: 1) cross-sectional area of available erodible material at any one location from within reach

length, 2) embankment material angle of repose, 3) embankment height, and 4) embankment slope. Figure 2 below illustrates the relationship between the cross-sectional area of available erodible material (149 sq. ft.), the embankment material angle of repose (38 degrees or 1.3H:1V), embankment height (12 ft.), and embankment slope (3H:1V) at River Station 7238.

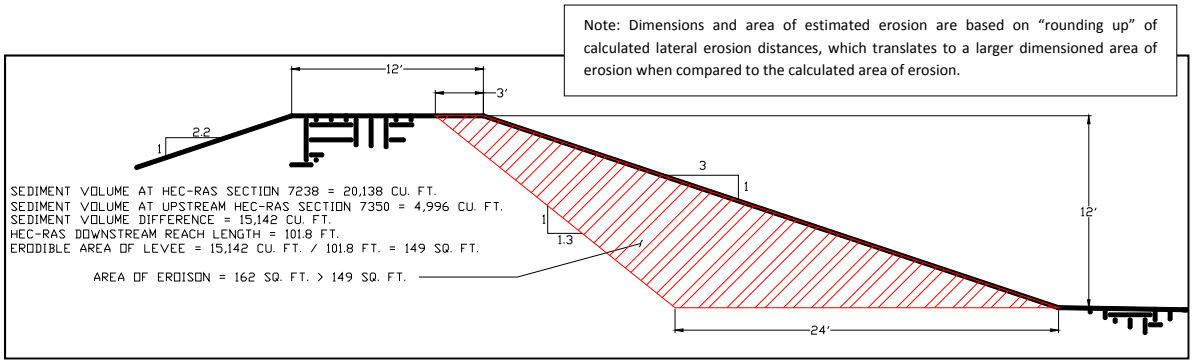


Figure 2. Estimated Erosion at Levee Station (HEC-RAS River Station) 7238.

5.1 Sediment Transport Calculations

Sediment transport capacity calculations were based on Yang's Sediment Transport Equation (Sand Formula – corresponding to a D50 of medium sized sand material) and calculated by using the SEDDISCH program code developed by Yang and presented in Sediment Transport Theory and Practice[1]. The SEDDISCH program computes fluvial sediment discharge, with the Yang Sand Formula being one of eight bed-material formulas to select from. The SEDDISCH program, and associated data input program DISDATA, are also provided at the following USGS website: http://water.usgs.gov/software/. A summary of **the SEDDISCH software is attached.**

To ensure the sediment transport capacity calculations were being performed correctly, the SEDDISCH program was run as a back-check using the following hydraulic and sediment characteristics at River Station 9000.

- Top Width = 51.44 ft
- Mean Velocity = 11.27 ft/s
- Mean Depth[2] = 2.3 ft = 1314.9 cfs / 11.27 ft/s / 51.44 ft
- Water Discharge[3] = 1,333.38 cfs = (2.3 ft)(51.44 ft)(11.27 ft/s)
- Water Temperature 21.1 degrees C
- Water Surface Slope 0.0177 ft/ft
- D50 = 2 mm
- Kinematic viscosity = 0.00001053
- Sediment Fall Velocity = 0.4769 ft/s

[1] Yang, Chih Ted; *Sediment Transport Theory and Practice*; The McGraw Hill Companies, Inc.; 1996.
[2] The 1314.9 cfs used to calculate the Mean Depth is the 100-year discharge per design HEC-1 model.
[3] Calculation by SEDDISCH.

The SEDDISCH-computed sediment discharge based on the above input data is 56,387 tons/day. The calculated sediment discharge used to estimate the potential EL embankment erosion at River Station 9000 is 54,961 tons/day. For the purpose of predicting sediment deficit and surplus within the ELC, the approximate 3 percent difference between the computed and calculated sediment discharges is not considered significant. The **SEDDISCH output table is attached**. The **SEDDISCH output table is attached**.

6 Results and Conclusions

As discussed above in Section 5, the likelihood of sediment deficit or surplus within the ELC was determined at each HEC-RAS River Station (cross-section). At cross-sections showing erosion potential, the predicted maximum erosion varied from 6 feet to 30 feet. Lateral erosion estimates were based on sediment transport capacity of the HEC-RAS cross-section, sediment transport capacity of the upstream HEC-RAS cross-section, HEC-RAS reach length between subject cross-sections, levee embankment height and slope (per as-built drawings), and angle of repose for embankment material (per geotechnical testing). **Calculations for the EL embankment's predicted erosion are attached**.

As with any hydraulic and sediment transport analyses, the uncertainties inherent in the input data and calculations/computations require a level of safety to be incorporated into the recommendations. This need for a level of safety is also shown to be warranted given the range of estimated lateral erosion at each levee River Station (**see attached erosion estimate calculations**). Therefore, it is recommended that the potential for lateral erosion of the EL embankment be taken as the maximum estimated lateral erosion from the toe-of-levee for each section of levee defined by the change in typical embankment slope, as shown below in Table 4.

Table 4. Potential Erosion of Equestrian Levee Embankment.

Levee Stations	Typical Embankment Slope	Predicted Maximum Erosion From Toe-of-Levee
64+00 to 70+00	5H:1V	6 feet
70+00 to 125+00	3H:1V	24 feet
125+00 to 165+00	5H:1V	30 feet
165+00 to 167+00	4H:1V	13 feet

Note: See attached supporting EL embankment erosion estimate tables.

Although the above analysis predicts up to 30 feet of levee embankment lateral erosion, a general field investigation of the EL, conducted by JEF on February 18, 2009, indicates the EL is in satisfactory condition and has not experienced significant erosion since construction. The investigation focused on apparent, surficial levee and channel conditions that relate to potential FEMA accreditation of the EL system. In addition to the field investigation, a comparison of channel and levee as-built and existing condition geometries was completed using supplemental survey data. The comparison yielded the following results:

- No significant channel degradation or aggradation has occurred in the ELC since construction.
- No significant erosion of the EL embankment has occurred since construction.

Based on the field investigation and as-built and existing condition comparison, JEF does not anticipate significant erosion of the EL embankment in the future. Furthermore, embankment deficiencies that are to occur in the future are to be addressed per the City of Henderson's adopted maintenance plan.

According to 44CFR65.10, paragraph (B)(3) Embankment Protection:

"Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, …"

Based on the above embankment erosion analysis, the levee embankment's predicted maximum erosion per method used varies; however, the eroded sections of levee meet the freeboard criteria per 44CFR65.10, paragraph (B)(1).

It should be stressed that this embankment erosion analysis was performed to evaluate freeboard alone and was not used to evaluate deficient geotechnical characteristics of the EL embankment that may occur as a result of flow-induced erosion. Therefore, it is recommended that a geotechnical analysis of the EL embankment be performed, based on the results and recommendations of this embankment erosion analysis, to determine if the EL satisfies the geotechnical criteria of 44CFR65.10, paragraph (B)(3).

LATERAL EROSION ANALYSIS

SUPPORTING CALCULATIONS

AND

REFERENCE MATERIAL

Equestrian Levee HEC-1

```
1*****************************************
*************************************
 *                                   *                                                 *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                 *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998              *                                                 *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1                *                                                 *         609 SECOND STREET
*
 *                                       *                                                 *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   25APR10  TIME  10:20:40   *                                                 *           (916) 756-1104
*
 *                                       *                                                 *
*
 *****************************************
*************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID   EVALUATION OF ORIGIONAL DESIGN OF EQUESTRIAN BASIN USEING AS BUILT BASINS
            2           ID   THIS RUN IS USED TO EVALUATE THE CHANNEL FLOW AND BASIN BASED ON FINAL
            3           ID   FLOW DESIGN
            4           ID   FLOW EVALUATION DOES NOT INCLUDE NE'Il BOULUER HIGIIWAY CULVERT
            5           ID   EVALUATION BUT DOES INLCUDE NEW EQUESTRIAN &MAGIC WAY INLET
            6           ID   ASSUMES NE'Il CI-DETENTION BASIN IS COMPLETED
            7           ID   DOES NOT INCLUDE FLOriS NORTH IN RACETRACK
            8           ID    FILE NAME: EQUOAL4.HC1
            9           IT       5 08OCT09    0000     600                    2000
           10           IO       5
           11           IN       5
                        *

           12           KK  OFF-10
           13           BA  0.4227
           14           PB    3.05
           15           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           16           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           17           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           18           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           19           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           20           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           21           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           22           PC    .998    .999   1.00
           23           LS       0      87
           24           UD   0.758
                        *

           25           KK  DIVERT
           26           KM   DIVERTl FLOWS CONVEYED INTO CULVERT 'A' STA 296+24
           27           DT  DIVER1
           28           DI       0      37     126     260     502
           29           DQ       0      10      20      30      40
                        *

           30           KK  OFF-21
           31           BA  0.0435
           32           LS       0      85
           33           UD   0.197
                        *

           34           KK    R-21
           35           RK    1700   0.005   0.016           TRAP     100       1
                        *

           36           KK  OFF-23
           37           BA  0.0587
           38           LS       0      85
           39           UD   0.250
                        *
```



```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           40           KK     C17
           41           HC       2
                        *

           42           KK   CSCAb
           43           BA  1.1309
           44           LS       0      68
           45           UD    0.28
                        *

           46           KK   QSPLT
```

```
 47          DT  DIVER9
 48          DI       0     148     200     300     400
 49          DQ       0       0      52     152     252
             *

 50          KK    RET1
 51          DR  DIVER1
             *

 52          KK   RDIV1
 53          RK    1200   0.004   0.016            TRAP       0      50
             *

 54          KK     CC1
 55          HC       2
             *

 56          KK   C5CAa
 57          BA  0.3541
 58          LS       0      85
 59          UD   0.558
             *

 60          KK     C19
 61          HC       2
             *

 62          KK  DIVER7
 63          KM   DIVERT FLOW INTO DET BASIN AT EQUESTRIAN DRIVE MAGIC WAY INLET SYSTEM
 64          DT  DIVER7
 65          DI       0    1151
 66          DQ       0     488
             *

 67          KK     C20
 68          HC       2
             *
1                                        HEC-1 INPUT                                    PAGE  3

          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 69          KK    C5FD
 70          BA  0.1851
 71          PB    2.97
 72          LS       0      85
 73          UD   0.285
 74          ZW   A=C5FD B=C5FD C=FLOW
             *

 75          KK    C5FB
 76          RK     500   0.015    0.25            TRAP      35       3
             *

 77          KK    C5FA
 78          BA  0.5380
 79          LS       0      88
 80          UD    0.23
             *

 81          KK    C5FB
 82          RK    4100  0.0615   0.040            TRAP     200       2
             *

 83          KK    C5FB
 84          BA  0.1707
 85          LS       0      68
 86          UD    0.35
             *

 87          KK   C5FBa
 88          HC       3
 89          ZW   A=C5FBa B=C5FBa C=FLOW
             *

 90          KK     100
 91          RK    1500   0.015   0.030            TRAP      35       3
             *

 92          KK    C5FC
 93          BA  0.1906
 94          LS       0      79
 95          UD    0.30
             *

 96          KK    100a
 97          HC       2
 98          ZW   A=100a B=100a C=FLOW
             *

 99          KK    C5EA
100          RK    1300   0.015   0.030            TRAP      35       3
             *
1                                        HEC-1 INPUT                                    PAGE  4

          LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

101          KK    C5EA
102          BA  0.5191
103          LS       0      86
104          UD    0.62
             *

105          KK   C5EAa
106          HC       2
107          ZW   A=C5EAa B=C5EAa C=FLOW
             *

108          KK    C5EC
109          RK    2500   0.015   0.030            TRAP      35       3
             *
```

```
110          KK    C5EB
111          BA  0.5885
112          LS       0      73
113          UD    0.64
             *

114          KK    C5EC
115          RK    2000    0.05    0.40            TRAP     200       3
             *

116          KK    C5EC
117          BA  0.2648
118          LS       0      73
119          UD    0.25
             *

120          KK     200
121          HC       3
122          ZW   A=200 B=200 C=FLOW
             *

123          KK     300
124          RK    2100   0.005   0.030            TRAP      35       3
             *

125          KK    C5ED
126          BA  0.1474
127          LS       0      80
128          UD    0.17
             *

129          KK     300
130          HC       2
131          ZW   A=300 B=300 C=FLOW
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

132          KK     400
133          RK    1000   0.005   0.030            TRAP      35       3
             *

134          KK    C5DA
135          BA  1.0241
136          LS       0      86
137          UD    0.40
             *

138          KK     400
139          HC       2
             *

140          KK     500
141          RK    1000    0.04    0.03            TRAP      35       6
             *

142          KK    C5DB
143          BA  0.6505
144          LS       0      85
145          UD   0.515
             *

146          KK     500
147          HC       2
             *

148          KK   BASIN
149          RK    3000   0.015   0.015            TRAP      20       2
             *

150          KK    C5DC
151          BA  1.0180
152          LS       0      69
153          UD   0.685
             *

154          KK   BASIN
155          HC       2
             *

156          KK    RET9
157          DR  DIVER9
             *

158          KK    C5CB
159          BA  0.1654
160          LS       0      58
161          UD    0.49
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

162          KK   BASIN
163          HC       4
             *

164          KK     DET
165          RS       1    STOR
166          SV       0       2      13      31      61      97     118     140     171     200
167          SV     229     261     290     315     344     379     409     437     470     504
168          SE    2048    2050    2052    2054    2056    2058    2059    2060    2061    2062
169          SE    2063    2064    2065    2066    2067    2068    2069    2070    2071    2072
170          SQ       0      37      80     117     142     163     173     182     191     198
171          SQ     206     213     221     228     235     242     248    2755    7761   14467
172          SS    2069     900     3.0     1.5
             *

173          KK  OFF-24
174          BA  0.0581
```

```
           175          LS       0      85
           176          UD   0.183
                        *

           177          KK    RET7
           178          DR  DIVER7
                        *

           179          KK     R24
           180          RK     500   0.012   0.020           TRAP     100       1
                        *

           181          KK   MAGIC
           182          HC       2
           183          ZZ
1*************************************
*************************************
 *                                   *                                       *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                   *    U.S. ARMY CORPS OF ENGINEERS
*
 *              JUN   1998             *                                       *    HYDROLOGIC ENGINEERING CENTER
*
 *           VERSION 4.1               *                                       *         609 SECOND STREET
*
 *                                     *                                       *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   25APR10  TIME  10:20:40   *                                     *           (916) 756-1104
*
 *                                     *                                       *
*
 *************************************
*************************************
```

