2003P059

NORTH AGUA FRIA REGION OFFSITE SEWER – PHASE 1 MARICOPA COUNTY, ARIZONA

SCOUR ANALYSIS

Prepared For:

Pulte Home Corporation
14780 West Mountain View Boulevard
Surprise, Arizona 85374

Prepared By:

Stanley Consultants, Inc.
2929 East Camelback Road, Suite 130
Phoenix, Arizona 85016

September 2003

SCI #16392

Stanley Consultants INC.
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

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Registered Professional Engineer (Civil)
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G. SCOTT
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ARIZONA, U.S.A.

NORTH AGUA FRIA REGION
OFFSITE SEWER – PHASE 1
MARICOPA COUNTY, ARIZONA

SCOUR ANALYSIS

ADDENDUM NO. 1

September 3, 2003

The following additions and revisions have been made to the Corte Bella Off-Site Sewer, Force Main and Lift Station Preliminary Scour Analysis report prepared by Stanley Consultants, Inc., dated March 2003, in response to review comments 8 through 11 made by the Flood Control District of Maricopa County in their letter dated July 10, 2003. Also, please be aware that the title of the report has been changed to North Agua Fria Region Offsite Sewer – Phase 1 Maricopa County, Arizona.

The additions and revisions consist of the following:

- Stanley Consultants, Inc. response to review comments letter dated August 29, 2003 added immediately following this page.
- Flood Control District review comment letter dated July 10, 2003 added immediately following the Stanley letter.
- HEC-RAS output for the Deer Valley Drive drainage channel existing conditions model (DeerValleyDriveChnlRev00.prj) added to revised Appendix A.

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September 3, 2003

Ms. Shelby Brown
Right-of-Way Permit Specialist
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Subject: **North Agua Fria Region Offsite Sewer – Phase 1**
(Previously known as Corte Bella Offsite Sewer)
District Permit Request 2003P059
McMicken Outfall Channel

Dear Ms. Brown:

The Flood Control District (FCD) of Maricopa County has reviewed the Corte Bella Off-Site Sewer, Force Main and Lift Station Preliminary Scour Analysis report dated March 2003 prepared by Stanley Consultants, Inc. (Stanley) for Del Webb Home Construction, Inc. In FCD's letter dated July 10, 2003 (see attached), Stanley was asked to address the comments below regarding scour analyses for the proposed Corte Bella off-site sewer alignment.

Comment 8
In Section 4.2.4 of the report, why is the pit depth for the headcut calculation reduced?

The pit depth was reduced to account for the 7 feet of long-term degradation that was estimated from FCD documents that were part of the Agua Fria River Watercourse Master Plan. The pit depth was reduced from 35.7 feet to 28.7 feet and assumes the bottom of the pit elevation does not change over time. The reduction lowers the midpoint of the upstream face of the pit, which provides for a more conservative headcut estimate (see Figure 4 from Scour Analysis).

Comment 9
Please discuss the selection of the safety factor within the text. How was the selection of 1.3 for the safety factor determined? If this is standard, then the calculations must be revised accordingly.

The safety factor is a measurement of the unknown conditions or circumstances that apply to the particular situation being assessed, including the methodologies utilized in the assessment. A safety factor of 1.3 times the estimated scour depth was incorporated into the overall scour depth at the Agua Fria River crossing. Use of a safety factor for

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the Agua Fria River crossing is appropriate given that the headcutting upstream from a gravel pit is a complicated process influenced by many factors. The 1.3 safety factor used by Stanley is the same safety factor used by FCD's consultant in preparing the Agua Fria River Watercourse Master Plan when calculating general scour depths. A 1.3 factor was utilized in the City of Tucson's (COT) Standards Manual for Drainage Design and Floodplain Management – Chapter VI – Erosion and Sedimentation, that was referenced by FCD's Agua Fria River Watercourse Master Plan consultant. The COT manual uses the 1.3 factor in their equation for calculating general scour to account for non-uniform flow distribution.

A safety factor was not incorporated in estimating the overall scour depths for the Deer Valley Drive Drainage Channel or McMicken Dam Outfall Wash for the following reasons:

- The methods used to estimate scour depth for the Deer Valley Drive Drainage Channel and McMicken Dam Outfall Wash differ from the method used for the Agua Fria River. The methods are considered to be conservative and thus, already have a safety factor built in.
- The Deer Valley Drive and McMicken Dam channels are man made as opposed to natural. They both incorporate grade control structures and they both exhibit relatively stable channel characteristics.
- There are no sand and gravel pits in ether channel as in the Agua Fria River.

Comment 10
Please provide the cross-section data for the HEC-RAS modeling in Appendix A.

The HEC-RAS output for the Deer Valley Drive drainage channel existing conditions model (DeerValleyDriveChnlRev00.prj) has been included in a revised Appendix A.

Comment 11
Please note in the text that this area is currently under a study update.

Subsequent to Stanley's submittal of the March 2003 Preliminary Scour Analysis, FCD has initiated an update of the 1989 Whitman ADMS, which may alter the hydrology and hydraulics associated with the McMicken Dam Outfall Wash and the Deer Valley Drive Drainage Channel.

If there are any questions concerning the above comments, please call the undersigned at 602-912-6500. Thank you for your time.

Sincerely,

STANLEY CONSULTANTS, INC.

G. Scott Buchanan

G. Scott Buchanan, P.E.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
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G. SCOTT
BUCHANAN
Date Signed 9-5-03
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encl

Larry's

FLOOD CONTROL DISTRICT
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July 10, 2003

Post-it® Fax Note 7671	Date 7/10/03	# of pages ▶ 3
To Raul Brita	From Shelby Brown	
Co./Dept. Stanley Consultants	Co. Flood Control	
Phone #	Phone # 602-506-4583	
Fax # 602-912-6599	Fax # 602-506-2903	

Mr. Raul Brita, P.E.
Stanley Consultants
2929 E. Camelback Road, Suite 130
Phoenix, AZ 85016

SUBJECT: Corte Bella Off-Site Sewer
District Permit Request 2003P059
McMicken Outfall Channel

Dear Mr. Brita:

The Flood Control District of Maricopa County (District) has reviewed the preliminary plans submitted for the referenced project. Before final approval can be given, and a right-of-way permit issued, the following items must be addressed:

1. A map and legal description in recordable format of the District's right-of-way is required. (A copy of the District's approved format is enclosed for your convenience.) The legal description shall indicate two sectional ties that will indicate the basis of bearings.
2. Backfill of the trench shall be compacted to 95% of Standard Proctor Density.
3. Please indicate the limits of the shotcrete removal. In addition, provide a note requiring the perimeter of the removal to be sawcut.
4. Please provide details indicating how the shotcrete will be replaced.
5. Please note that the finish of the replacement shotcrete must match the existing.
6. Replacement shotcrete shall be the greater of 4" thick or the existing thickness. In addition, the shotcrete shall have a strength of 3000psi with WWF reinforcement.
7. Please provide a 2' turndown at the west edge of the new shotcrete liner.
8. In Section 4.2.4, why is the pit depth for the headcut calculation reduced? How was the selection of 1.3 for the factor determined? If this is standard, then the calculations must be revised accordingly.
9. Please discuss the selection of the safety factor within the text.
10. Please provide the cross section data for the HEC-RAS modeling in Appendix A.
11. Please note in the text that this area is currently under a study update.

Thank you for the opportunity to review the referenced request. If you have any questions concerning these comments, please call the undersigned at 602-506-4583.

Sincerely,

Shelby Brown

Shelby Brown
Right-of-Way Permit Specialist

Enclosure

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

Prepared For:

Del Webb Home Construction, Inc.
14780 West Mountain View Boulevard
Surprise, Arizona 85374

Prepared By:

Stanley Consultants, Inc.
2929 East Camelback Road, Suite 130
Phoenix, Arizona 85016

March 2003

SCI #16392

Registered Professional Engineer (Civil)
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Engineering, Environmental and Construction Services - Worldwide

Corte Bella
Off-Site Sewer, Force Main and Lift Station
Preliminary Scour Analysis

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TABLE OF CONTENTS

Sections

1.0 INTRODUCTION, PROJECT DESCRIPTION 1
2.0 DEER VALLEY DRIVE DRAINAGE CHANNEL 4
2.1 Previous Reports 4
2.2 Existing Conditions 5
2.3 Scour Estimate 5
2.4 Channel Lateral Migration 6
3.0 McMICKEN DAM OUTFALL WASH CROSSING 7
3.1 Existing Conditions and Past Studies 7
3.2 Scour Estimate 7
3.3 Lateral Migration Estimate 8
4.0 AGUA FRIA RIVER CROSSING 9
4.1 Existing Conditions and Previous Reports 9
4.2 Channel Mining Operation and Associated Scour and Headcut 10
4.2.1 Long-Term Degradation Estimate 10
4.2.2 General Scour Estimate 11
4.2.3 Headcutting Estimate 11
4.2.4 Total Scour Depth Estimate for In-Channel Mining Operations 14
4.3 West Overbank Mining Operation and Associated Upstream Face Failure 15
4.3.1 Soil Failure Due to Saturation 15
4.3.2 Headcut Estimation 16
5.0 ESTIMATED SCOUR DEPTH CONCLUSIONS 18

List of Tables

Table 1. Computer Modeled Headcut Depths and DistancesBased on Boyle Sand and Gravel Mining Guidelines 13
Table 2. Watercourse, Estimated Scour Depth and Burial Depth 18

List of Figures

Figure 1. Location Map 2
Figure 2. Vicinity Map 3
Figure 3. Limits of Excavation Downstream from a Hydraulic Structure 13
Figure 5. Overbank Potential Scour Due to Soil Failure. 16
Figure 6. Overbank Potential Scour Due to Headcutting. 17

Corte Bella
Off-Site Sewer, Force Main and Lift Station
Preliminary Scour Analysis

TABLE OF CONTENTS CONTINUED

List of Appendices

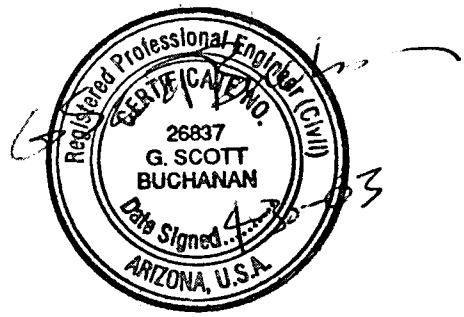
Appendix A Deer Valley Drive Drainage Channel Documentation
Appendix B McMicken Dam Outfall Wash Crossing Documentation
Appendix C Agua Fria Rivier Crossing Documentation
Appendix D CD-ROM, USGS Map, Agua Fria River Crossing Topography

CD-ROM Table of Contents

1989 Wittmann ADMS 100-year HEC-1 model (WTM100YR)

HEC-RAS Model deer5.prj

Agua Fria River Oblique Aerial Photographs



1.0 INTRODUCTION, PROJECT DESCRIPTION

The scour analyses presented in this report have been prepared by Stanley Consultants, Inc. (SCI), for Del Webb Home Construction, Inc., regarding the construction of a combination gravity and force main sewer line and associated lift station. The sewer line is to serve the Corte Bella and proposed Rio Sierra developments. The developments consist primarily of single-family units on lots averaging 5,000 to 8,000 square feet.

The sewer line alignment starts at Deer Valley Drive and the 127th Avenue alignment. The alignment is contained within the Deer Valley Drive right-of-way, heading east toward the McMicken Dam Outfall Wash. The alignment crosses the Outfall Wash at the Deer Valley Drive alignment and turns south to parallel the Outfall Wash along its east bank for approximately 1,250 feet. The alignment then turns east and continues to the southeast corner of the Rio Sierra development, where the proposed lift station will be constructed.

From the lift station, the alignment continues south following the 119th Avenue alignment to Rose Garden Lane. At Rose Garden Lane, the alignment turns east and continues across the Agua Fria River, remaining within the road right-of-way limits. Approximately 1,100 feet east of the Agua Fria River crossing the alignment turns south and continues for around 1,200 feet before terminating at the Sun City West Reclamation Facility. Please refer to the Location and Vicinity Maps (Figures 1 and 2, respectively) on the following pages.

The proposed facilities are located within portions of Section 13, 14, 23 and 24 (Township 4 North and Range 1 West) and Section 19 (Township 4 North and Range 1 East) of the 1978, USGS Calderwood Butte, Ariz., 7.5 minute quadrangle map. The proposed facilities are shown on Figure 2.

The proposed sewer line is gravity fed from the start of the alignment to the lift station. The remaining sewer line, from the lift station to the Sun City West Reclamation Facility, will be constructed as a force main utility.

Potential damage to the utility line due to scour is a concern at three locations along the proposed alignment: adjacent to the Deer Valley Drive drainage channel, at the McMicken Dam Outfall Wash crossing and at the Agua Fria River crossing.

The hydrology, hydraulics and scour estimates for the proposed utility line adjacent to the Deer Valley Drive drainage channel, at the McMicken Dam Outfall Wash crossing and at the Agua Fria River crossing are discussed in Sections 2.0, 3.0 and 4.0, respectively. Section 5.0 provides conclusions in the form of estimated scour depths at these locations.