EVALUATION OF ORIGIONAL DESIGN OF EQUESTRIAN BASIN USEING AS BUILT BASINS
THIS RUN IS USED TO EVALUATE THE CHANNEL FLOW AND BASIN BASED ON FINAL
FLOW DESIGN
FLOW EVALUATION DOES NOT INCLUDE NE'Il BOULUER HIGIIWAY CULVERT
EVALUATION BUT DOES INLCUDE NEW EQUESTRIAN &MAGIC WAY INLET
ASSUMES NE'Il CI-DETENTION BASIN IS COMPLETED
DOES NOT INCLUDE FLOriS NORTH IN RACETRACK
FILE NAME: EQUOAL4.HC1

```
  10 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     8OCT 9  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        600  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    10OCT 9  ENDING DATE
                     NDTIME       0155  ENDING TIME
                     ICENT          20  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   49.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
    -----DSS---ZOPEN:  Existing File Opened,  File: EQUESTRIAN.DSS
                       Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FD/C5FD/FLOW/07OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FD/C5FD/FLOW/08OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FD/C5FD/FLOW/09OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FD/C5FD/FLOW/10OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FBA/C5FBA/FLOW/07OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FBA/C5FBA/FLOW/08OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FBA/C5FBA/FLOW/09OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5FBA/C5FBA/FLOW/10OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /100A/100A/FLOW/07OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /100A/100A/FLOW/08OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /100A/100A/FLOW/09OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /100A/100A/FLOW/10OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5EAA/C5EAA/FLOW/07OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5EAA/C5EAA/FLOW/08OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5EAA/C5EAA/FLOW/09OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /C5EAA/C5EAA/FLOW/10OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /200/200/FLOW/07OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /200/200/FLOW/08OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /200/200/FLOW/09OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /200/200/FLOW/10OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /300/300/FLOW/07OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /300/300/FLOW/08OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /300/300/FLOW/09OCT2009/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.    2:  /300/300/FLOW/10OCT2009/5MIN//
1
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	OFF-10	283.	4.25	81.	20.	10.	.42		
+	DIVERSION TO	DIVER1	31.	4.25	12.	3.	1.	.42		

+	HYDROGRAPH AT	DIVERT	252.	4.25	68.	17.	8.	.42
+	HYDROGRAPH AT	OFF-21	53.	3.58	8.	2.	1.	.04
+	ROUTED TO	R-21	52.	3.67	8.	2.	1.	.04
+	HYDROGRAPH AT	OFF-23	67.	3.67	10.	3.	1.	.06
+	2 COMBINED AT	C17	119.	3.67	18.	4.	2.	.10
+	HYDROGRAPH AT	CSCAb	473.	3.75	79.	20.	10.	1.13
+	DIVERSION TO	DIVER9	325.	3.50	28.	7.	3.	1.13
+	HYDROGRAPH AT	QSPLT	148.	3.50	52.	13.	6.	1.13
+	HYDROGRAPH AT	RET1	31.	4.25	12.	3.	1.	.00
+	ROUTED TO	RDIV1	31.	4.25	12.	3.	1.	.00
+	2 COMBINED AT	CC1	179.	4.25	64.	16.	8.	1.13
+	HYDROGRAPH AT	C5CAa	266.	4.00	62.	16.	7.	.35
+	2 COMBINED AT	C19	442.	4.00	126.	32.	15.	1.49
+	DIVERSION TO	DIVER7	187.	4.00	53.	13.	6.	1.49
+	HYDROGRAPH AT	DIVER7	255.	4.00	73.	18.	9.	1.49
+	2 COMBINED AT	C20	335.	3.83	90.	23.	11.	1.59
+	HYDROGRAPH AT	C5FD	189.	3.75	31.	8.	4.	.19
+	ROUTED TO	C5FB	188.	3.75	31.	8.	4.	.19
+	HYDROGRAPH AT	C5FA	684.	3.67	104.	26.	12.	.54
+	ROUTED TO	C5FB	672.	3.75	104.	26.	13.	.54
+	HYDROGRAPH AT	C5FB	60.	3.83	11.	3.	1.	.17
+	3 COMBINED AT	C5FBa	915.	3.75	146.	37.	18.	.89
+	ROUTED TO	100	901.	3.75	147.	37.	18.	.89
+	HYDROGRAPH AT	C5FC	145.	3.75	24.	6.	3.	.19
+	2 COMBINED AT	100a	1046.	3.75	170.	43.	21.	1.08
+	ROUTED TO	C5EA	1025.	3.75	171.	43.	21.	1.08
+	HYDROGRAPH AT	C5EA	366.	4.08	91.	23.	11.	.52
+	2 COMBINED AT	C5EAa	1315.	3.83	262.	66.	32.	1.60
+	ROUTED TO	C5EC	1300.	3.83	262.	66.	32.	1.60
+	HYDROGRAPH AT	C5EB	207.	4.17	53.	13.	6.	.59
+	ROUTED TO	C5EC	204.	4.50	53.	13.	6.	.59
+	HYDROGRAPH AT	C5EC	153.	3.75	24.	6.	3.	.26
+	3 COMBINED AT	200	1438.	3.83	337.	85.	41.	2.46
+	ROUTED TO	300	1408.	3.92	337.	85.	41.	2.46
+	HYDROGRAPH AT	C5ED	149.	3.58	19.	5.	2.	.15
+	2 COMBINED AT	300	1494.	3.83	357.	90.	43.	2.60
+	ROUTED TO	400	1478.	3.92	357.	90.	43.	2.60
+	HYDROGRAPH AT	C5DA	933.	3.83	180.	45.	22.	1.02

+	2 COMBINED AT	400	2402.	3.83	535.	135.	65.	3.63		
+	ROUTED TO	500	2385.	3.92	536.	135.	65.	3.63		
+	HYDROGRAPH AT	C5DB	491.	4.00	109.	27.	13.	.65		
+	2 COMBINED AT	500	2873.	3.92	645.	162.	78.	4.28		
+	ROUTED TO	BASIN	2867.	3.92	645.	162.	78.	4.28		
+	HYDROGRAPH AT	C5DC	258.	4.25	72.	18.	9.	1.02		
+	2 COMBINED AT	BASIN	3058.	3.92	717.	180.	87.	5.30		
+	HYDROGRAPH AT	RET9	325.	3.75	28.	7.	3.	.00		
+	HYDROGRAPH AT	C5CB	17.	4.08	5.	1.	1.	.17		
+	4 COMBINED AT	BASIN	3658.	3.92	839.	211.	102.	7.05		
+	ROUTED TO	DET	236.	6.33	229.	190.	102.	7.05		
+									2067.20	6.33
+	HYDROGRAPH AT	OFF-24	71.	3.58	10.	2.	1.	.06		
+	HYDROGRAPH AT	RET7	187.	4.00	53.	13.	6.	.00		
+	ROUTED TO	R24	187.	4.00	53.	13.	6.	.00		
+	2 COMBINED AT	MAGIC	214.	3.92	63.	16.	8.	.06		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING

(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

						INTERPOLATED TO COMPUTATION INTERVAL			
ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
R-21	MANE	2.51	53.21	221.68	1.64	5.00	52.26	220.00	1.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3782E+01 EXCESS= .0000E+00 OUTFLOW= .3801E+01 BASIN STORAGE= .3901E-04 PERCENT ERROR= -.5

RDIV1	MANE	2.17	30.93	256.89	-1.00	5.00	30.92	255.00	-1.00
C5FB	MANE	1.55	188.35	226.45	1.56	5.00	187.79	225.00	1.56

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1543E+02 EXCESS= .0000E+00 OUTFLOW= .1545E+02 BASIN STORAGE= .5896E-05 PERCENT ERROR= -.1

C5FB	MANE	2.34	674.26	223.36	1.81	5.00	671.54	225.00	1.81

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5141E+02 EXCESS= .0000E+00 OUTFLOW= .5183E+02 BASIN STORAGE= .4871E-03 PERCENT ERROR= -.8

100	MANE	.67	911.56	226.11	1.53	5.00	900.74	225.00	1.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7282E+02 EXCESS= .0000E+00 OUTFLOW= .7286E+02 BASIN STORAGE= .1287E-03 PERCENT ERROR= .0

C5EA	MANE	.51	1045.08	226.06	1.47	5.00	1025.07	225.00	1.47

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8477E+02 EXCESS= .0000E+00 OUTFLOW= .8481E+02 BASIN STORAGE= .1242E-03 PERCENT ERROR= .0

C5EC	MANE	.97	1309.61	231.28	1.52	5.00	1300.35	230.00	1.52

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1302E+03 EXCESS= .0000E+00 OUTFLOW= .1303E+03 BASIN STORAGE= .2814E-03 PERCENT ERROR= -.1

C5EC	MANE	4.63	205.78	266.53	.84	5.00	204.46	270.00	.84

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2633E+02 EXCESS= .0000E+00 OUTFLOW= .2638E+02 BASIN STORAGE= .3469E-02 PERCENT ERROR= -.2

300	MANE	1.10	1432.94	232.57	1.29	5.00	1408.48	235.00	1.29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1685E+03 EXCESS= .0000E+00 OUTFLOW= .1686E+03 BASIN STORAGE= .9873E-03 PERCENT ERROR= .0

400	MANE	.62	1492.76	231.37	1.28	5.00	1478.24	235.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1782E+03 EXCESS= .0000E+00 OUTFLOW= .1782E+03 BASIN STORAGE= .5195E-03 PERCENT ERROR= .0

500	MANE	.29	2401.42	230.67	1.38	5.00	2384.51	235.00	1.38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2677E+03 EXCESS= .0000E+00 OUTFLOW= .2677E+03 BASIN STORAGE= .2121E-03 PERCENT ERROR= .0

BASIN	MANE	.52	2870.24	235.51	1.41	5.00	2867.31	235.00	1.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3220E+03 EXCESS= .0000E+00 OUTFLOW= .3221E+03 BASIN STORAGE= .5612E-03 PERCENT ERROR= .0

R24	MANE	.48	187.36	241.14	-1.00	5.00	186.75	240.00	-1.00

*** NORMAL END OF HEC-1 ***

-----DSS---ZCLOSE Unit: 71, File: EQUESTRIAN.DSS
Pointer Utilization: .25
Number of Records: 24
File Size: 51.6 Kbytes
Percent Inactive: .0

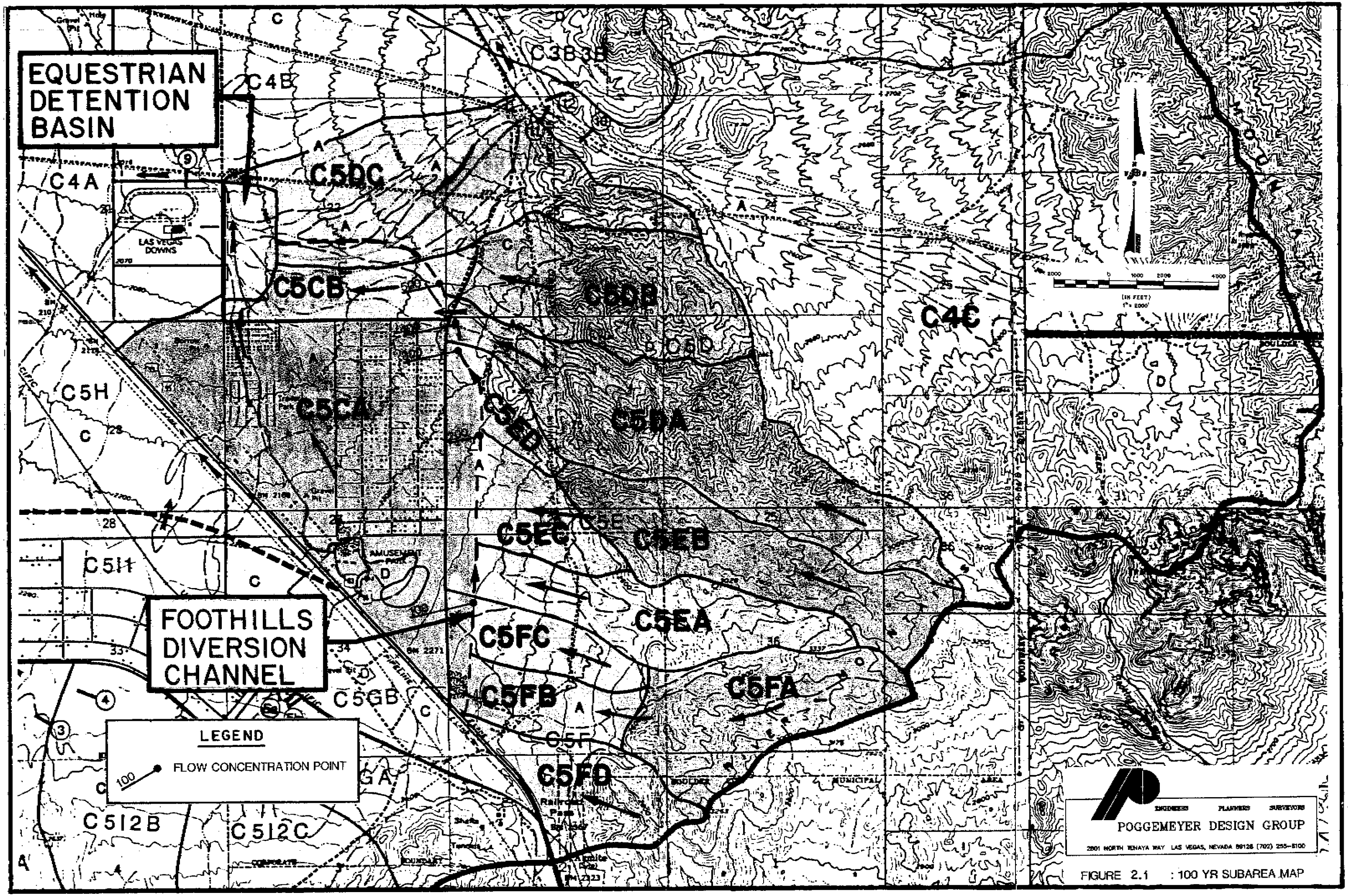


FIGURE 2.1 : 100 YR SUBAREA MAP

Equestrain Levee HEC-1 Hydrographs
Design HEC-1 Model EQUOAL4.HC1
(Discharges Reported as CFS)

		HEC-1 ID 100A	HEC-1 ID 200	HEC-1 ID 300	HEC-1 ID C5EAA	HEC-1 ID C5FBA	HEC-1 ID C5FD
1	10/7/2009 0:00	0	0	0	0	0	0
2	10/8/2009 0:05	0	0	0	0	0	0
3	10/8/2009 0:10	0	0	0	0	0	0
4	10/8/2009 0:15	0	0	0	0	0	0
5	10/8/2009 0:20	0	0	0	0	0	0
6	10/8/2009 0:25	0	0	0	0	0	0
7	10/8/2009 0:30	0	0	0	0	0	0.01
8	10/8/2009 0:35	0	0	0	0.1	0	0.04
9	10/8/2009 0:40	0	0	0	0.2	0	0.1
10	10/8/2009 0:45	0	0	0	0.3	0	0.15
11	10/8/2009 0:50	0	0	0	0.5	0.04	0.16
12	10/8/2009 0:55	0	0	0	0.7	0.17	0.14
13	10/8/2009 1:00	0	0	0	0.8	0.3	0.1
14	10/8/2009 1:05	0	0	0	0.8	1.55	0.08
15	10/8/2009 1:10	0.1	0.1	0	0.9	4.04	0.14
16	10/8/2009 1:15	1.1	0.2	0	1	6.54	0.29
17	10/8/2009 1:20	5.2	0.3	0	1.1	6.19	0.52
18	10/8/2009 1:25	6.3	0.5	0	3	4.78	0.85
19	10/8/2009 1:30	5.3	0.8	0	8	4.01	1.49
20	10/8/2009 1:35	4.5	1.7	0.1	8.3	4.07	2.49
21	10/8/2009 1:40	4.1	4.8	0.3	8.7	5.4	3.67
22	10/8/2009 1:45	4.9	7.8	0.7	9.8	8.28	4.72
23	10/8/2009 1:50	7.6	8.8	1.5	12.3	14.78	5.34
24	10/8/2009 1:55	15	10.4	3.6	17	24.19	5.3
25	10/8/2009 2:00	26.4	13.9	7	27.8	34.05	4.64
26	10/8/2009 2:05	34.3	22.7	9.9	40.7	33.52	3.8
27	10/8/2009 2:10	33.2	37.1	15.4	46.3	30.58	3.34
28	10/8/2009 2:15	30.3	45.1	28.7	45.1	25.82	3.92
29	10/8/2009 2:20	26.6	45.2	44.8	42.7	22.43	5.74
30	10/8/2009 2:25	24.7	43.1	49.3	40.7	21.95	8.1
31	10/8/2009 2:30	25.7	41.2	48.1	41.1	26.31	9.74
32	10/8/2009 2:35	32.1	41.2	45.4	45.9	37.39	10.07
33	10/8/2009 2:40	44.8	45.4	44.8	57.3	50.32	9.74
34	10/8/2009 2:45	55.4	57.1	48.9	71.9	53.36	9.92
35	10/8/2009 2:50	57.1	72.8	59.3	80.6	51.02	10.67
36	10/8/2009 2:55	55.4	81.6	74.8	82.4	49.8	10.81
37	10/8/2009 3:00	55.8	83.6	84.1	83.3	53.04	10.43
38	10/8/2009 3:05	58.8	85.8	90.1	86.7	53.58	11.28
39	10/8/2009 3:10	61.3	91.6	99	91.9	53.03	15.51

Equestrain Levee HEC-1 Hydrographs
Design HEC-1 Model EQUOAL4.HC1
(Discharges Reported as CFS)

		HEC-1 ID 100A	HEC-1 ID 200	HEC-1 ID 300	HEC-1 ID C5EAA	HEC-1 ID C5FBA	HEC-1 ID C5FD
40	10/8/2009 3:15	69.5	103	115.3	102.1	60.84	25.31
41	10/8/2009 3:20	101.4	130.1	148.7	134.1	96.33	43.71
42	10/8/2009 3:25	199.6	206.8	218.2	229.5	202.17	73.65
43	10/8/2009 3:30	408.4	407.5	376.4	446.2	397.92	115.66
44	10/8/2009 3:35	692.2	749.8	705.8	766.7	653.74	158.23
45	10/8/2009 3:40	942.8	1110.3	1079.5	1083	856.68	186.86
46	10/8/2009 3:45	1045.6	1357.6	1365.6	1274	914.8	188.96
47	10/8/2009 3:50	1006.7	1438	1494.4	1314.9	854.42	172.35
48	10/8/2009 3:55	888.3	1387.4	1474.4	1251.4	738	145.77
49	10/8/2009 4:00	739.8	1269.5	1370.1	1133.4	604.52	117.27
50	10/8/2009 4:05	605.4	1136.8	1236.4	1003.6	490.12	95.12
51	10/8/2009 4:10	494.5	1037.1	1114	880.1	399.07	76.43
52	10/8/2009 4:15	402.4	983.5	1031.4	764.2	323.52	60.4
53	10/8/2009 4:20	327.2	925.2	972.4	657.7	261.28	48.38
54	10/8/2009 4:25	267.8	842.5	902.7	561.9	212.52	40.38
55	10/8/2009 4:30	226.7	760.1	826.5	483.3	179.94	37.58
56	10/8/2009 4:35	206.6	694.7	761.7	429.7	165.79	39.99
57	10/8/2009 4:40	209.2	650	710.4	403.1	174.49	44.62
58	10/8/2009 4:45	231.3	625.4	673.6	403	201.03	47.58
59	10/8/2009 4:50	255.7	618.9	656.9	417	220.74	48.88
60	10/8/2009 4:55	267.4	618	654.1	425.8	226.31	49.09
61	10/8/2009 5:00	269	609.7	645.3	424.9	226.98	47.67
62	10/8/2009 5:05	262.3	591.1	625.2	416.5	221.31	43.25
63	10/8/2009 5:10	244.1	563.5	596	397	203.39	36.85
64	10/8/2009 5:15	213.2	525.3	559.2	363.7	173.32	29.41
65	10/8/2009 5:20	177	479.1	515	321	141.97	22.46
66	10/8/2009 5:25	143.7	429.8	466.6	276.2	113.61	17.34
67	10/8/2009 5:30	115.4	382.4	418.2	234.4	90.68	13.53
68	10/8/2009 5:35	93	339	372.1	197.6	72.8	10.8
69	10/8/2009 5:40	75.5	299.2	330	166.5	59.11	8.53
70	10/8/2009 5:45	62.1	264.2	292.8	140.2	48.68	7.05
71	10/8/2009 5:50	52	233.3	260.4	118.4	40.66	6.23
72	10/8/2009 5:55	44.3	206.2	230.9	100.9	34.48	5.74
73	10/8/2009 6:00	38.2	182.1	204.7	86.9	29.93	5.17
74	10/8/2009 6:05	33.6	161.4	181.5	75.6	27.15	4.52
75	10/8/2009 6:10	30.3	143.2	161.1	66.4	24.75	3.75
76	10/8/2009 6:15	27.1	127.3	143.1	58.7	22.29	2.83
77	10/8/2009 6:20	24	113.1	127.4	51.5	19.69	2.04
78	10/8/2009 6:25	20.8	100.5	113.5	44.8	16.78	1.36

Equestrain Levee HEC-1 Hydrographs
Design HEC-1 Model EQUOAL4.HC1
(Discharges Reported as CFS)

		HEC-1 ID 100A	HEC-1 ID 200	HEC-1 ID 300	HEC-1 ID C5EAA	HEC-1 ID C5FBA	HEC-1 ID C5FD
79	10/8/2009 6:30	17.6	89	101.3	38.3	14	0.87
80	10/8/2009 6:35	14.7	78.7	90.1	32.3	11.53	0.57
81	10/8/2009 6:40	12.2	69.2	80.1	26.9	9.25	0.38
82	10/8/2009 6:45	9.9	60.7	71	22.2	7.61	0.24
83	10/8/2009 6:50	8.2	53.3	62.7	18.3	6.26	0.16
84	10/8/2009 6:55	6.8	46.7	55.4	15	5.01	0.1
85	10/8/2009 7:00	5.6	41	49	12.4	4.29	0.07
86	10/8/2009 7:05	4.7	36	43.3	10.2	3.6	0.04
87	10/8/2009 7:10	4.1	31.8	38.4	8.5	2.97	0.03
88	10/8/2009 7:15	3.4	28.1	34.1	7.2	2.56	0.01
89	10/8/2009 7:20	2.9	24.9	30.3	6	2.24	0.01
90	10/8/2009 7:25	2.5	22.2	27	5.1	1.93	0
91	10/8/2009 7:30	2.2	19.6	24.2	4.3	1.62	0
92	10/8/2009 7:35	1.9	17.6	21.7	3.6	1.44	0
93	10/8/2009 7:40	1.7	15.7	19.4	3.1	1.29	0
94	10/8/2009 7:45	1.5	14	17.5	2.6	1.15	0
95	10/8/2009 7:50	1.3	12.7	15.7	2.2	1.01	0
96	10/8/2009 7:55	1.2	11.3	14.2	1.9	0.88	0
97	10/8/2009 8:00	1.1	10.2	12.9	1.7	0.79	0
98	10/8/2009 8:05	1	9.2	11.6	1.4	0.73	0
99	10/8/2009 8:10	0.9	8.3	10.5	1.3	0.67	0
100	10/8/2009 8:15	0.8	7.5	9.6	1.1	0.61	0
101	10/8/2009 8:20	0.7	6.9	8.7	1	0.55	0
102	10/8/2009 8:25	0.7	6.3	8	0.9	0.49	0
103	10/8/2009 8:30	0.6	5.7	7.3	0.8	0.44	0
104	10/8/2009 8:35	0.6	5.3	6.7	0.7	0.42	0
105	10/8/2009 8:40	0.5	4.9	6.2	0.7	0.39	0
106	10/8/2009 8:45	0.5	4.5	5.7	0.6	0.37	0
107	10/8/2009 8:50	0.4	4.1	5.3	0.6	0.34	0
108	10/8/2009 8:55	0.4	3.8	4.9	0.5	0.31	0
109	10/8/2009 9:00	0.4	3.6	4.5	0.5	0.29	0
110	10/8/2009 9:05	0.4	3.3	4.2	0.4	0.26	0
111	10/8/2009 9:10	0.3	3.1	3.9	0.4	0.24	0
112	10/8/2009 9:15	0.3	2.8	3.6	0.4	0.23	0
113	10/8/2009 9:20	0.3	2.6	3.4	0.4	0.22	0
114	10/8/2009 9:25	0.3	2.5	3.2	0.3	0.21	0
115	10/8/2009 9:30	0.3	2.3	3	0.3	0.2	0
116	10/8/2009 9:35	0.2	2.2	2.8	0.3	0.19	0
117	10/8/2009 9:40	0.2	2	2.6	0.3	0.18	0

Equestrain Levee HEC-1 Hydrographs
Design HEC-1 Model EQUOAL4.HC1
(Discharges Reported as CFS)

		HEC-1 ID 100A	HEC-1 ID 200	HEC-1 ID 300	HEC-1 ID C5EAA	HEC-1 ID C5FBA	HEC-1 ID C5FD
118	10/8/2009 9:45	0.2	1.9	2.5	0.3	0.16	0
119	10/8/2009 9:50	0.2	1.8	2.3	0.2	0.15	0
120	10/8/2009 9:55	0.2	1.7	2.2	0.2	0.14	0
121	10/8/2009 10:00	0.2	1.6	2	0.2	0.13	0
122	10/8/2009 10:05	0.2	1.5	1.9	0.2	0.13	0
123	10/8/2009 10:10	0.2	1.4	1.8	0.2	0.12	0
124	10/8/2009 10:15	0.2	1.3	1.7	0.2	0.12	0
125	10/8/2009 10:20	0.1	1.3	1.6	0.2	0.11	0
126	10/8/2009 10:25	0.1	1.2	1.6	0.2	0.11	0
127	10/8/2009 10:30	0.1	1.2	1.5	0.2	0.1	0
128	10/8/2009 10:35	0.1	1.1	1.4	0.2	0.1	0
129	10/8/2009 10:40	0.1	1	1.3	0.1	0.09	0
130	10/8/2009 10:45	0.1	1	1.3	0.1	0.09	0
131	10/8/2009 10:50	0.1	0.9	1.2	0.1	0.09	0
132	10/8/2009 10:55	0.1	0.9	1.2	0.1	0.08	0
133	10/8/2009 11:00	0.1	0.9	1.1	0.1	0.08	0
134	10/8/2009 11:05	0.1	0.8	1	0.1	0.07	0
135	10/8/2009 11:10	0.1	0.8	1	0.1	0.07	0
136	10/8/2009 11:15	0.1	0.7	1	0.1	0.07	0
137	10/8/2009 11:20	0.1	0.7	0.9	0.1	0.07	0
138	10/8/2009 11:25	0.1	0.7	0.9	0.1	0.06	0
139	10/8/2009 11:30	0.1	0.6	0.8	0.1	0.06	0
140	10/8/2009 11:35	0.1	0.6	0.8	0.1	0.06	0
141	10/8/2009 11:40	0.1	0.6	0.8	0.1	0.06	0
142	10/8/2009 11:45	0.1	0.6	0.7	0.1	0.06	0
143	10/8/2009 11:50	0.1	0.6	0.7	0.1	0.05	0
144	10/8/2009 11:55	0.1	0.5	0.7	0.1	0.05	0
145	10/8/2009 12:00	0.1	0.5	0.6	0.1	0.05	0
146	10/8/2009 12:05	0.1	0.5	0.6	0.1	0.05	0
147	10/8/2009 12:10	0.1	0.5	0.6	0.1	0.05	0
148	10/8/2009 12:15	0.1	0.5	0.6	0.1	0.04	0
149	10/8/2009 12:20	0.1	0.4	0.6	0.1	0.04	0
150	10/8/2009 12:25	0.1	0.4	0.5	0.1	0.04	0
151	10/8/2009 12:30	0.1	0.4	0.5	0.1	0.04	0
152	10/8/2009 12:35	0.1	0.4	0.5	0.1	0.04	0
153	10/8/2009 12:40	0	0.4	0.5	0.1	0.04	0
154	10/8/2009 12:45	0	0.4	0.5	0.1	0.04	0
155	10/8/2009 12:50	0	0.4	0.4	0.1	0.04	0
156	10/8/2009 12:55	0	0.3	0.4	0.1	0.03	0

Equestrain Levee HEC-1 Hydrographs
Design HEC-1 Model EQUOAL4.HC1
(Discharges Reported as CFS)

		HEC-1 ID 100A	HEC-1 ID 200	HEC-1 ID 300	HEC-1 ID C5EAA	HEC-1 ID C5FBA	HEC-1 ID C5FD
157	10/8/2009 13:00	0	0.3	0.4	0.1	0.03	0
158	10/8/2009 13:05	0	0.3	0.4	0.1	0.03	0
159	10/8/2009 13:10	0	0.3	0.4	0	0.03	0
160	10/8/2009 13:15	0	0.3	0.4	0	0.03	0
161	10/8/2009 13:20	0	0.3	0.4	0	0.03	0
162	10/8/2009 13:25	0	0.3	0.4	0	0.03	0
163	10/8/2009 13:30	0	0.3	0.3	0	0.03	0
164	10/8/2009 13:35	0	0.3	0.3	0	0.03	0
165	10/8/2009 13:40	0	0.3	0.3	0	0.03	0
166	10/8/2009 13:45	0	0.3	0.3	0	0.03	0
167	10/8/2009 13:50	0	0.2	0.3	0	0.03	0
168	10/8/2009 13:55	0	0.2	0.3	0	0.02	0
169	10/8/2009 14:00	0	0.2	0.3	0	0.02	0
170	10/8/2009 14:05	0	0.2	0.3	0	0.02	0
171	10/8/2009 14:10	0	0.2	0.3	0	0.02	0
172	10/8/2009 14:15	0	0.2	0.3	0	0.02	0
173	10/8/2009 14:20	0	0.2	0.3	0	0.02	0
174	10/8/2009 14:25	0	0.2	0.3	0	0.02	0
175	10/8/2009 14:30	0	0.2	0.2	0	0.02	0
176	10/8/2009 14:35	0	0.2	0.2	0	0.02	0
177	10/8/2009 14:40	0	0.2	0.2	0	0.02	0
178	10/8/2009 14:45	0	0.2	0.2	0	0.02	0
179	10/8/2009 14:50	0	0.2	0.2	0	0.02	0
180	10/8/2009 14:55	0	0.2	0.2	0	0.02	0
181	10/8/2009 15:00	0	0.2	0.2	0	0.02	0
182	10/8/2009 15:05	0	0.2	0.2	0	0.02	0
183	10/8/2009 15:10	0	0.2	0.2	0	0.02	0
184	10/8/2009 15:15	0	0.2	0.2	0	0.02	0
185	10/8/2009 15:20	0	0.1	0.2	0	0.02	0
186	10/8/2009 15:25	0	0.1	0.2	0	0.02	0
187	10/8/2009 15:30	0	0.1	0.2	0	0.02	0
188	10/8/2009 15:35	0	0.1	0.2	0	0.02	0
189	10/8/2009 15:40	0	0.1	0.2	0	0.01	0
190	10/8/2009 15:45	0	0.1	0.2	0	0.01	0
191	10/8/2009 15:50	0	0.1	0.2	0	0.01	0
192	10/8/2009 15:55	0	0.1	0.2	0	0.01	0
193	10/8/2009 16:00	0	0.1	0.2	0	0.01	0
194	10/8/2009 16:05	0	0.1	0.2	0	0.01	0
195	10/8/2009 16:10	0	0.1	0.1	0	0.01	0

Equestrain Levee HEC-1 Hydrographs
Design HEC-1 Model EQUOAL4.HC1
(Discharges Reported as CFS)

		HEC-1 ID 100A	HEC-1 ID 200	HEC-1 ID 300	HEC-1 ID C5EAA	HEC-1 ID C5FBA	HEC-1 ID C5FD
196	10/8/2009 16:15	0	0.1	0.1	0	0.01	0
197	10/8/2009 16:20	0	0.1	0.1	0	0.01	0
198	10/8/2009 16:25	0	0.1	0.1	0	0.01	0
199	10/8/2009 16:30	0	0.1	0.1	0	0.01	0
200	10/8/2009 16:35	0	0.1	0.1	0	0.01	0
201	10/8/2009 16:40	0	0.1	0.1	0	0.01	0
202	10/8/2009 16:45	0	0.1	0.1	0	0.01	0
203	10/8/2009 16:50	0	0.1	0.1	0	0.01	0
204	10/8/2009 16:55	0	0.1	0.1	0	0.01	0
205	10/8/2009 17:00	0	0.1	0.1	0	0.01	0
206	10/8/2009 17:05	0	0.1	0.1	0	0.01	0
207	10/8/2009 17:10	0	0.1	0.1	0	0.01	0
208	10/8/2009 17:15	0	0.1	0.1	0	0.01	0
209	10/8/2009 17:20	0	0.1	0.1	0	0.01	0
210	10/8/2009 17:25	0	0.1	0.1	0	0.01	0
211	10/8/2009 17:30	0	0.1	0.1	0	0.01	0
212	10/8/2009 17:35	0	0.1	0.1	0	0.01	0
213	10/8/2009 17:40	0	0.1	0.1	0	0.01	0
214	10/8/2009 17:45	0	0.1	0.1	0	0.01	0
215	10/8/2009 17:50	0	0.1	0.1	0	0.01	0
216	10/8/2009 17:55	0	0.1	0.1	0	0.01	0
217	10/8/2009 18:00	0	0.1	0.1	0	0.01	0
218	10/8/2009 18:05	0	0.1	0.1	0	0.01	0
219	10/8/2009 18:10	0	0.1	0.1	0	0.01	0
220	10/8/2009 18:15	0	0.1	0.1	0	0.01	0
221	10/8/2009 18:20	0	0.1	0.1	0	0.01	0
222	10/8/2009 18:25	0	0.1	0.1	0	0.01	0
223	10/8/2009 18:30	0	0.1	0.1	0	0.01	0
224	10/8/2009 18:35	0	0.1	0.1	0	0.01	0
225	10/8/2009 18:40	0	0.1	0.1	0	0.01	0
226	10/8/2009 18:45	0	0.1	0.1	0	0.01	0
227	10/8/2009 18:50	0	0.1	0.1	0	0.01	0
228	10/8/2009 18:55	0	0.1	0.1	0	0.01	0
229	10/8/2009 19:00	0	0.1	0.1	0	0.01	0
230	10/8/2009 19:05	0	0.1	0.1	0	0.01	0
231	10/8/2009 19:10	0	0.1	0.1	0	0.01	0
232	10/8/2009 19:15	0	0.1	0.1	0	0.01	0
233	10/8/2009 19:20	0	0.1	0.1	0	0.01	0
234	10/8/2009 19:25	0	0.1	0.1	0	0.01	0

Equestrain Levee HEC-1 Hydrographs
Design HEC-1 Model EQUOAL4.HC1
(Discharges Reported as CFS)

		HEC-1 ID 100A	HEC-1 ID 200	HEC-1 ID 300	HEC-1 ID C5EAA	HEC-1 ID C5FBA	HEC-1 ID C5FD
235	10/8/2009 19:30	0	0.1	0.1	0	0.01	0
236	10/8/2009 19:35	0	0.1	0.1	0	0.01	0
237	10/8/2009 19:40	0	0.1	0.1	0	0.01	0
238	10/8/2009 19:45	0	0.1	0.1	0	0.01	0
239	10/8/2009 19:50	0	0.1	0.1	0	0.01	0
240	10/8/2009 19:55	0	0.1	0.1	0	0.01	0
241	10/8/2009 20:00	0	0	0.1	0	0.01	0
242	10/8/2009 20:05	0	0	0.1	0	0.01	0
243	10/8/2009 20:10	0	0	0.1	0	0.01	0
244	10/8/2009 20:15	0	0	0.1	0	0.01	0
245	10/8/2009 20:20	0	0	0.1	0	0.01	0
246	10/8/2009 20:25	0	0	0.1	0	0.01	0
247	10/8/2009 20:30	0	0	0.1	0	0.01	0
248	10/8/2009 20:35	0	0	0.1	0	0.01	0
249	10/8/2009 20:40	0	0	0.1	0	0.01	0
250	10/8/2009 20:45	0	0	0.1	0	0.01	0
251	10/8/2009 20:50	0	0	0.1	0	0	0
252	10/8/2009 20:55	0	0	0.1	0	0	0
253	10/8/2009 21:00	0	0	0.1	0	0	0
254	10/8/2009 21:05	0	0	0.1	0	0	0
255	10/8/2009 21:10	0	0	0	0	0	0
256	10/8/2009 21:15	0	0	0	0	0	0

HEC-RAS Mixed Flow Output

EquestrianLeveeChan.prj
EquestrainLeveeChan.p02
EquestrianLeveeChan.g01
EquestrianLeveeChan.f01

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
16700	PF 1	5.34	2378.45	2378.89	2378.89	2379	0.022734	2.7	1.98	9.04	1.02
16700	PF 2	10.81	2378.45	2379.04	2379.04	2379.18	0.019763	3.06	3.54	12.07	0.99
16700	PF 3	188.96	2378.45	2379.99	2380.37	2381.21	0.037165	8.85	21.36	23.68	1.64
16700	PF 4	95.12	2378.45	2379.86	2379.86	2380.28	0.014592	5.2	18.3	22.35	1.01
16700	PF 5	43.25	2378.45	2379.45	2379.45	2379.74	0.016733	4.29	10.09	18.27	1.02
16700	PF 6	43.25	2378.45	2379.45	2379.45	2379.74	0.016733	4.29	10.09	18.27	1.02
16700	PF 7	4.52	2378.45	2378.86	2378.86	2378.97	0.02298	2.6	1.74	8.47	1.01
16700	PF 8	0.04	2378.45	2378.52	2378.51	2378.53	0.022473	0.79	0.05	1.46	0.74
16550	PF 1	5.34	2373.5	2374.09	2374.13	2374.29	0.027765	3.59	1.49	5.05	1.16
16550	PF 2	10.81	2373.5	2374.28	2374.33	2374.55	0.026539	4.2	2.57	6.65	1.19
16550	PF 3	188.96	2373.5	2375.99	2376.2	2376.58	0.026623	6.18	30.56	45.1	1.32
16550	PF 4	95.12	2373.5	2375.24	2375.48	2376.08	0.027745	7.36	12.92	14.89	1.39
16550	PF 5	43.25	2373.5	2374.8	2374.94	2375.35	0.026905	5.97	7.24	11.16	1.31
16550	PF 6	43.25	2373.5	2374.8	2374.94	2375.35	0.026905	5.97	7.24	11.16	1.31
16550	PF 7	4.52	2373.5	2374.06	2374.08	2374.24	0.027088	3.41	1.33	4.77	1.14
16550	PF 8	0.04	2373.5	2373.59	2373.59	2373.61	0.041677	1.25	0.03	0.72	1.04
16500	PF 1	5.34	2371.8	2372.25	2372.28	2372.41	0.030942	3.2	1.67	7.44	1.19
16500	PF 2	10.81	2371.8	2372.39	2372.43	2372.61	0.029818	3.77	2.87	9.76	1.22
16500	PF 3	188.96	2371.8	2373.46	2373.79	2374.53	0.036378	8.3	22.77	27.47	1.61
16500	PF 4	95.12	2371.8	2373.08	2373.31	2373.84	0.036448	6.99	13.6	21.23	1.54
16500	PF 5	43.25	2371.8	2372.77	2372.9	2373.25	0.034081	5.6	7.72	16	1.42
16500	PF 6	43.25	2371.8	2372.77	2372.9	2373.25	0.034081	5.6	7.72	16	1.42
16500	PF 7	4.52	2371.8	2372.23	2372.25	2372.37	0.028888	2.99	1.51	7.08	1.14
16500	PF 8	0.04	2371.8	2371.87	2371.86	2371.89	0.04314	1.07	0.04	1.12	1.02
16400	PF 1	5.34	2370.42	2370.74	2370.74	2370.85	0.021678	2.62	2.04	9.38	0.99
16400	PF 2	10.81	2370.42	2370.88	2370.88	2371.03	0.020195	3.14	3.44	11.46	1.01
16400	PF 3	188.96	2370.42	2372.08	2372.22	2372.77	0.01967	6.65	28.4	30.05	1.21
16400	PF 4	95.12	2370.42	2371.66	2371.74	2372.14	0.019551	5.57	17.09	23.52	1.15
16400	PF 5	43.25	2370.42	2371.31	2371.33	2371.61	0.018193	4.41	9.8	18.11	1.06
16400	PF 6	43.25	2370.42	2371.31	2371.33	2371.61	0.018193	4.41	9.8	18.11	1.06
16400	PF 7	4.52	2370.42	2370.72	2370.72	2370.82	0.02248	2.53	1.79	8.97	1
16400	PF 8	0.04	2370.42	2370.46	2370.46	2370.47	0.050755	0.81	0.05	2.52	1.02
16300	PF 1	5.34	2368.4	2368.56	2368.6	2368.71	0.057572	3.2	1.67	11.95	1.51
16300	PF 2	10.81	2368.4	2368.71	2368.71	2368.84	0.021457	2.93	3.68	14.27	1.02
16300	PF 3	188.96	2368.4	2369.75	2369.95	2370.53	0.024156	7.09	26.67	30	1.32
16300	PF 4	95.12	2368.4	2369.38	2369.48	2369.89	0.02246	5.72	16.62	24.4	1.22
16300	PF 5	43.25	2368.4	2369.07	2369.11	2369.37	0.020617	4.44	9.75	19.68	1.11
16300	PF 6	43.25	2368.4	2369.07	2369.11	2369.37	0.020617	4.44	9.75	19.68	1.11
16300	PF 7	4.52	2368.4	2368.56	2368.58	2368.67	0.035937	2.59	1.75	12.04	1.2
16300	PF 8	0.04	2368.4	2368.43	2368.43	2368.43	0.000851	0.14	0.29	10.05	0.14
16200	PF 1	5.34	2365.7	2365.96	2365.96	2366.06	0.022594	2.61	2.04	9.79	1.01
16200	PF 2	10.81	2365.7	2366.14	2366.09	2366.25	0.012721	2.65	4.07	12.36	0.82
16200	PF 3	188.96	2365.7	2369.27		2369.31	0.000478	1.7	111.38	56.27	0.21
16200	PF 4	95.12	2365.7	2368.21		2368.25	0.000637	1.59	59.91	41.49	0.23
16200	PF 5	43.25	2365.7	2367.23	2366.54	2367.28	0.001243	1.66	26	27.72	0.3
16200	PF 6	43.25	2365.7	2367.23	2366.54	2367.28	0.001243	1.66	26	27.72	0.3
16200	PF 7	4.52	2365.7	2365.93	2365.93	2366.03	0.02362	2.51	1.8	9.43	1.02
16200	PF 8	0.04	2365.7	2365.72	2365.72	2365.72	0.005831	0.29	0.14	6.51	0.35
16150	PF 1	34.05	2364.9	2365.53	2365.53	2365.76	0.017363	3.87	8.8	19.18	1.01
16150	PF 2	53.36	2364.9	2365.71	2365.71	2365.99	0.016071	4.27	12.49	22.15	1
16150	PF 3	914.8	2364.9	2368.14	2368.14	2369.13	0.010778	7.98	114.58	58.73	1.01
16150	PF 4	490.12	2364.9	2367.36	2367.36	2368.09	0.011844	6.86	71.5	49.51	1.01
16150	PF 5	221.31	2364.9	2366.58	2366.58	2367.11	0.013109	5.8	38.16	36.65	1
16150	PF 6	221.31	2364.9	2366.58	2366.58	2367.11	0.013109	5.8	38.16	36.65	1
16150	PF 7	27.15	2364.9	2365.46	2365.46	2365.67	0.017939	3.67	7.4	17.93	1.01
16150	PF 8	3.6	2364.9	2365.08	2365.07	2365.14	0.019981	2.01	1.79	11.63	0.9
16000	PF 1	34.05	2361.6	2362.22	2362.28	2362.54	0.025318	4.5	7.57	17.48	1.2
16000	PF 2	53.36	2361.6	2362.38	2362.47	2362.78	0.025573	5.11	10.45	20.09	1.25
16000	PF 3	914.8	2361.6	2364.48	2364.91	2366.07	0.021841	10.1	90.54	55.43	1.39

EquestrianLeveeChan.prj
EquestrainLeveeChan.p02
EquestrianLeveeChan.g01
EquestrianLeveeChan.f01

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
16000	PF 4	490.12	2361.6	2363.81	2364.12	2364.96	0.021893	8.59	57.03	44.62	1.34
16000	PF 5	221.31	2361.6	2363.14	2363.35	2363.94	0.023273	7.17	30.85	33.15	1.31
16000	PF 6	221.31	2361.6	2363.14	2363.35	2363.94	0.023273	7.17	30.85	33.15	1.31
16000	PF 7	27.15	2361.6	2362.16	2362.21	2362.43	0.025139	4.21	6.45	16.35	1.18
16000	PF 8	3.6	2361.6	2361.79	2361.79	2361.87	0.024481	2.26	1.59	10.09	1
15950	PF 1	34.05	2360.3	2360.94	2361.01	2361.23	0.029377	4.31	7.9	21.81	1.26
15950	PF 2	53.36	2360.3	2361.07	2361.17	2361.45	0.031198	4.96	10.77	25.17	1.34
15950	PF 3	914.8	2360.3	2362.95	2363.54	2364.91	0.025653	11.25	81.31	47.73	1.52
15950	PF 4	490.12	2360.3	2362.23	2362.68	2363.73	0.029608	9.83	49.87	40.01	1.55
15950	PF 5	221.31	2360.3	2361.63	2361.92	2362.62	0.033705	7.99	27.71	33.5	1.55
15950	PF 6	221.31	2360.3	2361.63	2361.92	2362.62	0.033705	7.99	27.71	33.5	1.55
15950	PF 7	27.15	2360.3	2360.89	2360.94	2361.14	0.029435	4.06	6.69	20.21	1.24
15950	PF 8	3.6	2360.3	2360.56	2360.57	2360.64	0.027583	2.24	1.61	11.28	1.05
15500	PF 1	34.05	2348.5	2349.3	2349.36	2349.6	0.026443	4.36	7.81	19.55	1.22
15500	PF 2	53.36	2348.5	2349.45	2349.53	2349.82	0.026755	4.9	10.89	23.08	1.26
15500	PF 3	914.8	2348.5	2351.33	2351.91	2353.29	0.025647	11.24	81.36	47.8	1.52
15500	PF 4	490.12	2348.5	2350.7	2351.07	2352.03	0.025782	9.26	52.94	41.87	1.45
15500	PF 5	221.31	2348.5	2350.1	2350.32	2350.93	0.026062	7.32	30.25	34.4	1.37
15500	PF 6	221.31	2348.5	2350.1	2350.32	2350.93	0.026062	7.32	30.25	34.4	1.37
15500	PF 7	27.15	2348.5	2349.24	2349.29	2349.5	0.026565	4.13	6.58	17.95	1.2
15500	PF 8	3.6	2348.5	2348.85	2348.86	2348.95	0.025308	2.44	1.47	8.51	1.03
15000	PF 1	26.4	2336.38	2336.79	2336.85	2337.04	0.031128	4.02	6.56	20.92	1.27
15000	PF 2	57.1	2336.38	2337.03	2337.1	2337.4	0.024076	4.86	11.74	23.22	1.2
15000	PF 3	1045.6	2336.38	2339.47	2339.94	2341.25	0.017945	10.7	97.69	47.07	1.31
15000	PF 4	605.4	2336.38	2338.83	2339.05	2340.01	0.015575	8.74	69.3	40.76	1.18
15000	PF 5	262.3	2336.38	2337.89	2338.08	2338.74	0.019378	7.39	35.47	31.66	1.23
15000	PF 6	262.3	2336.38	2337.89	2338.08	2338.74	0.019378	7.39	35.47	31.66	1.23
15000	PF 7	33.6	2336.38	2336.88	2336.91	2337.13	0.022977	3.98	8.44	21.78	1.13
15000	PF 8	4.7	2336.38	2336.59	2336.59	2336.64	0.022088	1.9	2.48	18.93	0.92
14700	PF 1	26.4	2329.76	2330.29	2330.32	2330.48	0.028325	3.52	7.5	27.32	1.18
14700	PF 2	57.1	2329.76	2330.48	2330.53	2330.78	0.023918	4.38	13.04	30.12	1.17
14700	PF 3	1045.6	2329.76	2332.36	2332.91	2334.22	0.025124	10.96	95.42	57.53	1.5
14700	PF 4	605.4	2329.76	2331.79	2332.17	2333.14	0.024681	9.33	64.9	49.19	1.43
14700	PF 5	262.3	2329.76	2331.15	2331.35	2331.95	0.023473	7.15	36.69	39.96	1.31
14700	PF 6	262.3	2329.76	2331.15	2331.35	2331.95	0.023473	7.15	36.69	39.96	1.31
14700	PF 7	33.6	2329.76	2330.35	2330.38	2330.55	0.024178	3.65	9.21	28.22	1.13
14700	PF 8	4.7	2329.76	2330.05	2330.04	2330.12	0.024475	2.12	2.22	15.55	0.99
14500	PF 1	26.4	2324.61	2324.95	2325	2325.18	0.031768	3.85	6.86	23.82	1.26
14500	PF 2	57.1	2324.61	2325.12	2325.23	2325.53	0.033017	5.14	11.11	25.67	1.38
14500	PF 3	1045.6	2324.61	2327.22	2327.88	2329.37	0.025499	11.79	88.71	48.3	1.53
14500	PF 4	605.4	2324.61	2326.55	2327.04	2328.2	0.027194	10.31	58.72	41.06	1.52
14500	PF 5	262.3	2324.61	2325.83	2326.13	2326.87	0.029323	8.21	31.93	33.28	1.48
14500	PF 6	262.3	2324.61	2325.83	2326.13	2326.87	0.029323	8.21	31.93	33.28	1.48
14500	PF 7	33.6	2324.61	2324.99	2325.06	2325.28	0.034784	4.32	7.77	24.23	1.34
14500	PF 8	4.7	2324.61	2324.76	2324.75	2324.81	0.021108	1.77	2.66	21.78	0.89
14000	PF 1	26.4	2312.78	2313.17	2313.19	2313.37	0.022805	3.53	7.48	23.02	1.09
14000	PF 2	57.1	2312.78	2313.36	2313.43	2313.71	0.025502	4.79	11.93	25.24	1.23
14000	PF 3	1045.6	2312.78	2315.46	2316.07	2317.48	0.024281	11.4	91.72	50.66	1.49
14000	PF 4	605.4	2312.78	2314.83	2315.25	2316.31	0.024092	9.76	62	42.98	1.43
14000	PF 5	262.3	2312.78	2314.11	2314.34	2315.02	0.02406	7.65	34.3	34.32	1.35
14000	PF 6	262.3	2312.78	2314.11	2314.34	2315.02	0.02406	7.65	34.3	34.32	1.35
14000	PF 7	33.6	2312.78	2313.22	2313.26	2313.46	0.023447	3.88	8.66	23.63	1.13
14000	PF 8	4.7	2312.78	2312.95	2312.95	2313	0.020923	1.81	2.59	20.29	0.9
13800	PF 1	26.4	2307.24	2307.62	2307.67	2307.86	0.032001	3.88	6.81	23.46	1.27
13800	PF 2	57.1	2307.24	2307.82	2307.9	2308.19	0.028811	4.92	11.6	25.83	1.29
13800	PF 3	1045.6	2307.24	2309.83	2310.51	2312.01	0.027523	11.87	88.09	50.31	1.58
13800	PF 4	605.4	2307.24	2309.2	2309.7	2310.84	0.028165	10.26	58.99	42.69	1.54
13800	PF 5	262.3	2307.24	2308.5	2308.81	2309.53	0.029399	8.13	32.25	34.21	1.48
13800	PF 6	262.3	2307.24	2308.5	2308.81	2309.53	0.029399	8.13	32.25	34.21	1.48

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River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
13800	PF 7	33.6	2307.24	2307.68	2307.73	2307.94	0.030387	4.16	8.08	24.11	1.27
13800	PF 8	4.7	2307.24	2307.42	2307.43	2307.48	0.0335	2.06	2.28	20.97	1.1
13250	PF 1	27.8	2293.65	2294.04	2294.08	2294.26	0.02731	3.73	7.46	24.24	1.18
13250	PF 2	83.3	2293.65	2294.4	2294.46	2294.77	0.020171	4.89	17.02	29.21	1.13
13250	PF 3	1314.9	2293.65	2296.91	2297.2	2298.41	0.014877	9.82	133.84	64.02	1.2
13250	PF 4	1003.6	2293.65	2296.76	2296.76	2297.77	0.010526	8.05	124.63	61.97	1
13250	PF 5	416.5	2293.65	2295.58	2295.61	2296.3	0.012925	6.82	61.1	45.57	1.04
13250	PF 6	416.5	2293.65	2295.58	2295.61	2296.3	0.012925	6.82	61.1	45.57	1.04
13250	PF 7	75.6	2293.65	2294.41	2294.41	2294.71	0.01601	4.39	17.23	29.31	1.01
13250	PF 8	10.2	2293.65	2293.91	2293.9	2294	0.019492	2.33	4.38	22.4	0.93
13000	PF 1	27.8	2287.75	2288.18	2288.23	2288.41	0.027712	3.85	7.22	22.56	1.2
13000	PF 2	83.3	2287.75	2288.48	2288.61	2289.01	0.030522	5.84	14.26	25.6	1.38
13000	PF 3	1314.9	2287.75	2290.8	2291.61	2293.39	0.026536	12.91	101.82	49.72	1.59
13000	PF 4	1003.6	2287.75	2290.41	2291.11	2292.68	0.027189	12.09	83.03	45.63	1.58
13000	PF 5	416.5	2287.75	2289.43	2289.86	2290.86	0.029195	9.61	43.32	35.47	1.53
13000	PF 6	416.5	2287.75	2289.43	2289.86	2290.86	0.029195	9.61	43.32	35.47	1.53
13000	PF 7	75.6	2287.75	2288.43	2288.57	2288.94	0.03173	5.72	13.21	25.17	1.39
13000	PF 8	10.2	2287.75	2288.07	2288.05	2288.14	0.014978	2.19	4.65	21.35	0.83
12700	PF 1	27.8	2281.49	2281.86	2281.88	2282.02	0.024861	3.19	8.73	33.45	1.1
12700	PF 2	83.3	2281.49	2282.12	2282.18	2282.47	0.023842	4.75	17.55	35.81	1.19
12700	PF 3	1314.9	2281.49	2284.13	2284.81	2286.42	0.024393	12.14	108.28	54.52	1.52
12700	PF 4	1003.6	2281.49	2283.77	2284.34	2285.72	0.024648	11.21	89.49	51.21	1.5
12700	PF 5	416.5	2281.49	2282.91	2283.22	2284.04	0.025546	8.55	48.73	43.16	1.42
12700	PF 6	416.5	2281.49	2282.91	2283.22	2284.04	0.025546	8.55	48.73	43.16	1.42
12700	PF 7	75.6	2281.49	2282.09	2282.14	2282.41	0.02377	4.57	16.53	35.54	1.18
12700	PF 8	10.2	2281.49	2281.67	2281.73	2281.91	0.149837	3.87	2.63	29.02	2.26
12500	PF 1	27.8	2277.56	2277.9	2277.87	2278.02	0.014951	2.8	9.92	31.47	0.88
12500	PF 2	83.3	2277.56	2278.17	2278.19	2278.48	0.018318	4.5	18.52	33.55	1.07
12500	PF 3	1314.9	2277.56	2280.46	2280.97	2282.44	0.01799	11.3	116.38	51.77	1.33
12500	PF 4	1003.6	2277.56	2280.05	2280.48	2281.75	0.018223	10.45	96.04	48.55	1.31
12500	PF 5	416.5	2277.56	2279.07	2279.28	2280.07	0.019162	8.02	51.94	40.7	1.25
12500	PF 6	416.5	2277.56	2279.07	2279.28	2280.07	0.019162	8.02	51.94	40.7	1.25
12500	PF 7	75.6	2277.56	2278.13	2278.15	2278.43	0.018697	4.37	17.3	33.27	1.07
12500	PF 8	10.2	2277.56	2277.76	2277.73	2277.81	0.013791	1.86	5.49	30.33	0.77
12000	PF 1	27.8	2269.07	2269.59	2269.57	2269.7	0.014722	2.63	10.56	36.39	0.86
12000	PF 2	83.3	2269.07	2269.79	2269.84	2270.12	0.023432	4.61	18.06	37.93	1.18
12000	PF 3	1314.9	2269.07	2271.87	2272.44	2273.95	0.020499	11.57	113.62	53.82	1.4
12000	PF 4	1003.6	2269.07	2271.5	2271.97	2273.27	0.020832	10.67	94.04	50.97	1.38
12000	PF 5	416.5	2269.07	2270.6	2270.85	2271.62	0.022067	8.1	51.4	44.14	1.32
12000	PF 6	416.5	2269.07	2270.6	2270.85	2271.62	0.022067	8.1	51.4	44.14	1.32
12000	PF 7	75.6	2269.07	2269.76	2269.81	2270.07	0.02356	4.46	16.97	37.71	1.17
12000	PF 8	10.2	2269.07	2269.44	2269.4	2269.49	0.014412	1.91	5.34	29.26	0.79
11500	PF 1	27.8	2261.49	2262.01	2261.98	2262.12	0.01552	2.7	10.3	35.49	0.88
11500	PF 2	83.3	2261.49	2262.29	2262.27	2262.54	0.014915	4.04	20.6	37.53	0.96
11500	PF 3	1314.9	2261.49	2264.58	2264.92	2266.28	0.014812	10.46	125.7	54.2	1.21
11500	PF 4	1003.6	2261.49	2264.17	2264.44	2265.61	0.014966	9.64	104.12	51.22	1.19
11500	PF 5	416.5	2261.49	2263.2	2263.29	2264.01	0.014981	7.21	57.77	44.14	1.11
11500	PF 6	416.5	2261.49	2263.2	2263.29	2264.01	0.014981	7.21	57.77	44.14	1.11
11500	PF 7	75.6	2261.49	2262.14	2262.24	2262.53	0.032984	5	15.13	36.46	1.37
11500	PF 8	10.2	2261.49	2261.85	2261.83	2261.91	0.015396	1.96	5.21	28.94	0.81
11000	PF 1	27.8	2254.01	2254.71		2254.8	0.010468	2.51	11.09	31.77	0.75
11000	PF 2	83.3	2254.01	2255.06	2254.95	2255.25	0.009368	3.51	23.73	37.7	0.78
11000	PF 3	1314.9	2254.01	2257.3	2257.62	2258.98	0.014374	10.39	126.51	53.84	1.19
11000	PF 4	1003.6	2254.01	2256.9	2257.14	2258.31	0.01426	9.52	105.43	50.95	1.17
11000	PF 5	416.5	2254.01	2256.1	2255.98	2256.7	0.009434	6.21	67.04	45.22	0.9
11000	PF 6	416.5	2254.01	2256.1	2255.98	2256.7	0.009434	6.21	67.04	45.22	0.9
11000	PF 7	75.6	2254.01	2255.02	2254.92	2255.2	0.009361	3.39	22.33	37.43	0.77
11000	PF 8	10.2	2254.01	2254.48		2254.54	0.01185	2.04	4.99	21.35	0.74

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River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
10500	PF 1	27.8	2246.93	2247.25	2247.32	2247.49	0.048199	3.9	7.13	33.12	1.48
10500	PF 2	83.3	2246.93	2247.67	2247.61	2247.9	0.012358	3.86	21.59	36.66	0.89
10500	PF 3	1314.9	2246.93	2249.74	2250.27	2251.74	0.019379	11.34	115.96	54.32	1.37
10500	PF 4	1003.6	2246.93	2249.36	2249.8	2251.06	0.019524	10.46	95.96	51.09	1.34
10500	PF 5	416.5	2246.93	2248.45	2248.66	2249.41	0.019599	7.88	52.87	43.32	1.26
10500	PF 6	416.5	2246.93	2248.45	2248.66	2249.41	0.019599	7.88	52.87	43.32	1.26
10500	PF 7	75.6	2246.93	2247.63	2247.58	2247.85	0.012329	3.72	20.32	36.36	0.88
10500	PF 8	10.2	2246.93	2247.22	2247.18	2247.26	0.01208	1.73	5.88	32.67	0.72
10000	PF 1	27.8	2239.43	2239.77	2239.75	2239.89	0.015673	2.76	10.06	33.77	0.89
10000	PF 2	83.3	2239.43	2240.01	2240.05	2240.33	0.0205	4.54	18.35	35.69	1.12
10000	PF 3	1314.9	2239.43	2242.21	2242.73	2244.2	0.018739	11.31	116.22	53.22	1.35
10000	PF 4	1003.6	2239.43	2241.81	2242.25	2243.53	0.019347	10.52	95.44	50.01	1.34
10000	PF 5	416.5	2239.43	2240.87	2241.1	2241.87	0.020548	8.05	51.73	42.49	1.29
10000	PF 6	416.5	2239.43	2240.87	2241.1	2241.87	0.020548	8.05	51.73	42.49	1.29
10000	PF 7	75.6	2239.43	2239.98	2240.02	2240.28	0.021028	4.41	17.12	35.41	1.12
10000	PF 8	10.2	2239.43	2239.63		2239.69	0.017951	1.95	5.22	32.61	0.86
9500	PF 1	27.8	2231.71	2232.08	2232.01	2232.16	0.009563	2.33	11.91	35.55	0.71
9500	PF 2	83.3	2231.71	2232.41	2232.3	2232.59	0.009197	3.48	23.91	37.9	0.77
9500	PF 3	1314.9	2231.71	2234.59	2234.95	2236.34	0.015311	10.61	123.91	53.6	1.23
9500	PF 4	1003.6	2231.71	2234.2	2234.47	2235.66	0.015185	9.72	103.3	50.76	1.2
9500	PF 5	416.5	2231.71	2233.46	2233.32	2234.04	0.0091	6.13	67.93	45.48	0.88
9500	PF 6	416.5	2231.71	2233.46	2233.32	2234.04	0.0091	6.13	67.93	45.48	0.88
9500	PF 7	75.6	2231.71	2232.36	2232.27	2232.54	0.009368	3.38	22.36	37.6	0.77
9500	PF 8	10.2	2231.71	2231.93	2231.87	2231.96	0.008953	1.55	6.57	34.46	0.63
9000	PF 1	27.8	2224.35	2224.59	2224.69	2224.91	0.071132	4.53	6.14	30.59	1.78
9000	PF 2	83.3	2224.35	2225.07	2225	2225.3	0.011407	3.87	21.53	34.27	0.86
9000	PF 3	1314.9	2224.35	2227.29	2227.78	2229.26	0.017667	11.26	116.78	51.46	1.32
9000	PF 4	1003.6	2224.35	2226.88	2227.28	2228.56	0.017948	10.42	96.3	48.28	1.3
9000	PF 5	416.5	2224.35	2225.89	2226.09	2226.87	0.018598	7.95	52.39	40.64	1.23
9000	PF 6	416.5	2224.35	2225.89	2226.09	2226.87	0.018598	7.95	52.39	40.64	1.23
9000	PF 7	75.6	2224.35	2225.03	2224.96	2225.24	0.011294	3.72	20.31	33.99	0.85
9000	PF 8	10.2	2224.35	2224.58	2224.54	2224.63	0.011408	1.75	5.82	30.51	0.71
8600	PF 1	27.8	2218.56	2219.34	2218.94	2219.36	0.000888	1.07	25.94	41.76	0.24
8600	PF 2	83.3	2218.56	2219.91	2219.21	2219.95	0.000964	1.64	50.82	45.84	0.27
8600	PF 3	1314.9	2218.56	2223.43	2221.73	2223.84	0.001941	5.12	257.8	78.08	0.47
8600	PF 4	1003.6	2218.56	2222.87	2221.27	2223.2	0.001842	4.61	217.84	67.11	0.45
8600	PF 5	416.5	2218.56	2221.42	2220.18	2221.58	0.001484	3.26	127.95	56.67	0.38
8600	PF 6	416.5	2218.56	2221.42	2220.18	2221.58	0.001484	3.26	127.95	56.67	0.38
8600	PF 7	75.6	2218.56	2219.85	2219.18	2219.89	0.000948	1.58	47.99	45.39	0.27
8600	PF 8	10.2	2218.56	2219.02	2218.82	2219.03	0.001197	0.8	12.69	39.42	0.25
8500	PF 1	27.8	2217.44	2218.26	2218	2218.32	0.003081	1.88	14.75	25.82	0.44
8500	PF 2	83.3	2217.44	2218.8	2218.38	2218.92	0.003291	2.81	29.67	29.91	0.5
8500	PF 3	1314.9	2217.44	2222.13		2223.04	0.00543	7.65	171.77	55.38	0.77
8500	PF 4	1003.6	2217.44	2221.61		2222.36	0.005123	6.96	144.27	51.45	0.73
8500	PF 5	416.5	2217.44	2220.27	2219.65	2220.67	0.004272	5.07	82.12	41.19	0.63
8500	PF 6	416.5	2217.44	2220.27	2219.65	2220.67	0.004272	5.07	82.12	41.19	0.63
8500	PF 7	75.6	2217.44	2218.74	2218.33	2218.85	0.003255	2.71	27.91	29.45	0.49
8500	PF 8	10.2	2217.44	2217.96	2217.82	2217.99	0.003812	1.4	7.3	23.51	0.44
8200	PF 1	13.9	2215.37	2216.18	2215.6	2216.19	0.000306	0.69	20.1	28.02	0.14
8200	PF 2	83.6	2215.37	2217.02		2217.07	0.000899	1.8	46.34	34.17	0.27
8200	PF 3	1438	2215.37	2220.91		2221.5	0.002725	6.14	234.21	62.46	0.56
8200	PF 4	1136.8	2215.37	2220.38		2220.87	0.002568	5.64	201.71	58.56	0.54
8200	PF 5	591.1	2215.37	2219.13		2219.43	0.002128	4.39	134.67	49.54	0.47
8200	PF 6	591.1	2215.37	2219.13		2219.43	0.002128	4.39	134.67	49.54	0.47
8200	PF 7	161.4	2215.37	2217.53		2217.63	0.001278	2.5	64.54	37.85	0.34
8200	PF 8	36	2215.37	2216.55		2216.57	0.000547	1.16	31.06	30.74	0.2
8150	PF 1	13.9	2215.06	2215.73	2215.26	2215.74	0.000302	0.61	22.8	38.11	0.14
8150	PF 2	83.6	2215.06	2216.63		2216.66	0.000541	1.38	60.63	45.89	0.21
8150	PF 3	1438	2215.06	2220.77		2221.08	0.001297	4.43	324.74	81.68	0.39

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River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
8150	PF 4	1136.8	2215.06	2220.2		2220.46	0.001229	4.07	279.51	76.74	0.38
8150	PF 5	591.1	2215.06	2218.88		2219.04	0.001046	3.18	185.65	65.32	0.33
8150	PF 6	591.1	2215.06	2218.88		2219.04	0.001046	3.18	185.65	65.32	0.33
8150	PF 7	161.4	2215.06	2217.18		2217.23	0.000693	1.86	86.88	50.6	0.25
8150	PF 8	36	2215.06	2216.13		2216.14	0.000395	0.93	38.58	41.54	0.17
7800	PF 1	13.9	2214.15	2214.79		2214.86	0.007095	2.14	6.51	17.67	0.62
7800	PF 2	83.6	2214.15	2215.5		2215.73	0.007434	3.87	21.58	24.73	0.73
7800	PF 3	1438	2214.15	2218.74	2218.74	2220.1	0.009629	9.33	154.12	56.93	1
7800	PF 4	1136.8	2214.15	2218.28	2218.25	2219.49	0.009824	8.84	128.58	52.29	0.99
7800	PF 5	591.1	2214.15	2217.29	2217.15	2218.1	0.009099	7.23	81.73	42.48	0.92
7800	PF 6	591.1	2214.15	2217.29	2217.15	2218.1	0.009102	7.23	81.72	42.48	0.92
7800	PF 7	161.4	2214.15	2215.95		2216.3	0.007857	4.79	33.68	29.18	0.79
7800	PF 8	36	2214.15	2215.09		2215.23	0.006834	2.9	12.43	20.73	0.66
7450	PF 1	7	2210.67	2211.21	2210.86	2211.22	0.000425	0.61	11.48	24.72	0.16
7450	PF 2	84.1	2210.67	2212.31		2212.37	0.001097	1.95	43.2	32.98	0.3
7450	PF 3	1494.4	2210.67	2216.29		2216.92	0.002986	6.4	233.64	62.81	0.58
7450	PF 4	1236.4	2210.67	2215.82		2216.39	0.002912	6.02	205.3	59.32	0.57
7450	PF 5	625.2	2210.67	2214.46		2214.81	0.002566	4.77	131.15	49.07	0.51
7450	PF 6	625.2	2210.67	2214.46		2214.81	0.002566	4.77	131.15	49.07	0.51
7450	PF 7	181.5	2210.67	2212.94		2213.06	0.001552	2.78	65.2	37.66	0.37
7450	PF 8	43.3	2210.67	2211.91		2211.94	0.000806	1.42	30.59	29.97	0.25
7423	PF 1	7	2210.53	2210.77	2210.7	2210.8	0.006403	1.4	5	23.75	0.54
7423	PF 2	84.1	2210.53	2211.63	2211.29	2211.77	0.004091	3	28	30.07	0.55
7423	PF 3	1494.4	2210.53	2215.92		2216.58	0.003524	6.52	229.29	68.12	0.63
7423	PF 4	1236.4	2210.53	2215.42		2216.04	0.003592	6.28	196.78	62.66	0.62
7423	PF 5	625.2	2210.53	2213.97		2214.4	0.003386	5.25	119.01	47.46	0.58
7423	PF 6	625.2	2210.53	2213.97		2214.4	0.003386	5.25	119.01	47.46	0.58
7423	PF 7	181.5	2210.53	2212.26	2211.74	2212.48	0.003673	3.72	48.73	34.8	0.55
7423	PF 8	43.3	2210.53	2211.25	2211.03	2211.35	0.004737	2.5	17.3	27.31	0.55
7350	PF 1	7	2209.93	2210.49		2210.5	0.001923	0.92	7.6	27.43	0.31
7350	PF 2	84.1	2209.93	2211.5		2211.56	0.001499	2.04	41.31	37.45	0.34
7350	PF 3	1494.4	2209.93	2215.92		2216.35	0.001799	5.25	286.79	81.52	0.46
7350	PF 4	1236.4	2209.93	2215.42		2215.8	0.001834	4.95	249.86	68.77	0.46
7350	PF 5	625.2	2209.93	2213.94		2214.19	0.001727	3.99	156.5	56.92	0.42
7350	PF 6	625.2	2209.93	2213.94		2214.19	0.001727	3.99	156.5	56.92	0.42
7350	PF 7	181.5	2209.93	2212.17		2212.28	0.00157	2.66	68.27	42.82	0.37
7350	PF 8	43.3	2209.93	2211.09		2211.13	0.001479	1.61	26.84	34.22	0.32
7238	PF 1	7	2209.85	2210.23		2210.26	0.004279	1.34	5.21	19.4	0.46
7238	PF 2	84.1	2209.85	2211.09		2211.27	0.005186	3.41	24.65	26.06	0.62
7238	PF 3	1494.4	2209.85	2214.92		2215.97	0.005928	8.24	181.32	55.79	0.81
7238	PF 4	1236.4	2209.85	2214.48		2215.43	0.005953	7.85	157.54	52.37	0.8
7238	PF 5	625.2	2209.85	2213.19		2213.84	0.00584	6.47	96.61	42.38	0.76
7238	PF 6	625.2	2209.85	2213.19		2213.84	0.00584	6.47	96.61	42.38	0.76
7238	PF 7	181.5	2209.85	2211.67		2211.97	0.005458	4.42	41.1	30.57	0.67
7238	PF 8	43.3	2209.85	2210.74		2210.86	0.004873	2.68	16.13	23.39	0.57
7100	PF 1	7	2209.4	2209.7		2209.72	0.004258	1.2	5.82	25.55	0.44
7100	PF 2	84.1	2209.4	2210.64		2210.74	0.002563	2.52	33.32	32.68	0.44
7100	PF 3	1494.4	2209.4	2214.61		2215.31	0.003509	6.73	222.16	62.66	0.63
7100	PF 4	1236.4	2209.4	2214.15		2214.78	0.003481	6.37	194.24	59.19	0.62
7100	PF 5	625.2	2209.4	2212.81		2213.22	0.00326	5.13	121.95	49.09	0.57
7100	PF 6	625.2	2209.4	2212.81		2213.22	0.00326	5.13	121.95	49.09	0.57
7100	PF 7	181.5	2209.4	2211.26		2211.43	0.002726	3.31	54.79	37.33	0.48
7100	PF 8	43.3	2209.4	2210.26		2210.32	0.002658	2.03	21.3	29.77	0.42
7000	PF 1	7	2209.06	2209.49		2209.5	0.001042	0.8	8.73	24.46	0.24
7000	PF 2	84.1	2209.06	2210.47		2210.56	0.001854	2.33	36.14	31.32	0.38
7000	PF 3	1494.4	2209.06	2213.91		2214.92	0.005501	8.08	184.89	55.3	0.78
7000	PF 4	1236.4	2209.06	2213.53		2214.41	0.005205	7.52	164.48	52.66	0.75
7000	PF 5	625.2	2209.06	2212.42		2212.92	0.004086	5.68	110.07	44.87	0.64
7000	PF 6	625.2	2209.06	2212.42		2212.92	0.004086	5.68	110.07	44.87	0.64

EquestrianLeveeChan.prj
EquestrainLeveeChan.p02
EquestrianLeveeChan.g01
EquestrianLeveeChan.f01

River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
7000	PF 7	181.5	2209.06	2211.05		2211.21	0.002486	3.29	55.15	35.31	0.46
7000	PF 8	43.3	2209.06	2210.11		2210.15	0.001479	1.73	25.07	28.75	0.33
6700	PF 1	7	2207.42	2208.07		2208.08	0.000391	0.52	13.39	34.24	0.15
6700	PF 2	84.1	2207.42	2208.95		2209	0.001139	1.78	47.17	42.57	0.3
6700	PF 3	1494.4	2207.42	2212.72		2213.18	0.002303	5.44	274.59	78.19	0.51
6700	PF 4	1236.4	2207.42	2212.24		2212.66	0.002326	5.18	238.56	73.69	0.51
6700	PF 5	625.2	2207.42	2210.93		2211.2	0.002189	4.18	149.74	61.23	0.47
6700	PF 6	625.2	2207.42	2210.93		2211.2	0.002188	4.17	149.75	61.23	0.47
6700	PF 7	181.5	2207.42	2209.5		2209.6	0.001522	2.52	71.89	47.75	0.36
6700	PF 8	43.3	2207.42	2208.61		2208.64	0.00087	1.3	33.26	39.35	0.25
6500	PF 1	7	2207.56	2207.87		2207.89	0.004675	1.08	6.45	35.56	0.45
6500	PF 2	84.1	2207.56	2208.48		2208.6	0.004991	2.74	30.69	44.16	0.58
6500	PF 3	1494.4	2207.56	2212.33		2212.7	0.002196	4.92	303.8	97.81	0.49
6500	PF 4	1236.4	2207.56	2211.81		2212.17	0.002439	4.85	254.73	90.55	0.51
6500	PF 5	625.2	2207.56	2210.34		2210.67	0.00349	4.56	137.13	70.14	0.57
6500	PF 6	625.2	2207.56	2210.34		2210.67	0.003488	4.56	137.17	70.15	0.57
6500	PF 7	181.5	2207.56	2208.92		2209.12	0.004885	3.51	51.66	50.35	0.61
6500	PF 8	43.3	2207.56	2208.23		2208.3	0.004905	2.16	20.03	40.65	0.54
6400	PF 1	7	2207.19	2207.44		2207.46	0.00507	1.07	6.54	39.02	0.46
6400	PF 2	84.1	2207.19	2208.08		2208.17	0.003847	2.43	34.58	48.99	0.51
6400	PF 3	1494.4	2207.19	2212.26		2212.51	0.001325	3.97	376.07	114.27	0.39
6400	PF 4	1236.4	2207.19	2211.72		2211.96	0.00145	3.9	316.82	105.87	0.4
6400	PF 5	625.2	2207.19	2210.18		2210.38	0.002013	3.64	171.92	81.76	0.44
6400	PF 6	625.2	2207.19	2210.18		2210.38	0.002012	3.64	171.96	81.77	0.44
6400	PF 7	181.5	2207.19	2208.59		2208.72	0.003207	2.95	61.55	56.93	0.5
6400	PF 8	43.3	2207.19	2207.8		2207.86	0.004397	2.02	21.48	44.63	0.51
6200	PF 1	7	2206.02	2206.19	2206.19	2206.26	0.02588	2.22	3.15	21.39	1.02
6200	PF 2	84.1	2206.02	2206.8	2206.8	2207.15	0.015127	4.74	17.74	25.64	1
6200	PF 3	1494.4	2206.02	2210.35	2210.35	2211.9	0.009467	10.01	149.3	48.59	1.01
6200	PF 4	1236.4	2206.02	2209.92	2209.92	2211.34	0.009712	9.58	129.11	45.82	1.01
6200	PF 5	625.2	2206.02	2208.67	2208.67	2209.7	0.010753	8.14	76.81	37.72	1.01
6200	PF 6	625.2	2206.02	2208.67	2208.67	2209.7	0.010709	8.13	76.92	37.74	1
6200	PF 7	181.5	2206.02	2207.28	2207.28	2207.82	0.013255	5.91	30.71	28.74	1.01
6200	PF 8	43.3	2206.02	2206.54	2206.54	2206.77	0.017089	3.88	11.16	23.91	1

SEDDISCH Output

1
Equestrian Levee, Sta 9000, Q=1314.9 cfs

Top width	51.44 feet	Water surf. slope	0.0177220 ft/ft
Mean depth	2.30 feet	D50	2.000 Millimeters
Mean velocity	11.27 ft/sec	Kinematic viscosity	0.00001053
Water discharge	1333.38 cfs	Sed. fall velocity	0.4769 ft/sed
Water temperature	21.1 deg C		

Computed bed-material concentration and discharge

Formula	conc. (ppm)	Unit disch (lbs/sec/ft)	Discharge (tons/day)
Yang sand (using D50)	15662.67	25.3745	56387.42

* * * *

Water Resources Applications Software

Geochemical || Ground Water || Surface Water || Water Quality || General

Summary of SEDDISCH

NAME

seddisch - Computation of fluvial sediment discharge

ABSTRACT

SEDDISCH computes fluvial sediment discharge by allowing the user to choose between five described bedload formulas and eight described bed-material formulas. The bedload discharge formulas are those of Schoklitsch (1934), Kalinske, Meyer-Peter and Muller (1948), Rottner, and Einstein. The bed-material formulas are those of Laursen, Engelund and Hansen, Colby, Ackers and White, Yang sand formula, Yang gravel formula, Einstein, and Toffaleti.

METHOD

Numerous sediment-discharge formulas have been proposed in literature. Selection of the thirteen formulas used in SEDDISCH was based on: (1) theoretical background, (2) extent of testing by original author and independent investigator(s), and (3) extent of use by engineers and researchers. The user is asked to choose from these formulas based on which field data are available.

Bedload Discharge Formulas

Bedload discharge is the discharge of sediment that moves in essentially continuous contact with the bed.

Schoklitsch developed a bedload formula based mainly on Gilbert's (1914) flume data with median sediment sizes ranging from 0.3 to 5 mm. The basis for this formula is that bed material begins to move at some critical discharge and that the bedload discharge is proportional to the rate of work done by the part of the tractive force in excess of that needed to overcome the resistance along the wetted perimeter.

The formula developed by Kalinske for computing bedload discharge of unigranular material is based on the continuity equation which states that the bedload discharge is equal to the product of the average velocity of the particles in motion, the weight of each particle, and the number of particles.

Meyer-Peter and Muller developed an empirical formula for the bedload discharge in natural streams. The computer program computes the effective diameter of the bed-material mixture from

the entered sediment size-fraction data. However, the program does not compute the bedload discharge by size fractions.

Rottner developed an equation to express bedload discharge in terms of the flow parameters based on dimensional considerations and empirical coefficients. In his derivation, wall and bed form effects were excluded, and Rottner stated that the equation may not be applicable when small quantities of bed material are being moved.

The bedload relation developed by Einstein is derived from the concept of probabilities of particle motion.

Bed-Materal Discharge Formulas

Bed-material discharge is the discharge of sediment which is derived from and readily exchanges with the particles in the bed material; particles comprising the bed-material discharge move both as bedload and in suspension.

The equation developed by Laursen to compute the mean concentration of bed-material discharge is based on empirical relations using natural sediments with a specific gravity of 2.65, and medium diameters that range from 0.011 to 4.08 mm.

Engelund and Hansen applied Bagnold's (1966) stream power concept and the similarity principle to derive a sediment transport equation. This equation can be used with moderately sorted bed materials having mean fall diameters larger than 0.15 mm.

Colby presented a graphical method to determine the discharge of sand-size bed material that ranged from 0.1 to 0.8 mm in water at a temperature of 15.6 degrees Celsius. This program uses a set of equations derived by Carl Nordin (U.S. Geological Survey) that represent Colby's curves at 0, 5, 10, 15.6, 20, 30, and 40 degrees Celsius.

Ackers and White developed a general sediment-discharge function in terms of three dimensionless groups: size, mobility, and discharge.

Yang derived an equation to compute concentration of the bed-material discharge, for sand-bed streams, based on dimensional analysis and the concept of unit stream power. He defined unit stream power as the rate of potential energy dissipated per unit weight of water, which is expressed by the velocity and slope product.

Yang, using the same dimensional analysis and multiple regression methods as was used to derive discharge rates in sand-bed streams, derived an equation to compute the bed-material discharge concentration, in gravel-bed streams. The same definition of unit stream power is used in both the sand and gravel transport equations.

Einstein's method combines his computed bedload discharge with a computed suspended bed-material discharge to yield the total bed-material discharge.

Toffaleti's method is based on the concepts of Einstein with three modifications: (1) velocity distribution in the vertical is obtained from an expression different from that used by Einstein;

(2) several of Einstein's correction factors are adjusted and combined; and (3) the height of the zone of bedload transport is changed from Einstein's two grain diameters. Toffaleti defines his bed-material discharge as total river sand discharge even though he defines the range of bed-size material from 0.062 to 16 mm.

HISTORY

Version 1.2 1998/01/16 - First release of original program as ported and after code clean-up for use on UNIX workstations.

DATA REQUIREMENTS

Input for SEDDISCH is generated during an interactive session using the program DISDATA. DISDATA generates a direct access file that is read by SEDDISCH. The following data are prompted for by DISDATA to form the SEDDISCH data set:

- measurement location
- top width
- mean depth
- mean velocity
- water-surface slope
- water temperature
- particle size, in millimeters, at which the 35, 50, 65, and 90 percent by weight is finer (enter zero if not required)

Bed-material particle size data are entered depending on the value of the option code selected at the start of the run. One option is that no size distribution data are to be entered. Zero values are given to the percent-in-class variables for the size fractions. The other two options are to enter the size data as percent-finer values or as percent-in-class values.

SYSTEM REQUIREMENTS

SEDDISCH is written in Fortran 77. Generally, the program is easily installed on most computer systems. The code has been used on UNIX-based computers and DOS-based 386 or greater computers having a math coprocessor and 1 mb of memory.

DOCUMENTATION

Stevens, H.H., and Yang, Chih Ted, 1989, Summary and use of selected fluvial sediment-discharge formulas: U.S. Geological Survey Water-Resources Investigations Report 89-4026, 121 p.

CONTACTS

Operation and Distribution:

U.S. Geological Survey
Hydrologic Analysis Software Support Program
437 National Center
Reston, VA 20192

h2osoft@usgs.gov

Official versions of U.S. Geological Survey water-resources analysis software are available for electronic retrieval via the World Wide Web (WWW) at:

http://water.usgs.gov/software/

and via anonymous File Transfer Protocol (FTP) from:

water.usgs.gov (path: /pub/software).

The WWW page and anonymous FTP directory from which the SEDDISCH software can be retrieved are, respectively:

http://water.usgs.gov/software/seddisch.html
--and--
/pub/software/surface_water/seddisch

SEE ALSO

disdata(1) - Data entry program for seddisch
mepdata(1) - Data entry program for modein
modein(1) - Total sediment discharge program using modified Einstein procedure
sedsize(1) - Particle-size statistics of fluvial sediments
sizedata(1) - Data entry program for sedsize

The URL for this page is: http://water.usgs.gov/cgi-bin/man_wrdapp?seddisch
Send questions or comments to h2osoft@usgs.gov

Sediment Volume Calculations

Equestrian Levee: Sediment Volume Calculations													