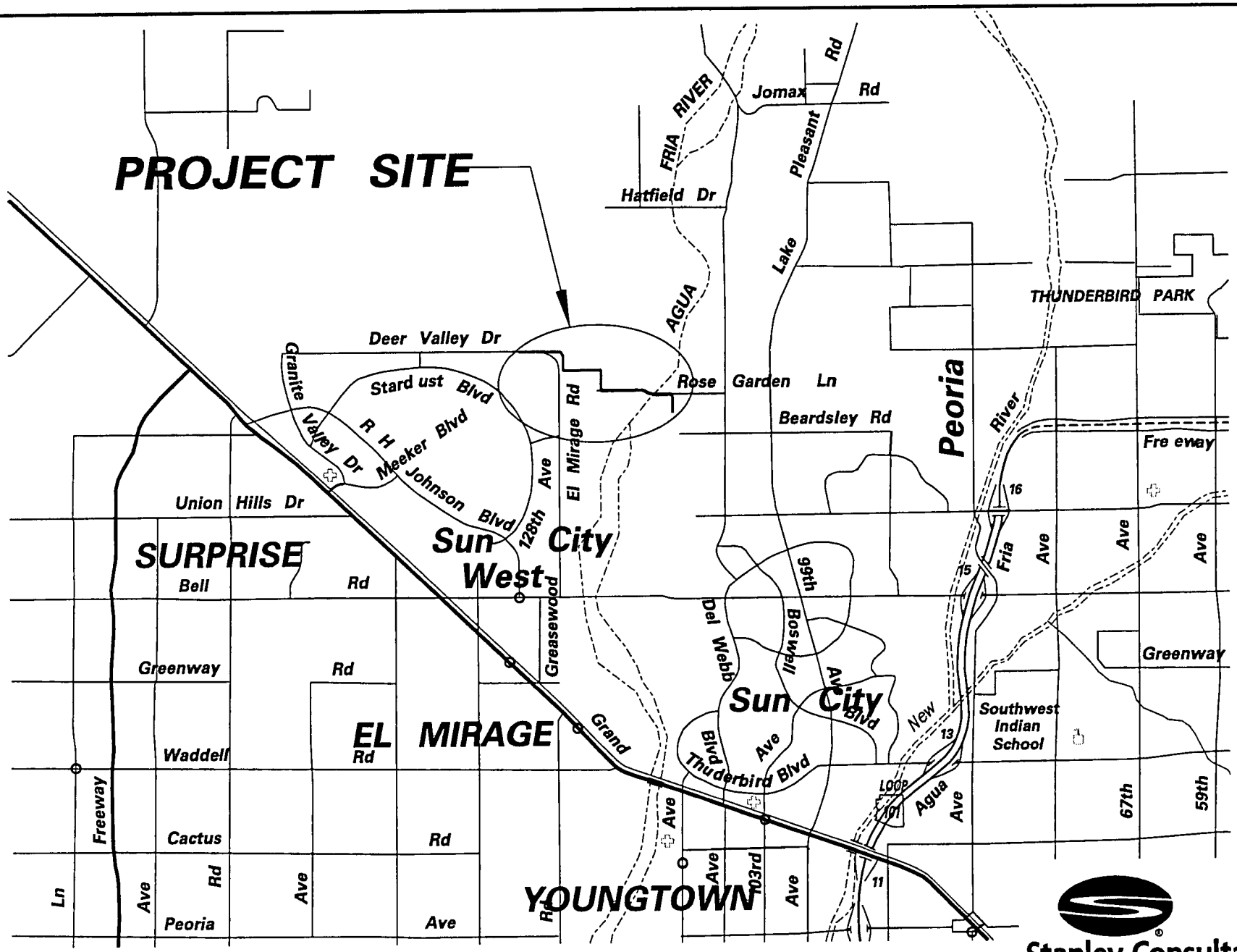


FIGURE 1 - LOCATION MAP
N.T.S.

Stanley Consultants INC.

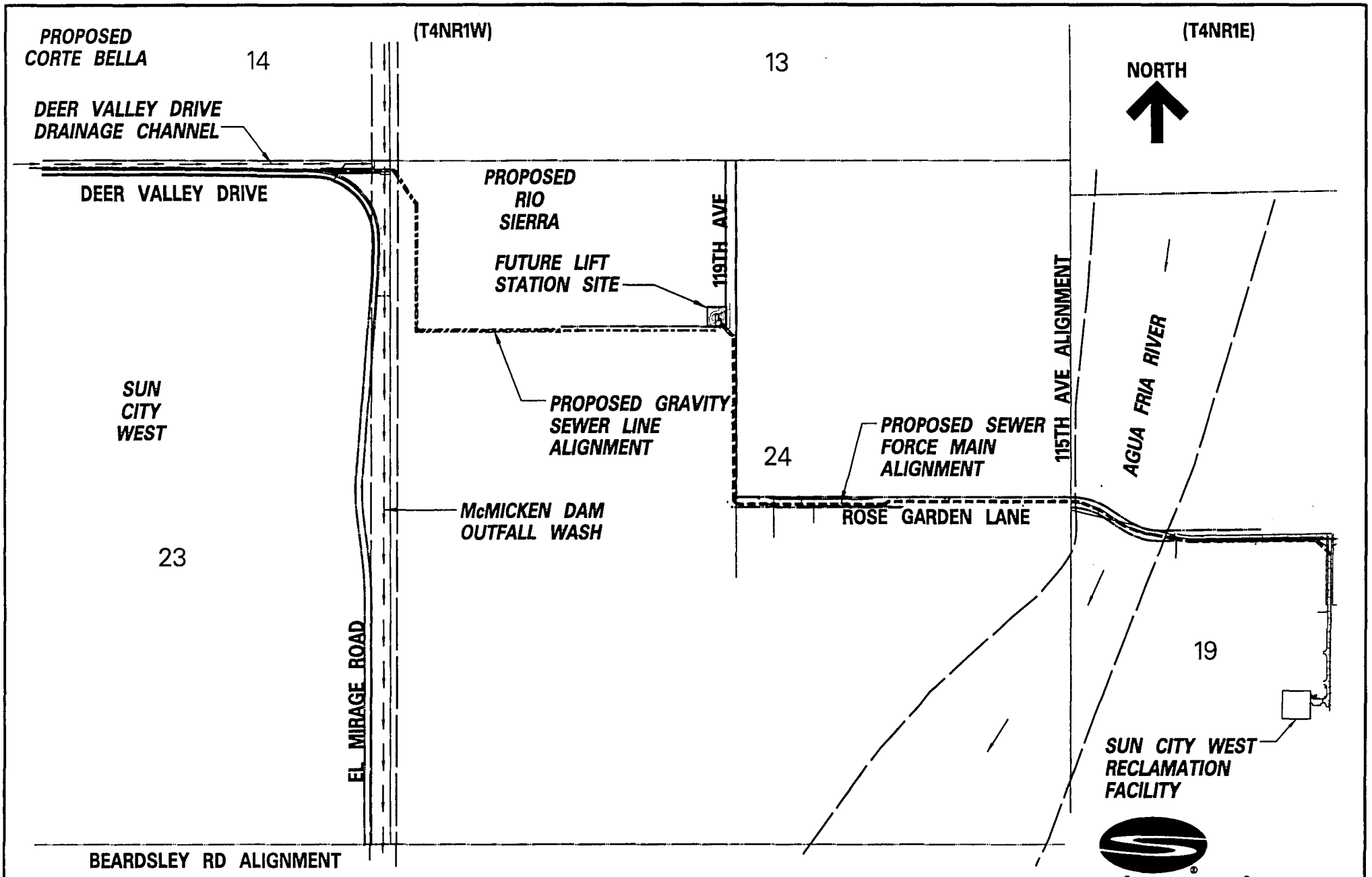


FIGURE 2 - VICINITY MAP
N.T.S.

2.0 DEER VALLEY DRIVE DRAINAGE CHANNEL

The proposed gravity sewer line begins at Deer Valley Drive and the 127th Avenue alignment, and runs adjacent to the north side of Deer Valley Drive to the McMicken Dam Outfall Wash. The sewer line will typically be located within the road right-of-way, between and an existing drainage channel to the north and an existing 18-inch diameter sewer line to the south. Figure 2 shows the location of the proposed utility alignment.

2.1 Previous Reports

Previous analyses of the Deer Valley Drive drainage channel are included in the following reports:

1. Wittmann Area Drainage Master Study (ADMS); Prepared by the WLB Group, Inc. for the Flood Control District of Maricopa County; March 1989.

2. Sun City West Expansion Area "DMP 92-1" and "Subject Properties" Master Drainage Report; Prepared by Stanley Consultants, Inc. for Del Webb Development Company L.P.; July 1993.

3. 90% Plans for the Construction of El Mirage Road – Beardsley Road to Loop 303; Prepared by Entranco Engineering and Premier Engineering for the Maricopa County Department of Transportation; November 2001.

The 1989 Wittmann ADMS provides pre-developed conditions hydrology for the area contributing to the Deer Valley Drive drainage channel. The hydrologic conditions were estimated using a HEC-1 computer model. The HEC-1 model is comprised of over 200 sub-basins, with sub-basins 128, 129 and 130 contributing to the drainage channel (approximately 4.1 square miles). The estimated 100-year, 24-hour peak discharge for the drainage channel, at the confluence with the McMicken Dam Outfall Wash, is approximately 1,620 cubic feet per second. The 1989 Wittmann ADMS 100-year HEC-1 model (WTM100YR) is provided on the CD-ROM in Appendix D. In addition, the Wittmann ADMS HEC-1 model sub-basin map is provided in Appendix A.

According to the Sun City West Expansion Area Master Drainage Report, a HEC-1 model was utilized to estimate the developed conditions. The resulting 100-year, 2-hour peak discharge entering the Deer Valley Drive drainage channel at the southeast corner of the Expansion Property is 1,450 cubic feet per second. The southeast corner of the Expansion Property is approximately 1 mile west (upstream) of the proposed alignment starting location. In addition to the Expansion Area hydrology estimate, a HEC-2 hydraulic model was developed for the Deer Valley Drive drainage channel. The hydraulic model estimated the drainage channel capacity, at bankfull, equal to 1,400 cubic feet per second. Flow velocities at bankfull were on the order of 6 feet per second.

The Maricopa County Department of Transportation has plans to realign both El Mirage Road and Deer Valley Drive. The proposed realignment of Deer Valley Drive also

entails realignment of the existing drainage channel. Currently, Deer Valley Drive transitions into El Mirage Road as the alignment turns from east-west to north-south at the southwest corner of the Deer Valley Drive drainage channel and McMicken Dam Outfall Wash confluence. The proposed Deer Valley Drive alignment is to turn north, crossing the drainage channel, and tying into the proposed El Mirage Road realignment. Deer Valley Drive is to cross the drainage channel by constructing a triple barrel – 3.0 meter by 1.8 meter (10 feet by 6 feet) concrete box culvert. Premier Engineering has developed a HEC-RAS hydraulic model (deer5.prj) for the existing drainage channel realignment and proposed box culvert (provided on the CD-ROM in Appendix D). The hydraulic model utilized the 1989 Wittmann ADMS 100-year, 24-hour peak discharge of 1,620 cubic feet per second. No adverse effects on the proposed sewer line are anticipated due to the plans to realign Deer Valley Drive to the north. Plans for the El Mirage Road, Deer Valley Drive and drainage channel realignments are provided in Appendix A.

2.2 Existing Conditions

The existing Deer Valley Drive drainage channel is trapezoidal in cross-section with an approximate top width of 60 feet, bottom width of 20 feet and depth of 6 feet. The channel was constructed around 1983 and minor improvements have occurred since that time. The channel is currently a clean, well-maintained, earthen conveyance. According to a Stanley Consultants existing conditions HEC-RAS hydraulic backwater analysis (DeerValleyDriveChnlRev00.prj), the channel will overtop the north bank while conveying the 1989 Wittmann ADMS 100-year, 24-hour peak discharge of 1,620 cubic feet per second. Overtopping of the north bank occurs at River Station 0.22 (approximately 1,200 feet from the McMicken Dam Outlet Wash confluence), which would result in shallow, low velocity flows that would eventually re-enter the drainage channel. Flow velocities for the 100-year, 24-hour peak discharge are on the order of 8 feet per second. Cross-sections and hydraulic data output tables from the HEC-RAS analysis are provided in Appendix A.

The existing 18-inch diameter sewer line, located between Deer Valley Drive and the drainage channel, was constructed to serve the Sun City West Expansion development. The alignment starts at the Expansion Property's southeast corner and runs adjacent to the drainage channel for approximately 1.4 miles before turning south and paralleling the El Mirage Road alignment. The existing utility line is offset approximately 10 feet from the south, top-of-bank of the drainage channel. The pipe was constructed at a 0.16 percent slope and ranges from approximately 2 to 6 feet below the existing channel flowline elevation. The proposed sewer line will typically be offset approximately 7 feet to the north of the existing sewer line.

2.3 Scour Estimate

A Level I scour analysis based on the technical guidelines provided by the Arizona Department of Water Resources (ADWR) State Standard 5-96 was used to estimate the potential depth of scour along the Deer Valley Drive drainage channel. A Level I scour analysis provides a conservative estimate of the potential scour depth to consider for design of structures to be placed near a streambed or along the banks of a channel. The

peak discharge associated with the 100-year flood (Q_{100}) is the only necessary information required for the analysis. The estimated total scour depth (d_s) is the combination of the general degradation (d_{gs}) and long-term degradation (d_{lts}), and shall be no less than 3 feet. The following equations are utilized to estimate d_{gs} and d_{lts}:

$d_{gs} = 0.157(Q_{100})^{0.4}$ (for straight channel reaches), and

$d_{lts} = 0.02(Q_{100})^{0.6}$ (applicable with no grade control within the channel reach).

The 1989 Wittmann ADMS 100-year, 24-hour peak discharge of 1,620 cubic feet per second was used to calculate d_{gs} and d_{lts}. The total scour depth, d_s, for the Deer Valley Drive drainage channel is estimated to be 5 feet. The Level I scour analysis calculations are provided in Appendix A.