River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Top Wdth Act	Hydr Radius	D50 (mm)	Sediment Transport Capacity	Sediment passing through	Sediment passing through
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft)	(ft)	(mm)	(tons/day)	(tons)	(cu. ft)
16700	5.34	2378.45	2378.89	2378.89	2379	0.022734	2.7	9.04	0.22	2	73.47		
16700	10.81	2378.45	2379.04	2379.04	2379.18	0.019763	3.06	12.07	0.29	2	158.68		
16700	188.96	2378.45	2379.99	2380.37	2381.21	0.037165	8.85	23.68	0.89	2	11027.57		
16700	95.12	2378.45	2379.86	2379.86	2380.28	0.014592	5.2	22.35	0.81	2	2019.35		
16700	43.25	2378.45	2379.45	2379.45	2379.74	0.016733	4.29	18.27	0.55	2	846.33		
16700	43.25	2378.45	2379.45	2379.45	2379.74	0.016733	4.29	18.27	0.55	2	846.33		
16700	4.52	2378.45	2378.86	2378.86	2378.97	0.02298	2.6	8.47	0.2	2	57.09		
16700	0.04	2378.45	2378.52	2378.51	2378.53	0.022473	0.79	1.46	0.03	2	0	624.67	9610.31
										2			
16550	5.34	2373.5	2374.09	2374.13	2374.29	0.027765	3.59	5.05	0.29	2	123.8		
16550	10.81	2373.5	2374.28	2374.33	2374.55	0.026539	4.2	6.65	0.38	2	286.15		
16550	188.96	2373.5	2375.99	2376.2	2376.58	0.026623	6.18	45.1	0.67	2	7052.8		
16550	95.12	2373.5	2375.24	2375.48	2376.08	0.027745	7.36	14.89	0.84	2	4041.1		
16550	43.25	2373.5	2374.8	2374.94	2375.35	0.026905	5.97	11.16	0.63	2	1555.95		
16550	43.25	2373.5	2374.8	2374.94	2375.35	0.026905	5.97	11.16	0.63	2	1555.95		
16550	4.52	2373.5	2374.06	2374.08	2374.24	0.027088	3.41	4.77	0.27	2	95.58		
16550	0.04	2373.5	2373.59	2373.59	2373.61	0.041677	1.25	0.72	0.04	2	0	610.39	9390.66
										2			
16500	5.34	2371.8	2372.25	2372.28	2372.41	0.030942	3.2	7.44	0.22	2	116.51		
16500	10.81	2371.8	2372.39	2372.43	2372.61	0.029818	3.77	9.76	0.29	2	280.32		
16500	188.96	2371.8	2373.46	2373.79	2374.53	0.036378	8.3	27.47	0.82	2	10526.71		
16500	95.12	2371.8	2373.08	2373.31	2373.84	0.036448	6.99	21.23	0.64	2	4816.14		
16500	43.25	2371.8	2372.77	2372.9	2373.25	0.034081	5.6	16	0.48	2	1784.67		
16500	43.25	2371.8	2372.77	2372.9	2373.25	0.034081	5.6	16	0.48	2	1784.67		
16500	4.52	2371.8	2372.23	2372.25	2372.37	0.028888	2.99	7.08	0.21	2	85.63		
16500	0.04	2371.8	2371.87	2371.86	2371.89	0.04314	1.07	1.12	0.03	2	0	805.68	12395.13
										2			
16400	5.34	2370.42	2370.74	2370.74	2370.85	0.021678	2.62	9.38	0.22	2	67.75		
16400	10.81	2370.42	2370.88	2370.88	2371.03	0.020195	3.14	11.46	0.3	2	168.55		
16400	188.96	2370.42	2372.08	2372.22	2372.77	0.01967	6.65	30.05	0.94	2	6094.56		
16400	95.12	2370.42	2371.66	2371.74	2372.14	0.019551	5.57	23.52	0.72	2	2649.57		
16400	43.25	2370.42	2371.31	2371.33	2371.61	0.018193	4.41	18.11	0.54	2	926.53		
16400	43.25	2370.42	2371.31	2371.33	2371.61	0.018193	4.41	18.11	0.54	2	926.53		
16400	4.52	2370.42	2370.72	2370.72	2370.82	0.02248	2.53	8.97	0.2	2	55.1		
16400	0.04	2370.42	2370.46	2370.46	2370.47	0.050755	0.81	2.52	0.02	2	0	452.28	6958.15
										2			
16300	5.34	2368.4	2368.56	2368.6	2368.71	0.057572	3.2	11.95	0.14	2	189.5		
16300	10.81	2368.4	2368.71	2368.71	2368.84	0.021457	2.93	14.27	0.26	2	161.27		
16300	188.96	2368.4	2369.75	2369.95	2370.53	0.024156	7.09	30	0.88	2	7310.75		
16300	95.12	2368.4	2369.38	2369.48	2369.89	0.02246	5.72	24.4	0.68	2	3001.29		
16300	43.25	2368.4	2369.07	2369.11	2369.37	0.020617	4.44	19.68	0.49	2	1016.02		
16300	43.25	2368.4	2369.07	2369.11	2369.37	0.020617	4.44	19.68	0.49	2	1016.02		
16300	4.52	2368.4	2368.56	2368.58	2368.67	0.035937	2.59	12.04	0.14	2	80.17		
16300	0.04	2368.4	2368.43	2368.43	2368.43	0.000851	0.14	10.05	0.03	2	0	528.34	8128.38
										2			
16200	5.34	2365.7	2365.96	2365.96	2366.06	0.022594	2.61	9.79	0.21	2	69.05		
16200	10.81	2365.7	2366.14	2366.09	2366.25	0.012721	2.65	12.36	0.33	2	89.85		
16200	188.96	2365.7	2369.27		2369.31	0.000478	1.7	56.27	1.96	2	20.78		
16200	95.12	2365.7	2368.21		2368.25	0.000637	1.59	41.49	1.43	2	8.94		
16200	43.25	2365.7	2367.23	2366.54	2367.28	0.001243	1.66	27.72	0.93	2	10.59		
16200	43.25	2365.7	2367.23	2366.54	2367.28	0.001243	1.66	27.72	0.93	2	10.59		
16200	4.52	2365.7	2365.93	2365.93	2366.03	0.02362	2.51	9.43	0.19	2	56		
16200	0.04	2365.7	2365.72	2365.72	2365.72	0.005831	0.29	6.51	0.02	2	0	9.64	148.25
										2			
16150	34.05	2364.9	2365.53	2365.53	2365.76	0.017363	3.87	19.18	0.46	2	615.88		
16150	53.36	2364.9	2365.71	2365.71	2365.99	0.016071	4.27	22.15	0.56	2	1004.39		
16150	914.8	2364.9	2368.14	2368.14	2369.13	0.010778	7.98	58.73	1.93	2	22298.81		
16150	490.12	2364.9	2367.36	2367.36	2368.09	0.011844	6.86	49.51	1.43	2	11384.57		
16150	221.31	2364.9	2366.58	2366.58	2367.11	0.013109	5.8	36.65	1.03	2	4795.98		
16150	221.31	2364.9	2366.58	2366.58	2367.11	0.013109	5.8	36.65	1.03	2	4795.98		
16150	27.15	2364.9	2365.46	2365.46	2365.67	0.017939	3.67	17.93	0.41	2	469.22		
16150	3.6	2364.9	2365.08	2365.07	2365.14	0.019981	2.01	11.63	0.15	2	23.23	1878.82	28904.96
										2			
16000	34.05	2361.6	2362.22	2362.28	2362.54	0.025318	4.5	17.48	0.43	2	944.04		
16000	53.36	2361.6	2362.38	2362.47	2362.78	0.025573	5.11	20.09	0.52	2	1683.17		
16000	914.8	2361.6	2364.48	2364.91	2366.07	0.021841	10.1	55.43	1.62	2	41307.06		
16000	490.12	2361.6	2363.81	2364.12	2364.96	0.021893	8.59	44.62	1.27	2	20186.97		
16000	221.31	2361.6	2363.14	2363.35	2363.94	0.023273	7.17	33.15	0.92	2	8396.06		
16000	221.31	2361.6	2363.14	2363.35	2363.94	0.023273	7.17	33.15	0.92	2	8396.06		
16000	27.15	2361.6	2362.16	2362.21	2362.43	0.025139	4.21	16.35	0.39	2	698.32		
16000	3.6	2361.6	2361.79	2361.79	2361.87	0.024481	2.26	10.09	0.16	2	38.09	3383.20	52049.23
										2			
15950	34.05	2360.3	2360.94	2361.01	2361.23	0.029377	4.31	21.81	0.36	2	1009.06		
15950	53.36	2360.3	2361.07	2361.17	2361.45	0.031198	4.96	25.17	0.43	2	1897.16		
15950	914.8	2360.3	2362.95	2363.54	2364.91	0.025653	11.25	47.73	1.69	2	48319.25		
15950	490.12	2360.3	2362.23	2362.68	2363.73	0.029608	9.83	40.01	1.24	2	26457.76		
15950	221.31	2360.3	2361.63	2361.92	2362.62	0.033705	7.99	33.5	0.82	2	11512.57		
15950	221.31	2360.3	2361.63	2361.92	2362.62	0.033705	7.99	33.5	0.82	2	11512.57		
15950	27.15	2360.3	2360.89	2360.94	2361.14	0.029435	4.06	20.21	0.33	2	761.55		
15950	3.6	2360.3	2360.56	2360.57	2360.64	0.027583	2.24	11.28	0.14	2	39.92	4209.39	64759.79
										2			

Equestrian Levee: Sediment Volume Calculations													
River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Top Wdth Act	Hydr Radius	D50 (mm)	Sediment Transport Capacity	Sediment passing through	Sediment passing through
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft)	(ft)	(mm)	(tons/day)	(tons)	(cu. ft)
15500	34.05	2348.5	2349.3	2349.36	2349.6	0.026443	4.36	19.55	0.4	2	951.95		
15500	53.36	2348.5	2349.45	2349.53	2349.82	0.026755	4.9	23.08	0.47	2	1668.77		
15500	914.8	2348.5	2351.33	2351.91	2353.29	0.025647	11.24	47.8	1.69	2	48309.73		
15500	490.12	2348.5	2350.7	2351.07	2352.03	0.025782	9.26	41.87	1.26	2	23511.94		
15500	221.31	2348.5	2350.1	2350.32	2350.93	0.026062	7.32	34.4	0.88	2	9291.27		
15500	221.31	2348.5	2350.1	2350.32	2350.93	0.026062	7.32	34.4	0.88	2	9291.27		
15500	27.15	2348.5	2349.24	2349.29	2349.5	0.026565	4.13	17.95	0.37	2	727.63		
15500	3.6	2348.5	2348.85	2348.86	2348.95	0.025308	2.44	8.51	0.17	2	44.12	3889.28	59835.11
										2			
15000	26.4	2336.38	2336.79	2336.85	2337.04	0.031128	4.02	20.92	0.31	2	756.47		
15000	57.1	2336.38	2337.03	2337.1	2337.4	0.024041	4.86	23.22	0.5	2	1630.33		
15000	1045.6	2336.38	2339.47	2339.94	2341.25	0.017939	10.7	47.07	2.05	2	42916.39		
15000	605.4	2336.38	2338.83	2339.05	2340.01	0.015575	8.74	40.76	1.68	2	20101.71		
15000	262.3	2336.38	2337.89	2338.08	2338.74	0.019378	7.39	31.66	1.11	2	9003.43		
15000	262.3	2336.38	2337.89	2338.08	2338.74	0.019378	7.39	31.66	1.11	2	9003.43		
15000	33.6	2336.38	2336.88	2336.91	2337.13	0.022977	3.98	21.78	0.39	2	775.41		
15000	4.7	2336.38	2336.59	2336.59	2336.64	0.022088	1.9	18.93	0.13	2	28.52	3493.82	53751.10
										2			
14700	26.4	2329.76	2330.29	2330.32	2330.48	0.028325	3.52	27.32	0.27	2	607.61		
14700	57.1	2329.76	2330.48	2330.53	2330.78	0.023918	4.38	30.12	0.43	2	1480.2		
14700	1045.6	2329.76	2332.36	2332.91	2334.22	0.025124	10.96	57.53	1.65	2	53981.78		
14700	605.4	2329.76	2331.79	2332.17	2333.14	0.024681	9.33	49.19	1.31	2	28289.51		
14700	262.3	2329.76	2331.15	2331.35	2331.95	0.023473	7.15	39.96	0.91	2	10021.22		
14700	262.3	2329.76	2331.15	2331.35	2331.95	0.023473	7.15	39.96	0.91	2	10021.22		
14700	33.6	2329.76	2330.35	2330.38	2330.55	0.024178	3.65	28.22	0.33	2	735.52		
14700	4.7	2329.76	2330.05	2330.04	2330.12	0.024475	2.12	15.55	0.14	2	41.61	4370.65	67240.81
										2			
14500	26.4	2324.61	2324.95	2325	2325.18	0.031768	3.85	23.82	0.29	2	747.92		
14500	57.1	2324.61	2325.12	2325.23	2325.53	0.033017	5.14	25.67	0.43	2	2152.33		
14500	1045.6	2324.61	2327.22	2327.88	2329.37	0.025499	11.79	48.3	1.82	2	56274.11		
14500	605.4	2324.61	2326.55	2327.04	2328.2	0.027194	10.31	41.06	1.42	2	31723.98		
14500	262.3	2324.61	2325.83	2326.13	2326.87	0.029323	8.21	33.28	0.95	2	12649.92		
14500	262.3	2324.61	2325.83	2326.13	2326.87	0.029323	8.21	33.28	0.95	2	12649.92		
14500	33.6	2324.61	2324.99	2325.06	2325.28	0.034784	4.32	24.23	0.32	2	1129.97		
14500	4.7	2324.61	2324.76	2324.75	2324.81	0.021108	1.77	21.78	0.12	2	20.99	4874.40	74990.82
										2			
14000	26.4	2312.78	2313.17	2313.19	2313.37	0.022805	3.53	23.02	0.32	2	518.29		
14000	57.1	2312.78	2313.36	2313.43	2313.71	0.025502	4.79	25.24	0.47	2	1689.6		
14000	1045.6	2312.78	2315.46	2316.07	2317.48	0.024281	11.4	50.66	1.8	2	53868.92		
14000	605.4	2312.78	2314.83	2315.25	2316.31	0.024092	9.76	42.98	1.43	2	28507.07		
14000	262.3	2312.78	2314.11	2314.34	2315.02	0.02406	7.65	34.32	0.99	2	10655.25		
14000	262.3	2312.78	2314.11	2314.34	2315.02	0.02406	7.65	34.32	0.99	2	10655.25		
14000	33.6	2312.78	2313.22	2313.26	2313.46	0.023447	3.88	23.63	0.37	2	768.37		
14000	4.7	2312.78	2312.95	2312.95	2313	0.020923	1.81	20.29	0.13	2	23.54	4434.95	68230.07
										2			
13800	26.4	2307.24	2307.62	2307.67	2307.86	0.032001	3.88	23.46	0.29	2	752.89		
13800	57.1	2307.24	2307.82	2307.9	2308.19	0.028811	4.92	25.83	0.45	2	1897.83		
13800	1045.6	2307.24	2309.83	2310.51	2312.01	0.027523	11.87	50.31	1.74	2	59243.02		
13800	605.4	2307.24	2309.2	2309.7	2310.84	0.028165	10.26	42.69	1.37	2	32290.53		
13800	262.3	2307.24	2308.5	2308.81	2309.53	0.029399	8.13	34.21	0.94	2	12676.23		
13800	262.3	2307.24	2308.5	2308.81	2309.53	0.029399	8.13	34.21	0.94	2	12676.23		
13800	33.6	2307.24	2307.68	2307.73	2307.94	0.030387	4.16	24.11	0.33	2	977.49		
13800	4.7	2307.24	2307.42	2307.43	2307.48	0.0335	2.06	20.97	0.11	2	51.67	5008.97	77061.08
										2			
13250	27.8	2293.65	2294.04	2294.08	2294.26	0.027243	3.72	24.24	0.31	2	675.78		
13250	83.3	2293.65	2294.4	2294.46	2294.77	0.020071	4.89	29.23	0.58	2	2115.51		
13250	1314.9	2293.65	2296.91	2297.2	2298.41	0.014877	9.82	64.02	2.07	2	45675.87		
13250	1003.6	2293.65	2296.75	2296.75	2297.77	0.010713	8.1	61.79	1.99	2	24715.13		
13250	416.5	2293.65	2295.58	2295.61	2296.3	0.012998	6.83	45.53	1.33	2	10303.14		
13250	416.5	2293.65	2295.58	2295.61	2296.3	0.012998	6.83	45.53	1.33	2	10303.14		
13250	75.6	2293.65	2294.41	2294.41	2294.71	0.01601	4.39	29.31	0.59	2	1477.16		
13250	10.2	2293.65	2293.91	2293.9	2294	0.019492	2.33	22.4	0.2	2	96.44	3961.35	60943.91
										2			
13000	27.8	2287.75	2288.18	2288.23	2288.41	0.027712	3.85	22.56	0.32	2	706.99		
13000	83.3	2287.75	2288.48	2288.61	2289.01	0.030522	5.84	25.6	0.55	2	3270.91		
13000	1314.9	2287.75	2290.8	2291.61	2293.39	0.026536	12.91	49.72	2.03	2	75556.6		
13000	1003.6	2287.75	2290.41	2291.11	2292.68	0.027189	12.09	45.63	1.8	2	56717.64		
13000	416.5	2287.75	2289.43	2289.86	2290.86	0.029195	9.61	35.47	1.21	2	21918.1		
13000	416.5	2287.75	2289.43	2289.86	2290.86	0.029195	9.61	35.47	1.21	2	21918.1		
13000	75.6	2287.75	2288.43	2288.57	2288.94	0.03173	5.72	25.17	0.52	2	3008.7		
13000	10.2	2287.75	2288.07	2288.05	2288.14	0.014978	2.19	21.35	0.22	2	66.69	7618.48	117207.42
										2			
12700	27.8	2281.49	2281.86	2281.88	2282.02	0.024861	3.19	33.45	0.26	2	519.74		
12700	83.3	2281.49	2282.12	2282.18	2282.47	0.023842	4.75	35.81	0.49	2	2342.83		
12700	1314.9	2281.49	2284.13	2284.81	2286.42	0.024393	12.14	54.52	1.97	2	69887.68		
12700	1003.6	2281.49	2283.77	2284.34	2285.72	0.024648	11.21	51.21	1.73	2	51525.14		
12700	416.5	2281.49	2282.91	2283.22	2284.04	0.025546	8.55	43.16	1.12	2	18887.47		
12700	416.5	2281.49	2282.91	2283.22	2284.04	0.025546	8.55	43.16	1.12	2	18887.47		
12700	75.6	2281.49	2282.09	2282.14	2282.41	0.02377	4.57	35.54	0.46	2	2022.27		
12700	10.2	2281.49	2281.67	2281.73	2281.91	0.149837	3.87	29.02	0.09	2	858.69	6879.20	105833.82
										2			

Equestrian Levee: Sediment Volume Calculations													
River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Top Wdth Act	Hydr Radius	D50 (mm)	Sediment Transport Capacity	Sediment passing through	Sediment passing through
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft)	(ft)	(mm)	(tons/day)	(tons)	(cu. ft)
12500	27.8	2277.56	2277.9	2277.87	2278.02	0.014951	2.8	31.47	0.31	2	283.72		
12500	83.3	2277.56	2278.17	2278.19	2278.48	0.018318	4.5	33.55	0.55	2	1830.4		
12500	1314.9	2277.56	2280.46	2280.97	2282.44	0.01799	11.3	51.77	2.22	2	55727.98		
12500	1003.6	2277.56	2280.05	2280.48	2281.75	0.018223	10.45	48.55	1.95	2	40995.87		
12500	416.5	2277.56	2279.07	2279.28	2280.07	0.019162	8.02	40.7	1.26	2	14969.29		
12500	416.5	2277.56	2279.07	2279.28	2280.07	0.019162	8.02	40.7	1.26	2	14969.29		
12500	75.6	2277.56	2278.13	2278.15	2278.43	0.018697	4.37	33.27	0.52	2	1642.33		
12500	10.2	2277.56	2277.76	2277.73	2277.81	0.013791	1.86	30.33	0.18	2	38.52	5430.62	83547.95
										2			
12000	27.8	2269.07	2269.59	2269.57	2269.7	0.014722	2.63	36.39	0.29	2	256.37		
12000	83.3	2269.07	2269.79	2269.84	2270.12	0.023432	4.61	37.93	0.47	2	2220.25		
12000	1314.9	2269.07	2271.87	2272.44	2273.95	0.020499	11.57	53.82	2.08	2	61020.56		
12000	1003.6	2269.07	2271.5	2271.97	2273.27	0.020832	10.67	50.97	1.82	2	45118.61		
12000	416.5	2269.07	2270.6	2270.85	2271.62	0.022067	8.1	44.14	1.16	2	16653.72		
12000	416.5	2269.07	2270.6	2270.85	2271.62	0.022067	8.1	44.14	1.16	2	16653.72		
12000	75.6	2269.07	2269.76	2269.81	2270.07	0.02356	4.46	37.71	0.45	2	1987.1		
12000	10.2	2269.07	2269.44	2269.4	2269.49	0.014412	1.91	29.26	0.18	2	43.33	5993.63	92209.71
										2			
11500	27.8	2261.49	2262.01	2261.98	2262.12	0.01552	2.7	35.49	0.29	2	280.22		
11500	83.3	2261.49	2262.29	2262.27	2262.54	0.014915	4.04	37.53	0.55	2	1407.68		
11500	1314.9	2261.49	2264.58	2264.92	2266.28	0.014812	10.46	54.2	2.29	2	47186.32		
11500	1003.6	2261.49	2264.17	2264.44	2265.61	0.014966	9.64	51.22	2.01	2	34560.33		
11500	416.5	2261.49	2263.2	2263.29	2264.01	0.014981	7.21	44.14	1.3	2	11839.35		
11500	416.5	2261.49	2263.2	2263.29	2264.01	0.014981	7.21	44.14	1.3	2	11839.35		
11500	75.6	2261.49	2262.14	2262.24	2262.53	0.032984	5	36.46	0.41	2	2770.89		
11500	10.2	2261.49	2261.85	2261.83	2261.91	0.015396	1.96	28.94	0.18	2	50.48	4575.82	70397.28
										2			
11000	27.8	2254.01	2254.71		2254.8	0.010468	2.51	31.77	0.35	2	178.92		
11000	83.3	2254.01	2255.06	2254.95	2255.25	0.009368	3.51	37.7	0.63	2	828.8		
11000	1314.9	2254.01	2257.3	2257.62	2258.98	0.014374	10.39	53.84	2.32	2	46087.89		
11000	1003.6	2254.01	2256.9	2257.14	2258.31	0.01426	9.52	50.95	2.04	2	33144.11		
11000	416.5	2254.01	2256.1	2255.98	2256.7	0.009434	6.21	45.22	1.47	2	7582.66		
11000	416.5	2254.01	2256.1	2255.98	2256.7	0.009434	6.21	45.22	1.47	2	7582.66		
11000	75.6	2254.01	2255.02	2254.92	2255.2	0.009361	3.39	37.43	0.59	2	709.7		
11000	10.2	2254.01	2254.48		2254.54	0.01185	2.04	21.35	0.23	2	44.39	4003.83	61597.35
										2			
10500	27.8	2246.93	2247.25	2247.32	2247.49	0.048199	3.9	33.12	0.21	2	1049.95		
10500	83.3	2246.93	2247.67	2247.61	2247.9	0.012358	3.86	36.66	0.59	2	1159.39		
10500	1314.9	2246.93	2249.74	2250.27	2251.74	0.019379	11.34	54.32	2.11	2	58513.53		
10500	1003.6	2246.93	2249.36	2249.8	2251.06	0.019524	10.46	51.09	1.86	2	43018.72		
10500	416.5	2246.93	2248.45	2248.66	2249.41	0.019599	7.88	43.32	1.21	2	15076.73		
10500	416.5	2246.93	2248.45	2248.66	2249.41	0.019599	7.88	43.32	1.21	2	15076.73		
10500	75.6	2246.93	2247.63	2247.58	2247.85	0.012329	3.72	36.36	0.56	2	1004.37		
10500	10.2	2246.93	2247.22	2247.18	2247.26	0.01208	1.73	32.67	0.18	2	25.75	5600.54	86162.22
										2			
10000	27.8	2239.43	2239.77	2239.75	2239.89	0.015673	2.76	33.77	0.3	2	294.74		
10000	83.3	2239.43	2240.01	2240.05	2240.33	0.0205	4.54	35.69	0.51	2	1995.78		
10000	1314.9	2239.43	2242.21	2242.73	2244.2	0.018739	11.31	53.22	2.16	2	57230.42		
10000	1003.6	2239.43	2241.81	2242.25	2243.53	0.019347	10.52	50.01	1.89	2	42922.2		
10000	416.5	2239.43	2240.87	2241.1	2241.87	0.020548	8.05	42.49	1.21	2	15800.22		
10000	416.5	2239.43	2240.87	2241.1	2241.87	0.020548	8.05	42.49	1.21	2	15800.22		
10000	75.6	2239.43	2239.98	2240.02	2240.28	0.021028	4.41	35.41	0.48	2	1791.95		
10000	10.2	2239.43	2239.63		2239.69	0.017951	1.95	32.61	0.16	2	56.47	5657.20	87033.89
										2			
9500	27.8	2231.71	2232.08	2232.01	2232.16	0.009563	2.33	35.55	0.33	2	139.52		
9500	83.3	2231.71	2232.41	2232.3	2232.59	0.009197	3.48	37.9	0.63	2	804.91		
9500	1314.9	2231.71	2234.59	2234.95	2236.34	0.015311	10.61	53.6	2.28	2	48537.7		
9500	1003.6	2231.71	2234.2	2234.47	2235.66	0.015185	9.72	50.76	2.01	2	35043.81		
9500	416.5	2231.71	2233.46	2233.32	2234.04	0.0091	6.13	45.48	1.48	2	7302.47		
9500	416.5	2231.71	2233.46	2233.32	2234.04	0.0091	6.13	45.48	1.48	2	7302.47		
9500	75.6	2231.71	2232.36	2232.27	2232.54	0.009368	3.38	37.6	0.59	2	708.44		
9500	10.2	2231.71	2231.93	2231.87	2231.96	0.008953	1.55	34.46	0.19	2	9.82	4157.68	63964.29
										2			
9000	27.8	2224.35	2224.59	2224.69	2224.91	0.071132	4.53	30.59	0.2	2	1612.03		
9000	83.3	2224.35	2225.07	2225	2225.3	0.011407	3.87	34.27	0.63	2	1094.43		
9000	1314.9	2224.35	2227.29	2227.78	2229.26	0.017667	11.26	51.46	2.24	2	54961.21		
9000	1003.6	2224.35	2226.88	2227.28	2228.56	0.017948	10.42	48.28	1.97	2	40593.2		
9000	416.5	2224.35	2225.89	2226.09	2226.87	0.018598	7.95	40.64	1.28	2	14660.74		
9000	416.5	2224.35	2225.89	2226.09	2226.87	0.018598	7.95	40.64	1.28	2	14660.74		
9000	75.6	2224.35	2225.03	2224.96	2225.24	0.011294	3.72	33.99	0.59	2	924.47		
9000	10.2	2224.35	2224.58	2224.54	2224.63	0.011408	1.75	30.51	0.19	2	25.68	5322.47	81884.18
										2			
8600	27.8	2218.56	2219.34	2218.94	2219.36	0.000888	1.07	41.76	0.62	2	0		
8600	83.3	2218.56	2219.91	2219.21	2219.95	0.000964	1.64	45.84	1.1	2	14.78		
8600	1314.9	2218.56	2223.43	2221.73	2223.84	0.001941	5.12	78.08	3.25	2	5885.52		
8600	1003.6	2218.56	2222.87	2221.27	2223.2	0.001842	4.61	67.11	3.19	2	3799.95		
8600	416.5	2218.56	2221.42	2220.18	2221.58	0.001484	3.26	56.67	2.23	2	802.18		
8600	416.5	2218.56	2221.42	2220.18	2221.58	0.001484	3.26	56.67	2.23	2	802.18		
8600	75.6	2218.56	2219.85	2219.18	2219.89	0.000948	1.58	45.39	1.05	2	10.07		
8600	10.2	2218.56	2219.02	2218.82	2219.03	0.001197	0.8	39.42	0.32	2	0	471.45	7253.00
										2			

Equestrian Levee: Sediment Volume Calculations													
River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Top Wdth Act	Hydr Radius	D50 (mm)	Sediment Transport Capacity	Sediment passing through	Sediment passing through
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft)	(ft)	(mm)	(tons/day)	(tons)	(cu. ft)
8500	27.8	2217.44	2218.26	2218	2218.32	0.003081	1.88	25.82	0.57	2	28.75		
8500	83.3	2217.44	2218.8	2218.38	2218.92	0.003291	2.81	29.91	0.98	2	245.6		
8500	1314.9	2217.44	2222.13		2223.04	0.00543	7.65	55.38	3.04	2	19070.83		
8500	1003.6	2217.44	2221.61		2222.36	0.005123	6.96	51.45	2.75	2	12890.77		
8500	416.5	2217.44	2220.27	2219.65	2220.67	0.004272	5.07	41.19	1.96	2	3423.77		
8500	416.5	2217.44	2220.27	2219.65	2220.67	0.004272	5.07	41.19	1.96	2	3423.77		
8500	75.6	2217.44	2218.74	2218.33	2218.85	0.003255	2.71	29.45	0.94	2	207.36		
8500	10.2	2217.44	2217.96	2217.82	2217.99	0.003812	1.4	23.51	0.31	2	0.19	1636.53	25177.41
										2			
8200	13.9	2215.37	2216.18	2215.6	2216.19	0.000306	0.69	28.02	0.71	2	0		
8200	83.6	2215.37	2217.02		2217.07	0.000899	1.8	34.17	1.34	2	22.58		
8200	1438	2215.37	2220.91		2221.5	0.002725	6.14	62.46	3.66	2	10202.57		
8200	1136.8	2215.37	2220.38		2220.87	0.002568	5.64	58.56	3.36	2	7043.17		
8200	591.1	2215.37	2219.13		2219.43	0.002128	4.39	49.54	2.66	2	2351.76		
8200	591.1	2215.37	2219.13		2219.43	0.002128	4.39	49.54	2.66	2	2351.76		
8200	161.4	2215.37	2217.53		2217.63	0.001278	2.5	37.85	1.68	2	163.5		
8200	36	2215.37	2216.55		2216.57	0.000547	1.16	30.74	1	2	0	922.31	14189.32
										2			
8150	13.9	2215.06	2215.73	2215.26	2215.74	0.000302	0.61	38.11	0.6	2	0		
8150	83.6	2215.06	2216.63		2216.66	0.000541	1.38	45.89	1.31	2	0		
8150	1438	2215.06	2220.77		2221.08	0.001297	4.43	81.68	3.91	2	3881.72		
8150	1136.8	2215.06	2220.2		2220.46	0.001229	4.07	76.74	3.58	2	2607.76		
8150	591.1	2215.06	2218.88		2219.04	0.001046	3.18	65.32	2.8	2	801.42		
8150	591.1	2215.06	2218.88		2219.04	0.001046	3.18	65.32	2.8	2	801.42		
8150	161.4	2215.06	2217.18		2217.23	0.000693	1.86	50.6	1.7	2	39.06		
8150	36	2215.06	2216.13		2216.14	0.000395	0.93	41.54	0.92	2	0	338.81	5212.42
										2			
7800	13.9	2214.15	2214.79		2214.86	0.007095	2.14	17.67	0.37	2	45.35		
7800	83.6	2214.15	2215.5		2215.73	0.007434	3.87	24.73	0.86	2	773.15		
7800	1438	2214.15	2218.74	2218.74	2220.1	0.009629	9.33	56.93	2.66	2	36073.83		
7800	1136.8	2214.15	2218.28	2218.25	2219.49	0.009824	8.84	52.29	2.42	2	27877.09		
7800	591.1	2214.15	2217.29	2217.15	2218.1	0.009099	7.23	42.48	1.89	2	11803.48		
7800	591.1	2214.15	2217.29	2217.15	2218.1	0.009102	7.23	42.48	1.89	2	11806.04		
7800	161.4	2214.15	2215.95		2216.3	0.007857	4.79	29.18	1.14	2	1994.35		
7800	36	2214.15	2215.09		2215.23	0.006834	2.9	20.73	0.6	2	209.88	3777.73	58118.87
										2			
7450	7	2210.67	2211.21	2210.86	2211.22	0.000425	0.61	24.72	0.46	2	0		
7450	84.1	2210.67	2212.31		2212.37	0.001097	1.95	32.98	1.29	2	37.47		
7450	1494.4	2210.67	2216.29		2216.92	0.002986	6.4	62.81	3.63	2	11853.69		
7450	1236.4	2210.67	2215.82		2216.39	0.002912	6.02	59.32	3.38	2	9040.91		
7450	625.2	2210.67	2214.46		2214.81	0.002566	4.77	49.07	2.62	2	3212.3		
7450	625.2	2210.67	2214.46		2214.81	0.002566	4.77	49.07	2.62	2	3212.3		
7450	181.5	2210.67	2212.94		2213.06	0.001552	2.78	37.66	1.7	2	271.08		
7450	43.3	2210.67	2211.91		2211.94	0.000806	1.42	29.97	1.01	2	0.73	1151.20	17710.80
										2			
7423	7	2210.53	2210.77	2210.7	2210.8	0.006403	1.4	23.75	0.21	2	0.22		
7423	84.1	2210.53	2211.63	2211.29	2211.77	0.004091	3	30.07	0.92	2	333.21		
7423	1494.4	2210.53	2215.92		2216.58	0.003524	6.52	68.12	3.3	2	13724.95		
7423	1236.4	2210.53	2215.42		2216.04	0.003592	6.28	62.66	3.08	2	11098.5		
7423	625.2	2210.53	2213.97		2214.4	0.003386	5.25	47.46	2.46	2	4453.91		
7423	625.2	2210.53	2213.97		2214.4	0.003386	5.25	47.46	2.46	2	4453.91		
7423	181.5	2210.53	2212.26	2211.74	2212.48	0.003673	3.72	34.8	1.38	2	907.53		
7423	43.3	2210.53	2211.25	2211.03	2211.35	0.004737	2.5	27.31	0.63	2	140.13	1465.93	22552.77
										2			
7350	7	2209.93	2210.49		2210.5	0.001923	0.92	27.43	0.28	2	0		
7350	84.1	2209.93	2211.5		2211.56	0.001499	2.04	37.45	1.09	2	58.38		
7350	1494.4	2209.93	2215.92		2216.35	0.001799	5.25	81.52	3.46	2	6486		
7350	1236.4	2209.93	2215.42		2215.8	0.001834	4.95	68.77	3.56	2	5079.35		
7350	625.2	2209.93	2213.94		2214.19	0.001727	3.99	56.92	2.7	2	1847.48		
7350	625.2	2209.93	2213.94		2214.19	0.001727	3.99	56.92	2.7	2	1847.48		
7350	181.5	2209.93	2212.17		2212.28	0.00157	2.66	42.82	1.58	2	253.81		
7350	43.3	2209.93	2211.09		2211.13	0.001479	1.61	34.22	0.78	2	10.3	649.50	9992.28
										2			
7238	7	2209.85	2210.23		2210.26	0.004279	1.34	19.4	0.27	2	0		
7238	84.1	2209.85	2211.09		2211.27	0.005186	3.41	26.06	0.94	2	497.16		
7238	1494.4	2209.85	2214.92		2215.97	0.005928	8.24	55.79	3.18	2	24464.72		
7238	1236.4	2209.85	2214.48		2215.43	0.005953	7.85	52.37	2.94	2	19511.13		
7238	625.2	2209.85	2213.19		2213.84	0.00584	6.47	42.38	2.24	2	8279		
7238	625.2	2209.85	2213.19		2213.84	0.00584	6.47	42.38	2.24	2	8279		
7238	181.5	2209.85	2211.67		2211.97	0.005458	4.42	30.57	1.33	2	1556.36		
7238	43.3	2209.85	2210.74		2210.86	0.004873	2.68	23.39	0.68	2	162.74	2617.98	40276.59
										2			
7100	7	2209.4	2209.7		2209.72	0.004258	1.2	25.55	0.23	2	0		
7100	84.1	2209.4	2210.64		2210.74	0.002563	2.52	32.68	1.01	2	161.69		
7100	1494.4	2209.4	2214.61		2215.31	0.003509	6.73	62.66	3.47	2	14081.77		
7100	1236.4	2209.4	2214.15		2214.78	0.003481	6.37	59.19	3.22	2	11012.79		
7100	625.2	2209.4	2212.81		2213.22	0.00326	5.13	49.09	2.44	2	4225.7		
7100	625.2	2209.4	2212.81		2213.22	0.00326	5.13	49.09	2.44	2	4225.7		
7100	181.5	2209.4	2211.26		2211.43	0.002726	3.31	37.33	1.45	2	599.63		
7100	43.3	2209.4	2210.26		2210.32	0.002658	2.03	29.77	0.71	2	50.2	1432.61	22040.12
										2			

Equestrian Levee: Sediment Volume Calculations													
River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Top Wdth Act	Hydr Radius	D50 (mm)	Sediment Transport Capacity	Sediment passing through	Sediment passing through
	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft)	(ft)	(mm)	(tons/day)	(tons)	(cu. ft)
7000	7	2209.06	2209.49		2209.5	0.001042	0.8	24.46	0.36	2	0		
7000	84.1	2209.06	2210.47		2210.56	0.001854	2.33	31.32	1.14	2	101.65		
7000	1494.4	2209.06	2213.91		2214.92	0.005501	8.08	55.3	3.26	2	22774.69		
7000	1236.4	2209.06	2213.53		2214.41	0.005205	7.52	52.66	3.05	2	17106.18		
7000	625.2	2209.06	2212.42		2212.92	0.004086	5.68	44.87	2.4	2	5577.86		
7000	625.2	2209.06	2212.42		2212.92	0.004086	5.68	44.87	2.4	2	5577.86		
7000	181.5	2209.06	2211.05		2211.21	0.002486	3.29	35.31	1.54	2	548.89		
7000	43.3	2209.06	2210.11		2210.15	0.001479	1.73	28.75	0.86	2	15.66	2154.61	33147.83
										2			
6700	7	2207.42	2208.07		2208.08	0.000391	0.52	34.24	0.39	2	0		
6700	84.1	2207.42	2208.95		2209	0.001139	1.78	42.57	1.1	2	27.26		
6700	1494.4	2207.42	2212.72		2213.18	0.002303	5.44	78.19	3.46	2	8247.72		
6700	1236.4	2207.42	2212.24		2212.66	0.002326	5.18	73.69	3.2	2	6525.61		
6700	625.2	2207.42	2210.93		2211.2	0.002189	4.18	61.23	2.42	2	2416.36		
6700	625.2	2207.42	2210.93		2211.2	0.002188	4.17	61.23	2.42	2	2402.74		
6700	181.5	2207.42	2209.5		2209.6	0.001522	2.52	47.75	1.49	2	219.53		
6700	43.3	2207.42	2208.61		2208.64	0.00087	1.3	39.35	0.84	2	0	826.63	12717.45
										2			
6500	7	2207.56	2207.87		2207.89	0.004675	1.08	35.56	0.18	2	0		
6500	84.1	2207.56	2208.48		2208.6	0.004991	2.74	44.16	0.69	2	338.69		
6500	1494.4	2207.56	2212.33		2212.7	0.002196	4.92	97.81	3.09	2	7144.38		
6500	1236.4	2207.56	2211.81		2212.17	0.002439	4.85	90.55	2.8	2	6313.04		
6500	625.2	2207.56	2210.34		2210.67	0.00349	4.56	70.14	1.94	2	3927.34		
6500	625.2	2207.56	2210.34		2210.67	0.003488	4.56	70.15	1.94	2	3926.03		
6500	181.5	2207.56	2208.92		2209.12	0.004885	3.51	50.35	1.02	2	1064.52		
6500	43.3	2207.56	2208.23		2208.3	0.004905	2.16	40.65	0.49	2	103.41	952.88	14659.69
										2			
6400	7	2207.19	2207.44		2207.46	0.00507	1.07	39.02	0.17	2	0		
6400	84.1	2207.19	2208.08		2208.17	0.003847	2.43	48.99	0.7	2	213.55		
6400	1494.4	2207.19	2212.26		2212.51	0.001325	3.97	114.27	3.27	2	3557.38		
6400	1236.4	2207.19	2211.72		2211.96	0.00145	3.9	105.87	2.98	2	3102.25		
6400	625.2	2207.19	2210.18		2210.38	0.002013	3.64	81.76	2.09	2	1864.69		
6400	625.2	2207.19	2210.18		2210.38	0.002012	3.64	81.77	2.09	2	1864.06		
6400	181.5	2207.19	2208.59		2208.72	0.003207	2.95	56.93	1.08	2	576.7		