2.4 Channel Lateral Migration

Potential lateral migration of the Deer Valley Drive drainage channel is dependent on factors such as channel lining, angle of side slopes and flow velocity. The existing conveyance is an earthen channel with no protective channel lining. Channel side slopes are approximately 3.3H to 1V. In addition, according to the 100-year existing condition hydraulic analysis (see Section 2.2), flow velocities in the channel are on the order of 8 feet per second.

According to the Flood Control District of Maricopa County (FCD) Hydraulic Design Manual (November 1991), Table 5.3, maximum velocities for earthen channels with side slopes of 4H to 1V range from 2.5 to 6.0 feet per second. However, there has been no evidence of bank erosion or lateral channel migration of the drainage channel over the past approximate 9 years. In addition, the estimated scour depth for the proposed sewer line adjacent to the channel is based on the conservative Level I analysis, which will provide adequate cover protection to the utility line in the event the drainage channel is to laterally migrate. Lateral migration of the drainage channel is not anticipated to have any negative impact on the proposed sewer line.

3.0 McMICKEN DAM OUTFALL WASH CROSSING

The proposed utility line crosses the McMicken Dam Outfall Wash at the Deer Valley Drive alignment. The McMicken Dam Outfall Wash serves as conveyance for flows originating from the McMicken Dam and outfalling into the Agua Fria River. Starting just north of the Deer Valley Drive alignment and ending just south of Beardsley Road, the Outfall Wash has an earthen, trapezoidal section. The remaining sections of conveyance between the McMicken Dam and the Agua Fria River are unimproved desert wash. Figure 2 shows the location of the proposed utility crossings of the McMicken Dam Outfall Wash.

3.1 Existing Conditions and Past Studies

In the project vicinity, the McMicken Dam Outfall Wash is a constructed, earthen channel with a trapezoidal section. The Outfall Wash bottom width is approximately 160 feet and the depth is approximately 5 feet. Channel sideslopes in the vicinity of the proposed alignment are approximately 3.3H:1V. The longitudinal slope at the crossing location is approximately 0.5 percent.

The 1989 Wittman ADMS (see Section 2.1) reports the 10-, 50- and 100-year discharges at the Deer Valley Drive alignment are equal to 2,876, 4,916 and 6,273 cubic feet per second, respectively. According to an ADMS HEC-2 model (MCWSH.DAT), the Outfall Wash has sufficient capacity to convey the 100-year discharge without overtopping the channel banks. The ADMS hydraulic analysis results correlate with the as-built outfall channel, which was designed to convey a COE estimated standard project flood (SPF) equal to 14,000 cubic feet per second. The 1989 Wittman ADMS SPF was estimated to equal 16,443 cubic feet per second.

A Federal Emergency Management Agency (FEMA) 1993 Flood Insurance Study (FIS) reports the approximate drainage area north of Deer Valley Drive that contributes to the McMicken Dam Outfall Wash is equal to 320 square miles. In addition, at a location 1,700 feet north of Deer Valley Drive FEMA has estimated the 10-, 50-, and 100-year discharges, which are equal to 2,835, 4,747 and 6,023 cubic feet per second, respectively.

3.2 Scour Estimate

In order to assess the McMicken Dam Outfall Wash scour potential at the proposed alignment crossing, the 1989 ADMS HEC-2 model was utilized to estimate the hydraulic conditions. The HEC-2 model was imported into a HEC-RAS hydraulic model by Stanley Consultants (McMicDamCnlRev00.prj) and is provided in Appendix B. Although the geometric data used in the hydraulic model is based on topography generated from aerial photographs flown in November of 1986, only minor changes to the Outfall Wash geometry have occurred since that time. Scour calculations are based on the 1989 Wittman ADMS 10- and 100-year discharges. Geotechnical survey data for the Outfall Wash was provided by Construction Inspection & Testing Co., and is provided in Appendix B.

Scour estimates for the Outfall Wash were calculated using equations from the 1984 Bureau of Reclamation technical report entitled Computing Degradation and Local Scour. Estimates were made for three types of scour – general scour (D_{gs}), long-term (D_l) and bed-form scour (D_{bfs}). The summation of these three forms of scour is the total scour (D_s) anticipated. The general, long-term and bed-form scour were estimated to be 2.98, 0.84 and 0.64 feet, respectively. The total estimated scour is 4.5 feet. McMicken Dam Outfall Wash scour calculation and supporting documentation are provided in Appendix B.

3.3 Lateral Migration Estimate

In order to estimate the potential for the McMicken Dam Outfall Wash to migrate laterally, a Level II analysis was performed based on the ADWR State Standard 5-96. A Level II analysis consists of velocity and tractive stress estimates. The hydraulic model used for estimating the scour potential hydraulic conditions was also utilized for the lateral migration estimate.

According to the allowable velocity (V_a) estimate, the maximum allowable flow velocity is equal to 6.4 feet per second. The actual mean channel velocity (V_m) is equal to 6.9 feet per second. According to the tractive stress analysis, the allowable and actual stresses are 0.76 and 0.73 pounds per feet squared, respectively. Although the velocity estimates indicate that the Outfall Wash banks are not stable, the tractive stress estimates imply bank stability.

Over the past approximate 20 years, since the Outfall Wash improvements, there does not appear to be any indication of lateral migration of the channel banks. Due to the historic plan-form of the channel, and the relatively small differences between allowable and actual hydraulic conditions affecting bank stability, lateral migration of the Outfall Wash is not anticipated in the vicinity of the project. Lateral migration calculations and supporting documentation is provided in Appendix B.

4.0 AGUA FRIA RIVER CROSSING

The proposed sewer force main crosses the Agua Fria River within the Rose Garden Lane right-of-way. Due to the anticipated deep burial depth of the force main at the crossing, a temporary construction easement will be necessary.

4.1 Existing Conditions and Previous Reports

The Agua Fria River reach from Hatfield Road (approximately 2 miles upstream from Rose Garden Lane) to the Beardsley Road alignment (approximately 0.5 mile downstream from Rose Garden Lane) is a braided channel system. Within the reach, both Hatfield Road and Rose Garden Lane cross the Agua Fria River as at-grade crossings. The channel appreciably narrows to approximately 1,000 feet at the Rose Garden Lane crossing. A 2-foot contour topography of the proposed crossing is provided in Appendix D. This topography is dated 2000 and was done for the Aqua Fria River Floodplain Delineation and Sediment Transport Study for the Flood Control District of Maricopa County.

As of the time of this report, extensive open-pit gravel mining operations are taking place within the reach from Hatfield Road to the Beardsley Road alignment. This mining activity is located within both the channel and the overbanks and has heavily impacted the reach. The mining operations are located downstream of Hatfield Road and upstream and downstream of Rose Garden Lane. Locations of mining operations are shown in aerial photographs provided in Appendix C. Potential headcutting is of primary concern due to the proximity of sand and gravel pits downstream from Rose Garden Lane.

According to the 2000 topography, the proposed force main alignment is approximately 700 feet upstream from a large, open-pit gravel mining operation taking place within the channel. The pit occupies the entire channel and extends downstream, south of Beardsley Road. The depth of the pit varies, but some portions have been excavated up to 60 feet. The existing channel pit has been continuously expanding both horizontally and vertically since the 2000 topography. Recent low-level, oblique aerial photographs taken of the pit in November 2002 show progressive mining operations taking place in the downstream end of the pit. The oblique aerial photographs of the mining progress are provided on CD-ROM in Appendix D. Historically, headcutting has extended from the upstream face of the pit to the roadway.

In addition, the 2000 topography shows the proposed force main alignment is approximately 60 feet upstream from a large open-pit located in the west overbank. The upstream end of the pit (nearest Rose Garden Lane) is approximately 30 feet deep.

The following two reports, submitted to the Flood Control District of Maricopa County (FCD), were used to gain an understanding of the Agua Fria River existing conditions and served as technical support in evaluating the force main crossing:

1. Agua Fria Watercourse Master Plan Lateral Migration Report, JE Fuller Hydrology and Geomorphology, June 2001;

2. Modeling Sediment Transport in the Agua Fria River, West Consultants, March 2002.

According to the Lateral Migration Report, discharges at the proposed force main alignment are 1,100 and 35,000 cubic feet per second for the 2- and 100-year storm events, respectively. The New Waddell Dam, approximately 11 miles upstream from the proposed force main alignment, controls flows and reduces the flood impact downstream.

In addition, the Lateral Migration Report provides floodway, floodplain and hazard zone limits for the Agua Fria River. According to these limits the mining operations taking place in the west overbank, upstream and downstream of Rose Garden Lane, are located within the severe erosion hazard zone and the lateral migration zone. The mining operation located immediately downstream of Hatfield Road is located within the current 100-year floodplain as depicted on the Lateral Migration Report exhibit for the subject reach. The Lateral Migration Report floodway, floodplain and erosion hazard limits are provided in Appendix C.

Because the mining operations located downstream from Rose Garden Lane pose the largest threat to the proposed force main, the associated channel and west overbank scour and headcut for these pits were estimated.

4.2 Channel Mining Operation and Associated Scour and Headcut

In order to determine an adequate burial depth for the proposed force main as it crosses the Agua Fria River channel, it is necessary to estimate the total scour. The total scour is comprised of three components: long-term degradation, general scour and headcutting.

4.2.1 Long-Term Degradation Estimate

According to the Modeling Sediment Transport report prepared by West Consultants, the Agua Fria River has experienced approximately 5 feet of channel degradation at Rose Garden Lane over a 35-year period. This depth of degradation is supported by topographic data taken between 1965 and 2000. In addition, sediment transport models have shown that the riverbed will continue to see degradation in the future. Sand and gravel mining is the main contributor to the degradation of the river system; therefore, it can be assumed that the riverbed will continue to degrade over the life of the force main if mining operations continue at their historic rate. Assuming a force main service life of 50 years, it was estimated that the long-term degradation of the Agua Fria River riverbed would be approximately 7 feet. This estimate is based on linear extrapolation of the degradation from 1965 to 2000.

Using a different approach based on the Lateral Migration Report, the reach of river that includes Rose Garden Lane is expected to degrade at a rate of 0.08 feet per year. This rate of degradation is based on historic riverbed profile comparisons. Assuming the same force main service life of 50 years, and the 0.08 feet per year historic degradation rate, the long-term degradation at the project alignment is 4 feet.

Because long-term degradation estimates tend to vary, the more conservative estimate of 7 feet will be used for that component of the total scour depth at the sewer force main alignment.

4.2.2 General Scour Estimate

According to West's Modeling Sediment Transport report, the general scour computed by Yang's equation is less than 1-foot for the 100-year flood event in the vicinity of Rose Garden Lane. The report suggests that Yang's formula provides the best relationship for modeling sediment transport in the Agua Fria River.

Similarly according to the Lateral Migration Report, general scour was considered negligible in the river reach containing Rose Garden Lane. The general scour that was estimated in the Lateral Migration Report used methods outlined in the City of Tucson's Standards Manual for Drainage Design and Floodplain Management.

Due to the negligible estimates of general scour depth, compared to the possible headcutting depth (see Section 4.2.3), general scour was not considered when calculating the total scour depth. In addition, a safety factor of 1.3 is used in calculating the overall estimated scour depth (see Section 4.2.4), which will further minimize any impact of not adding the general scour estimate.

4.2.3 Headcutting Estimate

The headcutting upstream of a gravel pit is a complicated process influenced by many factors such as the sediment load, the depth and volume of the pit, the hydrograph of the inflow and the channel hydraulics. Boyle Engineering Corporation prepared the "Central Arizona Water Control Study for Sand and Gravel Mining Guidelines" for the U.S. Army Corps of Engineers in 1980. In this study, Boyle used a computer model developed by Simons and Li to analyze the extent of headcutting associated with the gravel pits in a reach of Salt River. The computer model used the Meyer-Peter, Muller bed load equation, coupled with an adaptation of Einstein's suspended sediment integration method. The model yields the maximum headcut depths and distances for pits of 15-ft, 30-ft and 50-ft deep. The results are listed in Table 1, shown on page 13.

Based on the computer model results, Boyle Engineering recommended that any excavation "be located so that the grade cannot exceed one percent between the midpoint elevation of the upstream pit face and the nearest point in the sterambed 200 feet downstream of an existing structure or utility crossing" (see Figure 3 on the following page), "unless it is shown that the excavations would have no effect on the upstream structure or utility crossing".

In addition to the Simons and Li computer model, two other means of estimating the headcut at a gravel pit involve proprietary computer models – the Cotton and Ottozwa-Chatupron (1990) model, which utilizes regression equations; and Chang's Fluvial-12 (1998) model, which utilizes mathematical sediment formulas.

West Consultants estimated the headcut depth using both the Boyle's guidelines and the regression equations for the sand and gravel pit just downstream from Rose Garden Lane, assuming an average pit depth of 35.7 feet and a pit volume of 3,375 acre-feet. This analysis is contained in West's Modeling Sediment Transport report. Based on the regression equations, the resulting headcut depth at the upstream pit face is equal to 17.9 feet. This depth equals one-half of the average pit depth that coincides with the headcut depth given by Boyle's Sand and Gravel Guidelines. However, Boyle's Guidelines yielded a more conservative headcut distance of 5,425 feet when compared to the 565 feet by West's regression equations.

Although there are different techniques and models utilized to calculate the headcut length and depth, the Boyle Engineering Guidelines for sand and gravel mining operations produces the most conservative estimate. In addition, other approaches, such as utilizing the computer program Fluvial-12, would require a more complete understanding of the sediment data and the potential future mining operation activities. For the above reasons the Boyle Engineering Guidelines (Figure 3) were used to estimate the headcutting at the sewer force main alignment. Based on the Guidelines, the headcut depth at the Rose Garden Lane force main crossing is equal to 7 feet.

Table 1. Computer Modeled Headcut Depths and DistancesBased on Boyle Sand and Gravel Mining Guidelines

Depth of Pit (ft)	Volume of Pit (ac-ft)	Maximum Headcut Distance (ft)	Depth of Headcut at Pit Boundary Associated with Maximum Headcut Distance (ft)	Bed Slope Associated with Maximum Headcut Distance (ft)
15	900	940	9	0.0121
30	1,800	1,300	11	0.0105
50	3,000	2,500	20	0.0100

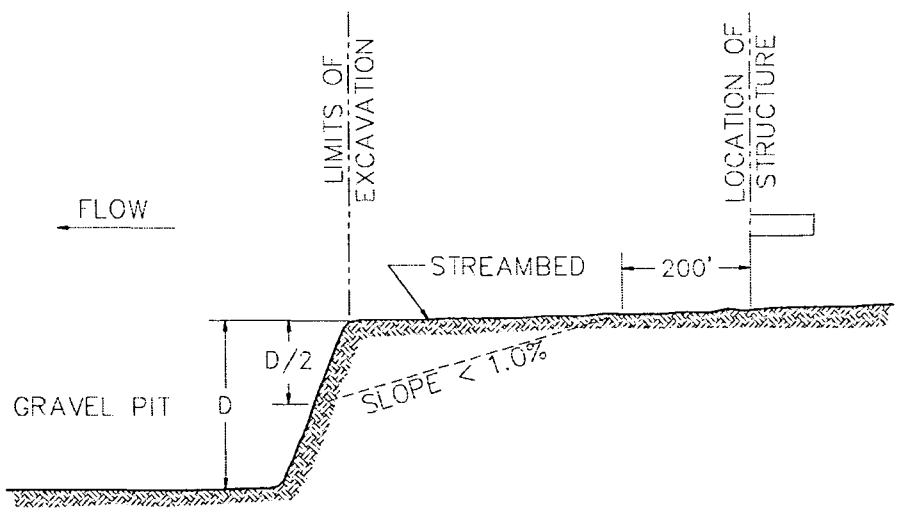


Figure 3. Limits of Excavation Downstream from a Hydraulic Structure as Recommended in Boyle Sand and Gravel Guidelines

Headcut estimates for the channel pit are reliant on the existing conditions, such as pit depth and distance from proposed alignment. Because of the uncertainty of future mining operations, it is possible that the existing conditions used in this assessment may change. If changes occur in the future, the headcut estimates for the channel pit located immediately downstream from Rose Garden Lane provided in this report may change as well.

Existing conditions used in the headcutting estimate of the channel pit located immediately downstream of Rose Garden Lane are as follows:

1. It is assumed that the average channel pit depth is 35.7 feet. This was the depth reported in the West Consultants' Sediment Transport Report for the subject pit. Although it is not certain how West Consultants calculated this depth, based on the 2000 topography it appears to be a reasonable average depth for the upstream region of the pit. However, portions of the upstream region of the pit are not as deep due to the tiered mining operation taking place. Depths in the upstream region of the pit range from approximately 10 to 60 feet below the predominant channel grade.

2. It is estimated that the distance from the upstream face of the channel pit to the Rose Garden Lane force main crossing is approximately 700 feet. Although portions of the upstream face of the pit are as close as 500 feet to the right-of-way boundary, the depth of the pit in these areas is approximately 10 feet. Utilizing the Boyle Engineering Guidelines, a distance of 700 feet in conjunction with an average pit depth of 35.7 feet produces a more conservative headcut estimate when compared with a distance of 500 feet and pit depth of 10 feet.

4.2.4 Total Scour Depth Estimate for In-Channel Mining Operations

The estimated total scour depth for the Agua Fria River channel is based on the following three components: long-term degradation, general scour and headcutting. As mentioned above in Section 4.2.3, the average channel pit depth is estimated to be 35.7 feet; however, accounting for the 7 feet of long-term degradation (Section 4.2.1), the pit depth is reduced to 28.7 feet for the headcut estimation. This reduced depth assumes that the bottom of the pit does not change in elevation. With the reduced pit depth, the estimated total scour depth resulting from long-term degradation and headcutting at the Rose Garden Lane force main crossing is equal to 14.4 feet (see Figure 4). Due to the uncertainty of mining activities and associated hydraulics, a safety factor of 1.3 times the estimated scour depth is recommended. The overall estimated scour depth is then equal to 19 feet. As mentioned in Section 4.2.2, the general scour component of the total scour was considered negligible.

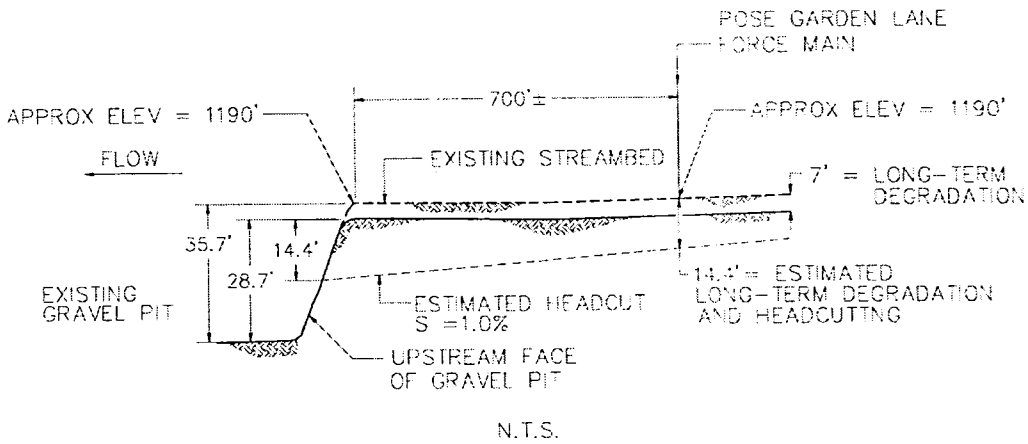


Figure 4. Combined Long-Term Degradation and Headcutting.

4.3 West Overbank Mining Operation and Associated Upstream Face Failure

Because this pit is located within the west overbank, it will not experience much flow-thru. However, during larger flood events, it is possible that overflow from the main channel may still enter the pit. Flows in the main channel may also enter the overbank pit by eroding or overtopping the remaining bank between the main channel and the pit. It is anticipated that if the upstream face of the pit were to fail, the failure would be a result of soil saturation and/or headcut induced scour. Due to the location of the overbank pit and lack of flow-thru, long-term degradation is not an applicable form of scour. The overbank pit is shown on the 2000 topography provided in Appendix D.

4.3.1 Soil Failure Due to Saturation

Assuming the saturated upstream face of the overbank pit is to fail due to instability of the soils, the angle of repose can be used to estimate a stable slope. According to the West Consultants' Agua Fria River Sediment Transport Study, the existing sediment has an approximate D_{75} of 10 millimeters, which yields an angle of repose of approximately 30 degrees. Given the angle of repose, the potential failure upstream of the pit is approximately 26 feet (See Figure 5).

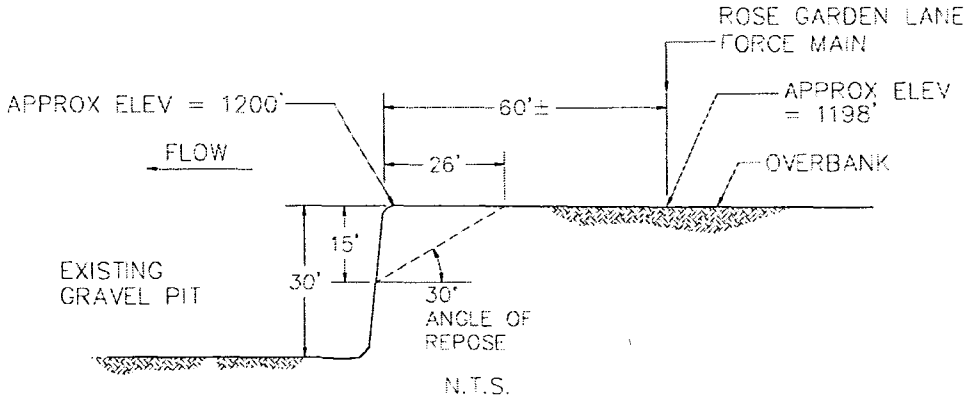


Figure 5. Overbank Potential Scour Due to Soil Failure.

4.3.2 Headcut Estimation

Given the existing conditions of the overbank pit, simple failure of the pit's north bank (Section 4.3.1) does not appear to be a threat. However, if significant flow were to enter the pit, the cover material protecting the sewer force main could be lost due to headcutting. According to the Lateral Migration Report for the Agua Fria Watercourse Master Plan, the overbank pit is located in the severe erosion hazard zone as well as the lateral migration zone. If the main channel of the Agua Fria River migrates to the west overbank where the pit is currently situated, the potential erosion from headcutting will increase. As discussed in Section 4.2.3, the Boyle Engineering Guidelines were used to estimate the headcutting at the sewer force main alignment.

Due to the uncertainty of future mining operations in the vicinity of Rose Garden Lane, the headcut estimate associated with the west overbank pit was based on the most recent available topography and known existing conditions. The west overbank pit located downstream of the proposed alignment was surveyed by West Consultants in 2000 and the associated topography is provided in Appendix D.

Similar to the channel pit, the existing overbank pit has been continuously expanding both horizontally and vertically since the West Consultants' survey. Headcut estimations for the overbank pit are reliant on the existing conditions, such as pit depth and distance from proposed alignment. Because of the uncertainty of future mining operations, it is possible that the existing conditions used in this assessment may change. If changes occur in the future, the headcut estimation of the west overbank pit immediately downstream from Rose Garden Lane provided in this report may also change.

Based on the 2000 topography, the average west overbank depth is approximately 30 feet. The distance from the upstream face of the west overbank pit to the proposed alignment is approximately 60 feet. These existing conditions yield a loss of cover material approximately 12.4 feet deep at the force main alignment (Figure 6). In addition, due to the uncertainty of mining activities and associated hydraulics, a safety factor of 1.3 times the estimated scour depth is recommended. The overall estimated scour depth is then equal to 16 feet.

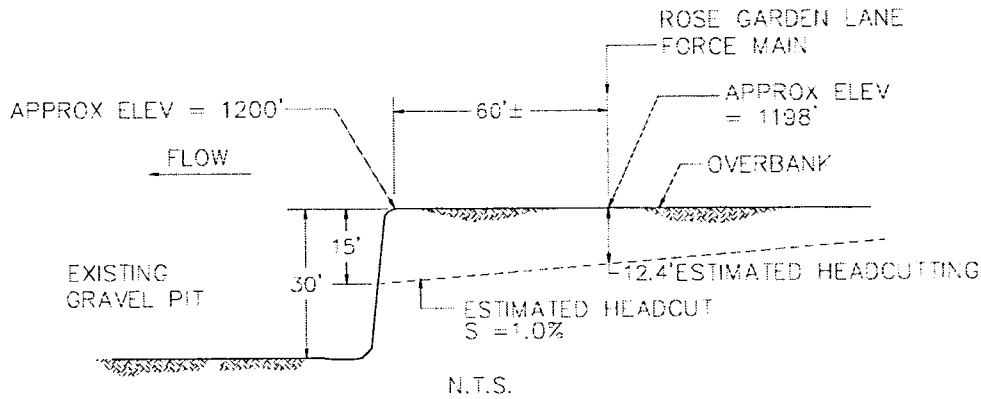


Figure 6. Overbank Potential Scour Due to Headcutting.

5.0 ESTIMATED SCOUR DEPTH CONCLUSIONS

Estimated scour depths associated with the Deer Valley Drive drainage channel, McMicken Dam Outfall Wash crossing and Agua Fria River crossing are discussed in Sections 2.0, 3.0 and 4.0, respectively. In addition, a safety factor of 1.3 times the estimated scour depth is recommended in order to determine the overall scour depth at the Agua Fria River crossing. The watercourse and estimated scour depth are provided in Table 2.

Table 2. Watercourse, Estimated Scour Depth and Burial Depth

Watercourse	Estimated Scour Depth (feet)
Deer Valley Drive Drainage Channel	5.0
McMicken Dam Outfall Wash	4.5
Agua Fria River Channel	19
Agua Fria River West Overbank	16

A safety factor was not used for determining the utility burial depth adjacent to the Deer Valley Drive drainage channel due to the fact a Level I scour analysis was used to estimate the scour potential. A Level I analysis estimates a scour depth sufficient to use without a factor of safety.

A safety factor was not used for determining the utility burial depth for the McMicken Dam Outfall Wash. A factor of safety is not necessary for this crossing for the following reasons:

- The Outfall Wash in the vicinity of the proposed utility crossing has been improved from a desert wash to an earthen trapezoidal channel, which is straight, uniform and well maintained;
- From field reconnaissance there appears to be a greater potential for armoring when compared to other watercourses in the vicinity;
- A concrete grade control structure exists approximately 3,200 feet downstream from the proposed utility crossing; and
- There does not appear to be any historic evidence of large scour events in the vicinity of the project.