6400	43.3	2207.19	2207.8		2207.86	0.004397	2.02	44.63	0.48	2	78.39	470.68	7241.16
										2			
6200	7	2206.02	2206.19	2206.19	2206.26	0.02588	2.22	21.39	0.15	2	74.85		
6200	84.1	2206.02	2206.8	2206.8	2207.15	0.015127	4.74	25.64	0.69	2	1690.49		
6200	1494.4	2206.02	2210.35	2210.35	2211.9	0.009467	10.01	48.59	2.99	2	38504.71		
6200	1236.4	2206.02	2209.92	2209.92	2211.34	0.009712	9.58	45.82	2.75	2	31559.58		
6200	625.2	2206.02	2208.67	2208.67	2209.7	0.010753	8.14	37.72	2	2	15331.19		
6200	625.2	2206.02	2208.67	2208.67	2209.7	0.010709	8.13	37.74	2	2	15265.69		
6200	181.5	2206.02	2207.28	2207.28	2207.82	0.013255	5.91	28.74	1.06	2	4037.81		
6200	43.3	2206.02	2206.54	2206.54	2206.77	0.017089	3.88	23.91	0.46	2	763.27	4482.16	68956.28

Erosion Calculations

Equestrian Levee Embankment Erosion Estimate								
HEC-RS River Sta	HEC-RAS Downstream Reach Length (ft)	Sediment Volume at HEC-RAS Section (cu. ft.)	Sediment Volume at Upstream HEC-RAS Section (cu. ft.)	Levee Height (ft)	Existing Slope (H:V)	Erodible Levee Area (sq. ft.)	Top of Levee Erosion Distance (ft)	Toe of Levee Erosion Distance (ft)
16700	161.48	4805	0	4.0	4.0	-	-	-
16550	63.7	4695	4805	7.0	4.0	0	No Movement	Deposition
16500	93.39	6198	4695	7.0	4.5	24	No Movement	13
16400	90.65	3479	6198	7.0	5.0	0	No Movement	Deposition
16300	155.05	4064	3479	7.0	5.0	7	No Movement	7
16150	148.97	14452	4064	9.0	5.0	67	No Movement	23
16000	499.71	26025	14452	9.0	5.0	78	No Movement	24
15500	497.84	29918	26025	12.0	5.0	8	No Movement	8
15000	291.65	26876	29918	12.0	5.0	0	No Movement	Deposition
14700	199.36	33620	26876	12.0	5.0	24	No Movement	14
14500	492.11	37495	33620	12.0	5.0	20	No Movement	12
14000	212.66	34115	37495	12.0	5.0	0	No Movement	Deposition
13800	552.29	38531	34115	12.0	5.0	21	No Movement	13
13250	232.43	30472	38531	12.0	5.0	0	No Movement	Deposition
13000	308.42	58604	30472	12.0	5.0	122	No Movement	30
12700	204.91	52917	58604	12.0	5.0	0	No Movement	Deposition
12500	484.94	41774	52917	12.0	3.0	0	No Movement	Deposition
12000	506.83	46105	41774	12.0	3.0	9	No Movement	6
11500	506.08	35199	46105	12.0	3.0	0	No Movement	Deposition
11000	484.98	30799	35199	12.0	3.0	0	No Movement	Deposition
10500	487.9	43081	30799	12.0	3.0	26	No Movement	10
10000	509.2	43517	43081	12.0	3.0	1	No Movement	2
9500	507.98	31982	43517	12.0	3.0	0	No Movement	Deposition
9000	376.74	40942	31982	12.0	3.0	18	No Movement	8
8600	125.18	3627	40942	12.0	3.0	0	No Movement	Deposition
8500	250.13	12589	3627	12.0	3.0	72	No Movement	16
8200	126.78	7095	12589	12.0	3.0	0	No Movement	Deposition
8150	311.53	2606	7095	12.0	3.0	0	No Movement	Deposition
7800	338.75	29059	2606	12.0	3.0	85	No Movement	17
7450	56.71	8855	29059	12.0	3.0	0	No Movement	Deposition
7423	63.35	11276	8855	12.0	3.0	43	No Movement	13
7350	101.83	4996	11276	12.0	3.0	0	No Movement	Deposition
7238	118.47	20138	4996	12.0	3.0	149	3	24
7100	82.47	11020	20138	12.0	3.0	0	No Movement	Deposition
7000	314.62	16574	11020	12.0	3.0	68	No Movement	16
6700	201.89	6359	16574	12.0	4.0	0	No Movement	Deposition
6500	92.02	7330	6359	12.0	5.0	5	No Movement	6
6400	225.93	3621	7330	12.0	7.0	0	No Movement	Deposition

Assumed Input Parameters	
Assumed Percentage of Flow Area Available to Impact Levee:	0.5
Slope of Angle of Repose (H:V):	1.3

Geotechnical Supporting Calculations



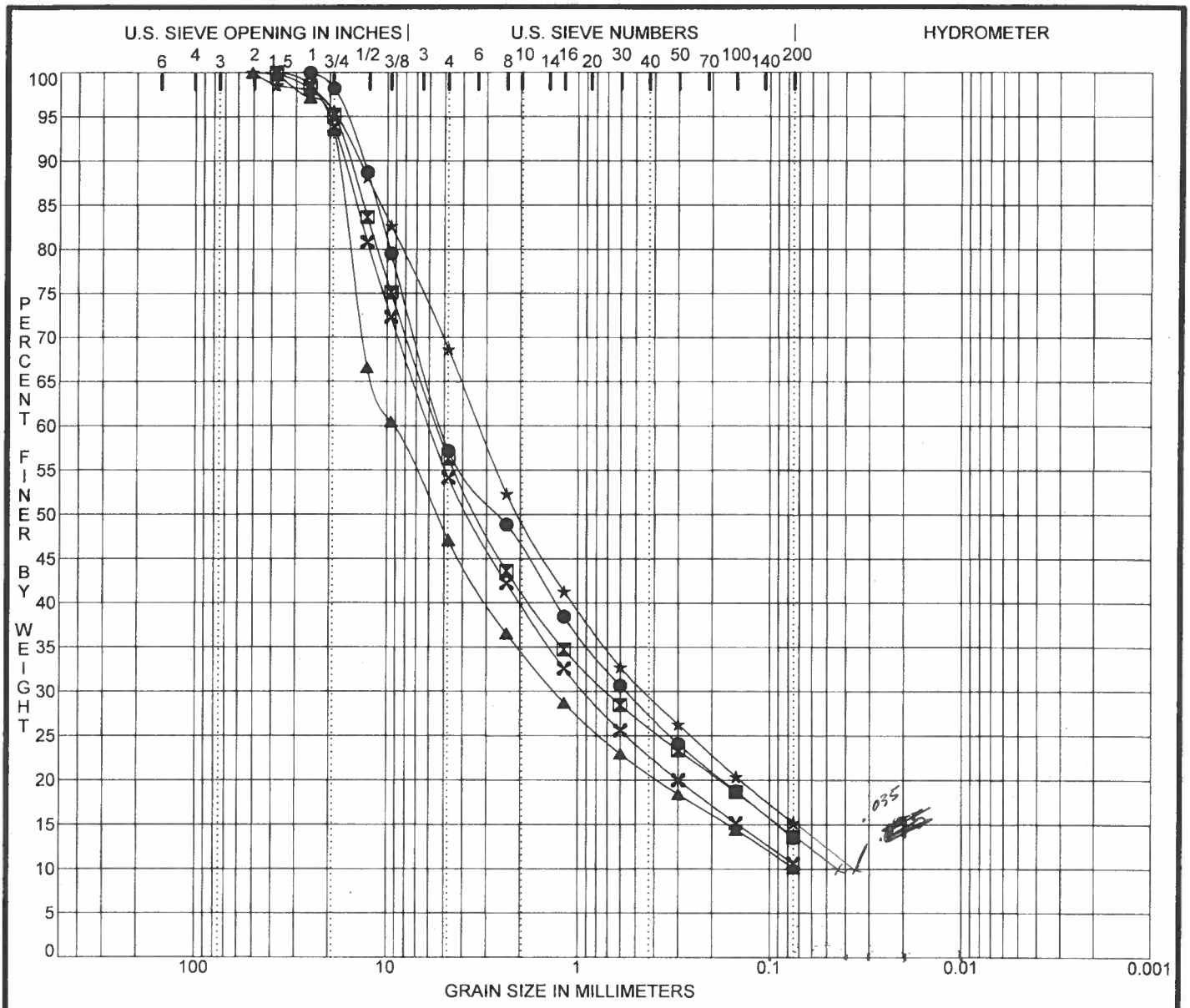
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6380 S Polaris Avenue
Las Vegas, NV 89118
Ph: (702) 736-2936 Fax: (702) 361-9094

SITE PLAN WITH EXPLORATIONS AND CROSS SECTION LOCATIONS
EQUESTRIAN LEVEE

PBS&J
Clark County Levee Certification Project
Equestrian Levee
Henderson, Nevada

Plate
3

Drawn By: KFH	Reviewed By: ALB	Date: 03/10/10	Project Number: 101764	File: D:\...\101764...\Equestrian_P2.mxd



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	B- 1	14.0	()					
⊠	B- 2	18.0	()					
▲	B- 3	4.0	()				2.56	126.3
★	B- 4	8.0	()					
✕	B- 5	12.0	()				2.09	87.3

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	B- 1	14.0	25.4	5.2	0.6		43	44	14	
⊠	B- 2	18.0	38.1	5.4	0.7		44	43	14	
▲	B- 3	4.0	50.8	9.3	1.3		53	37	10	
★	B- 4	8.0	50.8	3.3	0.4		31	53	15	
✕	B- 5	12.0	38.1	5.9	0.9		46	44	11	

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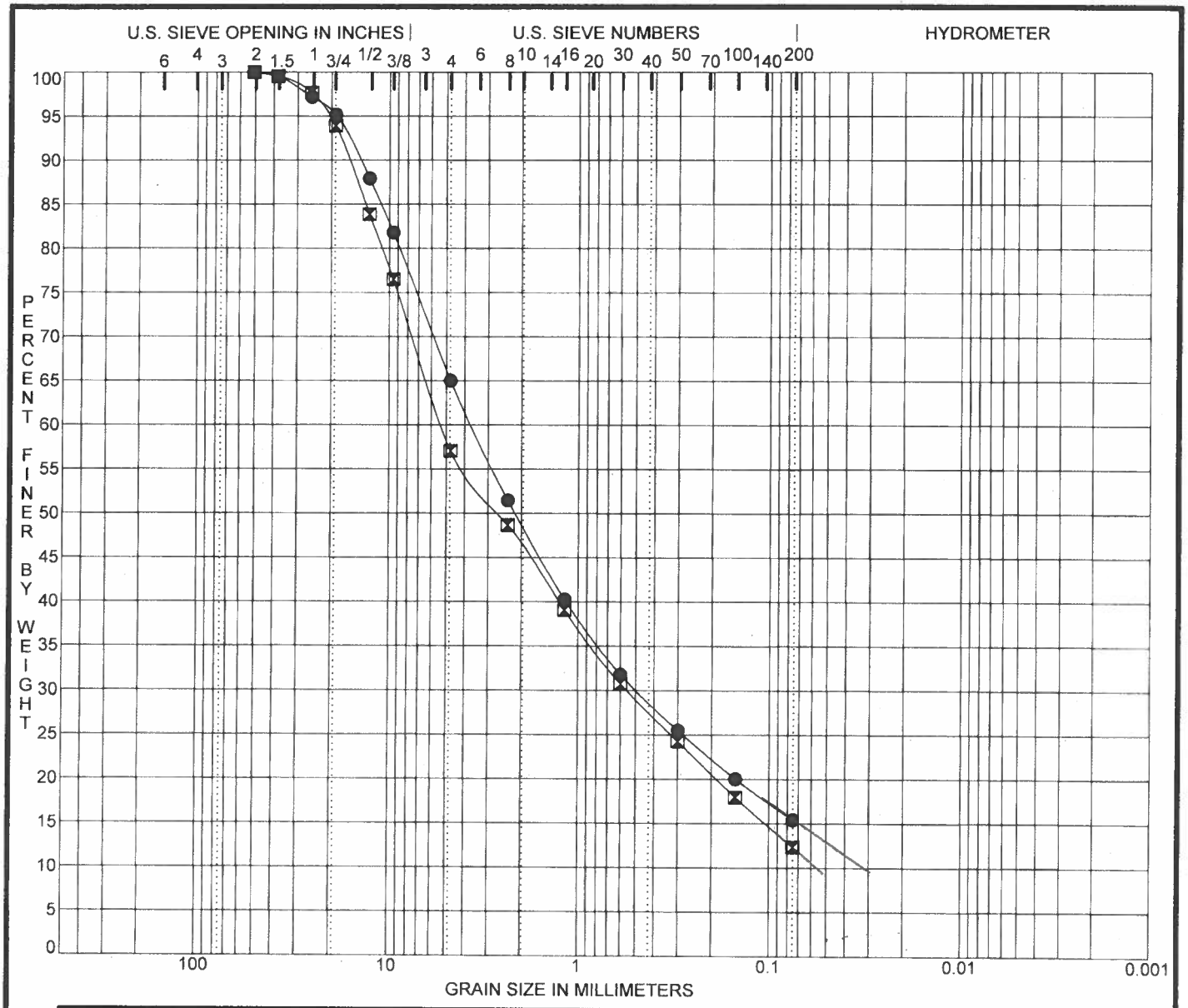
GRAIN SIZE ANALYSES

PROJECT: Equestrian Levee Certification

PROJECT NO. 101764.4.2

PLATE

B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	B- 6	4.0	()					
⊠	B- 7	3.0	()				1.03	93.9

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	B- 6	4.0	50.8	3.7	0.5		35	50	15	
⊠	B- 7	3.0	50.8	5.3	0.6		43	45	12	

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GRAIN SIZE ANALYSES

PROJECT: Equestrian Levee Certification

PROJECT NO. 101764.4.2

PLATE

B-2

KLEINFELDER

Geotechnical Investigation
Equestrian Detention Basin
Sections 22, 23, 26 and 35,
Township 22 North, Range 62 East
Clark County, Nevada

Prepared for: Poggemeyer Design Group
2601 North Tenaya Way
Las Vegas, Nevada 89128

Attention: Mr. Tim Pinter, P.E.

Kleinfelder Project No. 31-128834-001
January 19, 1994

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KLEINFELDER

January 19, 1994
Project No. 31-128834-001

Mr. Tim Pinter, P.E.
Poggemeyer Design Group
2601 North Tenaya Way
Las Vegas, Nevada 89128

Subject: **Geotechnical Investigation**
Proposed Equestrian Detention Basin
Sections 22, 23, 26 and 35,
Township 22 North, Range 63 East
Clark County, Nevada

Dear Mr. Pinter:

Enclosed please find our geotechnical investigation report for the proposed Equestrian Detention Basin site. The report details our field exploration and laboratory testing program for the proposed basin, embankments, diversion structures and energy dissipaters. The report presents our analyses, opinions and recommendations for design and construction of the proposed flood control structures.

We appreciate this opportunity to be of service on this phase of the project and look forward to providing additional services as the project progresses. If you have any questions, please do not hesitate to contact this office at your convenience.

Respectfully submitted,

KLEINFELDER, INC.

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA
WALTER E. VANDERPOOL
CIVIL
No. 08466
1/19/94

Walter E. Vanderpool, P.E.
Senior Engineer

Alan E. Money, P.E.
Geotechnical Engineering Manager

WEV/kmk

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Symbols and Terms used with this report is presented on Plate A-33 following the Log of exploration summary sheets in Appendix A.

Drilling was accomplished with a truck-mounted rotary air drill rig equipped for soil sampling. Representative soil samples were obtained by bulk methods and with a ring-lined 2.63 inch inside diameter (ID) sampler. The ring-lined sampler was driven with a 350 pound hammer free-falling through a distance of 30 inches. The sampler driving resistance was recorded as number of blows per inches of penetration. The Penetration Test results are presented on the Log of Test Boring summary sheets at the sampling point. Representative soil samples from the borings were classified in the field by the field geologist and representative portions of each sample were packaged and transported to our laboratory for additional testing, as appropriate.

2.3 TRENCH EXPLORATION

The subsurface conditions within the proposed detention basin and along the proposed interception channel/dike were explored by excavating 26 trenches to depths of 8 to 10 feet below existing site grade. Logs of the subsurface conditions as encountered in the trenches were recorded at the time of excavation and are presented on the trench logs, Plate A-6 through A-31.

The trench explorations were located approximately as shown on Figure 2, following the text of this report. The trench explorations were backfilled and compacted to the extent possible with the equipment available. However, the compaction may not meet the minimum compacted density recommendations presented in Section 6 of this report. If structures will be founded over the trench explorations the backfill should be removed and replaced in accordance with the recommendations presented in Section 6.

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4.0 GENERAL SITE CONDITIONS

4.1 SURFACE CONDITIONS

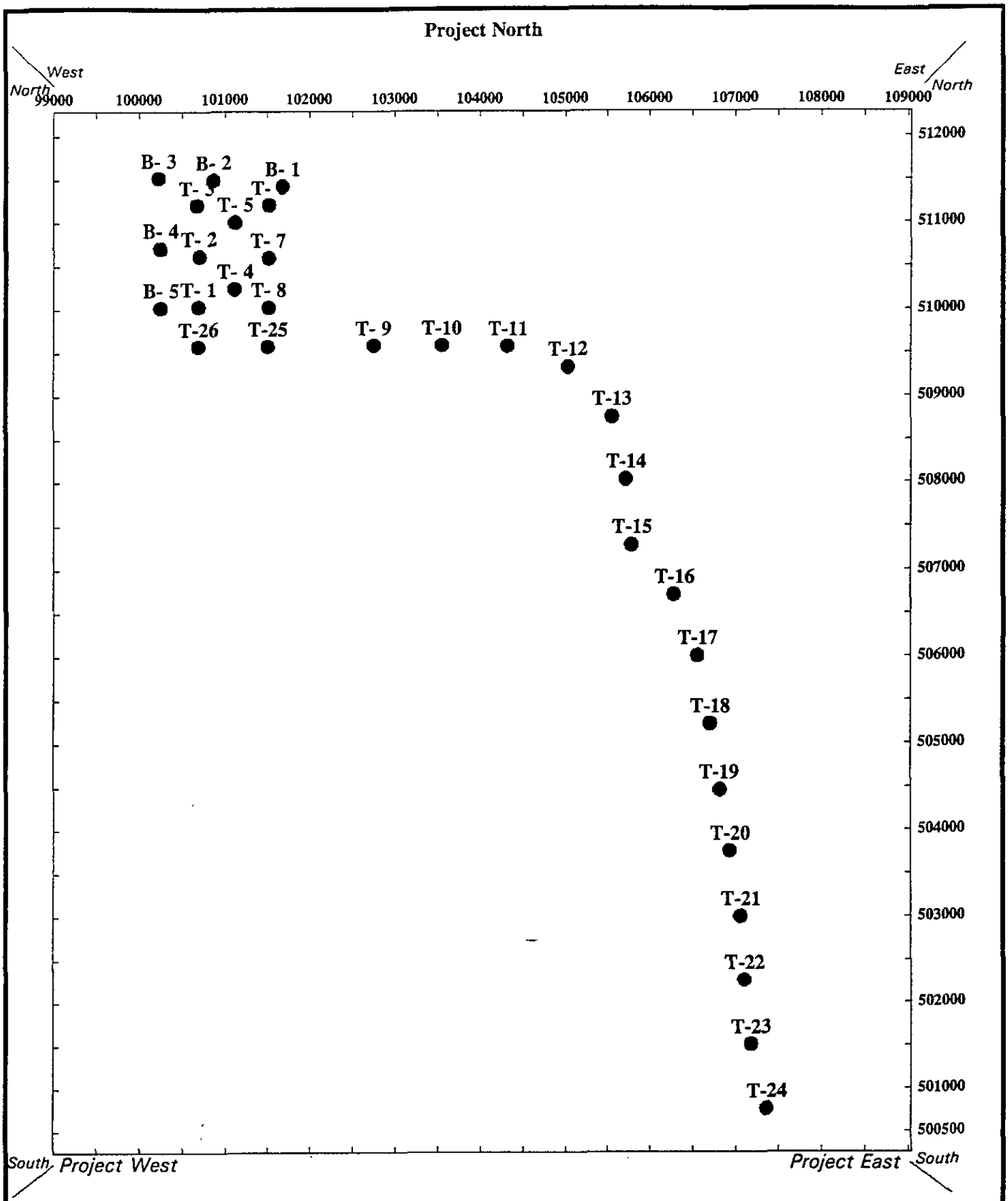
At the time of our exploration, the Equestrian Detention Basin site was an undeveloped, gently sloping alluvial fan. Vegetation was sparse. Surficial soils consisted of medium to coarse sand, gravel, cobbles, and some boulders up to two feet in nominal diameter. The surface materials were coated with desert varnish.

4.2 SUBSURFACE CONDITIONS

The native soil consisted of coarse grained alluvially deposited soil to the depths explored. All of the soils encountered were coarse grained and non-plastic. The alluvial detritus was volcanic in origin. The soils were generally loose at the surface and progressively more dense with depth. Very dense granular soil was encountered within three to seven feet of the present ground surface throughout the site. Partially cemented soils were encountered in one trench (T-17). Trench T-17 was one of the explorations located closest to bedrock outcrops along the interception channel/dike alignment. Numerous alluvially deposited lenses and strata of poorly graded fine sand to coarse gravel were observed throughout the soil profile at each exploration location. There was no consistent pattern to the sequence in which each soil type was encountered within each exploration or between explorations. However, the native soils generally became finer grained with decreasing elevation on the alluvial fan.

Groundwater was not encountered in any of the explorations at this site to the depth explored. Moisture content was low throughout the soil profile and throughout the site.

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● - Approximate Exploration Location

Scale : Approximately 1" = 1600 '

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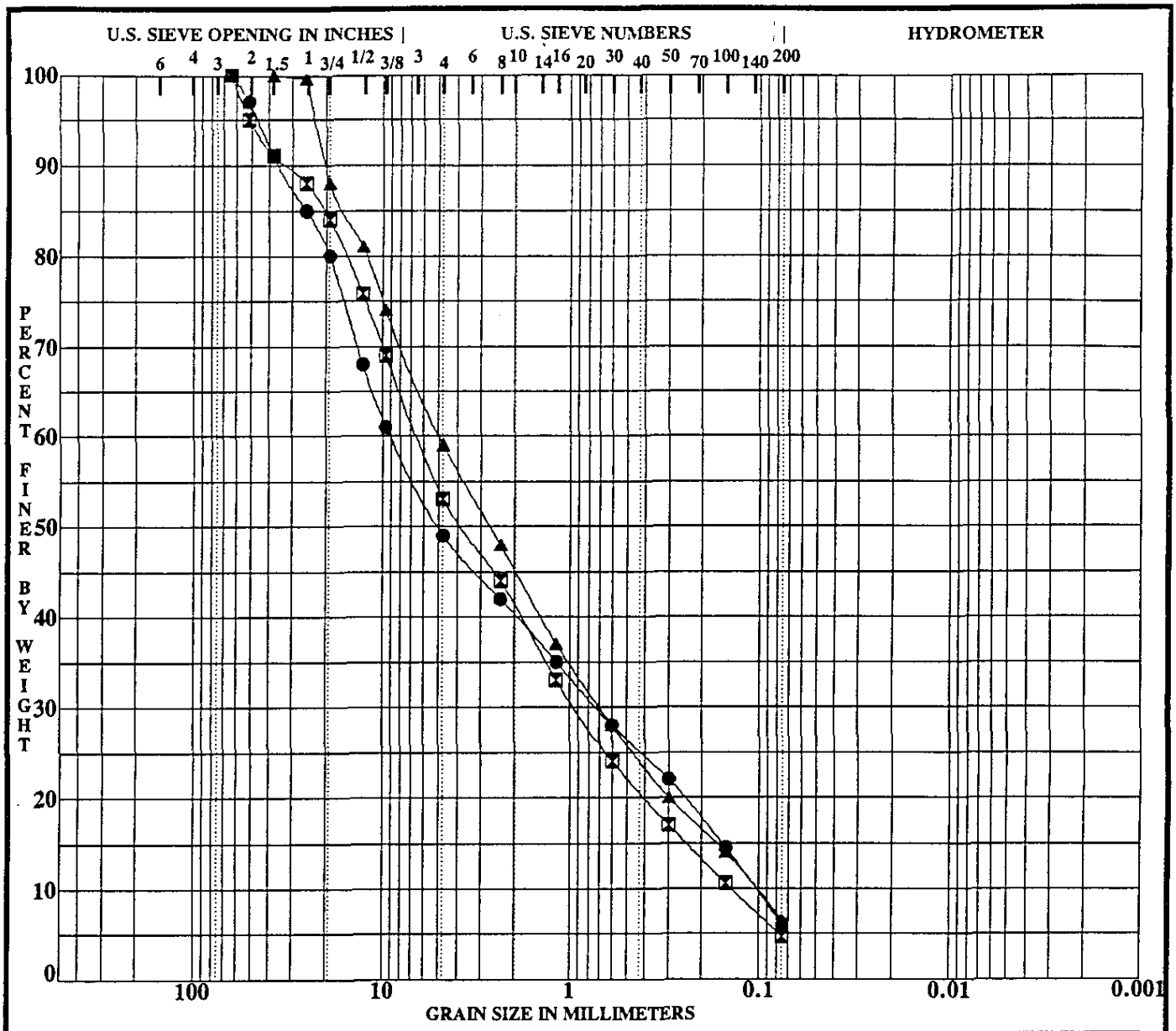
PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

LOCATION OF EXPLORATIONS

PLATE
2

APPENDIX B



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	T- 8	2.0	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	NP	NP	NP	0.57	86.9
⊠	T-11	3.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.99	46.1
▲	T-15	4.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.94	48.0

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	T- 8	2.0	63.50	8.99	0.728	0.1035	51.0	42.9	6.1	
⊠	T-11	3.0	63.50	6.44	0.942	0.1398	47.0	48.3	4.7	
▲	T-15	4.0	38.10	4.98	0.697	0.1036	41.0	52.5	6.5	

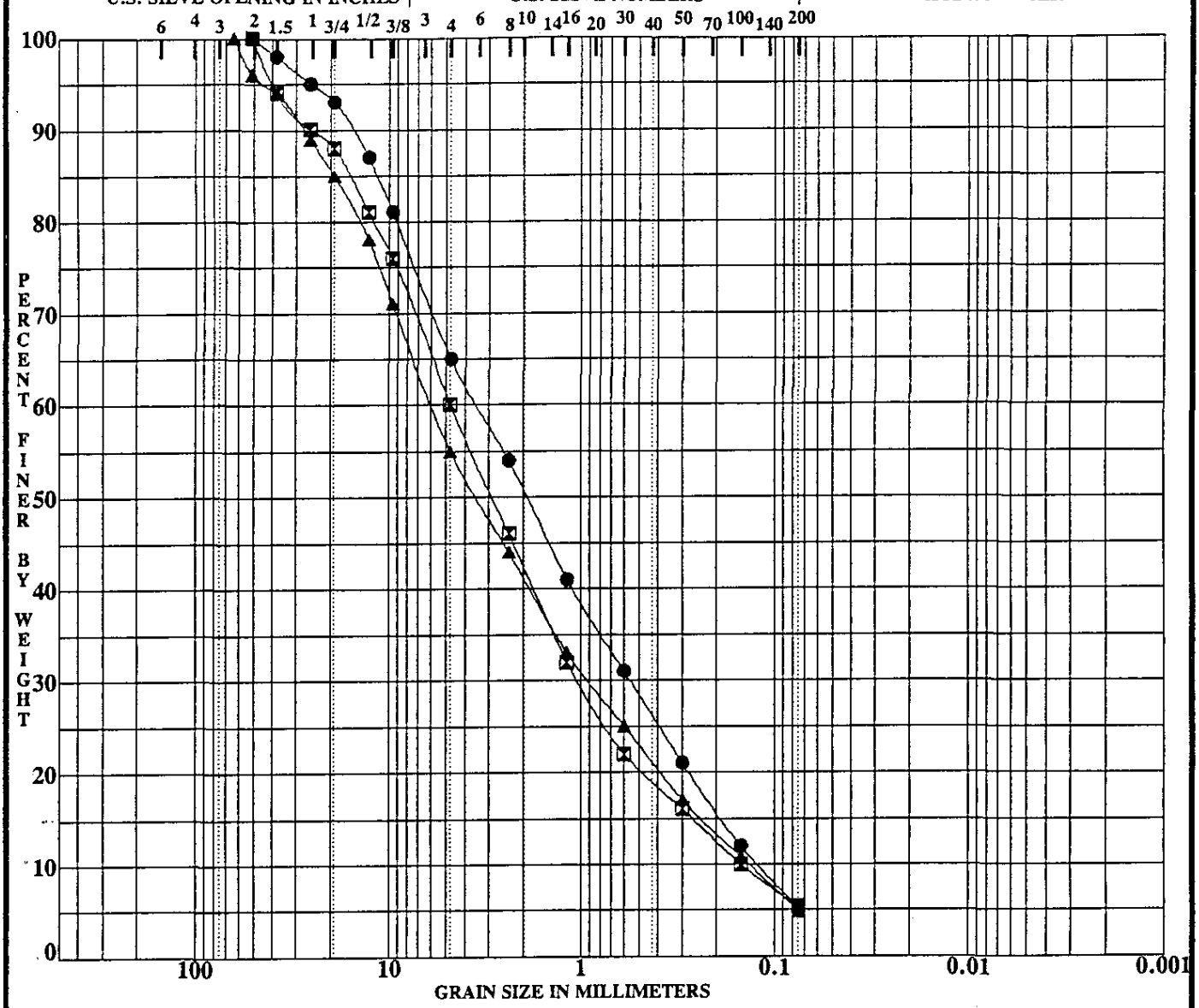
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SOILS AND MATERIALS TESTING

PROJECT NO. 31-128834-001

PROJECT: Equestrian Detention Basin

GRAIN SIZE ANALYSES

PLATE
B-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Exploration No.	Depth(ft)	Classification	LL	PL	PI	Cc	Cu
●	T-19	8.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	NP	NP	NP	0.74	28.3
⊠	T-23	4.0	WELL GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	1.49	31.7
▲	T-25	6.0	WELL GRADED SAND with SILT and GRAVEL (SW-SM)	NP	NP	NP	1.04	43.2

	Exploration No.	Depth(ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
●	T-19	8.0	50.80	3.46	0.560	0.1220	35.0	59.7	5.3	
⊠	T-23	4.0	50.80	4.75	1.031	0.1500	40.0	54.6	5.4	
▲	T-25	6.0	63.50	5.91	0.916	0.1365	45.0	50.1	4.9	

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PROJECT: Equestrian Detention Basin

GRAIN SIZE ANALYSES

PLATE
B-3

APPENDIX XII

Equestrian Detention Basin

Levee Reconstruction Project Documentation

70% Design Plans and Specifications

Equestrian Detention Basin Levee Reconstruction Project

Prepared by PBS&J

EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT

Contract No. XXX-XX-XX-XXX-XXX
PWP-CL-2010-XXX

FUNDED BY

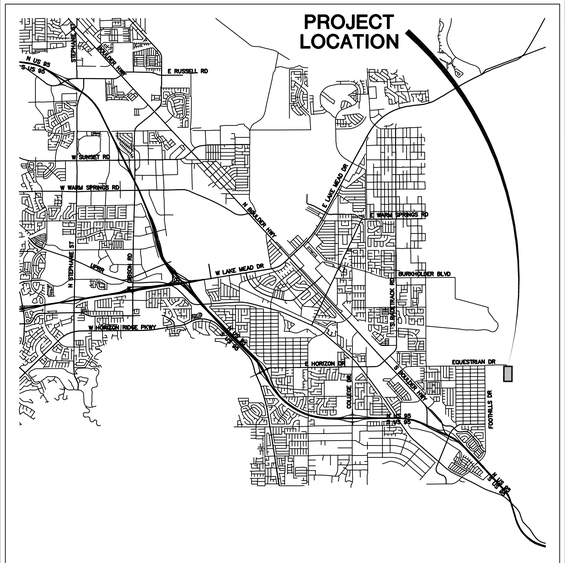
CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT

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Henderson, Nevada 89074
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Revisions

No.	DESCRIPTION	BY	DATE	APPROVAL

City Of Henderson
Clark County, Nevada

Department Of Public Works

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Mayor
Andy A. Hafen

City Council
Gerri Schroder
Debra March
Kathleen Boutin
Steven D. Kirk

City Manager
Mark T. Calhoun

Director Of Public Works
Robert A. Murnane, P.E.

INDEX TO DRAWINGS

1. C1.01 COVER SHEET
2. C1.02 GENERAL NOTES
3. C1.03 LEGEND AND ABBREVIATIONS
4. C1.04 HORIZONTAL CONTROL PLAN
5. C1.05 CONSTRUCTION ACCESS AND STOCKPILE PLAN
6. C2.01 EXCAVATION PLAN
7. C2.02 LEVEE GRADING PLAN
8. C2.03 DETAILS

70% SUBMITTAL

PROFESSIONAL ENGINEER-STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06-30-12
CIVIL
No. 16420

NOT FOR CONSTRUCTION

APPROVALS:

ROBERT A. MURNANE, P.E. DATE
DIRECTOR OF PUBLIC WORKS, COH

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT DATE

TITLE	APPROVED	DATE
DIRECTOR OF UTILITY SERVICES		
CITY ENGINEER		
TRAFFIC ENGINEER		
SURVEY / RIGHT OF WAY		
NEW DEVELOPMENT		

AGENCY APPROVAL:

AGENCY	NO SERVICE	REVIEWED BY	
SOUTHWEST GAS			DATE
COX COMMUNICATION LV INC			
NV ENERGY–TRANSMISSION			
NV ENERGY–DISTRIBUTION			

NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA UTILITY COMMISSION'S RULES AND REGULATIONS.

CENTURYLINK			

THE AFFIXED CENTURY LINK APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS.

SOUTHERN NEVADA WATER AUTHORITY DATE

CITY OF HENDERSON KIVA PERMIT NO. **PCOH 2010XXXXXX**

EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
Contract No. XXX-XX-XX-XXX-XXX
PWP-CL-2010-XXX

DATE: OCTOBER 11, 2010

DRAWING No.
C1.01

SHEET No. 1

CITY OF HENDERSON GENERAL NOTES

1. ALL CONSTRUCTION SHALL CONFORM TO THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, OFFSITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, 1986, AND THE UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, OFFSITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, 1988. (REVISED 10/14/04)
2. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE PROSECUTED TO COMPLETION WITHOUT DELAY SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO TRAVELING PUBLIC.
3. THE CONTRACTOR SHALL TAKE ALL NECESSARY AND PROPER PRECAUTIONS TO PROTECT ADJACENT PROPERTIES FROM ANY AND ALL DAMAGE THAT MAY OCCUR FROM STORM WATER RUNOFF AND/OR DEPOSITION OF DEBRIS RESULTING FROM ANY AND ALL WORK IN CONNECTION WITH SUBDIVISION CONSTRUCTION.
4. PRIOR TO FINAL ACCEPTANCE, BOND RELEASES, AND A CERTIFICATE OF OCCUPANCY, A CERTIFIED LEGIBLE AS-BUILT DRAWING MUST BE SUBMITTED TO THE CITY OF HENDERSON. AS-BUILT MUST SHOW ALL CHANGES AND ACTUAL FIELD LOCATIONS. IN THE ABSENCE OF CHANGES, A COPY OF APPROVED DRAWINGS WILL BE REQUIRED STATING "INSTALLED AS PER DRAWING" AND CERTIFIED AS SUCH BY THE DEVELOPER'S ENGINEER.
5. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITION BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND OF INGRESS AND EGRESS TO SAID CONSTRUCTION. THE EXTENT OF TRANSITIONS TO BE DETERMINED BY THE CITY ENGINEER.
6. EXISTING UTILITIES ARE LOCATED ON PLANS FOR THE CONVENIENCE OF THE CONTRACTOR ONLY. THE CONTRACTOR SHALL BEAR FULL RESPONSIBILITY FOR THE PROTECTION OF UTILITIES AND THE ENGINEER BEARS NO RESPONSIBILITY FOR UTILITIES NOT SHOWN ON THE PLANS OR NOT IN THE LOCATION SHOWN ON THE PLANS. THIS INCLUDES ALL SERVICE LATERALS OF ANY KIND.
7. POWER POLES AND/OR OTHER EXISTING FACILITIES NOT IN PROPER LOCATION BASED ON PROPOSED IMPROVEMENTS SHOWN HEREON WILL BE RELOCATED AT NO EXPENSE TO THE CITY OF HENDERSON.
8. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING PUBLIC STREETS IMMEDIATELY AFTER THE FIRST GRADING WORK IS ACCOMPLISHED AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "NEVADA TRAFFIC CONTROL MANUAL"- CURRENT EDITION AND TO THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES"- CURRENT EDITION AND BE APPROVED BY THE CITY OF HENDERSON BEFORE CONSTRUCTION BEGINS.
9. ALL STATIONING IS REFERENCED TO CENTERLINE.
10. ACTUAL LOCATION OF SAWCUT LINES SHALL BE DETERMINED IN THE FIELD BY A CITY OF HENDERSON PUBLIC WORKS INSPECTOR.
11. PROTECTION AND REPLACEMENT OF SURVEY MONUMENTS OR PROPERTY STAKES NOT DELINEATED ON THE CONTRACT DRAWINGS SHALL BE THE CONTRACTOR'S RESPONSIBILITY. REPLACEMENT OF SURVEY MONUMENTS OR PROPERTY STAKES SHALL BE DONE TO THE CITY OF HENDERSON SURVEY DIVISION'S SATISFACTION.
12. AFFECTED UTILITY COMPANIES SHALL BE NOTIFIED AT LEAST TWO WORKING DAYS PRIOR TO COMMENCEMENT OF CONSTRUCTION.
13. CALL BEFORE YOU DIG: 1-800-227-2600.
14. MODIFICATIONS TO EXISTING UTILITIES SHALL CONFORM TO THE OWNERS' UTILITY STANDARDS AND SPECIFICATIONS.
15. THE CONTRACTOR SHALL TAKE REASONABLE MEASURES TO PROTECT EXISTING IMPROVEMENTS FROM DAMAGE, AND ALL SUCH IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR RECONSTRUCTED TO THE ENGINEER'S SATISFACTION AT THE EXPENSE OF THE CONTRACTOR.
16. IF SEWER OR WATER LINES WITHIN THE PUBLIC UTILITY EASEMENTS REQUIRE REPAIRS, ALL SUCH REPAIRS WILL BE DONE IN ACCORDANCE WITH THE CITY OF HENDERSON'S UTILITY DEPARTMENT STANDARDS. CURBS AND GUTTERS AND SPECIAL PAVING REPAIRS SHALL BE THE RESPONSIBILITY OF THE HOMEOWNER'S ASSOCIATION.
17. IF SIGNS ARE PRESENT ON THIS CONSTRUCTION SITE, PLEASE CONTACT SIGN COMPANY LISTED ON THE SIGN 24 HOURS PRIOR TO COMMENCING CONSTRUCTION IN THE SIGN'S LOCATION. CITY OWNED AND CITY SPONSORED SIGNS (KIOSKS) SHALL BE REMOVED AND REPLACED FOLLOWING CONSTRUCTION IN THEIR ORIGINAL LOCATION IN LIKE NEW CONDITION AT CONSTRUCTION CONTRACTOR'S EXPENSE. ANY CONTRACTOR HAVING TO REMOVE A SIGN WHICH WAS DAMAGED PRIOR TO THE CONTRACTOR OCCUPYING THE SITE SHALL ARRANGE FOR VERIFICATION OF THE SIGN'S CONDITION BY A CITY INSPECTOR PRIOR TO REMOVAL. ALL SIGNS NOT PREVIOUSLY VERIFIED BY A CITY INSPECTOR SHALL BE ASSUMED TO BE IN LIKE NEW CONDITION PRIOR TO REMOVAL.
18. THE CONTRACTOR SHOULD CONTACT THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION (NDEP) TO OBTAIN A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT PRIOR TO CONSTRUCTION. ALL CONSTRUCTION PROJECTS ONE ACRE OR LARGER MUST APPLY FOR THE PERMIT THROUGH THE NDEP. ALL QUESTIONS REGARDING THE NPDES PERMIT REQUIREMENTS SHOULD BE DIRECTED TO THE NDEP (775) 687-9429.

BASIS OF BEARING

BEING THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST M.D.M. TAKEN AS NORTH 89°23'35" EAST, PER PLAT BOOK 55, PAGE 28 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

BENCHMARK

CITY OF HENDERSON BENCHMARK NO 100 BEING DESCRIBED AS A BRASS CAP IN THE TOP OF THE CURB ON THE SOUTHWEST CORNER OF EQUESTRIAN DRIVE AND LONGMEADOW STREET.
ELEVATION = 2091.675' (637.544) METERS.

CONDUIT NOTE

ALL CONDUIT (BOX CULVERT, REINFORCED CONCRETE PIPE, CAST-IN-PLACE PIPE, AND/OR CORRUGATED METAL PIPE) SHOWN ON THESE PLANS ARE DESIGNED FOR STANDARD HIGHWAY LOADINGS. THE STANDARD SATISFACTORY MINIMUM COVERAGE REQUIREMENTS AS ESTABLISHED BY THE CONDUIT MANUFACTURER MAY NOT ALWAYS BE ADEQUATE DURING CONSTRUCTION. WHEN CONSTRUCTION EQUIPMENT, WHICH IS FREQUENTLY HEAVIER THAN TRAFFIC LOADS FOR WHICH CONDUIT HAS BEEN DESIGNED, IS TO BE DRIVEN OVER OR CLOSE TO THE BURIED CONDUIT, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE THE ADDITIONAL COVERAGE REQUIRED TO AVOID DAMAGE TO THE CONDUIT. THE ADEQUACY OF THE COVERAGE REQUIREMENTS FOR CONDUITS SHALL BE ANALYZED AND CHECKED BY THE CONTRACTOR TO ADDRESS LOADING CONDITIONS IMPOSED BY CONSTRUCTION ACTIVITY. ANY CONDUIT DAMAGED BY CONSTRUCTION ACTIVITY SHALL BE REPLACED AT THE CONTRACTORS EXPENSE.

STORM WATER POLLUTION STANDARD PLAN NOTES

1. THE CONTRACTOR SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED, OR ACCUMULATED, IN THE PUBLIC RIGHTS OF WAY OF THE CITY OF HENDERSON AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.
2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN THE CITY OF HENDERSON AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE MANUAL.
3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY, REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION LLL.A.5.
4. AT A MINIMUM, THE CONTRACTOR SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS, AND ALL BMPS WEEKLY, AND WITHIN 24 HOURS AFTER ANY RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR SHALL UPDATE OR MODIFY THE STORM WATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO THE NEVADA STORM WATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12.
5. ACCUMULATED SEDIMENT IN BMPS SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORM WATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50.PERCENT OR MORE.

SNWA CONSTRUCTION NOTES

CONTRACTOR SHALL FIELD LOCATE AND PROTECT ALL SNWA/SNWS APPURTENANCES INCLUDING, BUT NOT LIMITED TO AV/AR, ACCESS MANWAYS AND CATHODIC PROTECTION SYSTEMS. ALL ABOVE GROUND STRUCTURES AND AT GRADE STRUCTURES MUST BE ADJUSTED TO NEW GRADE AT CONTRACTOR'S EXPENSE. CATHODIC PROTECTION TEST STATIONS, RECTIFIERS, AND AV/AR'S MUST BE RELOCATED TO THE SIDEWALK PER SNWA STANDARDS AND AT THE CONTRACTOR'S EXPENSE. CONTRACTOR TO NOTIFY **SOUTHERN NEVADA WATER AUTHORITY, DEVELOPMENT PLAN REVIEW**, AT (702) 862-3444 AT LEAST 48 HOURS **PRIOR** TO CONSTRUCTION ACTIVITY.

AREAS OF EXCAVATION OVER SNWA 135-A LATERAL SHALL REQUIRE HAND DIGGING WHEN COVER IS LESS THAN THREE (3) FEET. NO CONSTRUCTION EQUIPMENT IS TO TRANSIT THE AREA OVER THE PIPE WHEN THE COVER IS LESS THAN FIVE (5) FEET.

SNWA DATE

SNWA approval is valid for one (1) year from the signature date. if construction within the easement or restricted pipe safety zone is not complete, plans must be resubmitted to SNWA for approval.

Call before you Dig
AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY.
Call 811 OR 1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

70% SUBMITTAL

PROFESSIONAL ENGINEER-STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06-30-12
CIVIL
No. 16420

REVISIONS			
REV.	DESCRIPTION	BY	DATE	APPROVAL

PBS&J
225 Gateway Circle.
Henderson, NV 89014-2382
Telephone: 702.263.7272
Fax: 702.263.7200
ENGINEERING PLANNING SURVEYING CONSTRUCTION SERVICES

City of Henderson, Nevada

EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
GENERAL NOTES

JOB NO.: 100015350
FILE NAME: 15350-C1.02
SCALE: HORIZ.:NONE VERT.: NONE
DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: OCTOBER 11, 2010

JOB NO. 100015350
DRAWING NO. C1.02
SHEET 2 OF 8

NOT FOR CONSTRUCTION

COH KIVA # PCOH 2010XXXXXX

X:\Projects\100015350\Sheets\15350-C1.02.dwg Layout: C1.02 Oct 11, 2010 - 9:08am

@	AT
#	NUMBER
A	ANODE
A	AMPERES
AB	ABANDONED
AC	ASPHALTIC CONCRETE
ACP	ASBESTOS CEMENT PIPE
AD	ALGEBRAIC DIFFERENCE
AGG	AGGREGATE
AIP	ABANDON IN PLACE
ALT	ALTERNATE
AP	ANGLE POINT
APP	APPROACH
APPROX	APPROXIMATE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AV/AR	AIR VACUUM AIR RELIEF VALVE
AWG	AMERICAN WIRE GAUGE
BC	BACK OF CURB
BCR	BACK OF CURB RADIUS
BLK	BLOCK
BLVD	BOULEVARD
BM	BENCHMARK
BO	BLOW OFF
BOT	BOTTOM
BRG	BRIDGE
BS	BACK SLOPE
BSW	BACK OF SIDEWALK
BVC	BEGIN VERTICAL CURVE
BVCE	BEGINNING OF VERTICAL CURVE ELEVATION
BVCS	BEGINNING OF VERTICAL CURVE STATION
BW	BOTTOM WIDTH
BWC	BASIC WATER COMPANY
C&G	CURB AND GUTTER
C-C	CENTER TO CENTER
CATV	CABLE TELEVISION
CBC	CITY OF BOULDER CITY
CC	CLARK COUNTY
CCAUSD	CLARK COUNTY AREA UNIFORM STANDARD DRAWING
CCRFCD	CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
CCWRD	CLARK COUNTY WATER RECLAMATION DISTRICT
CCW	COUNTER CLOCKWISE
CF	CUBIC FOOT
CIP	CAST IRON PIPE OR CAST IN PLACE
CL	CENTERLINE
CLR	CLEAR
CLV	CITY OF LAS VEGAS
CM	CONSTRUCTION MANAGER OR CITY OF MESQUITE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CNDT	CONDUIT
CNLV	CITY OF NORTH LAS VEGAS
CO	CLEANOUT
COH	CITY OF HENDERSON
COL	COLUMN
COMM	COMMERCIAL
CON'T	CONTINUATION
CONC	CONCRETE
CONST	CONSTRUCT OR CONSTRUCTION
COR	CORNER
CPP	CORRUGATED PLASTIC PIPE
CSAP	CORRUGATED STEEL ARCH PIPE
CSP	CORRUGATED STEEL PIPE
CU	CUBIC
CULV	CULVERT
CW	CLOCKWISE
CY	CUBIC YARD
D	DEPTH
D	DISTANCE
DCSWCS	DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS
DET	DETAIL
DEPT	DEPARTMENT
DG	DESIGN GRADE
DI	DROP INLET
DIA	DIAMETER
DIAG	DIAGONAL
DMS	DYNAMIC MESSAGE SIGN
DW	DRIVEWAY
DWG	DRAWING
E	EAST
E/o	EAST OF
EA	EACH
EB	EASTBOUND
EC	END OF CURVE
ECR	END CURB RETURN
EF	EACH FACE
EG	EXISTING GROUND
ELEC	ELECTRICAL
ELEV	ELEVATION
EMBK	EMBANKMENT
EOP	EDGE OF PAVEMENT
EP	EDGE OF PAVEMENT
EQ	EQUAL
ESMT	EASEMENT
EVC	END VERTICAL CURVE
EVCS	END VERTICAL CURVE STATION
EW	EACH WAY
EX	EXISTING
EXP JT	EXPANSION JOINT
FA	FIRE ALARM
FC	FACE OF CURB
FF	FINISHED FLOOR ELEVATION
	FAR FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FL	FLOW LINE
FO	FIBER OPTIC
FT	FOOT OR FEET
G	GAS LINE
G	GRAMS
GALV	GALVANIZED
GB	GRADE BREAK
GL	GRATE LENGTH
GM	GAS METER
GR	GAS PRESSURE REGULATOR
GUT	GUTTER
GV	GATE VALVE
H	HEIGHT
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HDWL	HEADWALL
HE	HORIZONTAL ELLIPTICAL
HGL	HYDRAULIC GRADE LINE
HOR	HORIZONTAL
HP	HIGH POINT
	HIGH PRESSURE
ID	INSIDE DIAMETER
IN	INCH(ES)
INT	INTERSECTION
INV	INVERT
IQAC	INTERAGENCY QUALITY ASSURANCE COMMITTEE
IRR	IRRIGATION
ISL	ISLAND
JB	JUNCTION BOX
JCT	JUNCTION
JT	JOINT
K	VERTICAL CURVE K VALUE
KIPS	THOUSANDS OF POUNDS PER SQUARE INCH
KRG	KERN RIVER GAS COMPANY
KSI	THOUSANDS OF POUNDS PER SQUARE INCH
KV	KILOVOLT
L	LENGTH
LB	POUND(S)
LF	LINEAR FEET
LIE	LOWER INVERT ELEVATION
LIN	LINEAR
LOC	LENGTH OF CURVE
LOL	LAYOUT LINE
LP	LOW POINT
LT	LEFT
LVVWD	LAS VEGAS VALLEY WATER DISTRICT
MAS	MASONRY
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
MON	MONOLITHIC
MTL	MATERIAL
MUE	MUNICIPAL UTILITY EASEMENT
N	NORTH OR
	MANNINGS ROUGHNESS COEFFICIENT
N/o	NORTH OF
NAP	NOT A PART
NDOT	NEVADA DEPARTMENT OF TRANSPORTATION
NF	NEAR FACE
NG	NUMBER OF GRATES OR NATURAL GRADE
NIC	NOT IN CONTRACT
No.	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OG	OPEN GRADE
OH	OVERHEAD
OHP	OVERHEAD POWER
OS	OFFSET
P	POWER
PB	PULL BOX
PBS	PLANTMIX BITUMINOUS SURFACE
PC	POINT OF CURVATURE
PCC	PORTLAND CEMENT CONCRETE OR POINT OF COMPOUND CURVATURE
PE	POLYETHYLENE
PG	PROPOSED GRADE
PGL	PROFILE GRADE LINE
PH	POT HOLE
PI	POINT OF INTERSECTION
PIP	PROTECT IN PLACE
PL	PROPERTY LINE
PLCS	PLACES
PMF	PAVEMENT MARKING FILM
PP	POWER POLE
PRC	POINT OF REVERSE CURVATURE
PROP	PROPOSED
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENCY
PUE	PUBLIC UTILITY EASEMENT
PVC	POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
QTY	QUANTITY
(R)	RADIAL
R/W	RIGHT OF WAY
R	RADIUS
RC	REINFORCED CONCRETE
RCA	REINFORCED CONCRETE ARCH
RCB	REINFORCED CONCRETE BOX
RCC	ROLLER COMPACTED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
REINF	REINFORCED REINFORCEMENT
RELOC	RELOCATE
REV	REVISION
ROW	RIGHT OF WAY
RP	RADIUS POINT
RPM	RAISED PAVEMENT MARKER
RR	RAILROAD
RT	RIGHT
S	SOUTH/SLOPE
S/o	SOUTH OF
SCHED	SCHEDULE
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SF	SQUARE FOOT/SQUARE FEET
SHLD	SHOULDER
SHT	SHEET
SHP	STEEL HIGH PRESSURE PIPE
SL	STREET LIGHT
SMFO	SINGLE MODE FIBER OPTIC
SNWA	SOUTHERN NEVADA WATER AUTHORITY
SPA	SPACING
SQ	SQUARE
SS	SANITARY SEWER/SIDE SLOPE
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STLT	STREETLIGHT
STRUCT	STRUCTURAL OR STRUCTURE
SURV	SURVEY
SW	SIDEWALK
SY	SQUARE YARD
T	TELEPHONE LINE
TAN	TANGENT
TB	TOP OF BOX
TBA	TO BE ADJUSTED
TBC	TOP OF BACK OF CURB
TBR	TO BE REMOVED
TC	TOP OF CURB
TEL	TELEPHONE