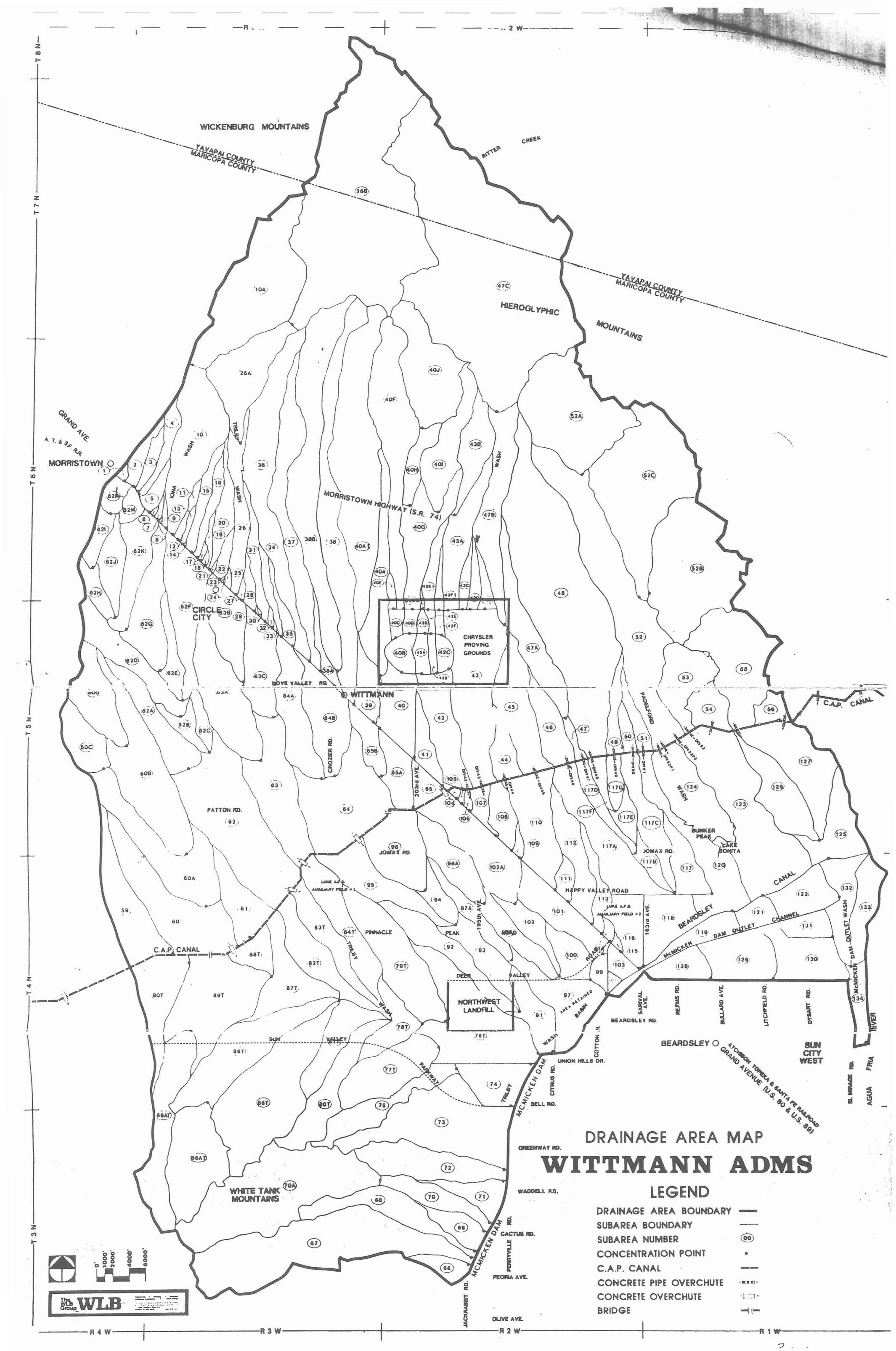
CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX A

1989 Wittmann ADMS Sub-Basin Map


DRAINAGE AREA MAP
WITTMANN ADMS
LEGEND
DRAINAGE AREA BOUNDARY
SUBAREA BOUNDARY
SUBAREA NUMBER
CONCENTRATION POINT
C.A.P. CANAL
CONCRETE PIPE OVERCHUTE
CONCRETE OVERCHUTE
BRIDGE
WICKENBURG MOUNTAINS
YAVAPAI COUNTY
MARICOPA COUNTY
HIEROGLYPHIC MOUNTAINS
BITTER CREEK
GRAND AVE.
A. T. & S.F. R.R.
MORRISTOWN
MORRISTOWN HIGHWAY (S.R. 74)
CIRCLE CITY
CHRYSLER PROVING GROUNDS
DOVE VALLEY RD.
WITTMANN
PADELFORD
C.A.P. CANAL
CROZIER RD.
203rd AVE.
PATTON RD.
JOMAX RD.
BUNKER PEAK
LAKE BONITA
HAPPY VALLEY ROAD
BEARDSLEY
McMICKEN DAM OUTLET CHANNEL
PINNACLE PEAK ROAD
DEER VALLEY
NORTHWEST LANDFILL
SUN VALLEY PARKWAY
WHITE TANK MOUNTAINS
McMICKEN DAM
BEARDSLEY RD.
UNION HILLS DR.
BELL RD.
GREENWAY RD.
WADDELL RD.
CACTUS RD.
PEORIA AVE.
OLIVE AVE.
SUN CITY WEST
BEARDSLEY
ATCHISON TOPEKA & SANTA FE RAILROAD
GRAND AVENUE (U.S. 60 & U.S. 89)
EL MIRAGE RD.
AGUA FRIA RIVER
T 8 N
T 7 N
T 6 N
T 5 N
T 4 N
T 3 N
R 4 W
R 3 W
R 2 W
R 1 W
WLB

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX A

El Mirage Road and Deer Valley Drive Drainage Channel Realignment

ENTRANCO

7740 North 16th Street, Suite 200
Phoenix, AZ 85020-4462
Phone (602) 889-7000
Fax (602) 889-7101
www.entranco.com

LETTER OF TRANSMITTAL

To: **Stanley**
2929 E. Camelback Rd., Ste 130
Phoenix, AZ 85016

Date: December 20, 2002

Project: **El Mirage Road**
Project No.: WO 68995

Attention: Brian Schalk

Subject: **El Mirage 90% Plans**

We Transmit: ☒ As Requested ☒ Attached ☐ Under Separate Cover

Via: ☐ Mail ☐ Messenger ☐ Federal Express

Item	Copies	Description
1	1	90% Plan Set

For Your: ☐ Information/Use ☐ Review and Comment

Action Requested: ☐ Review and Comment ☐ Approval/Acceptance

Remarks:

Brian,

Attached is the Deer Valley roadway and channel portion of the 90% Plans for El Mirage Road-Beardsley Road to Loop 303.

Prepared By: Deanna Huelskamp
Project Assistant
Phone: 602-889-7003

Copy:

F:\99188\Correa\ba122002.doc

If enclosures are not as noted, please notify the sender immediately.

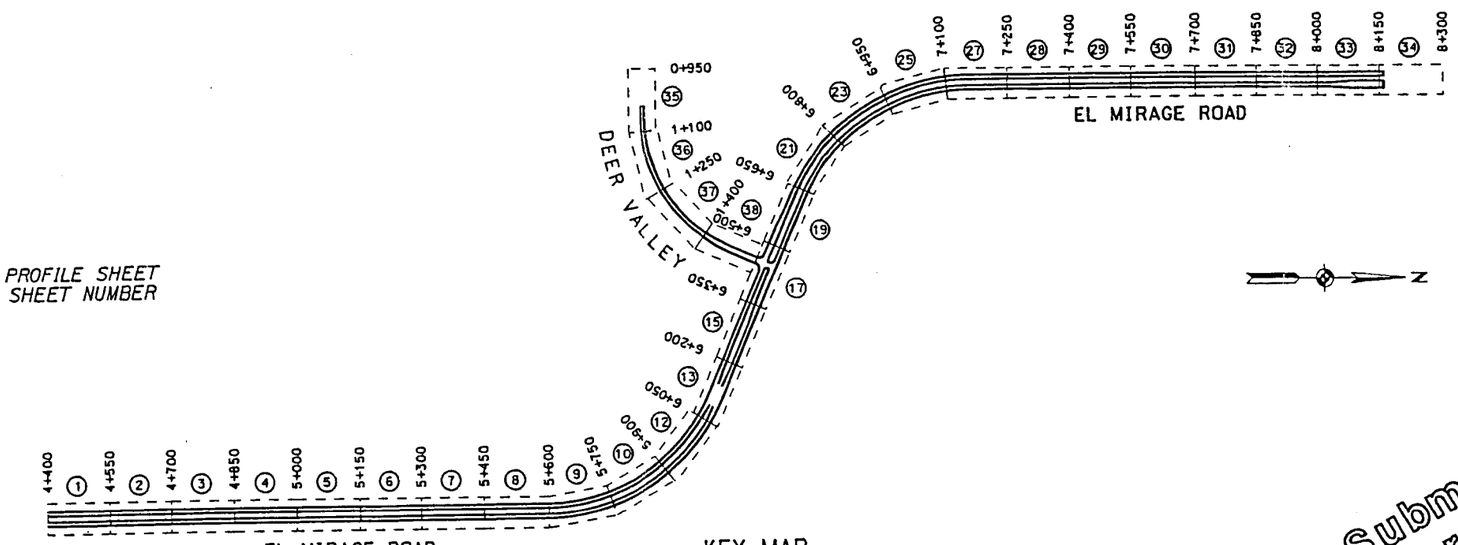
MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION

PLANS FOR THE CONSTRUCTION OF
EL MIRAGE ROAD - BEARDSLEY ROAD TO LOOP 303

PROJECT NO. 68995

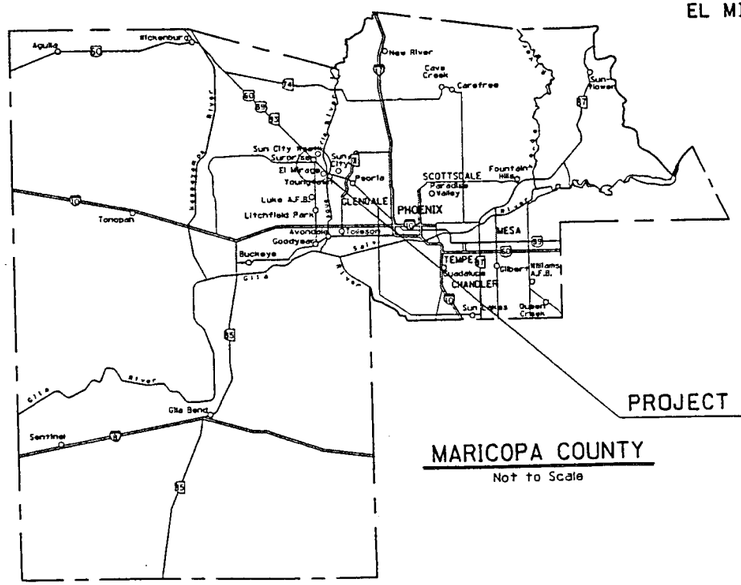
LEGEND

① PLAN OR PLAN AND PROFILE SHEET W/ CORRESPONDING SHEET NUMBER

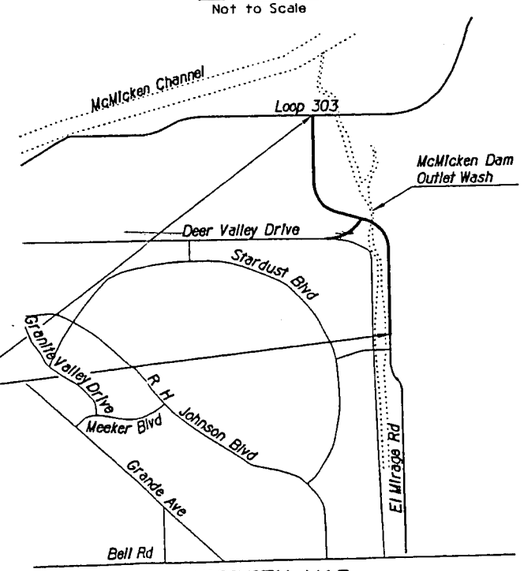


EL MIRAGE ROAD

KEY MAP
Not to Scale



MARICOPA COUNTY
Not to Scale



VICINITY MAP
Not to Scale

90% Submittal
November, 2001

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

ISSUED FOR PUBLIC BIDDING BY:

DIRECTOR DATE

COUNTY BOARD OF SUPERVISORS

R. FULTON BROCK - CHAIRMAN

DISTRICT 1	R. FULTON BROCK
DISTRICT 2	DON STAPLEY
DISTRICT 3	ANDREW W. KUNASEK
DISTRICT 4	JANICE K. GREWER
DISTRICT 5	MARY ROSE WILCOX

ENTRANCO
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DESIGN FILE: I:\99188\68995\PLANS\68995FACE01.DGN PLOT DATE: 11/07/01

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	2	88	

ABBREVIATIONS*

AASHTO.....American Association of State Highway and Transportation Officials
AB.....Aggregate Base
AC.....Asphaltic Concrete
ACFC.....Asphalt Concrete Friction Course
ACI.....American Concrete Institute
ACP.....Asbestos Cement Pipe
ACSC.....Asphalt Concrete Surface Course
ADOT.....Arizona Department of Transportation
Ahd.....Ahead
AISC.....American Institute of Steel Construction
APS.....Arizona Public Service Company
AR.....Axis of Rotation
AR-AC.....Asphalt Rubber Asphalt Concrete
Asph.....Asphalt
ASTM.....American Society for Testing Materials
AWS.....American Welding Society

B/C.....Back of Curb
BC.....Brass Cap
BCR.....Begin Curb Return
BCT.....Breakaway Cable Terminal
Bdy.....Boundary
Bev.....Beveled)
BFS.....Begin Full Super
Bit.....Bituminous
Bk.....Back
Bkfl.....Backfill
BLM.....Bureau of Land Management
BM.....Bench Mark
Br.....Bridge

C&G.....Curb and Gutter
CAP.....Corrugated Aluminum Pipe
CAPA.....Corrugated Aluminum Pipe Arch
CB.....Catch Basin
CBC.....Concrete Box Culvert
CM.....Cubic Meter
CG.....Cattle Guard
CIP.....Cast Iron Pipe
CIPP.....Cast-In-Place Pipe
Clr.....Clearance)
CLD.....Concrete Lined Ditch
CMP.....Corrugated Metal Pipe
CO.....Clean Out
Conc.....Concrete
Conn.....Connection
Const.....Construction
Cont.....Continuous
Cor.....Corner
Corr.....Correction (VPI to VC)
Cr.....Crown

CSP.....Corrugated Steel Pipe
CSPA.....Corrugated Steel Pipe Arch
CTB.....Concrete Treated Base
CM.....Cubic Meters

DA.....Drainage Area
DE.....Drainage Easement
Defl.....Deflection
Det.....Detail
DIP.....Ductile Iron Pipe
Drn.....Drainage)
D/W.....Driveway
Dwg.....Drawing

E.....Electricity)
e.....External
ECR.....End Curb Return
EFS.....End Full Super
El.....Elevation
Emb.....Embankment
EP.....Edge of Pavement
Esmt.....Easement
Exc.....Excavation
Exist.....Existing)
Exp Jt.....Expansion Joint

F/C.....Face of Curb
FCDMC.....Flood Control District of Maricopa County
FF.....Finished Floor (Elevation)
FH.....Fire Hydrant
Fnd.....Found
Frwy.....Freeway

G.....Gutter (Flowline Elevation)
ga.....Gauge
GB.....Grade Break
GM.....Gas Meter
Gnd.....Ground
GP.....Guy Pole
Gr.....Grade
GR.....Guardrail
GV.....Gas Valve

HDPE.....High Density Polyethyline
Hdwl.....Headwall
HH.....Hand Hole
HW.....High Water

ID.....Inside Diameter
Inv.....Invert
Irr.....Irrigation

L.....Length of Curve
LC.....Long Chord
LM.....Linear Meter

LS.....Lump Sum
Lt.....Left

MAG.....Maricopa Association of Governments

Matl.....Material
MCDOT.....Maricopa County Department of Transportation
MCFCD.....Maricopa County Flood Control District

MH.....Manhole
Min.....Minimum
Mod.....Modify
Mon.....Monument

NC.....Normal Crown
NPI.....Non-pay Item
NPDES.....National Pollutant Discharge Elimination System
NTS.....Not to Scale

OC.....On Center
OD.....Outside Diameter

P.....Pavement (Surface Elevation)
Ped.....Pedestal
PC.....Point of Curvature
PCC.....Point of Compound Curvature
PCC.....Portland Cement Concrete
PGL.....Profile Grade Line
PI.....Point of Intersection
POC.....Point on Curve
POT.....Point on Tangent
PP.....Power Pole
PRC.....Point of Reverse Curvature
Prel.....Preliminary
Proj.....Project
Prop.....Proposed
PRVC.....Point of Reverse Vertical Curvature
PT.....Point of Tangency
PVC.....Point of Vertical Curvature
PVC.....Poly Vinyl Chloride
PVI.....Point of Vertical Intersection
Pvmt.....Pavement
PVT.....Point of Vertical Tangency

Q.....Quantity of Drainage Runoff
Qtr.....Quarter

R.....Radius
R.....Range
RCP.....Reinforced Concrete Pipe
RCPA.....Reinforced Concrete Pipe Arch
Rdwy.....Roadway
RPM.....Raised Pavement Markers

Rebar.....Reinforcing Bar
Reinf.....Reinforcedling)
Reloc.....Relocate
Rem.....Remove
Ret.....Retaining)
RGRCP.....Rubber Gasket Reinforced Concrete Pipe
RR.....Railroad
Rt.....Right
R/W.....Right of Way

S.....Slope
Sch.....Schedule
SCS.....Soil Conservation Service
SD.....Storm Drain
SE.....Slope Easement
Sec.....Section
SM.....Square Meter
SG.....Subgrade
Shldr.....Shoulder
Shr.....Shrinkage
Sht.....Sheet
SLD.....State Land Department
Sk.....Skew
SM.....Select Material
Specs.....Specifications
SRP.....Salt River Project
SS.....Sanitary Sewer
Sta.....Station
Struc.....Structural
Subdiv.....Subdivision
Super.....Superelevation
Sw.....Swell
S/W.....Sidewalk
SWG.....Southwest Gas Corporation

T.....Tangent Length
T.....Township
TBM.....Temporary Bench Mark
TC.....Top of Curb
TCE.....Temporary Construction Easement
Trans.....Transition
TrRk.....Trash Rack
TS.....Traffic Signal Pole
Typ.....Typical

USW.....US West Communications

VC.....Vertical Curve
VCP.....Vitrified Clay Pipe
VG.....Valley Gutter

w/.....with
w/o.....without
WM.....Water Meter
WV.....Water Valve
WWF.....Welded Wire Fabric

* Standard dictionary abbreviations not included.

SYMBOLS*

Exist Rdwy Conc Items
Exist Edge of Pvmt
Exist R/W Line
Property Line
Railroad Tracks
Top of Cut
Toe of Slope
Trans Cut to Fill
Exist Barb Wire Fence
Exist Chain Link & Gate
Exist Block Wall & Gate
Exist Wood Fence
Exist Guardrail
Exist Water Line — 6"W (TYPE)
Exist Sanitary Sewer Line — 8"SS (TYPE)
Exist Buried Electric Line
Exist Electric Duct Bank
Exist Gas Line — 2"G HP (TYPE)
Exist Irrigation Line — 24"IRR (TYPE)
Exist Storm Drain Line — 24"SD (TYPE)
Exist Buried Cable TV Line
Exist Buried Telephone Line
Exist Fiber Optic Tel Line
New Pipe
Minor Wash

Angle Point
Bench Mark
New Survey Monument
Meter per Meter
Center Line
Flow Line
Monument Line
Property Line or Plate
Section Line
Exist Manhole
Exist US Mail Box
Exist Util Valve
Exist Util Meter
Exist Gas Regulator
Exist Power or Joint Use Pole
Exist Steel Power Pole
Exist Guy Wire
Exist Street Light
Exist Util Ped
Exist Stand Pipe
Exist Fire Hydrant
Exist Street Sign
Exist Traf Cont Cab
Exist Traf Pull Box
Exist Traf Signal Pole
Exist Slope Direction

Tree or Hedge Line
Palm Tree
Deciduous Tree
Arid Tree
Conifer Tree
Saguaro Cactus
Misc Cactus
Cholla Cactus
Prickly Pear Cactus
Barrel Cactus
Exist Sign (1 Post)
Exist Sign (2 Posts)
Ground Surface
New Bit Pvmt (Section)
New Select Material (Section)
New ABC (Section)
Riprap (Plan)
New Bit Pvmt (Plan)
New Conc Pvmt (Plan)
Remove Pvmt (Plan)
New Conc (Section)
New Metal (Section)
Exist Ground Elevation at Right R/W
Exist Ground Elevation at Left R/W

* Symbols labeled on plans not included. Traffic Signal and Striping Symbols are on Sfts XX and XX of the plans.

GENERAL NOTES

1. All work to conform to the MAG Uniform Standard Specifications and Details for Public Works Construction (Metric Edition) Dated 1999 and current revisions thereto, together with the MCDOT Metric Supplement to the MAG Standard Specifications and the Special Provisions.
2. Standard Details refer to the MAG Uniform Standard Specifications and Details (Metric Edition) Dated 1999 for Public Works Construction unless noted otherwise.
3. All existing utility lines shown on the plans are from available utility records. The Contractor shall verify the actual location before starting construction. The Contractor shall contact "Blue Stake", 263-1100, prior to beginning construction.
4. Utilities interfering with construction shall be reset or relocated by the utility company concerned unless noted otherwise.
5. Disposal of all waste material, broken concrete, etc. will be the responsibility of the contractor, subject to the approval of the Engineer.
6. All stations and callout distances left and right refer to the construction centerline unless noted otherwise.
7. All trees, bushes and fences inside the existing right-of-way which interfere with construction, will be removed by MCDOT forces unless noted otherwise.
8. All paved turnouts shall have the same asphalt and base requirements as the adjacent roadway.
9. The Contractor shall obtain all the necessary permits from local governments for work within their jurisdiction.
10. The Contractor shall verify all bench mark elevations before using them for construction. BM's in utility poles are particulary susceptible to damage.
11. All mail boxes interfering with construction shall be relocated by the Contractor as to provide uninterrupted mail service. This is a non-pay item.
12. All new pipe shall be Class III RGRCP unless otherwise noted.

LENGTH OF PROJECT

EL MIRAGE ROAD STA 4+400.000 TO STA 8+160.069=3,760.069 LM
DEER VALLEY DRIVE STA 1+040.000 TO STA 1+573.377=533.377 LM
TOTAL=4,293.446 LM
4,293.446 LM/1,000=4.30 KM

NPDES AREA OF PROJECT

EL MIRAGE ROAD STA 4+400.000 TO STA 8+160.069 X 62.484M (AVE. R/W WIDTH) =234,944 SM
DEER VALLEY DRIVE STA 1+040.000 TO STA 1+573.377 X 27.432M (AVE. R/W WIDTH) =14,632 SM
TOTAL=249,576 SM
249,576 SM/10,000=24.96 HA
24.96 HA X 2.471=61.68 ACRES

MAG STANDARDS

NUMBER	DESCRIPTION
120-2	SURVEY MONUMENT, TYPE D & E
201	THICKENED PAVEMENT EDGE, TYPE B

ADOT STANDARDS

NUMBER	DESCRIPTION
C-15.80	CATCH BASIN
C-13.25	CMP END SECTION
B-02.30	TRIPLE BARREL BOX CULVERT
B-04.10	BOX CULVERT OUTLET WINGS
B-04.30	BOX CULVERT INLET WINGS
B-11.12	HEADWALLS 1220 mm - 2130 mm PIPES
B-11.14	MULTIPIPE HEADWALLS

MCDOT DETAILS

NUMBER	DESCRIPTION
3002	TYPE A GUARDRAIL INSTALLATION
3003	TYPE B GUARDRAIL INSTALLATION
3010	BOLTED GUARDRAIL ANCHORS
3012	GUARDRAIL TRANSITION TO STRUCTURE

DESIGN DATA

EL MIRAGE ROAD

CLASSIFICATION.....MODIFIED RURAL PRINCIPAL ARTERIAL
TERRAIN.....LEVEL
DESIGN SPEED.....100 KPH
AVERAGE DAILY TRAFFIC.....41,150
DESIGN YEAR.....2020

DEER VALLEY ROAD

CLASSIFICATION.....RURAL COLLECTOR
TERRAIN.....LEVEL
DESIGN SPEED.....65 KPH
AVERAGE DAILY TRAFFIC.....6,000
DESIGN YEAR.....2020

INDEX

1.....FACE SHEET
2.....GENERAL NOTE SHEET
3-5.....TYPICAL SECTIONS SHEETS
6-8.....QUANTITY SUMMARY SHEETS
9.....PIPE SUMMARY SHEET
10.....BOX CULVERT SUMMARY SHEET
11-12.....GEOMETRIC DATA AND CONTROL SHEETS
13-50.....PAVING PLAN AND PROFILE SHEETS
51-52.....INTERSECTION DETAIL SHEETS
53-56...REMOVAL PLAN SHEETS
57-58....DRAINAGE PIPE PROFILE SHEETS
59.....CHANNEL TYPICAL SECTION SHEET
60-64....CHANNEL PLAN AND PROFILE SHEETS
65-68....DETAIL SHEETS
69.....MASS DIAGRAM SHEET
70-71....UNDERGROUND CONDUIT SHEETS
72-88....SIGNING AND STRIPING SHEETS
*.....BRIDGE STRUCTURE SHEETS
88.....SHEETS TOTAL

* NOT INCLUDED IN THIS SUBMITTAL

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	RAH	11/01
DRAWN	MG	11/01
CHECKED	FST	11/01

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GENERAL NOTE SHEET

SHEET 1 OF 1

TRACS NO.