TEMP	TEMPORARY
THK	THICK
THR	THRUST
THW	TOP OF HEADWALL
TOF	TOP OF FACE
TOW	TOP OF WALL
TP	TOP OF PIPE
TRANS	TRANSITION
TS	TRAFFIC SIGNAL
TSI	TRAFFIC SIGNAL INTERCONNECT
TW	TOP OF WALL
TYP	TYPICAL
UDACS	UNIFORM DESIGN AND CONSTRUCTION STANDARDS FOR WATER DISTRIBUTION SYSTEMS
UG	UNDERGROUND
UGP	UNDERGROUND POWER
UIE	UPPER INVERT ELEVATION
UNO	UNLESS NOTED OTHERWISE
UPRR	UNION PACIFIC RAILROAD
USD	UNIFORM STANDARD DRAWING
UTACS	ULTRA THIN ASPHALT CONCRETE SURFACE
V	VOLT
VAR	VARIABLE
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VG	VALLEY GUTTER
VOTR	VIDEO OPTICAL TRANSCEIVER
W	WEST/WATER
W/	WITH
W/o	WEST OF
WB	WEST BOUND
WL	WATER LINE
WM	WATER METER
WN	WEAKENED PLANE JOINT
WO/	WITHOUT
WOUS	WATERS OF THE U.S.
WPJ	WEAKENED PLANE JOINT
WV	WATER VALVE
WW	WING WALL
YD	YARD(S)

RPPA

BLOWOFF

CAP

CELL TOWER

LOOP DETECTOR

DROP INLET

AREA INLET

DRUM

BENCHMARK

MONUMENT CALCULATED

MONUMENT FOUND

MONUMENT TYPE 1

MONUMENT TYPE 2

MONUMENT TYPE 3

MONUMENT TYPE Z

FDC

FH EXISTING

FH PROPOSED

POST INDICATING VALVE

GATE VALVE

HC DOMES

MH

REDUCER

UTILITY VAULT

GUY WIRE

TRANSMISSION POLE

UTILITY POLE

TEST STATION

AIR-VACUUM VALVE

WATER METER

NDOT BARRIER A

NDOT BARRIER B

NDOT BARRIER FA

NDOT BARRIER FB

NDOT BARRIER PORTABLE

NDOT CURB 2

NDOT CURB 3

NDOT CURB A

NDOT CURB B

NDOT CURB GUTTER 1

NDOT CURB GUTTER 4

NDOT CURB GUTTER 5

NDOT CURB GUTTER 6

NDOT CURB GUTTER 7

NDOT CURB GUTTER 8

NDOT GUARDRAIL 3

NDOT GUARDRAIL 4

NDOT PED RAIL R

FLAGGER

IMPACT

PPCBR

PULLBOX No. 3 1/2

PULLBOX No. 5

PULLBOX TRAFFIC SIGNAL

PULLBOX No. 7

PULLBOX No. 9

PULLBOX P-30

PULLBOX T-300

ANGLE POINT

COORDINATE

PVI

HYDRAULIC GRADE LINE

EXISTING ELEVATION

NEW ELEVATION

ELEVATION [PROPOSED BY OTHERS]

CONDUIT RUN NUMBER

SIGNAL POLE LABEL

EXISTING STREETLIGHT

STREETLIGHT 100w

STREETLIGHT 150w

STREETLIGHT 200w

STREETLIGHT 250w

STREETLIGHT 400w

STREETLIGHT 450w

STREETLIGHT 750w

SERVICE PEDESTAL

EXISTING SERVICE POINT

SIGNPOST AND D3

SIGNPOST EXISTING

SIGNPOST NEW

OPTICOM

RED LIGHT INDICATOR

VIDEO CAMERA

CONTROLLER

SCHOOL FLASHER

PEDESTRIAN INDICATOR

SIGNAL HEAD

SIGNAL HEAD PERMISSIVE

SIGNAL HEAD PROTECTED

ILLUMINATED STREET NAME SIGN

SIGN ON ARM

EXISTING SIGNAL ARM

PROPOSED SIGNAL ARM

DETECTION ZONE, MINIMUM AREA

PROPOSED SIGN

EXISTING SIGN

CENTERLINE

PROPERTY LINE

RIGHT OF WAY

MATCHLINE

PROPOSED STREETLIGHT CONDUIT

EXISTING STREETLIGHT CONDUIT

PROPOSED 4" INTERCONNECT CONDUIT

PROPOSED 3" INTERCONNECT CONDUIT

TRAFFIC SIGNAL CONDUITS

EXISTING CHAIN LINK FENCE

EXISTING BLOCK WALL

RETAINING WALL

EXISTING OVERHEAD POWER

EXISTING UNDERGROUND POWER

EXISTING SANITARY SEWER

EXISTING WATER

EXISTING GAS

EXISTING CABLE T.V.

EXISTING STORM DRAIN

EXISTING TELEPHONE

EXISTING CONCRETE ENCASEMENT

EXISTING STREETLIGHT CONDUIT

TRAFFIC SIGNAL CONDUITS

PROPOSED INTERCONNECT

STUB AND CAP

SAWCUT PAVEMENT

LIMITS OF OPEN GRADE

EDGE OF PAVEMENT

GUARD RAIL

LANE LINE 8"

LANE LINE CAT TRACKS

LANE LINE DROP

LANE LINE STORAGE 8"

LANE LINE TYPE 1

LANE LINE TYPE 2

LANE LINE TYPE 3

LANE LINE TYPE 4

NEW STORM DRAIN W/MANHOLE

NEW STORM DRAIN W/PRECAST TEE

EXISTING SCARP

PROPOSED SCARP

CURB AND GUTTER

EXISTING

PROPOSED

PROPOSED BY OTHERS

DISH ANTENNA

EXISTING GATE

LIGHT POLE

PALM TREE

PEDESTRIAN SIGNAL

BOLLARD

DOUBLE POST SIGN

OVERHEAD SIGN

TREE

STREET SIGN

CULVERT

FLAG

MISC SYMBOL

AERIAL PANEL

CACTUS

CATCH BASIN

OFF ROAD CATCH BASIN

BILLBOARD

TRAFFIC SIGNAL

SIGN BRIDGE

TRANSMISSION POLE

UTILITY POLE

VALVE

Call before you Dig
AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY.
Call 811 OR 1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

70% SUBMITTAL

PROFESSIONAL ENGINEER-STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06-30-12
CIVIL
No. 16420

NOT FOR CONSTRUCTION

COH KIVA # PCOH 2010XXXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

PBS&J
2215 Sqecora Circle,
Henderson, NV 89074-5362
Phone: 702.263-7272
Fax: 702.263-7200
ENGINEERING PLANNING SURVEYING CONSTRUCTION SERVICES

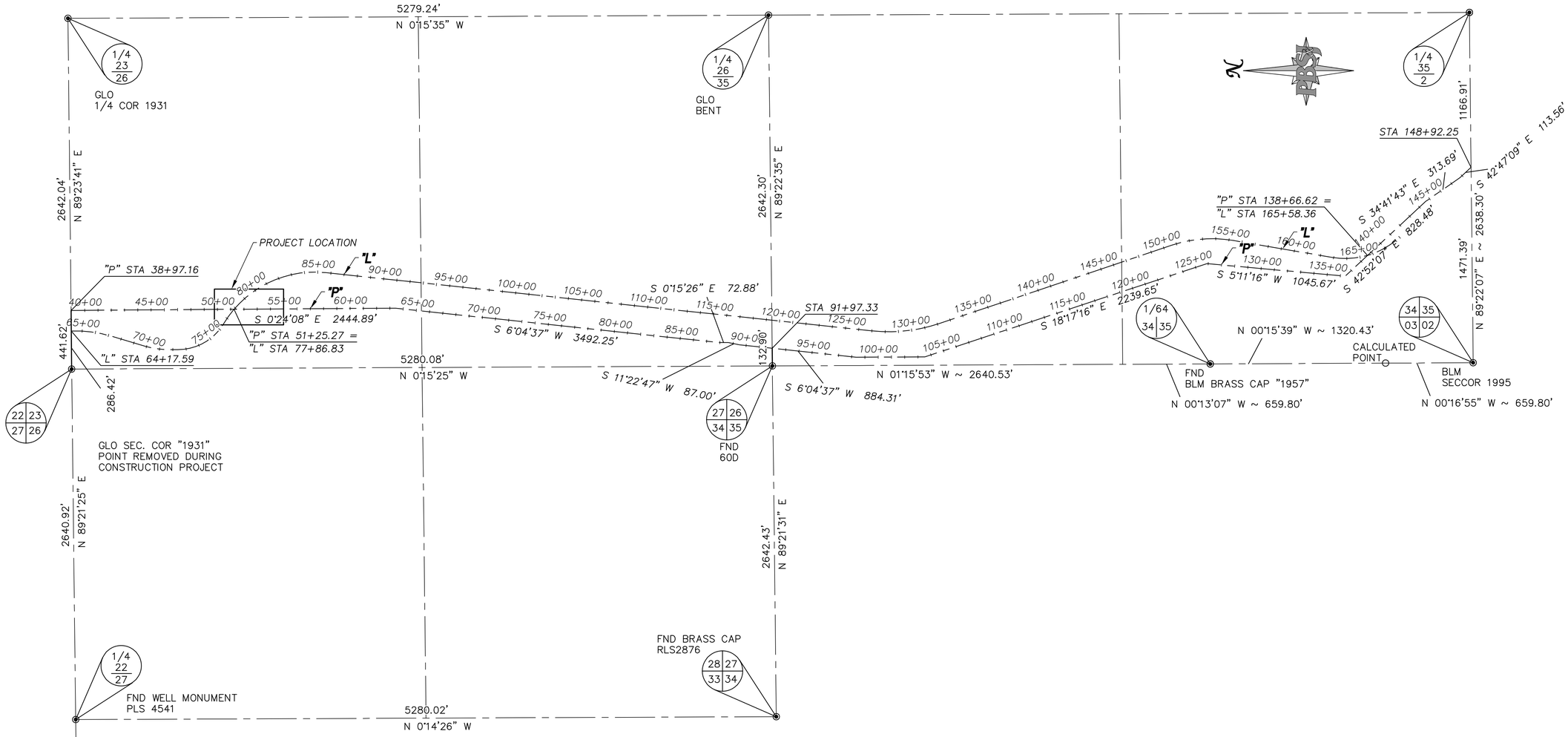
City of Henderson, Nevada

EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
LEGEND AND ABBREVIATIONS

JOB NO.: 100015350
FILE NAME: 15350-C1.03
SCALE: HORIZ.:NONE VERT.: NONE
DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: OCTOBER 11, 2010

JOB NO. 100015350
DRAWING NO. C103
3 / 8

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LEGEND

- FOUND POINT AS NOTED ◉
- CALCULATED POINT ○
- SECTION LINE ——— – ———
- CENTER LINE ——— – ———
- "L" – LEVEE FLOW LINE
- "P" – SNWA PIPELINE CENTERLINE

BASIS OF BEARINGS

BEING THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST M.D.M. TAKEN AS NORTH 89°23'35" EAST, PER PLAT BOOK 55, PAGE 28 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

NAVD88 BENCHMARK

CITY OF HENDERSON BENCHMARK NO 100 BEING DESCRIBED AS A BRASS CAP IN THE TOP OF THE CURB ON THE SOUTHWEST CORNER OF EQUESTRIAN DRIVE AND LONGMEADOW STREET.
ELEVATION = 2091.675' (637.544) METERS.

SOUTHERN NEVADA WATER AUTHORITY DATE

SNWA APPROVAL IS VALID FOR (1) YEAR FROM THE SIGNATURE DATE. IF CONSTRUCTION WITHIN THE EASEMENT OR RESTRICTED PIPE SAFETY ZONE IS NOT COMPLETE, PLANS MUST BE RESUBMITTED TO SNWA FOR APPROVAL

GRAPHIC SCALE
400 0 200 400 800
HORIZONTAL: 1"=400'

70% SUBMITTAL

PROFESSIONAL LAND SURVEYOR-STATE OF NEVADA
ERIC P. CHRISTIANSON
Exp 12-31-10
No. 8895

NOT FOR CONSTRUCTION

COH KIVA # PCOH 2010XXXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

PBS&J
2270 Corporate Circle
Suite 100
Henderson, NV 89074-7722
Tel: 702.268-8900
Fax: 702.268-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

City of Henderson, Nevada

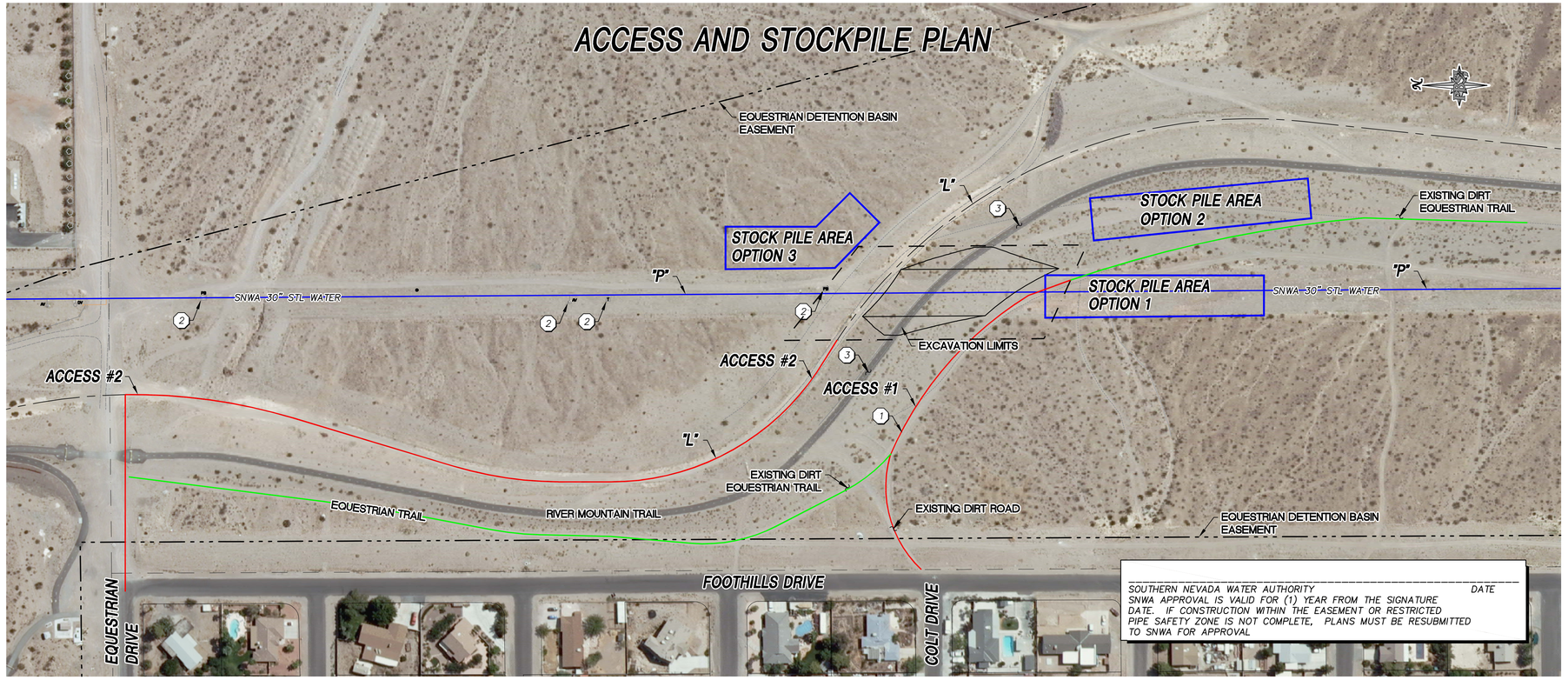
EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
HORIZONTAL CONTROL PLAN

JOB NO.: 100015350
FILE NAME: 15350-C1.04
SCALE: HORIZ.: NONE VERT.: NONE
DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: E. CHRISTIANSON
DATE: OCTOBER 11, 2010

JOB NO. 100015350
DRAWING NO. C104
SHEET NO. 4
OF 8

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ACCESS AND STOCKPILE PLAN



SOUTHERN NEVADA WATER AUTHORITY DATE
SNWA APPROVAL IS VALID FOR (1) YEAR FROM THE SIGNATURE DATE. IF CONSTRUCTION WITHIN THE EASEMENT OR RESTRICTED PIPE SAFETY ZONE IS NOT COMPLETE, PLANS MUST BE RESUBMITTED TO SNWA FOR APPROVAL

KEY NOTES

1. PROTECT IN PLACE MARKERS FOR EQUESTRIAN TRAIL
2. PROTECT IN PLACE EXISTING SNWA PIPELINE MARKERS, PULLBOXES, TEST STATIONS AND OTHER APPURTENANCES
3. PROTECT IN PLACE EXISTING ASPHALT

EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION

GRAPHIC SCALE
100 0 50 100 200
HORIZONTAL: 1"=100'

BASIS OF BEARING

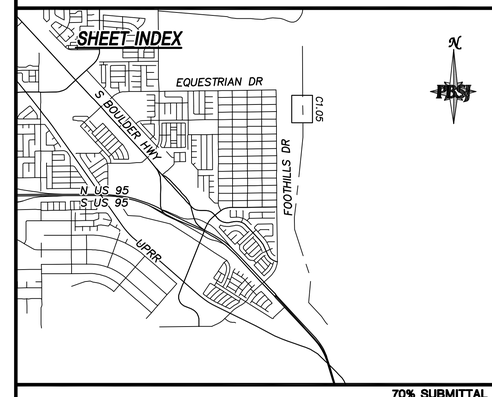
BEING THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST M.D.M. TAKEN AS NORTH 89°23'35" EAST, PER PLAT BOOK 55, PAGE 28 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

BENCHMARK

CITY OF HENDERSON BENCHMARK NO 100 BEING DESCRIBED AS A BRASS CAP IN THE TOP OF THE CURB ON THE SOUTHWEST CORNER OF EQUESTRIAN DRIVE AND LONGMEADOW STREET.

ELEVATION = 2091.675' (637.544 METERS).

SHEET INDEX



70% SUBMITTAL

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PROFESSIONAL ENGINEER-STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06-30-12
CIVIL
No. 16420

NOT FOR CONSTRUCTION

COH KIVA # PCOH 2010XXXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

PBS&J
225 Gateway Circle
Henderson, NV 89014-2382
Tel: 702.263-7272
Fax: 702.263-7200
ENGINEERING PLANNING SURVEYING CONSTRUCTION SERVICES

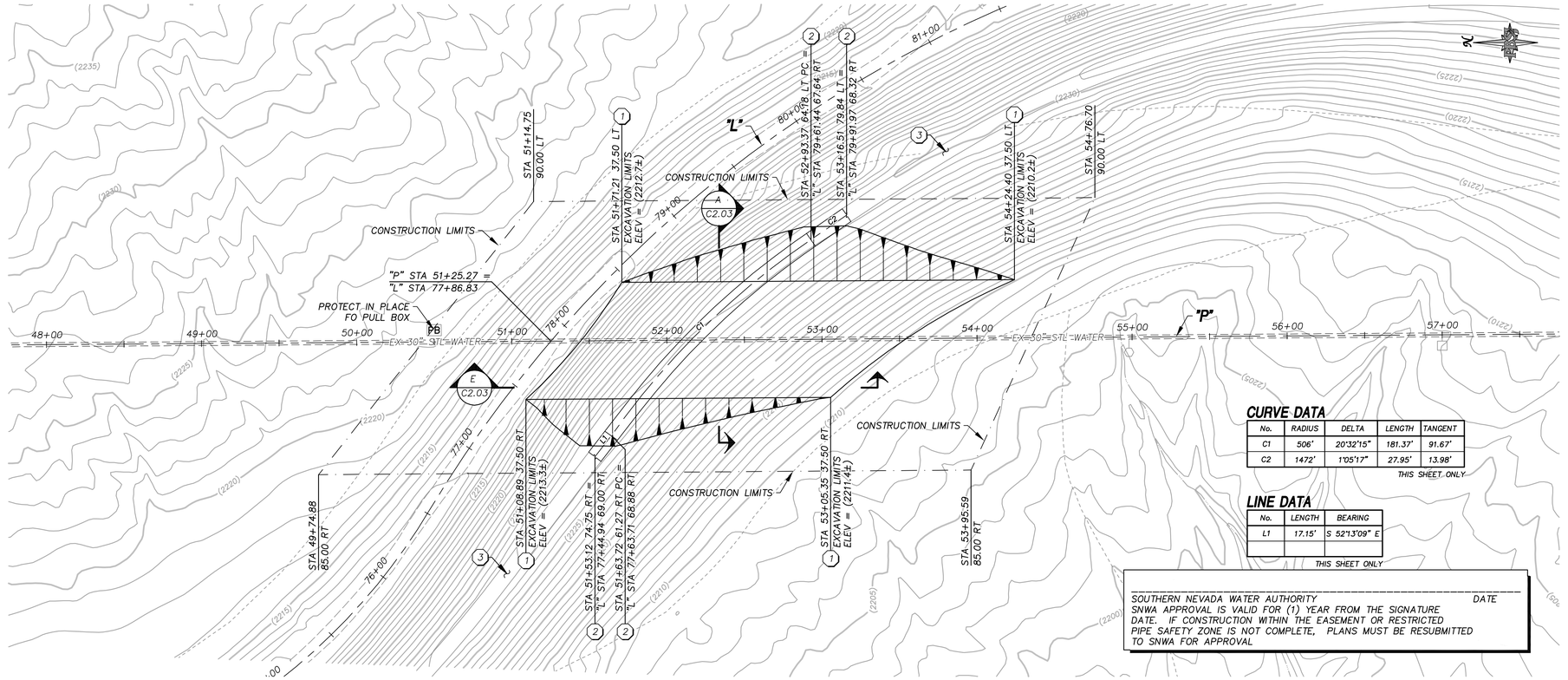
City of Henderson, Nevada

EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
CONSTRUCTION ACCESS AND STOCKPILE PLAN

JOB NO.: 100015350
FILE NAME: 15350-C1.05
SCALE: HORIZ.:NONE VERT.: NONE
DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: OCTOBER 11, 2010

JOB NO. 100015350
DRAWING NO. C1.05
5 / 8

X:\Projects\100015350\Sheets\15350-C1.05.dwg Layout: C1.05 Oct 11, 2010 - 8:09am



KEY NOTES

1. REMOVE EXISTING EMBANKMENT FILL IN ACCORDANCE WITH EXCAVATION PLAN AND REPLACE FILL IN ACCORDANCE WITH GRADING PLAN
2. SAWCUT, REMOVE AND REPLACE ASPHALT TRAIL SEE DETAIL D SHEET C2.03
3. PROTECT IN PLACE ASPHALT TRAIL
4. REMOVE 6" OF SURFACE SOIL AND VEGETATION

CURVE DATA

No.	RADIUS	DELTA	LENGTH	TANGENT
C1	506'	20°32'15"	181.37'	91.67'
C2	1472'	1°05'17"	27.95'	13.98'

THIS SHEET ONLY

LINE DATA

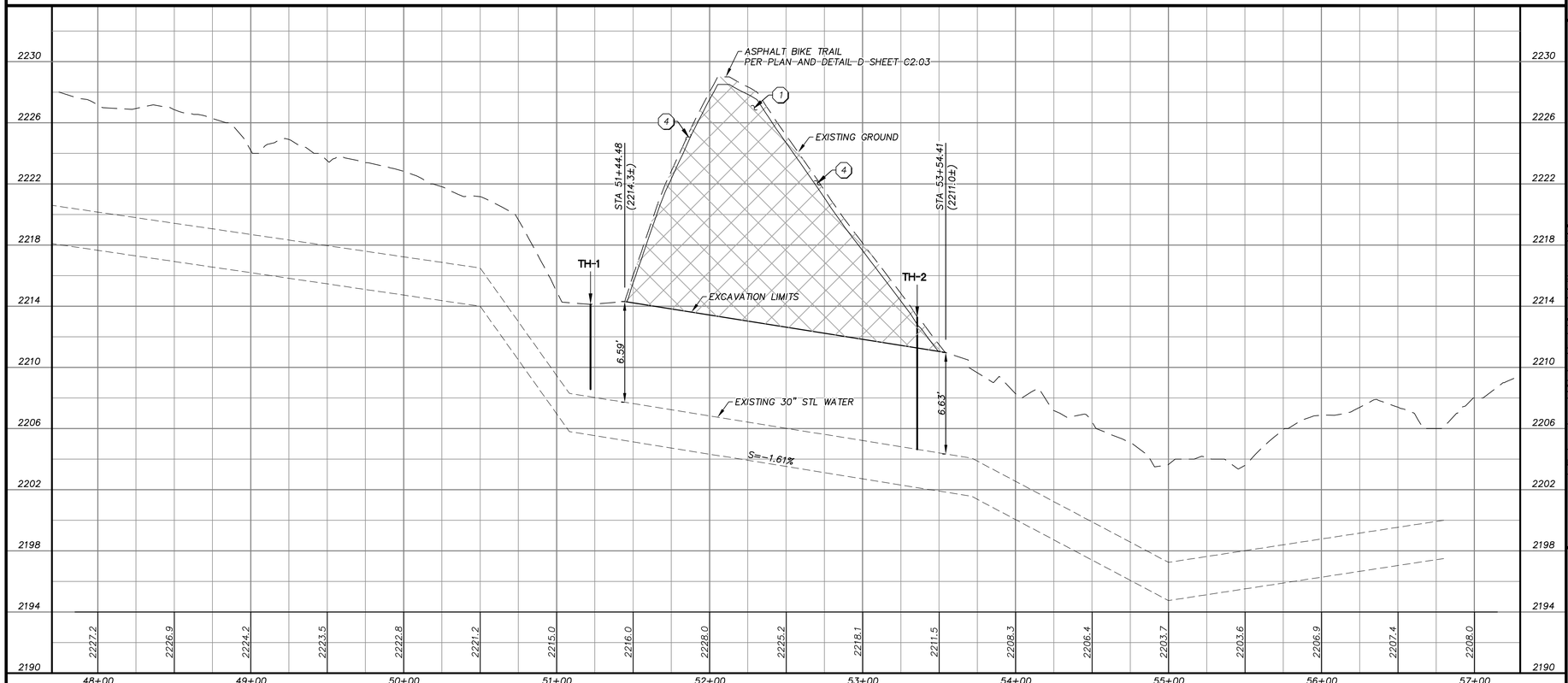
No.	LENGTH	BEARING
L1	17.15'	S 52°13'09" E

THIS SHEET ONLY

SOUTHERN NEVADA WATER AUTHORITY DATE
SNWA APPROVAL IS VALID FOR (1) YEAR FROM THE SIGNATURE DATE. IF CONSTRUCTION WITHIN THE EASEMENT OR RESTRICTED PIPE SAFETY ZONE IS NOT COMPLETE, PLANS MUST BE RESUBMITTED TO SNWA FOR APPROVAL

EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION

GRAPHIC SCALE
40 0 20 40 80
HORIZONTAL: 1"=40'



BASIS OF BEARING

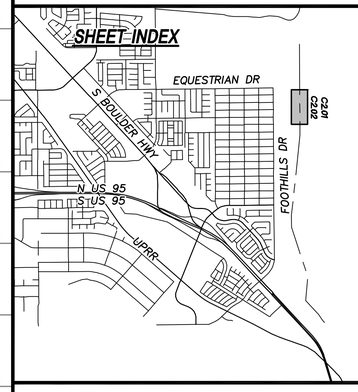
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ELEVATION = 2091.675' (637.544 METERS).

SHEET INDEX



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PROFESSIONAL ENGINEER-STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06-30-12
CIVIL
No. 16420

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CALL BEFORE YOU DO OVERHEAD 1-702-227-2929

NOT FOR CONSTRUCTION

COH KIVA # PCOH 2010XXXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

PBS&J
2270 Corporate Circle.
Suite 100
Henderson, NV 89074-7722
Phone: 702.263-7272
Fax: 702.263-7200
ENGINEERING PLANNING SURVEYING CONSTRUCTION SERVICES

City of Henderson, Nevada

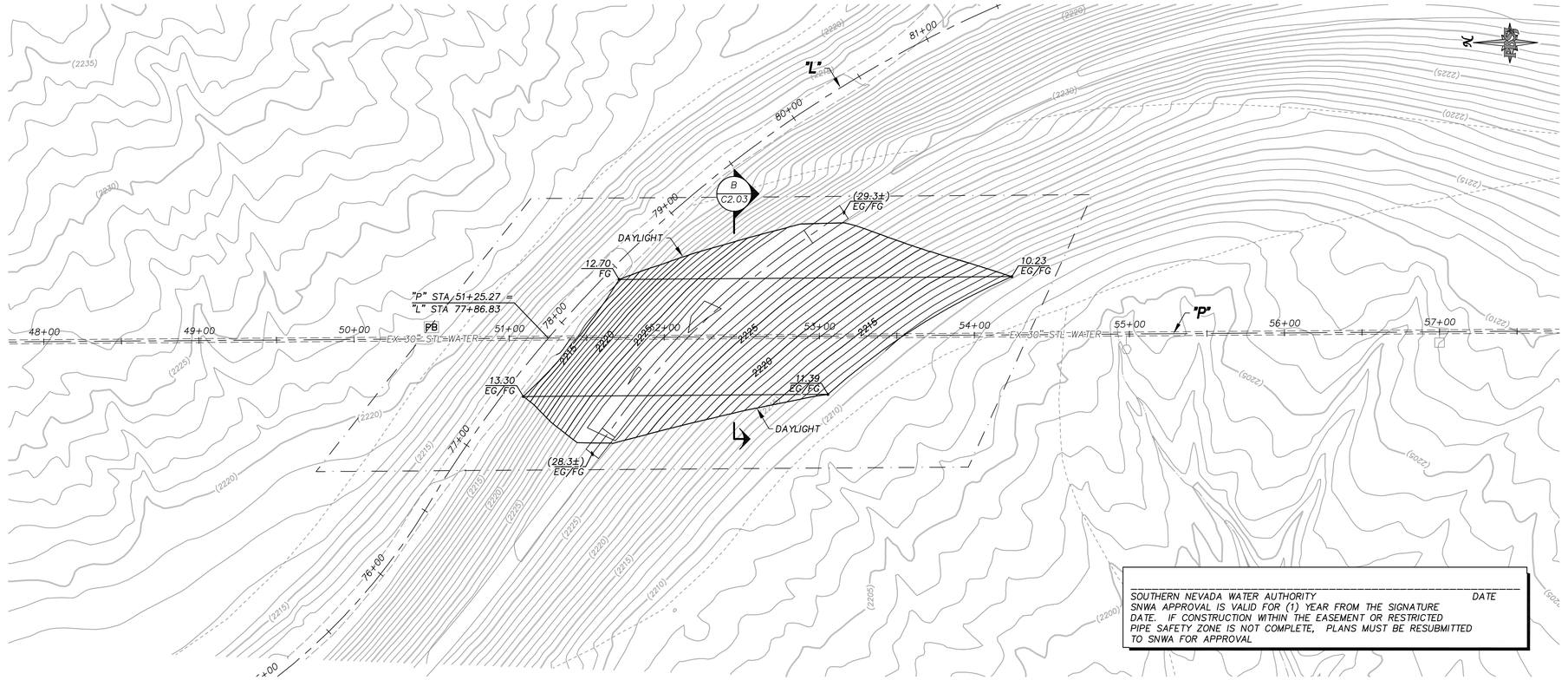
EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
EXCAVATION PLAN

JOB NO.: 100015350
FILE NAME: 15350-C2.01
SCALE: HORIZ.: 1"=40' VERT.: 1"=4'

DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: OCTOBER 11, 2010

JOB NO. 100015350
DRAWING NO. C2.01
SHEET NO. 6 OF 8

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SOUTHERN NEVADA WATER AUTHORITY DATE

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GRAPHIC SCALE

40 0 20 40 80

HORIZONTAL: 1"=40'

BASIS OF BEARING

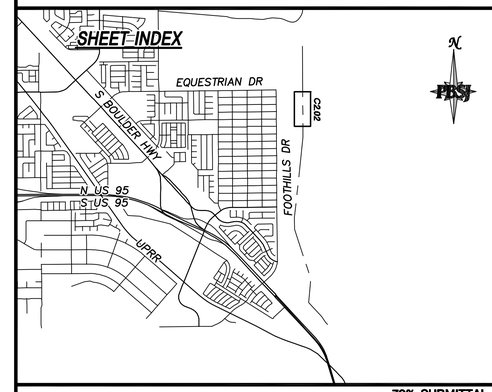
BEING THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST M.D.M. TAKEN AS NORTH 89°23'35" EAST, PER PLAT BOOK 55, PAGE 28 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

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SHEET INDEX



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AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
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1-702-227-2929

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MATTHEW K. WILKINSON
EXP. 06-30-12
CIVIL
No. 16420

NOT FOR CONSTRUCTION

COH KIVA # PCOH 2010XXXXXX

REVISIONS			
REV.	DESCRIPTION	BY	DATE APPROVAL

PBS&J
2270 Corporate Circle, Suite 100
Henderson, NV 89074-5982
Tel: 702.263.3273
Fax: 702.263.7200
ENGINEERING PLANNING SURVEYING CONSTRUCTION SERVICES

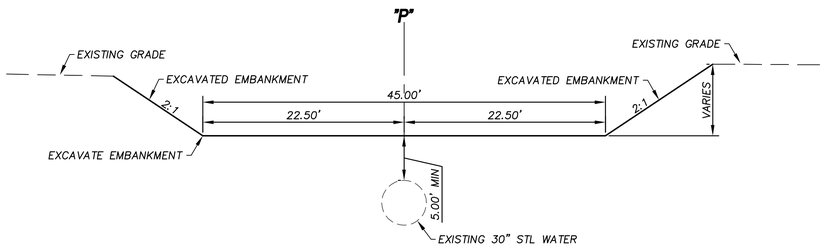
City of Henderson, Nevada

EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
LEVEE GRADING PLAN

JOB NO.:	100015350
FILE NAME:	15350-C2.02
SCALE:	HORIZ.: 1" = 40'
	VERT.: NONE
DESIGNED BY:	M. LANUM
DRAWN BY:	M. LANUM
CHECKED BY:	M. WILKINSON
DATE:	OCTOBER 11, 2010

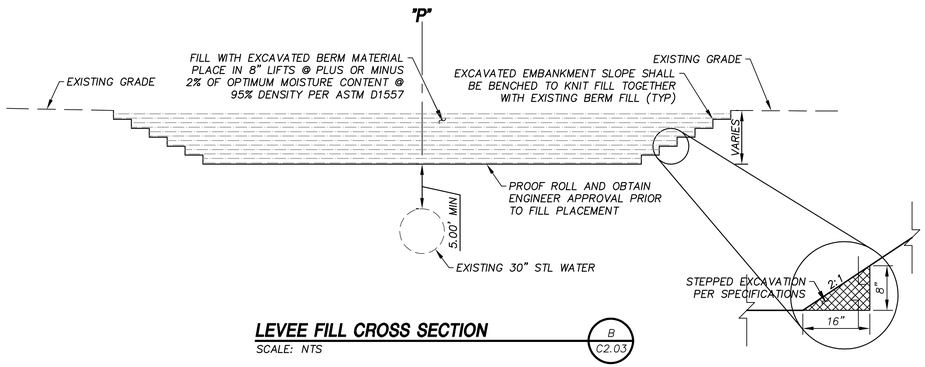
JOB NO. 100015350
DRAWING NO. C2.02
7
8

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LEVEE EXCAVATION CROSS SECTION — A / C2.03

SCALE: NTS

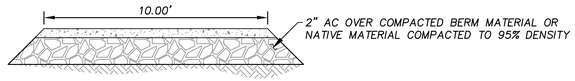


LEVEE FILL CROSS SECTION — B / C2.03

SCALE: NTS

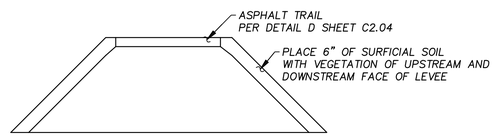
STEPPED EXCAVATION — C / C2.03

SCALE: NTS



ASPHALT TRAIL PAVEMENT SECTION — D / C2.03

SCALE: NTS



EMBANKMENT SECTION — E / C2.03

SCALE: NTS

CONTRACTOR TO NOTIFY SOUTHERN NEVADA WATER AUTHORITY, DEVELOPMENT PLAN REVIEW, AT (702) 862-3444 AT LEAST 48 HOURS PRIOR TO CONSTRUCTION ACTIVITY.

AREAS OF EXCAVATION OVER SNWA 135-A LATERAL SHALL REQUIRE HAND DIGGING WHEN COVER IS LESS THAN THREE (3) FEET. NO CONSTRUCTION EQUIPMENT IS TO TRANSIT THE AREA OVER THE PIPE WHEN THE COVER IS LESS THAN FIVE (5) FEET.

_____
SOUTHERN NEVADA WATER AUTHORITY DATE
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REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

PBS&J
2270 Corporate Circle,
Suite 100,
Henderson, NV 89074-5382
Phone: 702.263-1100
Fax: 702.263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

City of Henderson, Nevada

EQUESTRIAN DETENTION BASIN
LEVEE RECONSTRUCTION PROJECT
DETAILS

JOB NO.: 100015350
FILE NAME: 15350-C2.03
SCALE: HORIZ.: NONE VERT.: NONE
DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: OCTOBER 11, 2010

JOB NO. 100015350
DRAWING NO. C2.03 | 8 | 8

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PROFESSIONAL ENGINEER-STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06-30-12
CIVIL
No. 16420

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NOT FOR CONSTRUCTION

COH KIVA # PCOH 2010XXXXXX



70% Technical Specifications
For
Equestrian Detention Basin Levee Reconstruction Project
Contract No. xxxx-xx-xxxx
PWP-CL-xxxx-xx

Prepared by

2270 Corporate Circle Suite 100
Henderson, NV 89074

October 2010

BID SCHEDULE I

Equestrian Detention Basin Levee Reconstruction Project
Contract No. 2010-xx-xxxx
PWP # CL-2010-xx

Item	Description	Quantity	Unit	Unit Price		Extended Total Amount	
				Dollars	Cents	Dollars	Cents
105.01	Survey	1	LS				
107.01	Traffic Control	1	LS				
109.01	Construction Conflicts and Contingencies	1	LS	$7,000	00		
200.01	Mobilization	1	LS				
202.01	Removal of Asphalt Concrete Trail	1	LS				
203.01	Levee Excavation and Fill	7400	CY				
203.02	Levee Subgrade Over-excavation	720	CY				
402.01	2-inch Asphalt Concrete Trail	1	LS				
637.01	Dust Control	1	LS				
637.02	SWPPP Permit	1	LS				
Total Bid Amount							

Legend: LS = Lump Sum CY = Cubic Yards LF = Linear Feet SF = Square Feet EA = Each

SECTION 200

MOBILIZATION

ADD THE FOLLOWING SECTION 200 IN ITS ENTIRETY:

DESCRIPTION

200.01.01 GENERAL

A. Mobilization shall consist of all work and operations which must be performed, or costs incurred, not otherwise paid for prior to the beginning of work and at final completion of work on various items on the project site.

200.02.01 PROJECT SIGNS

A. The CONTRACTOR shall be required at the locations designated by the CITY to furnish and maintain **TWO (2)** "Project Construction" signs. When construction activities are frequently moved to various locations, the CONTRACTOR shall utilize a truck or trailer-mounted sign positioned to properly notify the public of the nature of the construction activity. The signs are to be relocated when and as directed by the CITY.

B. Drawings of the signs and their requirements are included at the end of this section. At a minimum, the information detailed on the signs should include the name of the project, agency administering the Contract (i.e. – City of Henderson Department of Public Works), Engineering Firm, CONTRACTOR, and phone number as point of contact for information on the project. On prevailing wage jobs, information on prevailing wage rates shall be added to the reverse side of every project sign.

C. The placement of the signs shall be made the first order of work, however, the placing of signs as a token start of construction shall not be permitted. If after placement of the signs there is no visible indication of actual construction, the signs shall be masked until such activity is apparent. Signs shall be properly maintained by the CONTRACTOR and in the correct position and in good condition throughout the construction period and until final completion of the Contract, or as directed by the CITY.

D. After final acceptance has been given by the CITY, the CONTRACTOR must remove all signs and return them to the CITY.

CONSTRUCTION

200.03.01 MOBILIZATION

A. Mobilization shall include preparatory work and operations, including those necessary for movement of personnel, equipment, supplies, and incidental to the project site, for the establishment of all offices, buildings, and other facilities necessary for work on the project.

B. This work shall also include the establishment and upkeep of temporary utilities, Project Signs, sanitary facilities, and the maintenance of a habitable project site including the following provisions:

1. Installation, maintenance and removal of the Project Signs as shown in the contract drawings including all labor, material and equipment.

2. All trash and litter from work zone shall be placed in covered trash receptacles and removed daily. Trash and litter includes all items made of paper, glass, plastic, all food remnants, food wrappers, and containers, all newspapers, rags, boxes, metals, etc.

3. The refuse from the covered receptacles shall be disposed of in an approved manner at an existing solid waste dump or disposal facility at the end of each work week.

C. This work shall also consist of final project close-out and cleanup operations, including, but not limited to, those necessary for the removal of equipment, supplies, incidentals and debris from the project site, cleaning the streets and sidewalks of all soils and construction debris, record drawings, correction of deficiencies in the work, and for all other work required by the CONTRACTOR which must be performed prior to final acceptance by the CITY.

METHOD OF MEASUREMENT

200.04.01 MEASUREMENT

A. Mobilization will be measured as lump sum.

BASIS OF PAYMENT

200.05.01 PAYMENT

A. Mobilization partial payments shall be made in accordance with the following schedule:

1. When 5 percent of the original contract amount is earned from other bid items, 25 percent of the amount bid for mobilization, or 5 percent of the original contract amount, whichever is less, will be paid.

2. When 25 percent of the original contract amount is earned from other bid items, 50 percent of the amount bid for mobilization, or 7 percent of the original contract amount, whichever is less, will be paid.

3. When 50 percent of the original contract amount is earned, excluding the amount for mobilization, the remaining contract amount bid for mobilization, or 10 percent of the original contract amount, whichever is less, will be paid.

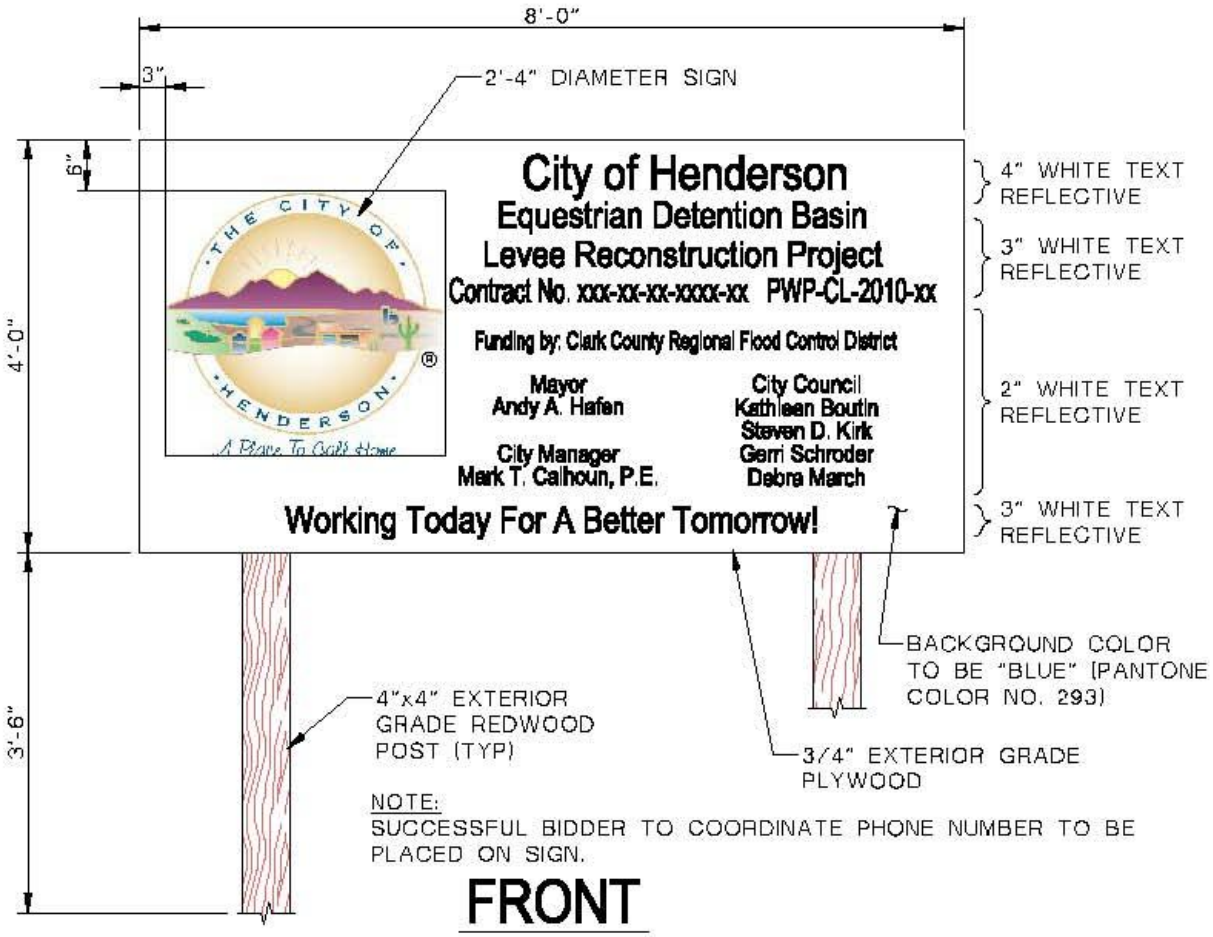
4. Upon completion of all work on the project, payment of any amount bid for mobilization in excess of 10 percent of the original contract amount will be paid.

B. All payments will be made in accordance with subsection 109.02, "Partial Payment."

C. Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
200.01	Mobilization	Lump Sum

END OF SECTION 200



THIS IS A PREVAILING WAGE PROJECT

The hourly labor rates for this project are determined by the State of Nevada. Information on the rates can be obtained by calling the Office of the Labor Commission at (702) 486-2650.

ESTE ES UN PROYECTO DE SALARIOS DETERMINADOS

El salario laboral correspondiente por hora es determinado por El Estado de Nevada. Informacion acerca de los salarios puede ser obtenida Llamando a la Commision Laboral al (702) 486-2650.

REAR

(Use Minimum 3-Inch High Letters)

SECTION 201

CLEARING AND GRUBBING

DESCRIPTION

201.01.01 GENERAL

ADD THE FOLLOWING TO THIS SUBSECTION:

B. This work shall also consist of removing the top 6 inches of soil and vegetation material and stockpiling separately as specified in Section 203.

METHOD OF MEASUREMENT

201.04.01 MEASUREMENT

REPLACE SUBSECTION 201.04.01 WITH THE FOLLOWING:

A. There shall be no separate measurement for clearing and grubbing.

B. All measurements will be made in accordance with Subsection 109.01, "Measurement of Quantities."

BASIS OF PAYMENT

201.05.01 PAYMENT

REPLACE SUBSECTION 201.05.01 WITH THE FOLLOWING:

A. No payment will be made for clearing and grubbing as such; the cost thereof is considered as included in the price bid for the construction or installation of the items to which such work is incidental or appurtenant.

B. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."

END OF SECTION 201

SECTION 202

REMOVAL OF STRUCTURES AND OBSTRUCTIONS

DESCRIPTION

202.01.01 GENERAL

Insert the following paragraph in this section:

B. This work shall consist of the removal and proper disposal of asphalt concrete trail from Station “L” 77+44.94 to Station “L” 79+91.97.

MATERIALS

202.02.01 BLANK

CONSTRUCTION

202.03.06 DISPOSING OF MATERIALS

Delete paragraphs B. and C. and replace with the following:

B. Broken concrete and masonry must be removed and properly disposed of off-site in accordance with Subsection 107.14, “Disposal of Material Outside Project Right-of-Way.” Broken concrete and masonry may not be incorporated into backfills and embankments.

METHOD OF MEASUREMENT

202.04.01 MEASUREMENT

Insert the following paragraphs in this section:

D. The quantity for “Removal of Asphalt Concrete Trail” will be measured for payment as a Lump Sum.

BASIS OF PAYMENT

202.05.01 PAYMENT

Insert the following paragraphs E and F and renumber paragraph E to paragraph G.

E. “Removal of Asphalt Concrete Trail” will be paid for as a Lump Sum. The bid price shall be full compensation for a complete job as shown on drawings, as specified herein, and as directed by the ENGINEER, including saw cutting, removal of asphalt concrete, hauling and proper disposal of said material, and for all labor, equipment, materials, and incidentals necessary to complete the work.

F. Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
202.01	Removal of Asphalt Concrete Trail	Lump Sum

SECTION 203

EXCAVATION AND EMBANKMENT

DESCRIPTION

203.01.01 GENERAL

Add the following paragraph to this section:

B. This work shall consist of excavation of a section of an existing levee embankment and placement of excavated levee material in levee opening. The existing levee was previously excavated and backfilled as part of a pipeline project. However, the Contractor may not have restored the levee to its original condition. Therefore, the portion of the levee disturbed by the pipeline construction must be removed and then replaced to earthwork standards for water-retaining earthen structures.

MATERIALS

203.02.04 EMBANKMENT EXCAVATION

Insert the following paragraph and renumber “Borrow” to 203.02.05 and “Selected Borrow” to 203.02.06

A. All materials designated on the excavation drawings to be removed shall be removed to the lines and grades shown. This includes stripping and stockpiling separately the top 6 inches of material. The remaining material shall be temporarily stockpiled on the landside of the levee at a location shown on the drawings. Contractor shall place material in the stockpile using methods that will minimize segregation.

203.02.05 BORROW

Insert the following paragraphs in this section:

C. Borrow material, if required, shall be obtained from an on-site borrow site as shown on the drawings. The borrow material shall be a well-graded mixture of alluvial sands and gravels with a uniformity coefficient greater than 75, at least 5 percent by weight passing the No. 200 sieve, and a maximum particle size of 4 inches.

D. If an off-site borrow source is approved by the ENGINEER, the Contractor must verify the borrow materials meet the specified requirements in Paragraph C using an independent testing laboratory.

CONSTRUCTION

203.03.04 BLASTING

Delete paragraphs A and B and replace with the following:

A. Use of explosives is prohibited.

203.03.12 DRAINAGE

Insert the following paragraphs in this section:

E. Contractor shall excavate existing levee embankment and backfill opening in embankment in a manner that will not block the flow path of the existing channel.

F. Contractor shall place a cofferdam on the waterside of the excavation to prevent breach of the levee if a flood event occurs during excavation and reconstruction of the levee. Contractor shall design the cofferdam for the following conditions, which represent a 10-year storm event.

Station	Flow rate (cfs)	Flow depth (ft)	Velocity (fps)
78+00	720	3.4	7.6

Contractor shall submit design of cofferdam to ENGINEER for review and approval in accordance with Section 105.02.04.

Contractor shall install cofferdam before excavation of levee is below the water surface elevation of the 10-year flood. Cofferdam must remain in place until Contractor has backfilled opening in the levee to an elevation above the water surface elevation of the 10-year flood. The Contractor may remove the cofferdam for the remainder of the work.

203.03.15 FOUNDATION

Insert the following paragraph in this section:

E. Following removal of existing levee embankment materials to the lines and grades shown on excavation plans, the Contractor shall prepare the foundation. The subgrade shall be proof-rolled with 50-ton, rubber-tired roller or other approved equipment. The Contractor shall over-excavate loose or disturbed soils in soft areas detected by proof-rolling. Contractor shall over-excavate unsuitable materials to expose competent, undisturbed dense soils. ENGINEER shall approve limits of over-excavation prior to placement of fill. Contractor shall scarify the subgrade to a minimum depth of 8 inches, moisture condition the soil within a range of -2 to +2 percent of optimum moisture content, and compact the subgrade to 90 percent of maximum dry density as determined by ASTM D-1557.

If over-excavation of unsuitable material is required, the subgrade shall be surveyed before and after over-excavation to determine the volume of over-excavation. If required, Contractor must over-excavate unsuitable material in the levee foundation by hand methods if unsuitable material is located in a 10 ft wide corridor, centered on water line, and less than 3 ft above crown of pipe. Contractor will be paid for this work, if required, under a separate subgrade over-excavation pay item.

Contractor shall backfill over-excavated areas to the excavation limit shown on the drawings with a well-graded mixture of alluvial sands and gravels, with uniformity coefficient greater than 75, at least 5 percent by weight passing the No. 200 sieve, and a maximum particle size of 4 inches. The over-excavation fill shall be placed in lifts with a maximum loose thickness of 8 inches, moisture conditioned within a range of -2 to +2 percent of optimum moisture content, and compacted to 95 percent of maximum dry density in accordance with ASTM D1557.

203.03.16 EMBANKMENT MATERIALS

Insert the following paragraph in this section:

F. The openings in the levee embankment shall be backfilled with material excavated and temporarily stockpiled from the levee. The material shall consist of a well-graded mixture of alluvial sands and gravels with a uniformity coefficient greater than 75, at least 5 percent by weight passing the No. 200 sieve, and a maximum particle size of 4 inches.

203.03.17 PLACING EMBANKMENT

Delete the fourth sentence in Paragraph D and replace it with the following:

The thickness of the layer shall be as necessary to secure the required compaction with 8 inch maximum loose thickness.

Delete Paragraphs E through M and renumber Paragraph N to Paragraph E. Insert the following paragraphs:

F. The surface of the fill in the levee embankment opening shall be maintained approximately horizontal as work proceeds. The difference in elevation for each lift surface shall be less than 1 ft. The fill shall be placed so it is knit together with the existing levee embankment at the temporary slopes. Temporary slopes shall be 2H:1V or flatter. The slope of adjoining fill, against which new material is placed, shall be cut into horizontal benches immediately prior to placement of each layer of new fill. The horizontal width of each bench shall be twice the compacted lift thickness, or 1 ft 4 inches and the vertical cut shall be approximately equal to the lift thickness, or 8 inches.

G. All fill material shall be placed in approximately horizontal layers not to exceed 8 inches in loose thickness. After dumping, the material shall be spread by dozers, graders, or other approved equipment, to obtain a uniform lift thickness prior to compaction. The distribution of material throughout the fill section shall be uniform and free from lenses, pockets, and layers of material differing substantially in texture and gradation from the specified material.

H. The entire surface of each lift shall be maintained in such condition that construction equipment can travel thereon. Ruts shall be filled in to the satisfaction of the ENGINEER prior to compaction. Whenever a lift surface has been made too smooth to bond properly to the succeeding layer by a concentration of hauling equipment or for other reasons, the smooth surface shall be roughened by scarifying or equivalent methods and moisture conditioned as required before a succeeding layer is placed thereon.

I. After each layer is spread to a uniform thickness and worked to a uniform consistency, the material shall be wetted to provide a uniform distribution of moisture throughout the lift. The lift shall then be compacted to the specified density before a succeeding layer is placed thereon. Each lift shall be kept moist and not allowed to dry out. If a lift dries out, the material shall be scarified, wetted and reworked to increase the moisture content to the specified range, and compacted prior to placement of the next lift.

203.03.18 COMPACTION, SOIL EMBANKMENT

Delete paragraphs A through G and replace with the following:

A. The fill, consisting of a well-graded mixture of alluvial sands and gravels, shall be compacted to 95 percent of maximum dry density within a range of -2 to +2 percent of optimum moisture content in accordance with ASTM D1557.

B. The Contractor shall provide equipment specifically designed for compacting soil embankments. Equipment shall be self propelled, vibratory pad foot rollers. Compaction by rubber-tired hauling equipment is not acceptable. Contractor shall determine the optimum working speed, frequency, and amplitude to obtain specified compaction of levee fill.

203.03.19 COMPACTION, ROCK EMBANKMENT

Delete this section in its entirety.

METHOD OF MEASUREMENT

203.04.01 MEASUREMENT

Delete paragraph C.1 and replace with the following:

a. If proof-rolling of the subgrade reveals soft areas, the Contractor shall remove these unsuitable materials to expose competent, undisturbed, dense soils. Contractor shall obtain approval of excavation limits by ENGINEER. Contractor shall determine volume of over-excavation by surveying cross sections of subgrade. Unsuitable material shall be disposed of properly. Contractor shall backfill over-excavated areas to the excavation limit shown on the drawings with a well-graded mixture of alluvial sands and gravels, with uniformity coefficient greater than 75, at least 5 percent by weight passing the No. 200 sieve, and a maximum particle size of 4 inches. The over-excavation fill shall be placed in lifts with a maximum loose thickness of 8 inches, moisture conditioned within a range of -2 to +2 percent of optimum moisture content, and compacted to 95 percent of maximum dry density in accordance with ASTM D1557.

Paragraph C.3, is revised to read as follows:

3. **Widening Cuts:** If the ENGINEER directs the Contractor to excavate beyond the limits of the typical cross section and before the excavation is substantially completed, the material shall be classified as "Levee Excavation and Fill" and shall be paid for at the contract bid price. However, if widening cuts requires special equipment, or unusual and extra expense, it may be paid for as extra work according to the provisions of Subsection 104.03, "Extra Work."

BASIS OF PAYMENT

203.05.01 PAYMENT

Delete paragraphs A through D, renumber paragraphs E and F to C and D, and insert the following:

A. The accepted quantity of “Levee Excavation and Fill” as specified in Subsection 203.04.01, “Measurement”, will be paid at the contract unit price bid per cubic yard. Compensation shall include excavating the levee embankment, hauling, stockpiling, proof-rolling the foundation, loading, hauling, depositing, spreading, moisture conditioning, compacting, benching the side slopes of the existing levee, finish grading, and maintaining the material complete and in place, which includes all labor, tools, equipment, and incidentals. The unit price shall include stripping 6 inches of the surface soils prior to excavation, stockpiling surficial soils separately, and spreading 6 inches of surficial soils on waterside and landside of levee after fill is complete. The unit price shall also include furnishing, installing, and removing cofferdams required to protect the downstream residential area from a 10-year flood event if it occurs while levee excavation is open.

B. The accepted quantity of “Levee Subgrade Over-Excavation”, if required, as specified in Subsection 203.04.01, “Measurement”, will be the contract price bid per cubic yard. Compensation shall include over-excavating unsuitable materials until competent undisturbed dense material is exposed, surveying of subgrade to determine volume of over-excavation, disposal of unsuitable material, furnishing specified levee fill, hauling, depositing, spreading, moisture conditioning, and compacting the material, complete and in place, which includes all labor, tools, equipment, and incidentals.

C. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."

D. Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
203.01	Levee Excavation and Fill	Cubic Yard
203.02	Levee Subgrade Over-excavation	Cubic Yard

TESTING

203.05.02 TESTING

A. Revise the frequency of testing for the following items in the testing table. The density of the proof-rolled foundation shall be tested a minimum of four times. The density of each lift shall be tested a minimum of four times. Two of the tests shall be located at the interface between the benched slope of the existing levee embankment and the newly placed fill in the levee opening.

SECTION	DESCRIPTION	TEST	REFERENCE SPECIFICATION AND/OR TEST PROCEDURE	RECOMMENDED FREQUENCY
203.03.15	Foundation (Subgrade)	Field Density	AASHTO T 310	1/4000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change

203.03.18	Embankment	Field Density Fill	AASHTO T 310	1/4000 SF/Lift/Day
		Field Density Native Below Embankment Fill Operations	AASHTO T 310	1/4000 SF/Lift/Day
		Proctor	AASHTO T 180	1/Project or Change

SECTION 402

PLANTMIX BITUMINOUS SURFACE

DESCRIPTION

402.01.01 GENERAL

THE FOLLOWING PARAGRAPH IS ADDED TO THIS SUBSECTION:

C. This work shall consist of construction of 2-inch asphalt concrete trail from Station "L" 77+44.94 to Station "L" 79+91.97. This work shall also consist of painting trail center line.

CONSTRUCTION

402.03.02 SPREADING AND FINISHING

THE FOLLOWING PARAGRAPH IS ADDED TO THIS SUBSECTION:

G. Unless otherwise specified, bituminous plantmix surfacing shall be placed in courses not exceeding four (4) inches in compacted thickness. When more than one course is placed, the courses shall be approximately equal thickness.

METHOD OF MEASUREMENT

402.04.01 MEASUREMENT

REPLACE PARAGRAPH A. WITH THE FOLLOWING:

A. The quantity for "2-inch Asphalt Concrete Trail" will not be measured for payment. Basis of payment is Lump Sum.

BASIS OF PAYMENT

402.05.01 PAYMENT

DELETE PARAGRAPHS A. THROUGH D. AND REPLACE WITH THE FOLLOWING:

A. "2-inch Asphalt Concrete Trail" will be paid for as a Lump Sum. The bid price shall be full compensation for a complete job as shown on the drawings, as specified herein, and as directed by the ENGINEER, including furnishing all the material, mixing, loading, hauling, placing, compacting, painting trail center line, and for all labor, equipment, materials, and incidentals necessary to complete the work.

B. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."

C. Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
402.01	2-inch Asphalt Concrete Trail	Lump Sum

END OF SECTION 402

SECTION 637

POLLUTION CONTROL

DESCRIPTION

637.01.01 GENERAL

ADD THE FOLLOWING TO THIS SUBSECTION:

D. The Clark County Department of Air Quality Management's Air Pollution Control Regulations Regulation 94, *Construction Activities Dust Control Handbook*, and those Best Management Practices (BMPs) described therein are hereby incorporated by reference as preconditions of this Contract. Contractor shall familiarize himself with these regulations and practices, and is advised that prior to engaging in any construction activities defined in Section 94.2 of these regulations, Contractor shall obtain a Dust Control Permit from the Clark County Department of Air Quality Management. As applicant, Contractor shall ensure that all contractors, subcontractors, and all other persons abide by the conditions of the permit. As applicant, Contractor is further responsible for supplying complete copies of the Dust Control Permit and Dust Mitigation Plan, if applicable, to all project subcontractors.

ADD THE FOLLOWING SUBSECTION TO THIS SECTION:

637.01.02 SWPPP PERMIT

A. Nevada Division of Environmental Protection (NDEP), Bureau of Water Pollution Control, has issued general permit NVR100000 that covers construction activities within the state of Nevada. In order to be covered by the permit, Contractor shall submit, at no extra cost to Owner, a Notice of Intent (NOI) with a Stormwater Pollution Prevention Plan (SWPPP) and the required filing fee to the attention of Clifford Lawson (775-687-9429) at: Nevada Division of Environmental Protection, Bureau of Water Pollution Control, Capital Complex, 333 West Nye Lane, Carson City, Nevada 89706. Further information and copies of the required NOI may be obtained on the Internet at http://www.ndep.nv.gov/bwpc/storm_cont03.htm.

B. Prior to performance of the Work, Contractor shall be aware of the NDEP requirements for the control of stormwater runoff during construction for this project. Contractor shall apply for, pay for, and gain approval of the required permit from the local authority in a timely manner so as not to affect the project schedule. Contractor shall comply with the requirements of the permit and shall bear all associated costs. Application forms are also available at the local NDEP offices but must be properly submitted to the Carson City, Nevada offices of the State of Nevada Water Pollution Control Division. If Owner suffers damages including but not limited to delays and fines as a result of Contractor's failure to obtain a required permit or for non-compliance with the requirements of the permit, Contractor shall reimburse Owner for such damages and Owner may withhold amounts equal to the damages from Contractor's payments.

C. Failure of Contractor to obtain required permits in a timely manner shall not be justification for delay of the issuance of the Notice to Proceed by Owner.

ADD THE FOLLOWING SUBSECTIONS TO THIS SECTION:

637.03.01 GENERAL

K. Dust palliative shall be applied to all disturbed areas within the construction limits as shown on the drawings (excepting pavement), stockpile footprints, borrow areas, and other areas disturbed by the Contractor during course of construction.

637.03.02 DUST CONTROL

A. Contracts between Contractor and applicable subcontractors shall provide a monetary allowance for dust control options specified in either the Dust Control Permit or, if applicable, the Dust Mitigation Plan.

B. In accordance with Section 94.7.5 of the dust control regulations, if at any time Contractor's operations cause more than 50 acres of disturbed soil to exist, Contractor shall cause to have in place a person (dust control monitor) with full authority to ensure that dust control measures are implemented, including inspections, record keeping, deployment of resources, and shut-down or modification of construction activities as needed.

C. Throughout the project area and for the duration of the project, all disturbed soil shall be maintained to minimize wind erosion and particulate emissions. Best available control measures (BACM) are required 24 hours a day, 7 days a week, whether or not there is current construction activity on-site. When any part of the project area is inactive for a period of 30 days or longer, long term stabilization shall be implemented within 10 days following the cessation of active operations in that area. As permit holder, Contractor shall notify the Clark County Department of Air Quality Management in writing within 10 days following the cessation of active operations on all or a part of the project area.

D. Contractor's superintendent or other designated on-site representative shall be required to have successfully completed a Clark County Dust Control Class. All water truck drivers and water pull drivers on the project shall be required to have successfully completed a Clark County Dust Control Class.

E. As permit holder, Contractor shall keep records of construction site self-inspections for the project duration in accordance with Section 94.7.8.

637.03.03 DUST PALLIATIVE

A. All areas in the construction limits, stockpile footprints, borrow areas, and other areas disturbed by the Contractor not covered by concrete, asphalt, rock mulch, or riprap shall be treated with a dust palliative for soil stabilization as shown on the Drawings and as specified.

B. Prior to the application of dust palliative, all earthen slopes and surfaces shall be finished to the grades shown on the Drawings or as directed by Engineer, including the removal of all existing vegetation and the filling and smoothing of erosional features and surface irregularities. The finished surfaces shall then be scarified to a depth of 6 inches and

groomed to produce a smooth surface with all particles greater than 3 inches in diameter removed.

C. Soil surfaces prepared as described above shall then be treated with dust palliative as specified above in Subsection 637.02.02.

METHOD OF MEASUREMENT

637.04.01 MEASUREMENT

DELETE THIS SUBSECTION IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING:

A. Measurement for “Dust Control” shall be lump sum for all dust control activities specified herein and required to satisfy the requirements of Construction Activities Dust Control Handbook.

B. The quantities of “Dust Palliative” measured for payment will be the number of acres completed as specified. The estimated quantity shown on the Drawings, plus or minus authorized quantity changes, will be the quantity used for payment. The quantity will be calculated based on the total disturbed area, excluding new improvements such as asphalt trail.

C. Measurement “SWPPP Permit” shall be lump sum for all SWPPP permit activities specified herein and required to satisfy the requirements of permit.

D. The cost of furnishing materials and equipment and conditioning crushing, mixing, and processing plants and other equipment to comply with the requirements of NRS 445, especially the "Air Quality Regulations" adopted by the State Commission of Environmental Protection, January 18, 1972, including watering for dust control, shall be considered as included in the contract price bid for other items of work and no further compensation will be allowed therefore.

BASIS OF PAYMENT

637.05.01 PAYMENT

DELETE THIS SUBSECTION IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING:

A. “Dust Control” will be paid for as a Lump Sum as specified in Subsection 637.04.01, “Measurement.” The bid price shall be full compensation for all work required to comply with Construction Activities Dust Control Handbook requirements, including but not limited to permit fees, plan preparation, required signage, monies paid to Subcontractors, provisions for dust control monitor(s), shut-down expenses caused by violations of this regulation, monetary penalties or sanctions resulting from violations of this regulation, record keeping, training, long-term stabilization due to cessations of the work more than 30 days, and all labor, equipment, and materials required to employ Best Available Control Measures as set forth in the Construction Activities Dust Control Handbook to prevent particulate matter from becoming airborne. Work shall be performed on all weekends, holidays, and non-working days encountered during the duration of the Contract, including any days required for completion of corrective punch list items.

B. The accepted quantities of “Dust Palliative” will be paid for at the Contract unit price bid per acre of the completed work. The Contract unit price bid for Dust Palliative shall include the cost of furnishing the materials, adding and mixing additional water at the job site, applying the mixture, and furnishing all labor, materials, tools, supplies, equipment, and incidentals necessary to complete the work, complete and in place as indicated on the Drawings and as directed by Engineer. The lump sum bid amount will be divided by the number of calendar days in the Contract to establish a daily value for dust control. Each progress payment will reflect payment on the lump sum equal to this daily value times the number of days since the previous progress payment. In the event compensable time is added to the Contract, the lump sum for this item will be increased by an amount equal to the daily value times the number of compensable days extended.

C. The lump sum payment for “SWPPP Permit” shall be full compensation for obtaining and complying with the NPDES Discharge Permit and shall include all labor, materials, and equipment necessary to carry out the Storm Water Pollution Prevention Plan (SWPPP) for the entire duration of the project as required by the permit. Payments shall be determined by dividing the Lump Sum by the number of calendar days in the contract. Each progress payment for this item will equal the daily value times the number of days since the previous progress payment. In the event compensable time is added to the contract, the Lump Sum for this item will be increased by an amount equal to the daily value times the number of compensable days added to the contract.

D. All payments will be made in accordance with Subsection 109.02, "Scope of Payment."

E. Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
637.01	Dust Control	Lump Sum
637.02	Dust Palliative	Acre
637.03	SWPPP Permit	Lump Sum

END OF SECTION 637

Geotechnical Recommendations Letter

October 8, 2010

Prepared by Kleinfelder

KLEINFELDER
Bright People. Right Solutions.

October 8, 2010
Project No. 112973

Mr. Harshal Desai, P.E.
PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

Subject: **Equestrian Detention Basin Levee**
Geotechnical Recommendations for Reconstruction
Two SNWA Waterline Penetration Locations
Clark County, Nevada

Dear Mr. Desai:

We have prepared this letter to provide geotechnical recommendations associated with the reconstruction of two existing Southern Nevada Water Authority (SNWA) pipelines that penetrate the foundation of the Equestrian Levee. A geotechnical evaluation of the Equestrian Levee has been performed by us. The construction of an SNWA pipeline penetrated (crossed) the Equestrian Levee (EL) at two locations. We concluded from our study that the materials surrounding the penetrations may provide an unwanted path for seepage through the levee embankment and recommended that remediation of these two areas be performed. It is our understanding that the selected alternative for remediation is to excavate and reconstruct the embankment in the area of the pipe penetrations.

This letter presents a review of available information regarding the original pipe construction; a discussion of design criteria for pipelines crossing levees summarized from United States Army Corps of Engineers (USACE) Engineer Manual (EM) 1110-2-1913 Design and Construction of Levees; and earthwork recommendations for levee excavation and reconstruction in the area of the two waterline penetrations.

Background Information – SNWA Waterline Design and Construction Details

Construction plan sheets pertaining to the construction of the pipeline crossings are entitled *Boulder City Water Delivery Improvements, Southern Nevada Water Authority, Drawing Nos. 2-C-6, 2-C-14, 2-C-39, and 2-C-41*, prepared by Pentacore, dated March, 2003. The four drawings are presented following this letter and show details of the

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SNWA 30-inch diameter waterline penetration at SNWA pipeline Stations 136+50 to 139+00 and 50+50 to 54+00 (approximate EL Stations 78+00 and 165+00). Based on the plans, the pipe is constructed of mortar coated steel, and pressurized with design pressures of 250 pounds per square inch (psi) and 200 psi at the northern and southern crossings, respectively. The plan and profile sheets (Drawing Nos. 2-C-6 and 2-C-14) indicate the top of waterline at a location between approximately 5.5 and 6.0 feet below the channel invert and landside toe. Levee geometry and penetration length at the two locations are summarized in the following table:

Approx EL Station	Waterside Height (feet)	Waterside Slope (H:V)	Landside Height (feet)	Landside Slope (H:V)	Approx Penetration Length (feet)
78+00	15	3:1	19	5:1	210
165+00	7	5:1	6	6:1	235

The Berm Breach Plan sheet, Drawing No. 2-C-39, indicates a "cut-and–cover" type installation of the waterline using a two-phase approach, with Phases 1 and 2 consisting of installing the pipeline (excavate embankment, install pipeline, then restore embankment to original condition) within the waterside and landside of the levee, respectively, and within a construction easement of 75 feet centered on the pipe alignment. A note on the sheet states that the backfill material in the berm shall be Type II, compacted to 95 percent of the maximum dry density.

The plans show a trench width of 4.5 feet at the pipe spring line. The trench width increased up toward the channel invert but was not dimensioned on the plans (Drawing No. 2-C-41).

The Pipe Trench Details sheet, Drawing No. 2-C-41, depicts the pipe bedding material as being drain rock, pipe zone backfill as Controlled Low Strength Material (CLSM) to the pipe spring zone, and Type II aggregate base compacted to 90 percent relative compaction from spring zone to one foot above the pipe crown. The remaining trench zone backfill is shown as being Selected Backfill compacted to 90 percent relative compaction.

Waterline construction records documenting the installation through the levee were provided by SNWA and consist of the following:

- A photocopy of six photographs taken of the cut at the northern crossing;
- SNWA documentation of the Contractor's request to use material from the berm excavation for the berm reconstruction in place of the originally specified Type II aggregate base;

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- SNWA documentation for an increase in compaction of trench backfill from 90 percent of maximum dry density to 95 percent;
- Documentation for the construction of a CLSM cut-off collar, 4 feet wide, to be located just upstream of the waterside levee toe extending from the bottom of pipe trench to the top of trench; and
- Construction inspection reports including equipment and personnel lists, CLSM strength reports, and seven compaction test results for the north crossing and two compaction test results for the south crossing.

The compaction test results from tests performed on the trench backfill varied from 90 percent to greater than 95 percent of maximum dry density. Compaction test results from tests performed on the embankment fill were 95 percent of maximum dry density or greater.

Criteria for Pipelines Crossing Levees

The following criteria for leaving existing pipeline in foundations for levees are summarized from Table 8-1 of the previously referenced USACE EM 1110-2-1913.

1) Pipeline must be known to be in good condition.
2) Pipeline must have adequate strength to withstand levee loading.
3) Pipeline must have sufficient flexibility in joints to adjust under expected pipe deflection and stretching of pipe.
4) Pressure lines must have provisions for rapid closure in event of leakage or rupture.
5) Must have pervious backfill under landside third of levee where foundation materials are susceptible to piping.

SNWA provided a letter, dated September 27, 2010, addressing USACE Criterion 1 through 4. The backfill scheme as described for the original waterline construction would be considered adequate to meet Criterion 5.

Levee Excavation and Reconstruction Earthwork Recommendations

The existing levee embankment should be excavated to an elevation equal to the top of the waterline trench backfill zone within the zone of disturbance as documented on SNWA Boulder City Water Delivery Improvements Record Drawings Plan Sheet 2-C-39, dated June 27, 2002. SNWA requires that no equipment be allowed within 5 feet of top of pipe. It is our understanding that SNWA will be on-site full-time during construction. It is also our understanding that confirmation of top of pipe has been documented. The excavation should be centered on the pipe and extend down to an

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elevation equal to top of waterline trench, and should extend up from the base in both directions transverse to the pipe alignment at a slope no steeper than 1-1/2:1 (H:V).

Following remediation of unsuitable conditions, if required, the excavation subgrade should be proof-rolled to identify areas of loose or disturbed soils. Areas of loose, disturbed or otherwise unstable soils encountered in the excavation subgrade should be completely overexcavated to expose competent, undisturbed dense to very dense soil in all areas. Following treatment of loose or disturbed zones, if present, the excavation subgrade should be scarified to a minimum depth of 8 inches, moisture conditioned to within 2 percent of the optimum moisture content, and compacted to 95 percent of maximum dry density. All compaction recommendations refer to methods established by ASTM D1557.

The previously excavated embankment soils may be used and placed in lifts to achieve the design grades. Oversized materials are defined as materials greater than 4 inches nominal diameter and should be removed from the levee excavation prior to reuse as embankment fill. Materials other than levee excavation proposed for use as embankment fill should be submitted to the Geotechnical Engineer for review and approval prior to use.