PLOT DATE: 11/07/2001 09:29:24
DESIGN FILE: I:\99188\68995\PLANS\68995GEN01.DGN

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
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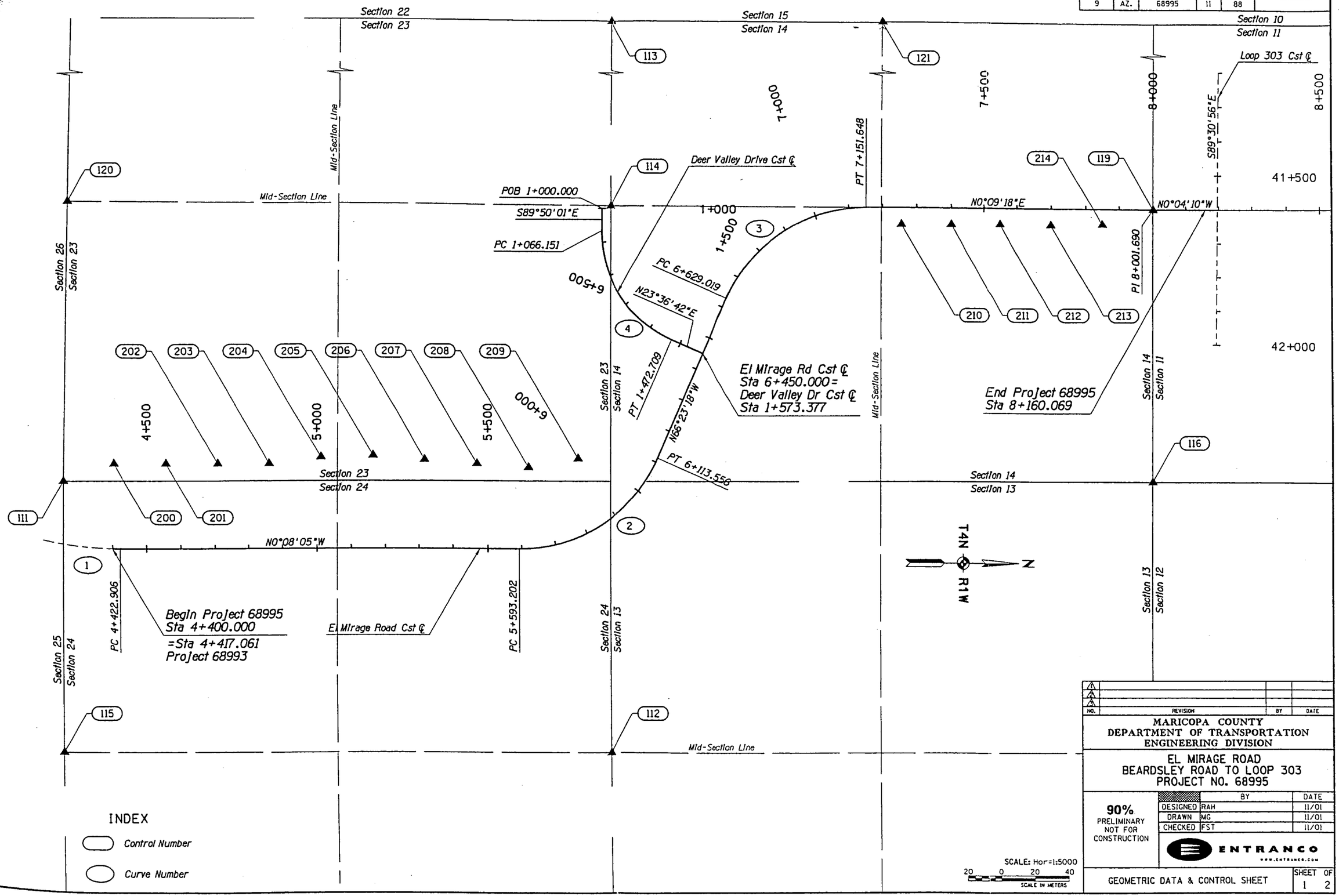

NO.	REVISION	BY	DATE
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
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GEOMETRIC DATA & CONTROL SHEET

SHEET 1 OF 2

TRACS NO.

DESIGN FILE: I:\99188\68995\PLANS\68995GEOM01.DGN PLOT DATE: 11/07/2001 09:35:04

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	12	88	

GEOMETRIC DATA TABLE

Roadway	Curve No.	Point	Station	Bearing	Distance	Northing	Easting	Curve Data				Superelevation
								Radius	Deflection	Length	Tangent	
El Mirage	1	PC	4+193.428			295852.417	175689.261					
		PI	4+308.673			295964.702	175715.211	1000.000m	13°08'53"	229.478m	115.241m	0.042 m/m
		POC/POB	4+400.000			296057.042	175714.732					
		PT	4+422.906			296079.947	175714.940					
	2	PC	5+593.202	N0°08'05"W	1,193.202m	297250.240	175712.187					
		PI	5+886.853			297543.590	175711.496	450.000m	66°15'13"	520.354m	293.651m	0.060 m/m
		PT	6+113.556			297661.508	175442.429					
	3	PC	6+629.019	N66°23'18"W	515.463m	297867.969	174970.121					
		PI	6+924.294			297986.237	174699.565	450.000m	66°32'36"	522.629m	295.276m	0.060 m/m
		PT	7+151.648			298281.512	174700.363					
		POE	8+160.069			299289.930	174702.469					
Deer Valley		POB	1+000.000			297494.407	174705.967					
	4	PC	1+066.151	S89°50'01"E	66.151m	297494.215	174722.117					
		PI	1+295.859			297493.549	175001.825	350.000m	66°33'17"	229.559m	229.709m	0.056 m/m
		PT	1+472.709			297704.026	175093.831					
		POE	1+573.377			297796.266	175134.152					

CONTROL DATA TABLE

Point No.	Station	Offset	Northing	Easting	Elevation	Section	Corner	Description
111	4+255.132	199.685m Lt	295911.704	175515.651	367.105	T4N, R1W, S23	SE Corner	13mm (1/2") Rebar
112	5+705.646	635.174m Rt	297520.001	176313.026	372.352	T4N, R1W, S24	N 1/4 Corner	76mm (3") APS Brass Capped Pipe
113	6+906.709	1,014.960m Lt	297525.092	173895.063	385.939	T4N, R1W, S14	SW Corner	19mm (3/4 ") Rebar
114	6+685.525	432.674m, Lt	297522.164	174698.311	384.895	T4N, R1W, S14	S 1/4 Corner	25mm (1") Iron Pipe With Nail
115	4+253.032	601.804m Rt	295911.490	176317.142	360.370	T4N, R1W, S24	S 1/4 Corner	13mm (1/2 ") Rebar
116	8+001.690	805.135m Rt	299129.757	175507.794	392.974	T4N, R1W, S13	NW Corner	76mm (3") Aluminum Capped Pipe
119	8+001.690	0m	299131.551	174702.661	393.964	T4N, R1W, S14	N 1/4 Corner	16mm (5/8 ") Iron Rod
120	4+270.606	1,024.567m Lt	295925.237	174690.734	375.876	T4N, R1W, S23	S 1/4 Corner	64mm (2-1/2") McDot Brass Cap Flush
121	7+198.123	803.300m Lt	298330.158	173897.192	114.567	T4N, R1W, S14	W 1/4 Corner	13mm (1/2") Rebar
200	4+404.692	250.847m Lt	296061.143	175464.137	376.570	T4N, R1W, S23	-	Iron Rod (TBM)
201	4+556.876	250.525m Lt	296213.328	175464.101	377.199	T4N, R1W, S23	-	Iron Rod (TBM)
202	4+709.264	250.646m Lt	296365.715	175463.618	377.532	T4N, R1W, S23	-	Iron Rod (TBM)
203	4+861.656	251.248m Lt	296518.105	175462.661	377.394	T4N, R1W, S23	-	Iron Rod (TBM)
204	5+012.615	269.356m Lt	296669.021	175444.198	379.262	T4N, R1W, S23	-	Iron Rod (TBM)
205	5+165.349	274.100m Lt	296821.743	175439.094	380.052	T4N, R1W, S23	-	Iron Rod (TBM)
206	5+317.296	262.354m Lt	296973.718	175450.483	380.635	T4N, R1W, S23	-	Iron Rod (TBM)
207	5+469.318	250.456m Lt	297125.767	175462.023	381.161	T4N, R1W, S23	-	Iron Rod (TBM)
208	5+652.974	237.726m Lt	297277.789	175472.526	381.813	T4N, R1W, S23	-	Iron Rod (TBM)
209	5+933.730	197.154m Lt	297423.204	175445.620	382.480	T4N, R1W, S23	-	Iron Rod (TBM)
210	7+254.987	49.121m Rt	298384.718	174749.764	387.770	T4N, R1W, S14	-	Iron Rod (TBM)
211	7+400.256	48.164m Rt	298529.989	174749.199	388.761	T4N, R1W, S14	-	Iron Rod (TBM)
212	7+548.450	49.972m Rt	298678.186	174748.408	389.848	T4N, R1W, S14	-	Iron Rod (TBM)
213	7+699.187	48.246m Rt	298828.919	174750.089	392.198	T4N, R1W, S14	-	Iron Rod (TBM)
214	7+849.498	45.426m Rt	298979.237	174747.675	393.030	T4N, R1W, S14	-	Iron Rod (TBM)

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

	BY	DATE
DESIGNED	RAH	11/01
DRAWN	MG	11/01
CHECKED	FST	11/01

90%
PRELIMINARY
NOT FOR
CONSTRUCTION

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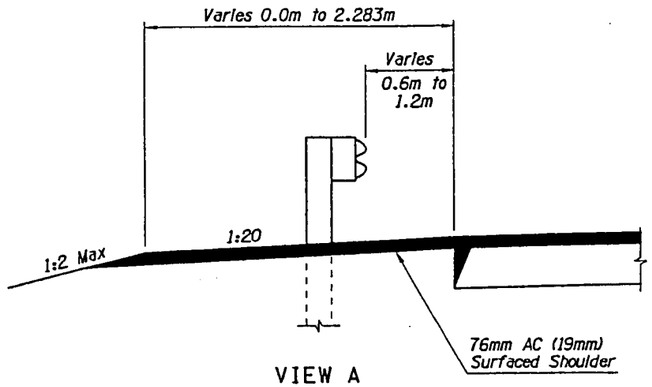
GEOMETRIC DATA & CONTROL SHEET

SHEET 2 OF 2

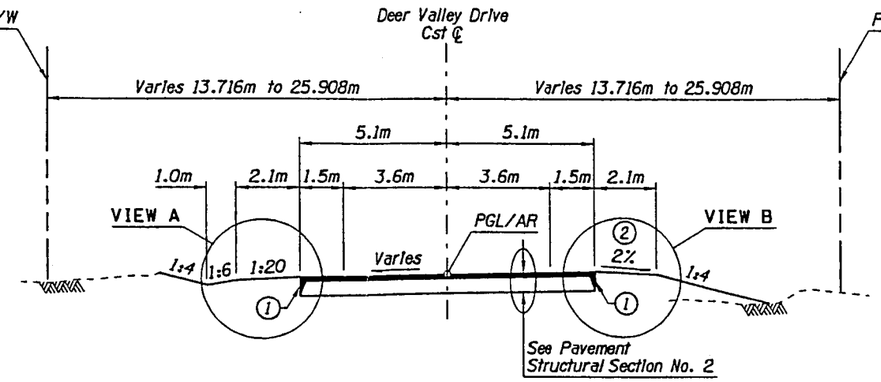
TRACS NO.

DESIGN FILE: I:\99188\68995\PLANS\68995GEOM02.DGN PLOT DATE: 11/07/2001 9:15:00 AM

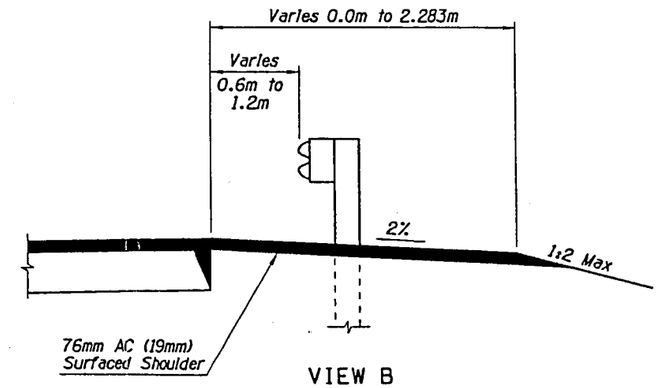
F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	5	88	



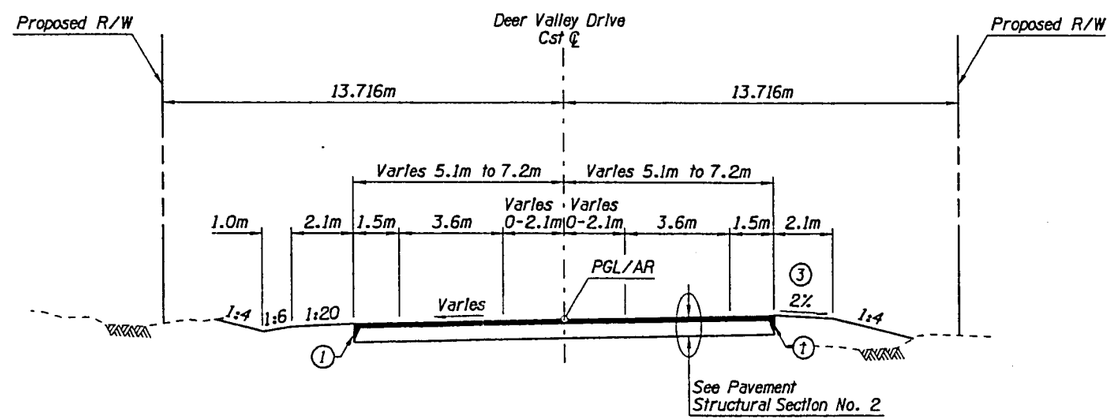
VIEW A
Guardrail, Type B
Sta 1+175.680 to Sta 1+253.143, Lt



TYPICAL SECTION
DEER VALLEY ROAD
Sta 1+040.000 to Sta 1+379.000



VIEW B
Guardrail, Type B
Sta 1+179.173 to Sta 1+265.398, Rt



TYPICAL SECTION
DEER VALLEY ROAD
Sta 1+379.000 to Sta 1+552.277

(1) Thickened Edge per MAG Std Det 201, Type B

(2) Varies from 1:20 to 2%
Station 1+040 to 1+075

(3) Varies from 2% to 1:20
Station 1+465 to 1+490

SCALE: NTS

NO.	REVISION	BY	DATE
1			
2			
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
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TYPICAL SECTION SHEET

SHEET 3 OF 3

TRACS NO.