Embankment fill should be placed in lifts not exceeding 8 inches in loose thickness, moisture conditioned as necessary to within 5 percent of optimum moisture content, and compacted to 95 percent of maximum dry density. Embankment fill placed against the excavation side slopes should be benched. It is our understanding that benches 16 inches wide and 8 inches tall are proposed, which is an acceptable benching scheme.

Compaction equipment should be of appropriate size, type and configuration to achieve the specified compaction without damaging the pipe. Additional effort using "walk-behind" equipment should be employed in the area of the benches at the interface between existing and reconstructed embankment. We recommend bidder specification of proposed compaction equipment and methods be considered as a bid requirement and criteria for selection.

Full time observation during embankment removal, subgrade preparation, and fill placement operations should be performed by individual(s) meeting the requirements of the Southern Nevada 2006 Building Code Amendments Table 1704.7 Special Inspection Category D. A minimum of four compaction tests should be performed per lift, with a minimum of two tests per lift performed in the areas of benching at the interface between the existing slope and reconstructed embankment. Results indicating satisfactory compaction must be achieved for each lift before successive lifts may be placed.

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Limitations

This work was performed in a manner consistent wit that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the areas and/or data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This letter may be used only by PBS&J and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than one year from the date of this letter.

The work performed was based on project information provided by PBS&J and JE Fuller/Hydrology and Geomorphology, Inc. The recommendations contained herein are provided with the understanding that Kleinfelder will be retained to review plans and specifications for the project, including revisions or modifications. In addition, if there are any changes in the field to the plans and specifications, PBS&J must obtain written approval from Kleinfelder's engineer that such changes do not affect our recommendations. Failure to do so will vitiate Kleinfelder's recommendations.

Respectfully submitted,

KLEINFELDER

Jonathan Lehman-Svoboda, P.E.
Project Professional

PROFESSIONAL ENGINEER-STATE OF NEVADA
ANN BACKSTROM
Exp: 12/31/2010
GEOLOGICAL
No. 10099

Ann L. Backstrom, P.E.
Senior Professional
10/8/2010

ALB:jrs

cc: Kleinfelder Project File 101764

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Geotechnical 70% Plans/Specifications Review

October 19, 2010

Prepared by Kleinfelder

KLEINFELDER
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October 19, 2010
Project No. 112973

Mr. Harshal Desai, P.E.
PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

Subject: Results of 70 Percent Plan and Specification Review
Equestrian Detention Basin Levee Reconstruction Project
Henderson, Clark County, Nevada

Dear Mr. Desai:

Kleinfelder has reviewed the Equestrian Detention Basin Levee Reconstruction 70 percent Plans and Section 203 of the accompanying Specifications, prepared by PBS&J, dated October 11, 2010. It is our understanding that the Owner, COH, has elected to only reconstruct Equestrian Levee at the penetration located at approximate Station 78+10 and not reconstruct the levee at the penetration located at approximate Station 165+00.

The plan sheets and referenced specifications are in general conformance with the recommendations presented in our letter dated October 8, 2010 (Kleinfelder Project No. 112973) for the penetration located at approximate Station 78+10.

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. This letter may be used only by PBS&J and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than one year from the date of this letter.

The work performed was based on project information provided by PBS&J. The results of our plan and specification review contained herein are provided with the understanding that Kleinfelder will be retained to review any revisions or modifications to the plans and specifications. In addition, if there are any changes in the field to the

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plans and specifications, PBS&J must obtain written approval from Kleinfelder's engineer that such changes do not affect our recommendations. Failure to do so will vitiate Kleinfelder's recommendations. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

Respectfully submitted,

KLEINFELDER

Jonathan Lehman-Svoboda, P.E.
Project Professional



Ann L. Backstrom, P.E.
Senior Professional

10/19/2010

ALB:jrs

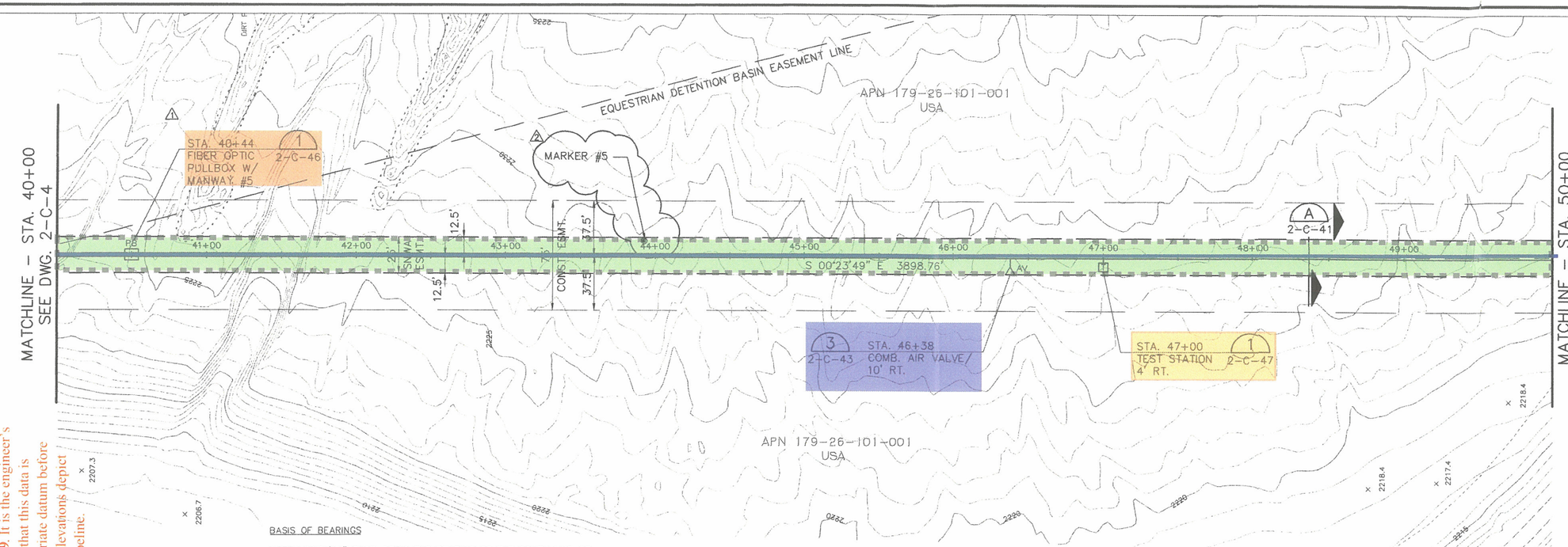
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Boulder City Water Delivery Improvements (SNWA pipeline)

SNWA As-Built Plans and Letter

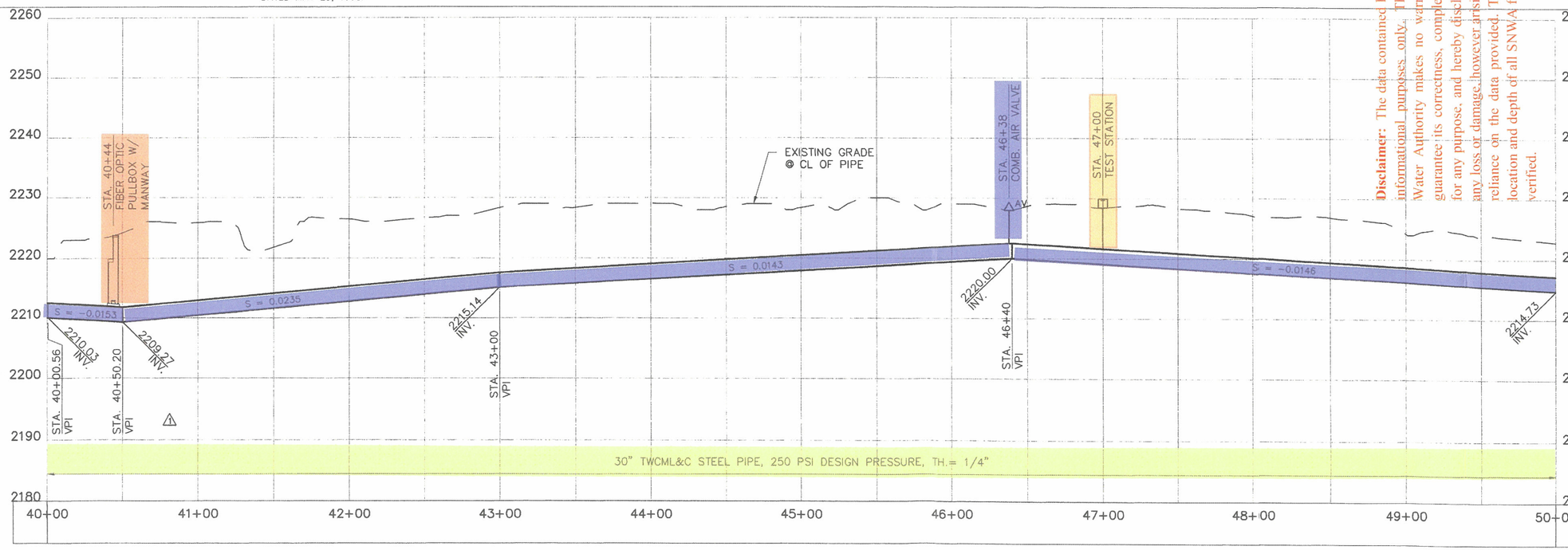


BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

DESCRIPTION: FOUND 2 INCH BRASS CAP IN CONCRETE STAMPED "COH C1/4" DATED 1987 IN CONCRETE FLUSH WITH NATURAL GROUND, SHOWN AS CP950 IN THE CLARK COUNTY RECORDERS OFFICE IN FILE 79 AT PAGE 72 OF SURVEYS.
ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.



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Call before you do Overhead

1-702-593-6111

Avoid cutting underground utility lines. It's costly.

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1-800-227-2600

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 03/18/02 BY MYRON R. WELSH UNDER NEVADA LICENSE NO. 2646

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

SL 03/03 MW

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 40+00 TO STA. 50+00

REV.	PIPELINE VERT. ALIGNMENT THRU COH WATERLINES	DD	08/01	MW
1	RECORD DRAWING	SL	03/03	MW

SCALE: HORIZ. 1"=40' VERT. 1"=10'

PlpP-005.dwg 08/08/01 4:47:19 pm

PENTACORE
THE BOULDER CITY WATER DELIVERY IMPROVEMENTS CONSTRUCTION MANAGEMENT JOINT VENTURE
2551 S. JONES BLVD. LAS VEGAS, NEVADA 89146 (702)258-3115

DSGN: B. FIELDS/D. DAVIDSE
DR: D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-5
SHEET 22 OF 121

DPES# 2010-0096

The data is based on the **National Geodetic Vertical Datum of 1929**. It is the engineer's responsibility to ensure that this data is converted to the appropriate datum before using said data. Given elevations depict centerline of SNWA pipeline.

MATCHLINE – STA. 50+00
SEE DWG. 2-C-5

STA. 50+50 (2, 2-C-46)
FIBER OPTIC PULLBOX #6

EQUESTRIAN DETENTION BASIN BERM

APN 179-26-101-001
USA

25' SNWA EASEMENT
12.5'
12.5'
CONST. ESMT.
37.5'
37.5'

SEE NOTES 1 AND 2

(1, 2-C-43) STA. 54+98 DRAIN VALVE 10' RT.

DV S 00°23'49" E 3898.76'

APN 179-26-101-001
USA

STA. 57+00 (1, 2-C-47) TEST STATION 4' RT.

(A, 2-C-41)

MATCHLINE – STA. 60+00
SEE DWG. 2-C-7

BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

DESCRIPTION: FOUND 2 INCH BRASS CAP IN CONCRETE STAMPED "COH C1/4" DATED 1987 IN CONCRETE FLUSH WITH NATURAL GROUND, SHOWN AS CP950 IN THE CLARK COUNTY RECORDERS OFFICE IN FILE 79 AT PAGE 72 OF SURVEYS.
ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.

NOTES:

1. CONSTRUCTION THROUGH THE EXISTING BERM SHALL BE ACCOMPLISHED IN TWO PHASES. SEE DRAWING 2-C-39, DETAILS 1 AND 2 FOR REQUIREMENTS OF EACH PHASE.
2. THE TOTAL CONISTRUCTION TIME INCLUDING THE FINAL BACKFILL AND COMPACTION BETWEEN STATION 50+50 AND 54+00 SHALL BE NO MORE THAN 10 CONSECUTIVE CALENDAR DAYS.

Avoid hitting overhead power lines. It's costly.

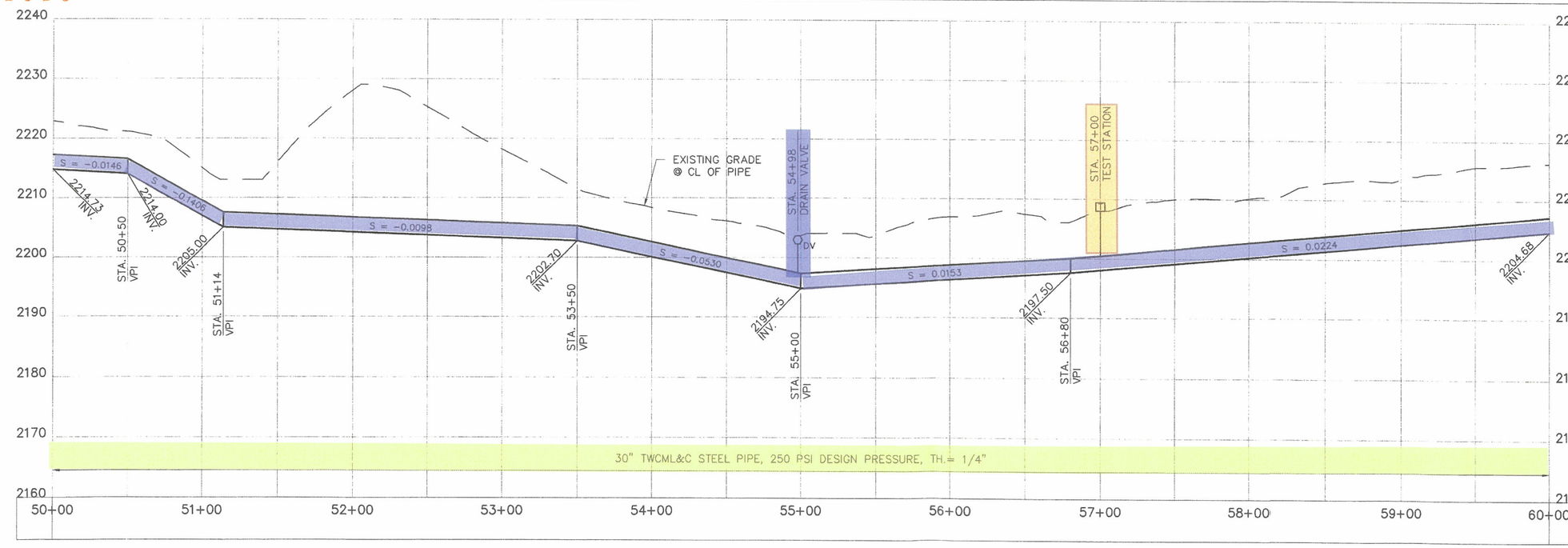
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1-800-227-2600



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ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 50+00 TO STA. 60+00

1	RECORD DRAWING	SL	03/03

SCALE: HORIZ. SCALE 1"=40' VERT. SCALE 1"=10'

Plpf-006.DWG 11/10/00 9:48:23 a.m

PENTACORE
CIVIL ENGINEERING, LAND SURVEYING, PLANNING CONSTRUCTION MANAGEMENT AND CONSULTING
LAS VEGAS, NEVADA (702)258-3115

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH
DR: D. DAVIDSE

CONTRACT NO. 135-A
DRAWING NO. 2-C-6
SHEET 23 OF 121

DPRS # 2010-0096

MATCHLINE – STA. 130+00
SEE DWG. 2-C-13

MATCHLINE – STA. 140+00
SEE DWG. 2-C-15

SEE NOTES 1 AND 2

APN 179-35-301-001
USA

STAGING AREA
SEE DWG. 2-C-14

STAGING AREA BOUNDARY

EQUESTRIAN DETENTION BASIN EASEMENT LINE

S 05°11'35" W 1045.67'

S 42°51'48" E 828.48'

2 STA. 136+36.52
2-C-46 FIBER OPTIC PULLBOX #14

A 2-C-41

RESTORE ALL DISTURBED RIP-RAP

US 93 R/W

US 93

STA. 137+00 1 2-C-47
TEST STATION
4' RT.

MARKER #11

STA. 136+36.52
48°3'23" BEND
N 1001170.5332
E 2052256.6051

12.5' TEMP. CONST. EASEMENT

12.5'

37.5' PERM. ESMT.

37.5'

20'

BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

PROJECT BENCHMARK

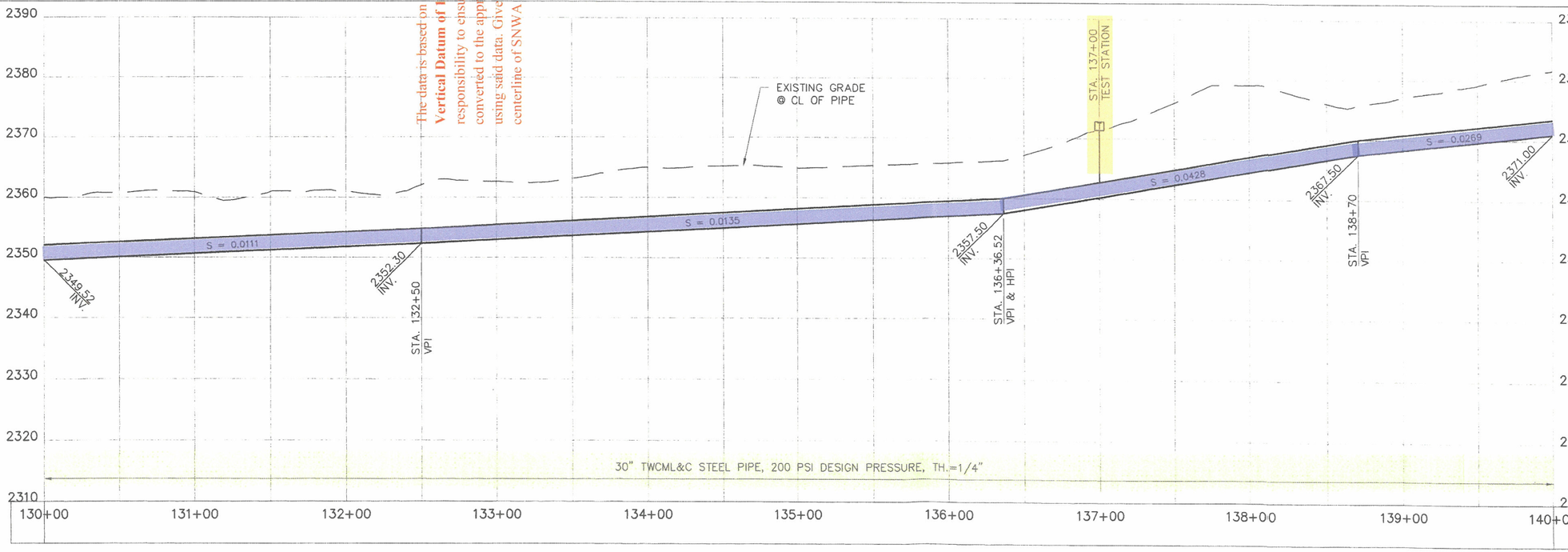
DESCRIPTION: FOUND 2 INCH BRASS CAP IN CONCRETE STAMPED "COH C1/4" DATED 1987 IN CONCRETE FLUSH WITH NATURAL GROUND, SHOWN AS CP950 IN THE CLARK COUNTY RECORDERS OFFICE IN FILE 79 AT PAGE 72 OF SURVEYS.
ELEVATION = 2131.09 US FEET (NAVD'88)
SOURCE: SOUTHERN NEVADA WATER AUTHORITY RIVER MOUNTAINS WATER TREATMENT FACILITY, CONTRACT No. 080-A, DRAWING C-1, SHEET 31 OF 1361 DATED MAY 29, 1998.

NOTES:

1. CONSTRUCTION THROUGH THE EXISTING BERM SHALL BE ACCOMPLISHED IN TWO PHASES. SEE DRAWING 2-C-39, DETAILS 3 AND 4 FOR REQUIREMENTS OF EACH PHASE.
2. THE TOTAL CONSTRUCTION TIME BETWEEN STATION 136+50 AND 139+00 SHALL BE NO MORE THAN 10 CONSECUTIVE CALENDAR DAYS.

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1-702-593-6111

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-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

MARKER #

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE PLAN & PROFILE
STA. 130+00 TO STA. 140+00

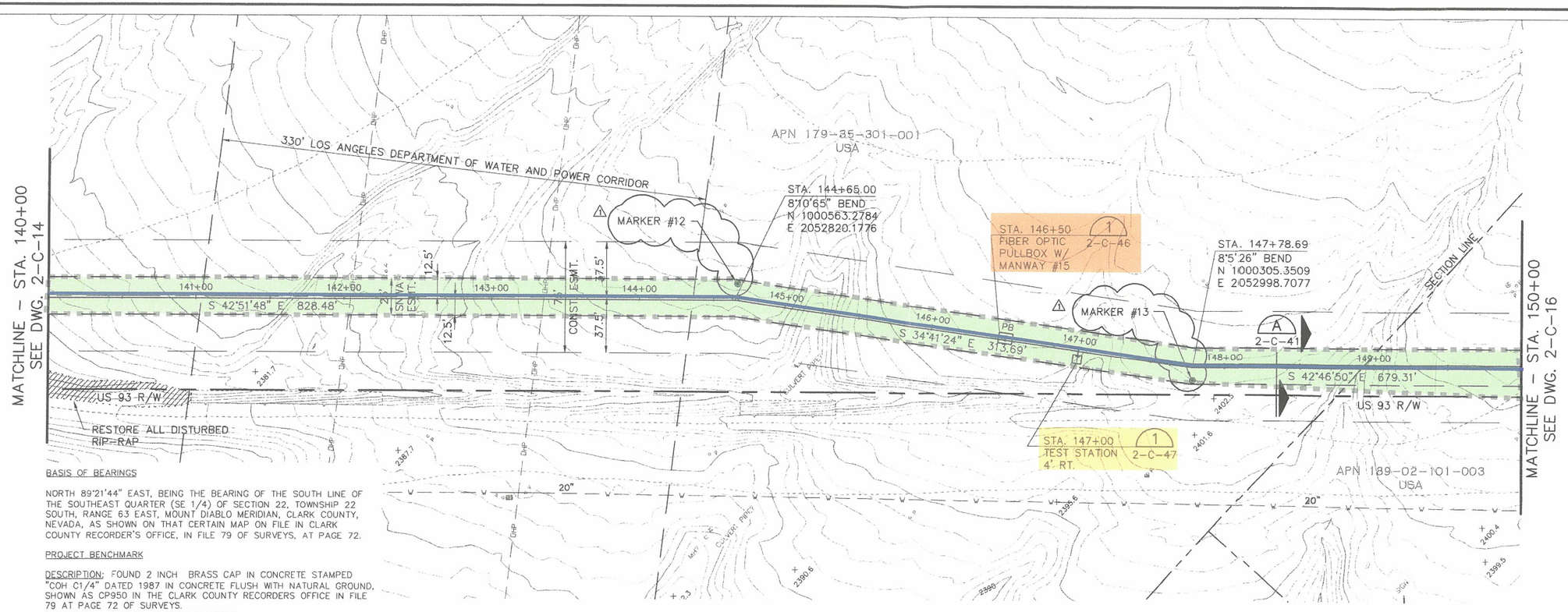
			SCALE: HORIZ. 1"=50' VERT. 1"=10'	
SL	03/03	MW		
RECORD DRAWING				
P:\pf-014.dwg	11/10/00	9:54:14 am		

PENTACORE
CIVIL ENGINEERING, LAND SURVEYING & PROJECT MANAGEMENT
CONSTRUCTION MANAGEMENT AND CONSULTING
6671 SOUTHWEST BLVD. SUITE 110
LAS VEGAS, NEVADA 89148 (702)256-0115

DSGN: B. FIELDS/D. DAVIDSE
DR: D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH

CONTRACT NO.
135-A
DRAWING NO.
2-C-14
SHEET 31 OF 121

DPIES# 2010-0096



BASIS OF BEARINGS

NORTH 89°21'44" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 22, TOWNSHIP 22 SOUTH, RANGE 63 EAST, MOUNT DIABLO MERIDIAN, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN CLARK COUNTY RECORDER'S OFFICE, IN FILE 79 OF SURVEYS, AT PAGE 72.

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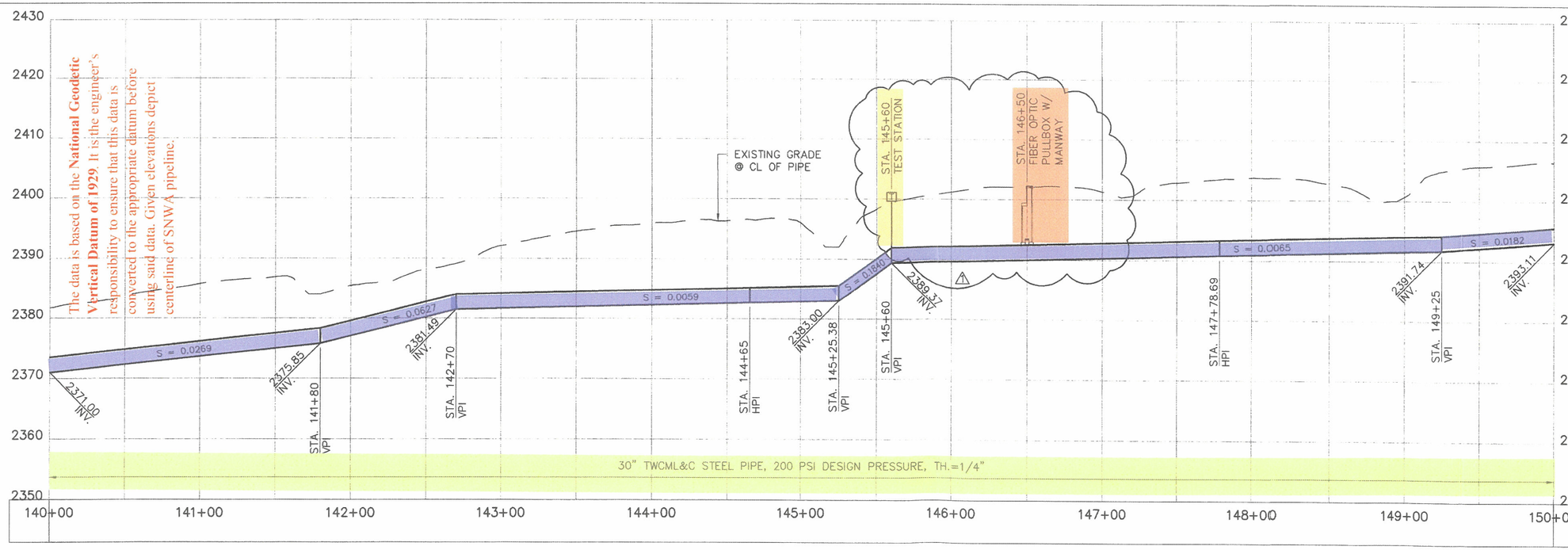
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-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS

PIPELINE PLAN & PROFILE
STA. 140+00 TO STA. 150+00

MOVE TEST STATION LOCATION, MARKER #	KS	02/03	MW
RECORD DRAWING	SL	03/03	MW

SCALE: HORZ. SCALE 1"=40' VERT. SCALE 1"=10'

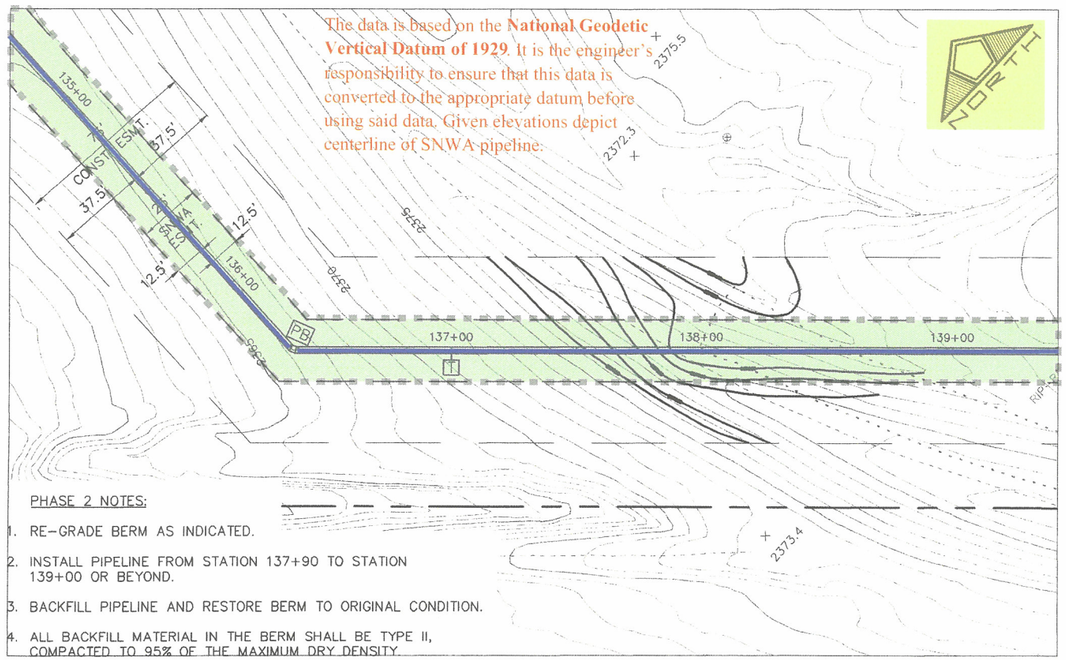
PENTACORE
CIVIL ENGINEERING • LAND SURVEYING • PLANNING
6030 S. RAINBOW BOULEVARD, SUITE 100
LAS VEGAS, NEVADA 89118 (702) 740-0010

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
DR: D. DAVIDSE
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-15
SHEET 32 OF 121

PipF-015.dwg 11/10/00 95451 am

DRWG # 2-C-15



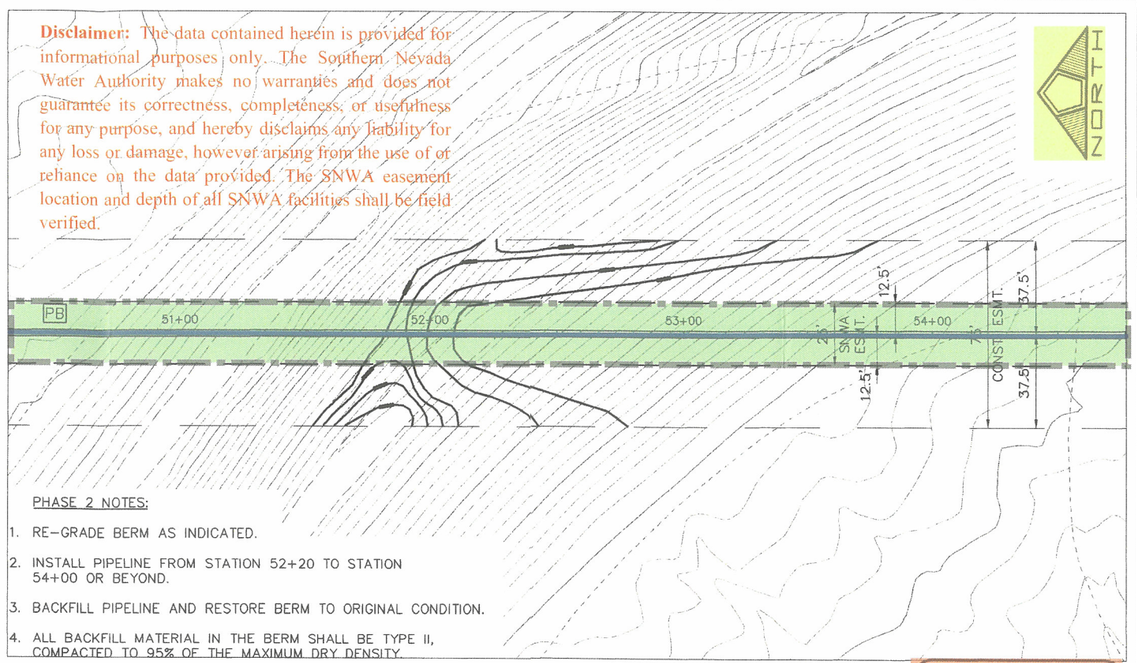
PHASE 2 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE FROM STATION 137+90 TO STATION 139+00 OR BEYOND.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

BERM BREACH PLAN – PHASE 2
STA. 136+50 TO STA. 139+00

4 / 2-C-39

SCALE: 1" = 30'



PHASE 2 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE FROM STATION 52+20 TO STATION 54+00 OR BEYOND.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

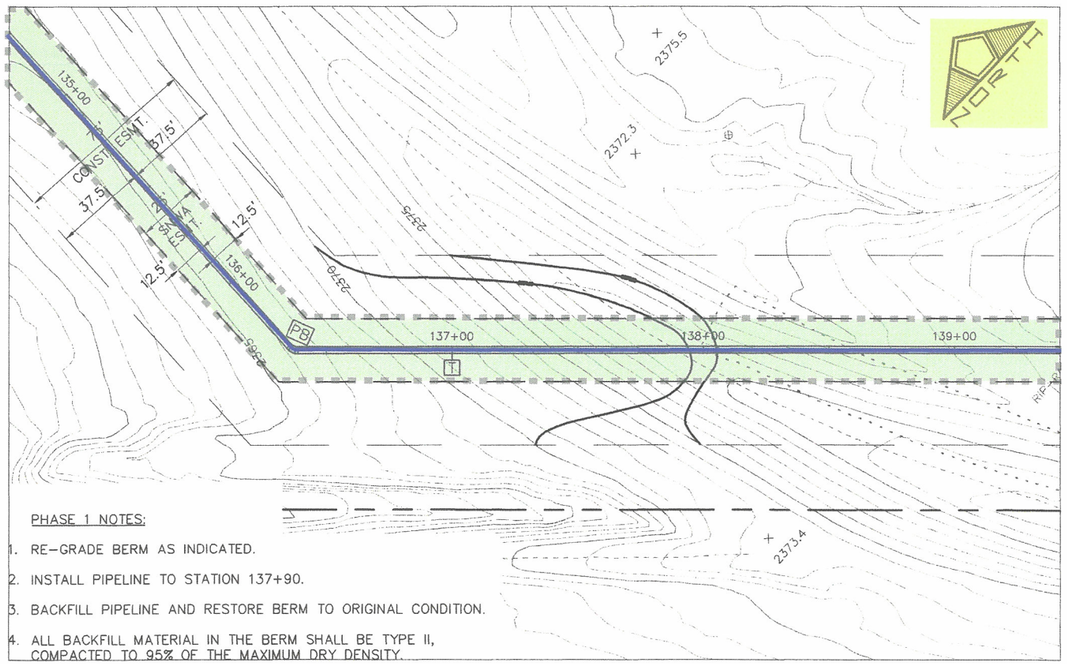
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BERM BREACH PLAN – PHASE 2
STA. 50+50 TO STA. 54+00

2 / 2-C-39

SCALE: 1" = 30'

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION



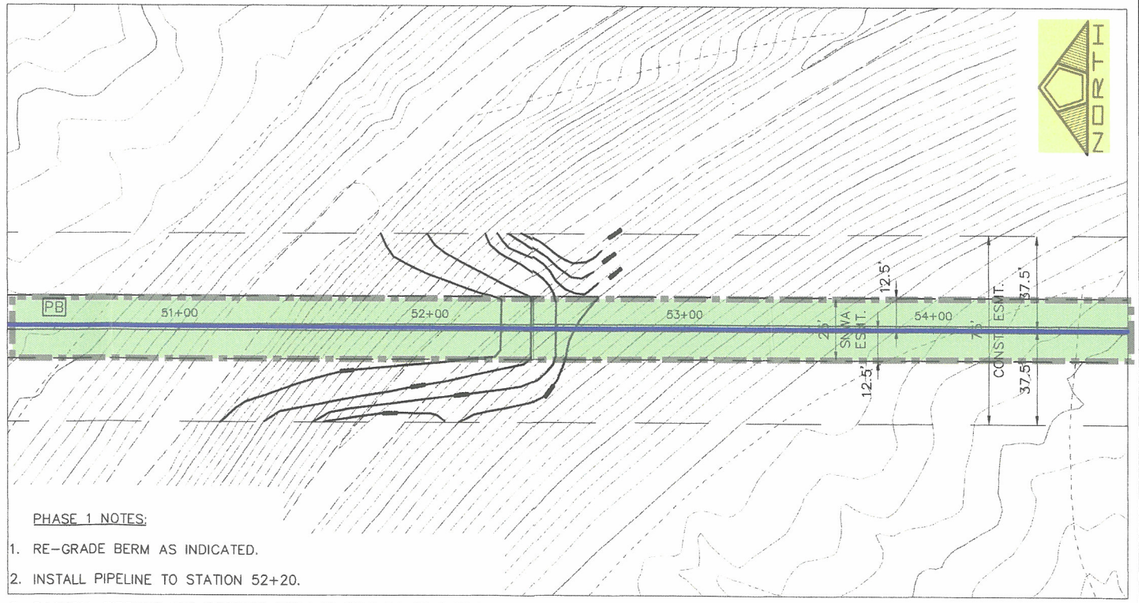
PHASE 1 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE TO STATION 137+90.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

BERM BREACH PLAN – PHASE 1
STA. 136+50 TO STA. 139+00

3 / 2-C-39

SCALE: 1" = 30'



PHASE 1 NOTES:

1. RE-GRADE BERM AS INDICATED.
2. INSTALL PIPELINE TO STATION 52+20.
3. BACKFILL PIPELINE AND RESTORE BERM TO ORIGINAL CONDITION.
4. ALL BACKFILL MATERIAL IN THE BERM SHALL BE TYPE II, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY.

BERM BREACH PLAN – PHASE 1
STA. 50+50 TO STA. 54+00

1 / 2-C-39

SCALE: 1" = 30'

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1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
BERM BREACH PLAN

1	RECORD DRAWING	11/09/00	3:57:34 pm	
	BERMGRAD.dwg	SL	03/03	MW

SCALE: AS SHOWN

PENTACORE
CIVIL ENGINEERING • LAND SURVEYING • PLANNING
8725 WEST SAHARA AVENUE, SUITE 210
LAS VEGAS, NEVADA 89117 (702) 255-4315

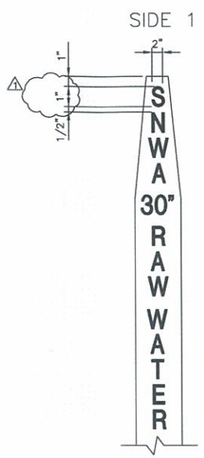
DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
DR: D. DAVIDSE
APVD: M. WELSH

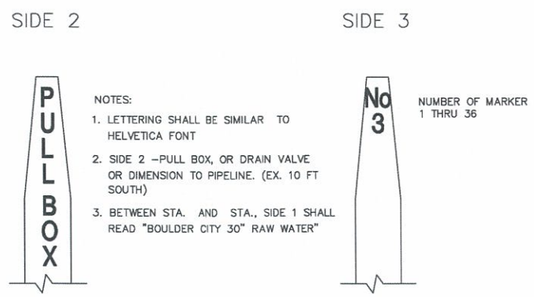
CONTRACT NO. 135-A
DRAWING NO. 2-C-39
SHEET 56 OF 121

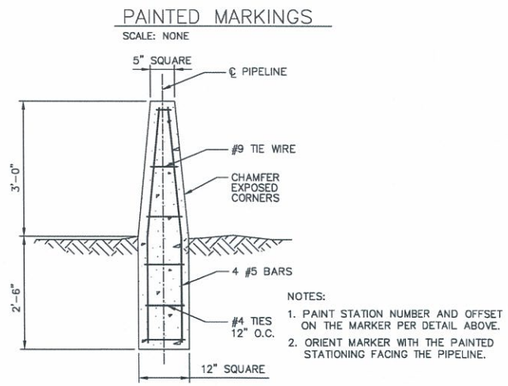
DRES # 2010-0096

SNWA Contract 135-A
Boulder City Water Improvements
Pipeline Marker Schedule

	Point	Northing	Easting	Station	Offset	Direction
Southern Nevada Water Authority	1	1013901.1191	2051083.2807	3+35.64	-10.00	West
	2	1013561.9879	2051142.9711	6+67.11	10.00	North
	3	1013543.2195	2051534.3596	10+49.58	-10.00	West
	4	1012229.1696	2051998.8254	24+43.30	-10.00	West
	5	1010276.5732	2052012.9012	43+92.68	-10.00	West
	6	1008326.1012	2052026.3485	63+42.07	-10.00	West
	7	1005817.2229	2051767.0528	88+63.82	-10.00	West
	8	1004854.5323	2051636.3779	98+35.13	10.00	East
	9	1004335.3650	2051639.1777	103+51.21	10.00	East
	10	1002211.0000	2052361.2103	125+90.86	-10.00	West
	11	1001171.4424	2052246.6465	136+36.52	10.00	East
	12	1000568.9698	2052828.4001	144+65.00	-10.00	West
	13	1000298.5568	2052991.3701	147+78.69	10.00	East
	14	999812.1302	2053468.5282	154+58.00	-10.00	West
	15	997950.2011	2054476.0809	175+65.88	10.00	North
	16	998016.8275	2054590.6491	176+88.04	-10.00	West
	17	997754.4492	2054717.3321	179+76.54	-10.00	West
	18	997522.2365	2054734.8228	182+08.55	10.00	East
	19	996677.8368	2055098.8012	191+41.21	-10.00	West
	20	996586.0699	2054992.6023	192+71.21	10.00	East
	21	994868.2655	2056612.7230	216+65.35	-10.00	South
	22	994614.1528	2058982.9199	240+59.50	10.00	South
	23	994713.1807	2058979.8778	241+48.07	-10.00	South
	24	994901.4002	2059196.6529	245+34.07	-10.00	East
	25	994847.7304	2059673.5292	250+13.54	10.00	North
	26	995354.8094	2060240.9829	18+08.14	-10.00	South
	27	995257.1713	2060433.9136	20+24.37	-10.00	South
	28	994768.9733	2060832.3040	26+50.42	10.00	North
	29	994659.6513	2062625.6817	279+71.61	-10.00	South
	30	994513.9816	2064407.5091	297+59.27	10.00	North
Boulder City	31	994631.0080	2065381.0206	307+37.93	10.00	North
	32	995104.9471	2065367.0747	312+02.06	-10.00	South
	33	995297.5748	2066887.0410	327+29.75	-10.00	South
	34	996385.3934	2068947.9460	355+28.64	-10.00	East
	35	997615.2041	2069960.6479	371+21.75	-10.00	East
	36	998838.1853	2070991.0559	387+14.86	10.00	West







STANDARD PIPELINE MARKERS
SCALE: NONE

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPELINE MARKER DETAIL

C.O. NO 32.	SL	03/03	MW
CHANGED DIM.			
RECORD DRAWING			

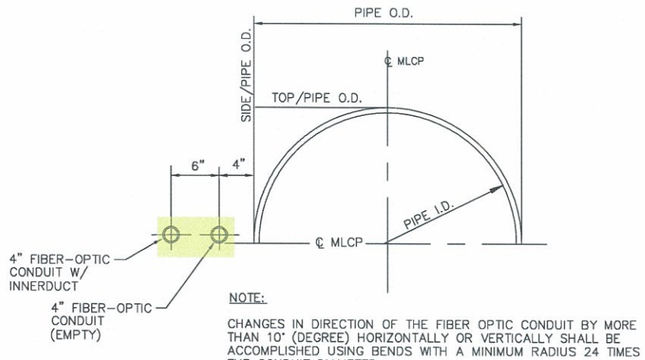
SCALE: AS SHOWN

PENTACORE
CONSTRUCTION MANAGEMENT AND CONSULTING
DSGN:
DR: K. SCHREPFER
CHK:
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-40
SHEET 57 OF 121

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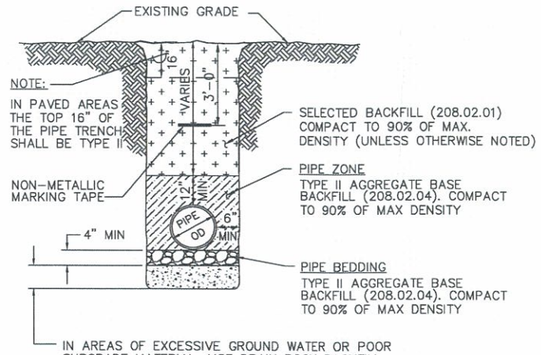


NOTE:

CHANGES IN DIRECTION OF THE FIBER OPTIC CONDUIT BY MORE THAN 10° (DEGREE) HORIZONTALLY OR VERTICALLY SHALL BE ACCOMPLISHED USING BENDS WITH A MINIMUM RADIUS 24 TIMES THE CONDUIT DIAMETER.

FIBER OPTIC CONDUIT DETAIL (1)

NOT TO SCALE — 2-C-41



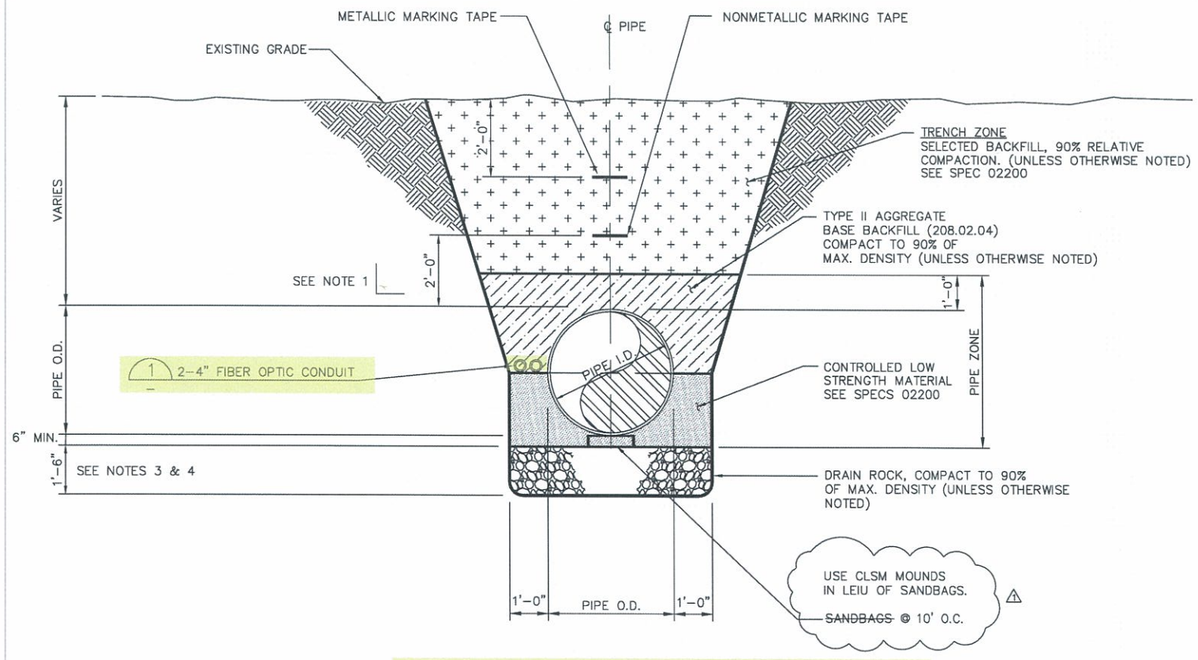
IN AREAS OF EXCESSIVE GROUND WATER OR POOR SUBGRADE MATERIAL, USE DRAIN ROCK BACKFILL SECTION (208.02.05) TO A MAXIMUM DEPTH OF 18" FOR STABILIZATION. DEPTHS GREATER THAN 18" SHALL BE AS DIRECTED BY THE CONSTRUCTION MANAGER. DRAIN ROCK UP TO 18" DEEP SHALL BE AT NO ADDITIONAL COST TO THE AUTHORITY

NOTE:

SEE PIPELINE TRENCH NOTES BELOW

PIPE TRENCH SECTION (B)

NOT TO SCALE — 2-C-41



TYPICAL PIPE TRENCH SECTION (A)

NOT TO SCALE — 2-C-41

PIPELINE TRENCH NOTES:

1. TRENCH EXCAVATION SHALL COMPLY WITH THE CURRENT REGULATIONS AS DETERMINED BY NEVADA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION.
2. FIBER OPTIC CONDUIT TO BE PLACED ON THE NORTH AND EAST SIDE(S) OF THE PIPE AS INDICATED ON THE PLAN & PROFILE DRAWINGS.
3. IN AREAS OF EXCESSIVE GROUND WATER OR POOR SUBGRADE MATERIAL, AS DETERMINED BY THE CONSTRUCTION MANAGER, USE DRAIN ROCK BACKFILL TO A DEPTH OF 18" FOR STABILIZATION. DEPTHS GREATER THAN 18" SHALL BE AS DIRECTED BY THE CONSTRUCTION MANAGER. DRAIN ROCK UP TO 18" DEEP SHALL BE AT NO ADDITIONAL COST TO THE AUTHORITY.
4. IF THE EXPOSED NATIVE SOILS ARE SOFT OR LOOSE, OR ARE DISTURBED BY TRENCHING OPERATIONS, THE EXPOSED SOILS SHALL BE RE-COMPACTED TO 90% MAX. DENSITY.
5. TWO 4" FIBER OPTIC CONDUITS SHALL BE INSTALLED, ONE OF WHICH SHALL HAVE THREE SMOOTH WALL 1-1/4" HIGH DENSITY POLYETHYLENE (HDPE) INNERDUCTS, SEE SPEC 16810.
6. THIS TRENCH SECTION SHALL BE USED FOR ALL STEEL PIPELINES HAVING A DIAMETER OF 24-INCHES OR GREATER. ALL OTHER PIPELINES SHALL USE SECTION B ABOVE.
7. WITHIN THE NDOT RIGHT-OF-WAY, ALL COMPACTION SHALL BE 95% OF MAX. DENSITY
8. WITHIN THE RMWTF, ALL COMPACTION SHALL BE 95% OF MAX. DENSITY.

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
PIPE TRENCH DETAILS

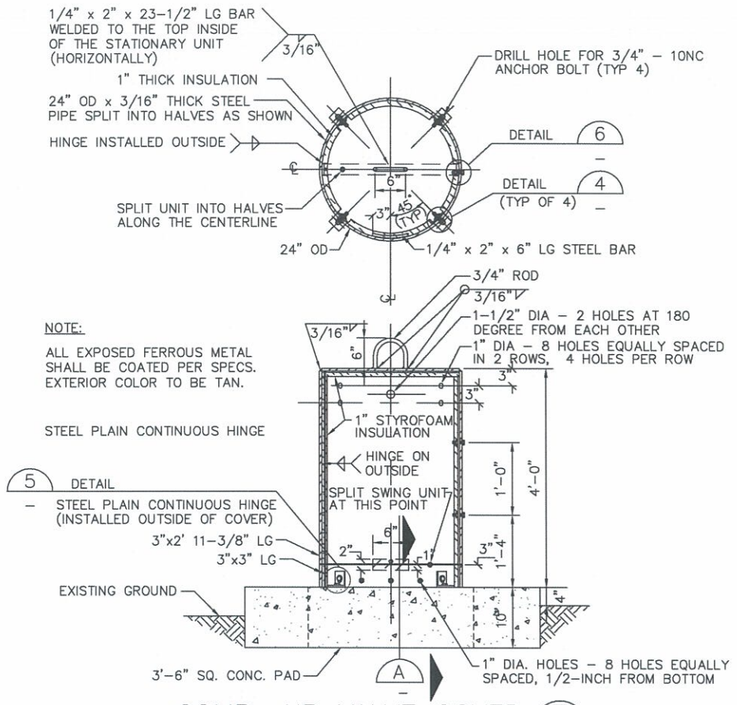
RECORD DRAWING	11/09/00	3:55:55 pm	Trench.dwg
SL	03/03	MW	SCALE: AS SHOWN

SL 03/03 MW CLSM MOUNDS INSTEAD OF SANDBAGS

PENTACORE
DESIGN | CONSTRUCTION MANAGEMENT | PROJECT MANAGEMENT
CONSTRUCTION MANAGEMENT AND CONSULTING
Las Vegas, Nevada 89146 (702)260-3113

DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
DR: K. ALEXANDER
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-41
SHEET 58 OF 121

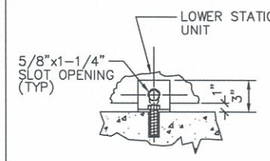


COMB. AIR VALVE COVER 7

NOT TO SCALE

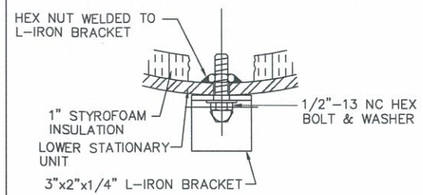
USE DRAIN ROCK BACKFILL TO A MAXIMUM DEPTH

3-C-43



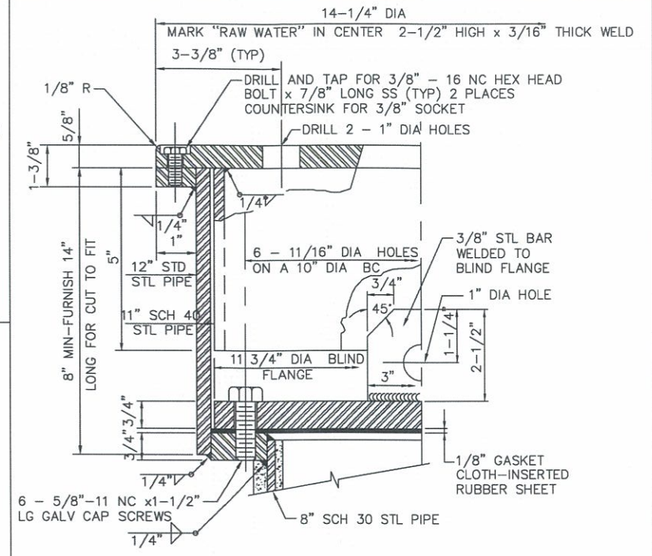
DETAIL 5

NOT TO SCALE 2-C-43



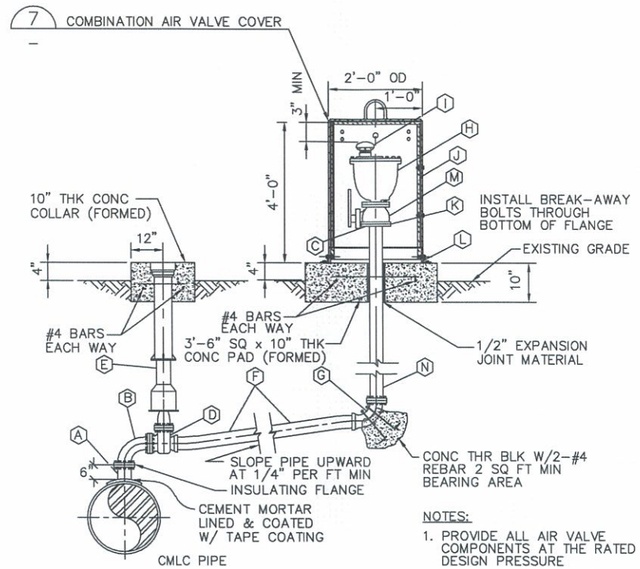
DETAIL 4

NOT TO SCALE 2-C-43



DRAIN VALVE COVER 2

NOT TO SCALE 2-C-43

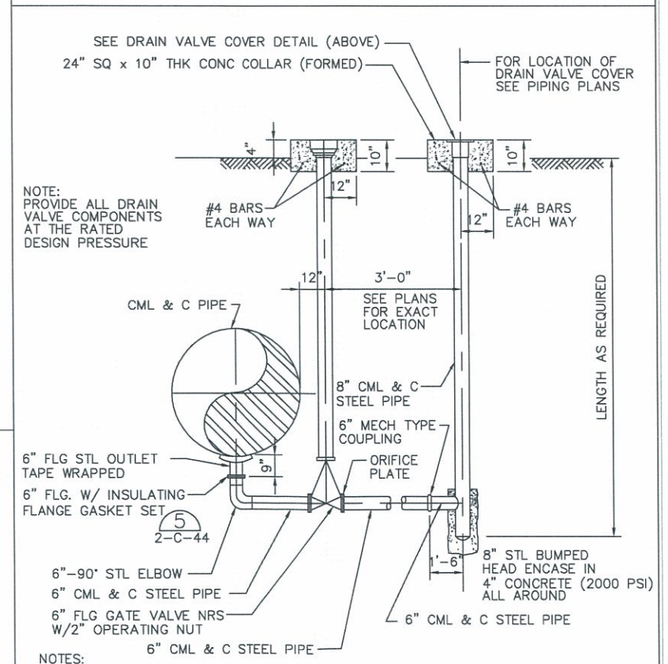


NOTES:

1. PROVIDE ALL AIR VALVE COMPONENTS AT THE RATED DESIGN PRESSURE
2. SEE LEGEND THIS SHEET.

4" COMB. AIR VALVE ASSEMBLY 3

NOT TO SCALE 2-C-43

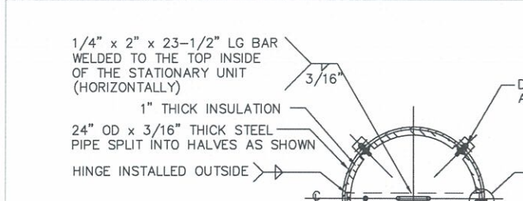


NOTES:

1. ALL 6" & 8" STL PIPE & FITTINGS TO HAVE CEMENT MORTAR LINING & COATING
2. CONCRETE TO BE 1/8" TO 1/4" BELOW FINAL STREET GRADE
3. FOR ORIFICE PLATE SIZE SEE SCHEDULE THIS SHEET.

DRAIN VALVE ASSEMBLY 1

NOT TO SCALE 2-C-43



DETAIL 6

NOT TO SCALE 2-C-43

DETAIL A

NOT TO SCALE 2-C-43

LEGEND

- (A) 4" FLG STL OUTLET FOR CMLC STL. PIPE, WITH CML&C OR TAPE WRAPPED
- (B) 4"- 90° FLG DUCTILE IRON BEND
- (C) 4" DUCTILE IRON FLANGE
- (D) 4" FLG x PO OR FLG x MJ GATE VALVE W/2" OPERATING NUT
- (E) VALVE BOX & COVER - SEE DETAIL 1 / 2-C-45
- (F) 4" DUCTILE IRON PIPE
- (G) 4" - 90° FLG x PO OR FLG x MJ CI BEND
- (H) 4" COMBINATION AIR VALVE, FLANGED INLET
- (I) 4" MUSHROOM FOR 4" COMBINATION AIR VALVE ASSY
- (J) 2'-0" OD x 3'-6" HIGH STEEL COVER
- (K) 5/8"-11NC BREAK-AWAY ZINC PLATED HEX HD BOLT, HEX NUT AND LOCKWASHER
- (L) 1/2"-13NC x 2-1/2" LG "RED HEAD" ANCHOR BOLT INSTALLED OUTSIDE
- (M) 4" BALL VALVE - QUARTER TURN - FOR 4" COMB AIR VALVE ASSY
- (N) 4" DUCTILE IRON PIPE

ORIFICE PLATE SCHEDULE

DRAIN VALVE STATION	ORIFICE DIAMETER	DRAIN VALVE STATION	ORIFICE DIAMETER
2+42.92	2"	209+88	4"
6+48	2"	214+93	4"
25+73	2"	218+62.97	4"
38+93	2"	222+43	4"
54+98	2"	225+68	4"

NOTE:

ALL OTHER DRAIN VALVES HAVE NO ORIFICE PLATE.

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692

-RECORD DRAWING-

PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

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SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE
1/2 0 1/2 1
BAR REPRESENTS ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS

COMBINATION AIR VALVE & DRAIN VALVE DETAILS

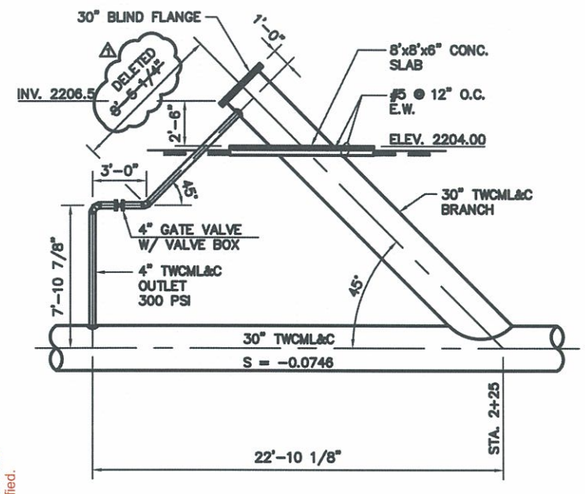
SCALE: AS SHOWN			
SL	03/03	MW	
RECORD DRAWING			

PENTACORE
CIVIL ENGINEERING - LAND SURVEYING - PLANNING
6725 W. RUSSELL ROAD, SUITE 320, LAS VEGAS, NEVADA 89118
LAS VEGAS (702) 562-3900 FAX (702) 562-3901

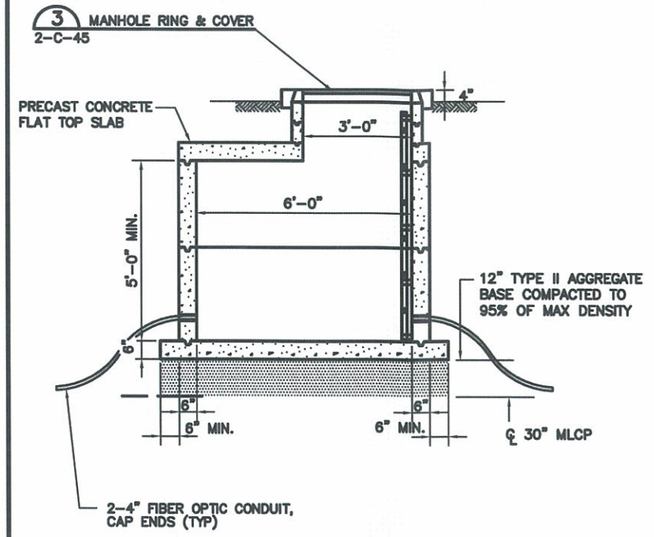
DSGN: B.FIELDS/D. DAVIDSE
CHK:
APV'D:
DR: K. ALEXANDER

CONTRACT NO. 135-A
DRAWING NO. 2-C-43
SHEET 60 OF 121

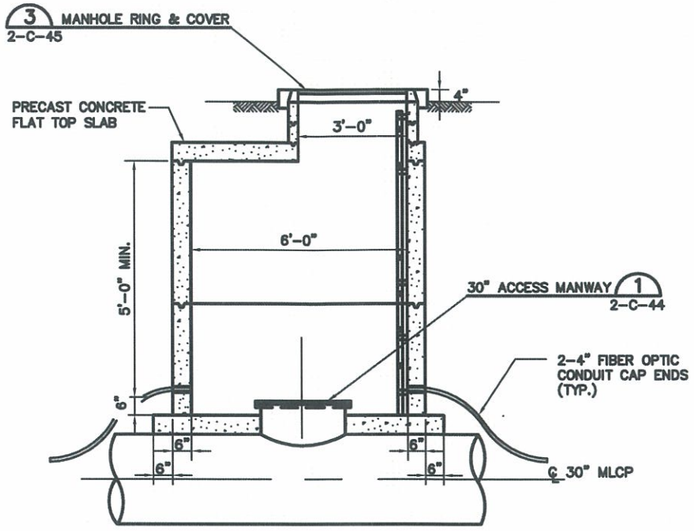
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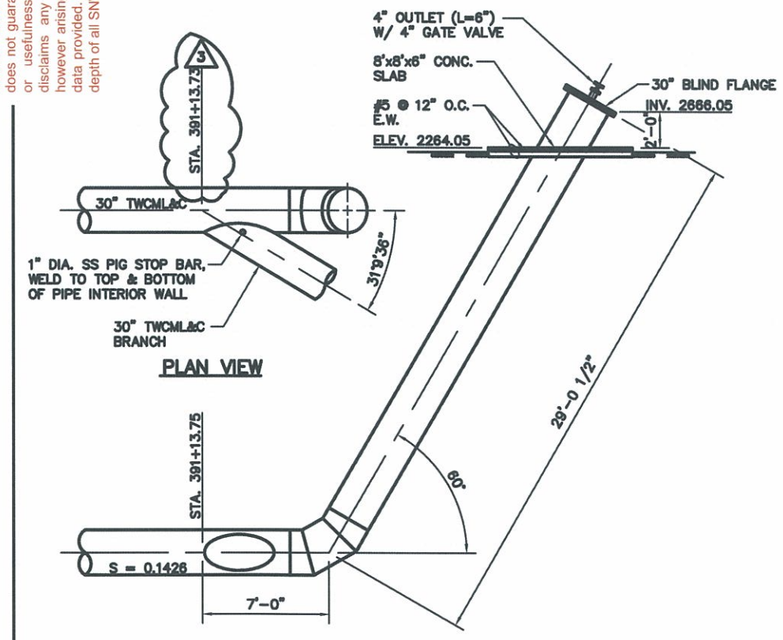
PIPE PIG ENTRY PROFILE 4
SCALE: 1/4"=1'-0" 2-C-46



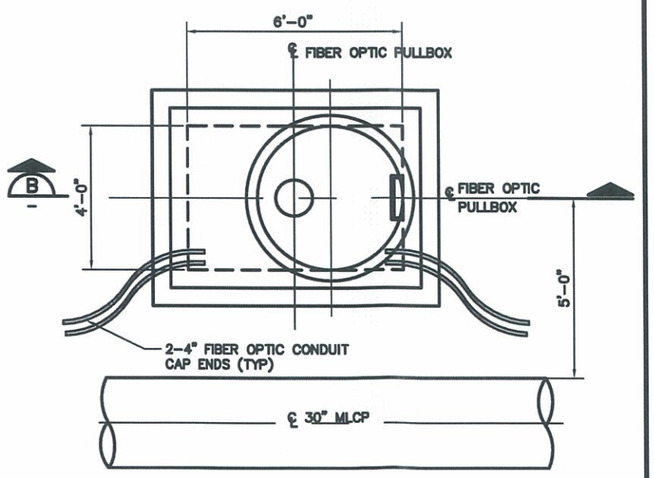
SECTION B
SCALE: 1/2"=1'-0" 2-C-46



SECTION A
SCALE: 1/2"=1'-0" 2-C-46

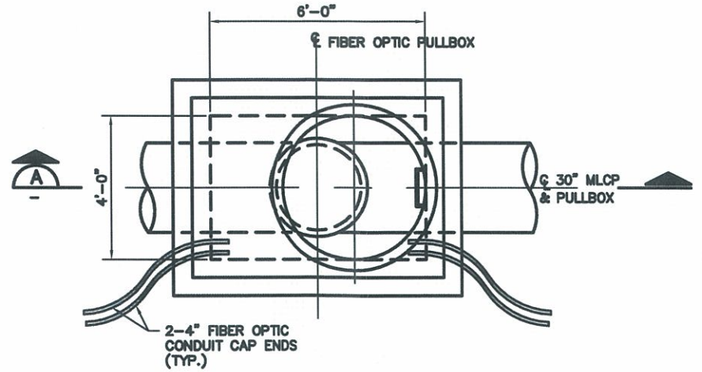


PIPE PIG EXIT PROFILE 3
SCALE: 1/4"=1'-0" 2-C-46



FIBER OPTIC PULLBOX 2
SCALE: 1/2"=1'-0" 2-C-46

ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY BRIAN S. FIELDS UNDER NEVADA LICENSE NO. 13692



-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

FIBER OPTIC PULLBOX W/ MANWAY 1
SCALE: 1/2"=1'-0" 2-C-46

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE 1/2 0 1/2
BAR MEASURES ONE INCH ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS

MISCELLANEOUS PIPE DETAILS - III

4	EQUATION STATION REMOVAL AND STATION NUMBERS UPDATED	HF	11/00
3	DELETED DWG.	SL	03/03
2		MW	
1			

pipedet-t3.dwg 11/09/00 3:56:58 pm

SCALE: AS SHOWN

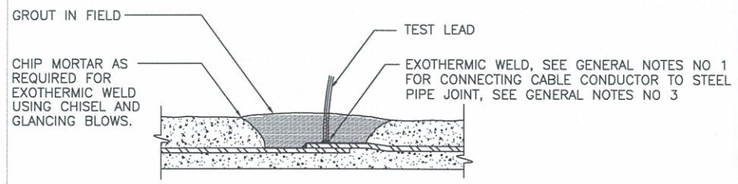
DSGN: B. FIELDS/D. DAVIDSE
CHK: T. SHIELDS
APVD: M. WELSH
DR: K. ALEXANDER

PENTACORE

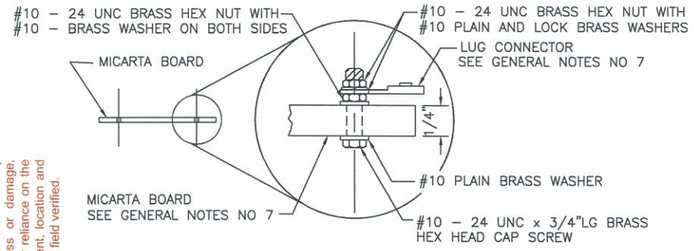
CONTRACT NO. 135-A
DRAWING NO. 2-C-46
SHEET 63 OF 121

RECORD DRAWING

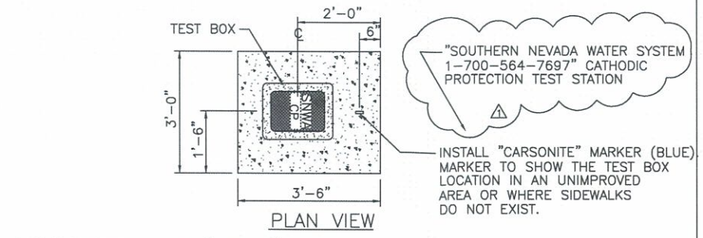
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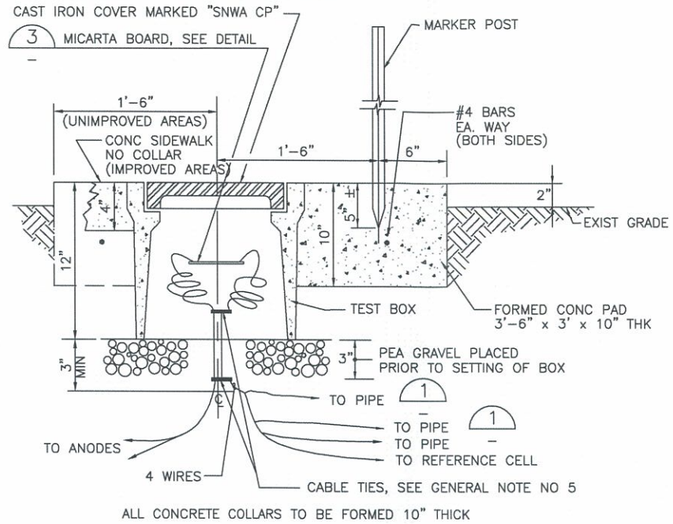
TEST LEAD CONNECTION 5
NOT TO SCALE 2-C-47



TEST BOARD DETAIL 4
NOT TO SCALE 2-C-47

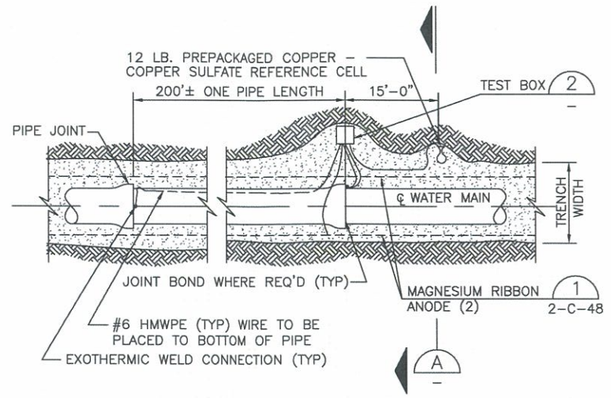


PLAN VIEW



TEST BOX DETAIL 2
NOT TO SCALE 2-C-47

M.J. SCHIFF & ASSOCIATES
1308 MONTE VISTA AVE., SUITE 6
UPLAND, CA 91786
(909) 931-1360

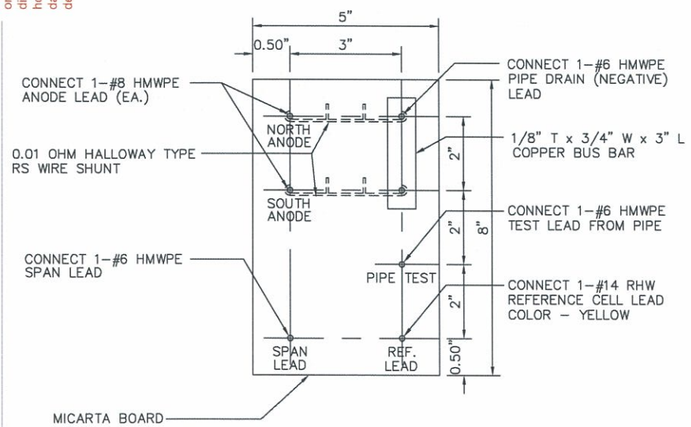


PLAN VIEW

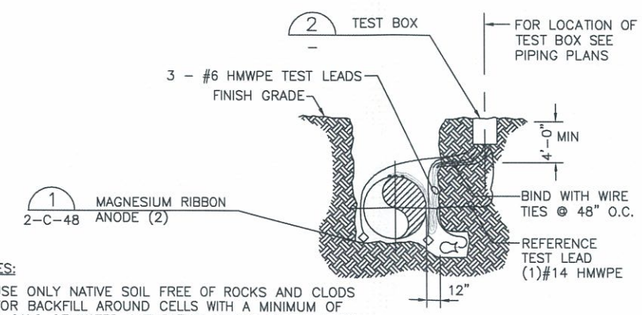
ORIGINAL CONTRACT DOCUMENTS ARE ON FILE WITH THE SOUTHERN NEVADA WATER AUTHORITY. THE DOCUMENTS WERE SIGNED AND SEALED ON 11/10/00 BY GRAHAM E. C. BELL UNDER NEVADA LICENSE NO. 11869

-RECORD DRAWING-
PRESSURE TEST DATE: JUNE 27, 2002
STATE HEALTH SAMPLE DATE: N/A
ACCEPTANCE DATE:
INSPECTOR: PARSONS
CONTRACTOR: WASHINGTON CONSTRUCTION

TEST STATION 1
NOT TO SCALE 2-C-47



TYPICAL TEST BOARD 3
NOT TO SCALE 2-C-47



NOTES:
1. USE ONLY NATIVE SOIL FREE OF ROCKS AND CLODS FOR BACKFILL AROUND CELLS WITH A MINIMUM OF 5 GALS OF WATER SATURATION DURING INSTALLATION. DO NOT USE SAND AS BACKFILL.
2. SUPPLY ENOUGH WIRE FROM EACH LEAD TO REACH FULL R/W WIDTH PLUS FIVE (5) ADDITIONAL FEET. COIL WIRE IN BOTTOM OF BOX.

SECTION A

SECTION A
NOT TO SCALE 2-C-47

GENERAL CATHODIC PROTECTION NOTES:

1 ALL TEST LEADS SHALL BE ATTACHED TO THE STEEL CYLINDER OF THE PIPE BY MEANS OF A "CADWELD" EXOTHERMIC WELD.

2 ALL TEST LEADS SHALL BE ATTACHED TO EITHER THE PIPELINE'S BELL END, SPIGOT END OR PLAIN END AS SHOWN ON THE DRAWING.

3 ALL EXPOSED PORTIONS OF THE EXOTHERMIC WELD AND COPPER CABLE CONDUCTORS SHALL BE COATED WITH A SCOTCHCOAT 4 INSULATING RESIN PRIOR TO PLACING GROUT AROUND THE PIPELINE JOINT.

4 ALL TEST LEADS AND ANODE LEADS SHALL BE RUN WITHOUT SPLICES FROM THE CONNECTION AT THE PIPE OR ANODE TO THE CONNECTION AT THE TEST STATION BOX.

5 ALL TEST LEADS OR ANODE LEADS INSIDE THE TEST BOX SHALL BE BUNDLED TOGETHER AT 48 INCH INTERVALS WITH NYLON CABLE TIES. ALL TEST STATION LEADS SHALL BE PROVIDED WITH SUFFICIENT SLACK SO THAT THE TEST BOARD MAY BE EXTENDED A MINIMUM OF 4 FEET ABOVE THE TEST BOX.

6 ALL TEST LEADS AND ANODE LEADS SHALL BE COLOR CODED WITH COLORED TAPE AT EACH END AND AT 4 FOOT INTERVALS. COLOR CODE SHALL BE AS FOLLOWS:

TEST STATION LEADS FROM PIPE	– WHITE
REFERENCE CELL TEST LEADS	– RED
ANODE LEADS	– GREEN
200' TEST LEAD	– BLUE
FOREIGN PIPE LEAD	– YELLOW

7 ALL TEST LEADS AND ANODE LEADS SHALL BE CONNECTED TO THE BRASS BOLTS ON THE TEST BOARD WITH SOLDERLESS SCREW TIGHT COPPER LUG CONNECTORS OR PRESSURE TERMINAL CONNECTORS.

8 ALL TEST LEADS AND ANODE LEADS SHALL HAVE A MINIMUM OF 4' OF SLACK NEAR THE PIPE JOINT TO PREVENT DAMAGE DURING THE BACKFILL OPERATION.

9 ALL TEST LEADS AND ANODE LEADS SHALL BE PLACED ALONG THE SIDE AND BELOW THE SPRINGLINE OF THE PIPE.

SOUTHERN NEVADA WATER AUTHORITY
1900 E. FLAMINGO ROAD SUITE 170
LAS VEGAS, NEVADA 89119
(702) 862-3400

VERIFY SCALE 1/2 0 1/2 1
BAR REPRESENTS ONE AND ONE-HALF INCHES ON ORIGINAL

BOULDER CITY WATER DELIVERY IMPROVEMENTS
CATHODIC PROTECTION
TEST STATION DETAILS

SCALE: AS SHOWN
MW 03/03 SL
RECORD DRAWING
cathprot.dwg 11/07/00 1:51:27 pm

PENTACORE
CIVIL ENGINEERING LAND SURVEYING PLANNING
LAS VEGAS, NEVADA (702)228-7015
LAS VEGAS, NEVADA (702)228-7015

DSGN: G. BARTON
DR: K. ALEXANDER
CHK: B. FIELDS
APVD: M. WELSH

CONTRACT NO. 135-A
DRAWING NO. 2-C-47
SHEET 64 OF 121

ADD NOTE SL 03/03 MW

SOUTHERN NEVADA WATER AUTHORITY
100 City Parkway, Suite 700 • Las Vegas, NV 89106
MAILING ADDRESS: P.O. Box 99956 • Las Vegas, NV 89193-9956
(702) 862-3400 • snwa.com

October 12, 2010

City of Henderson
Public Works Engineering
240 Water Street.
P.O. Box 95050, MSC113
Henderson, Nevada 89009-5050

SUBJECT: EQUESTRIAN DETENTION BASIN LEVEE RECONSTRUCTION PROJECT

The Southern Nevada Water Authority (SNWA) owns and operates a 30-inch diameter concrete mortar lined and coated steel pipeline, as shown on the Equestrian Detention Basin Levee Reconstruction Plans. The SNWA pipeline delivers raw water to the City of Boulder City. The construction of the 30-inch diameter pipeline was completed in 2003 and it was designed and constructed to withstand the dead plus live loads in accordance with AWWA Manual M-11.

The pipeline is protected from erosion by a galvanic magnesium ribbon, as well as anodes and test stations. SNWA regularly reviews record data obtained from the test stations to adequately assess the condition of this pipeline. Additionally, there is numerous low point drains (LPDs) installed along the pipeline route. The LPDs are operated to drain the pipeline in the event of planned or emergency outages.

Should you have any questions, please contact me at (702) 862-3451.

Sincerely,

M. DISHARI

Michael Dishari
Senior Civil Engineer

MD/mhy

cc: Brian Rowley, PBS&J
DPR project file

Data CD

Technical Appendices and Reference Material