DESIGN FILE: I:\99188\68995\PLANS\68995TYP02.DGN PLOT DATE: 11/07/2001 09:30:11

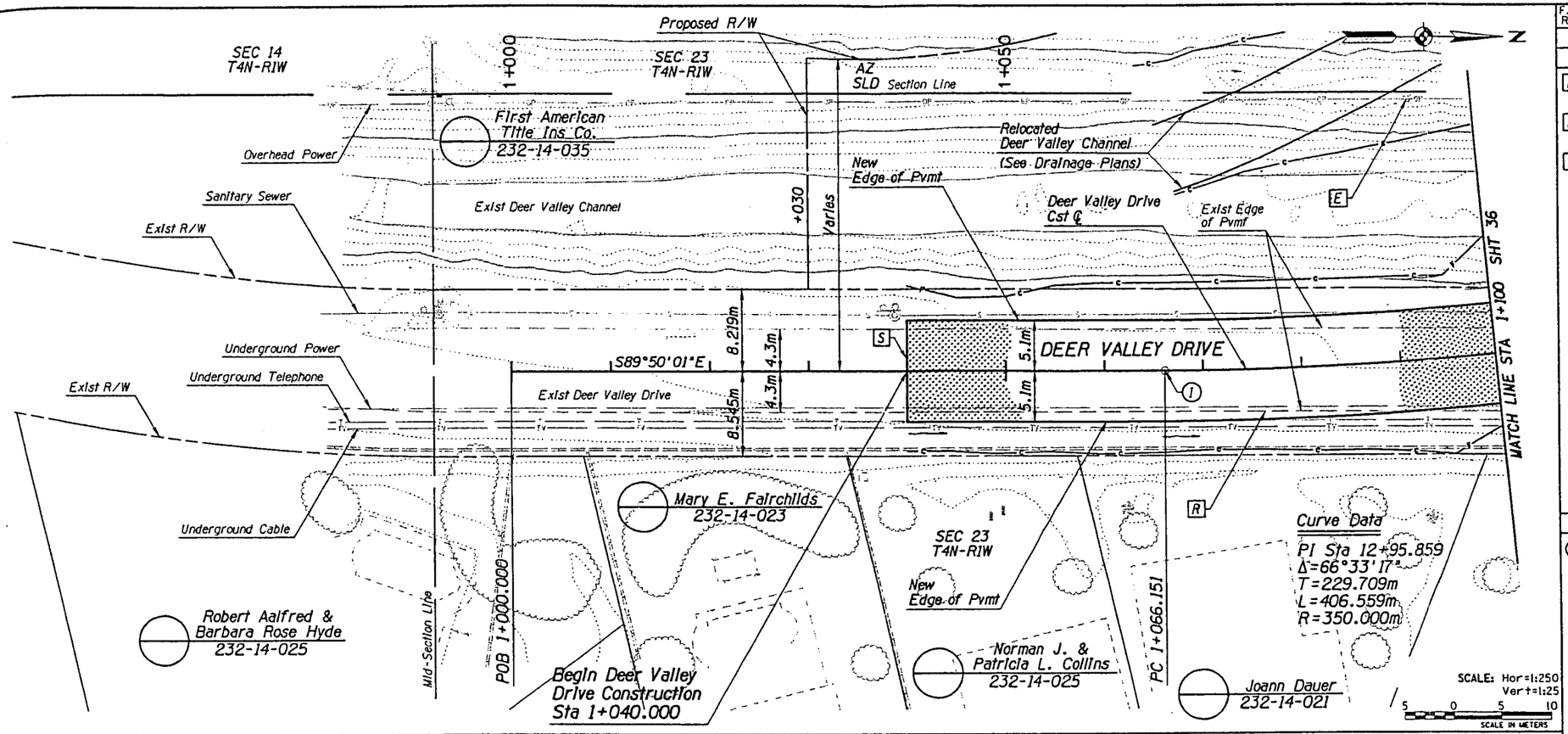
F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	47	88	

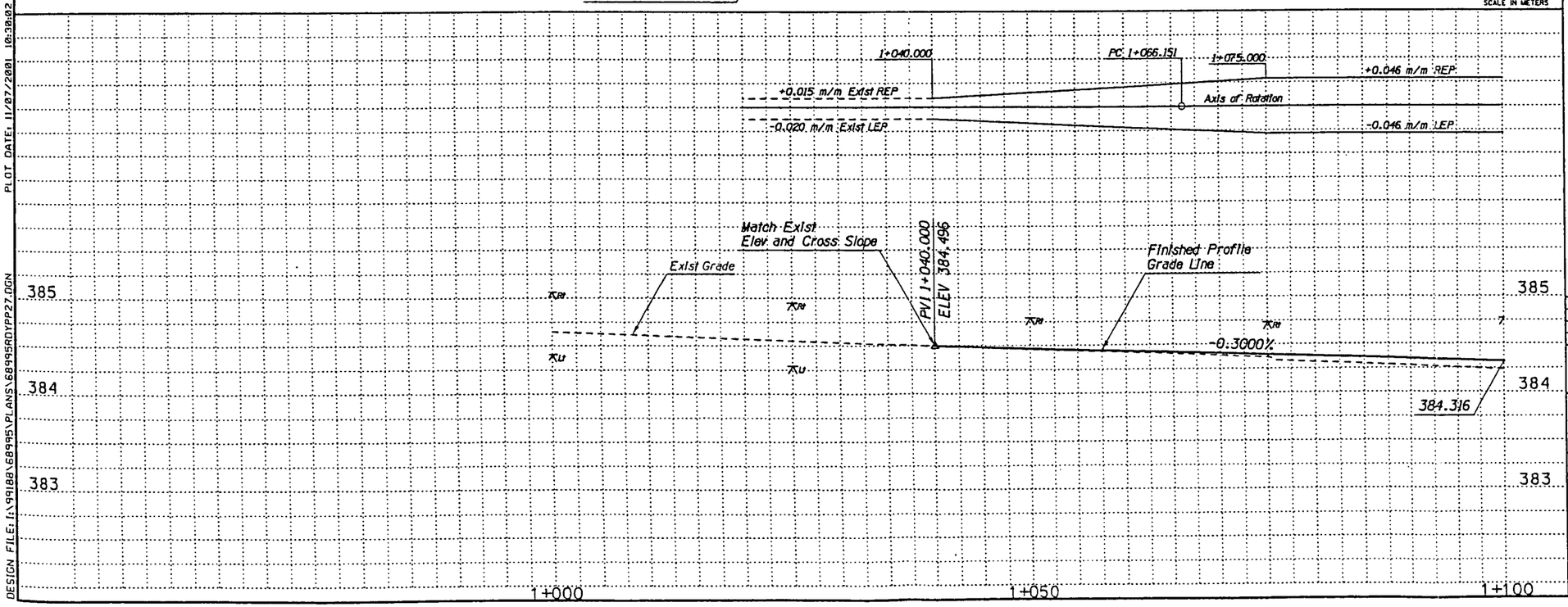
☐ REMOVAL/RELOCATE ☐

E	Relocate Exist Power Pole (By Others)	1 Ea
R	Remove Exist AC Pavement (See Removal Sheets)	
S	Sawcut Exist AC Pavement	9 m

◯ CONSTRUCTION ◯

1	Install Survey Monument MAG Std Det 120-2, Type D Sta 1+066.151	1 Ea





TWO WORKING DAYS BEFORE YOU DIG, CALL
1-800-782-5348
BLUE STAKE

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	RAH	11/01
DRAWN	MG	11/01
CHECKED	FST	11/01

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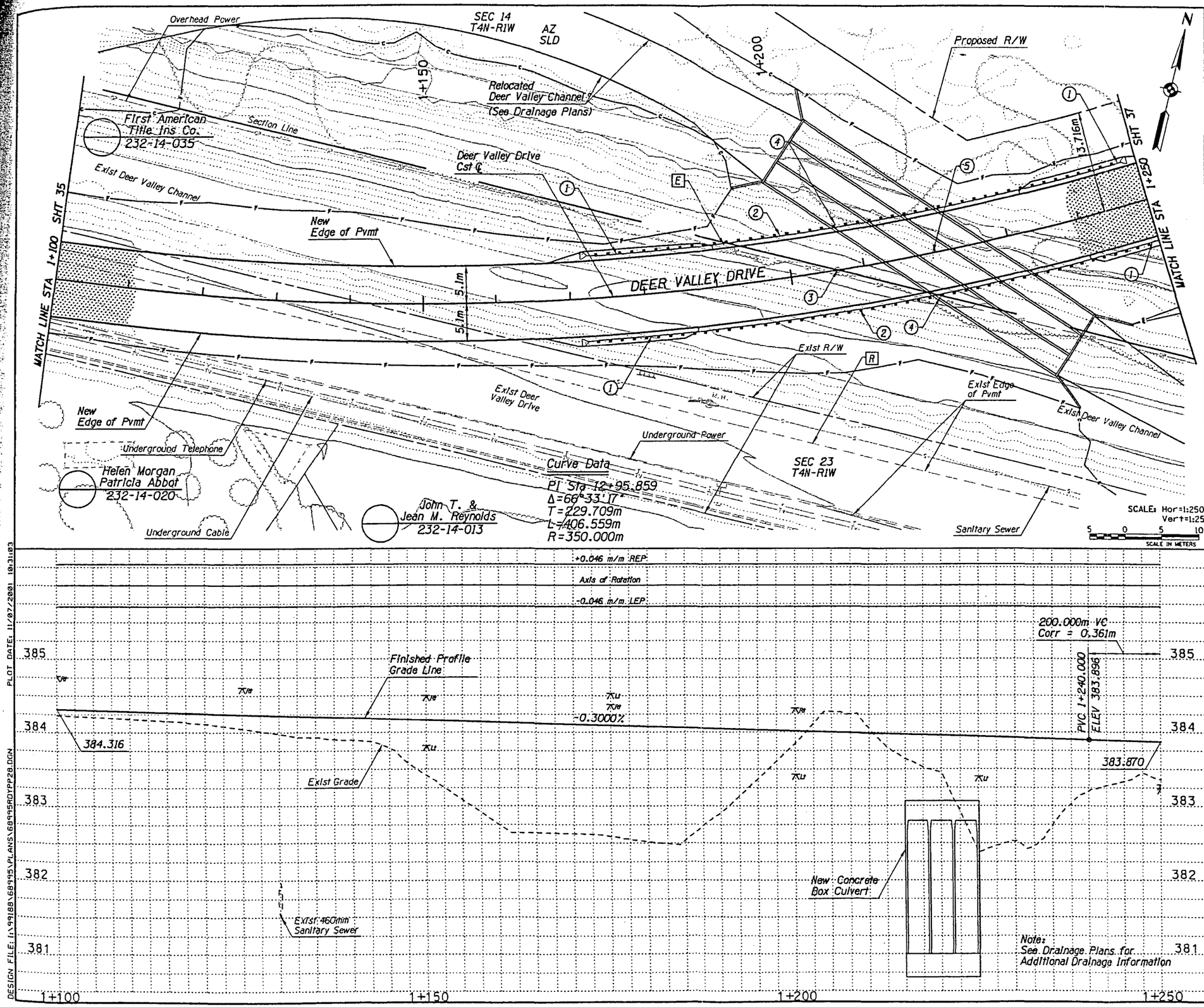
DEER VALLEY DRIVE PLAN AND PROFILE
Sta 1+000 to Sta 1+100

SHEET 35 OF 38

TRACS NO

DESIGN FILE: I:\98188\68995\PLANS\68995ROYPP27.DGN
PLOT DATE: 11/07/2001 10:38:02



PLOT DATE: 11/07/2001 10:31:03

DESIGN FILE: I:\99188\68995\PLANS\68995ROYPP28.DGN

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	48	88	

☐ REMOVAL/RELOCATE ☐

E	Relocate Exist Power Pole (By Others)	1 Ea
R	Remove Exist AC Pavement (See Removal Sheets)	

◯ CONSTRUCTION ◯

1	ET 2000 PLUS or Approved Equivalent per Detail A and the Manufacturer's most recent Drawings. Sta 1+172.020 to Sta 1+187.260, Lt Sta 1+171.660 to Sta 1+186.900, Rt Sta 1+232.980 to Sta 1+248.220, Lt Sta 1+240.240 to Sta 1+255.480, Rt	4 Ea
2	Install Guardrail, Type B Without Embankment Curb MCDOT Std Det 3001 and 3003 Sta 1+187.260 to Sta 1+232.980, Lt Sta 1+186.900 to Sta 1+240.240, Rt	 46 m 54 m
3	Install Survey Monument MAG Std Det 120-2, Type D Sta 1+206.421	 1 Ea
4	Install Bolted Guardrail Anchor MCDOT Std Det 3001 and 3010-2 Sta 1+206.400 to 1+221.3, Lt Sta 1+218.200 to 1+232.4, Rt	 8 Ea 8 Ea
5	New 3-3.0m x 1.8m x 47.7m CBC with Headwalls ADOT Std Det B-02.30, B-04.10 and B-04.30 Sta 1+220.000, 45° Skew Lt See Channel Plan and Profile (Sheet 1 of 5) & Detail D1.	

TWO WORKING DAYS BEFORE YOU DIG, CALL
1-800-782-5348
BLUE STAKE

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

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DESIGNED	RAH	11/01
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CHECKED	FST	11/01

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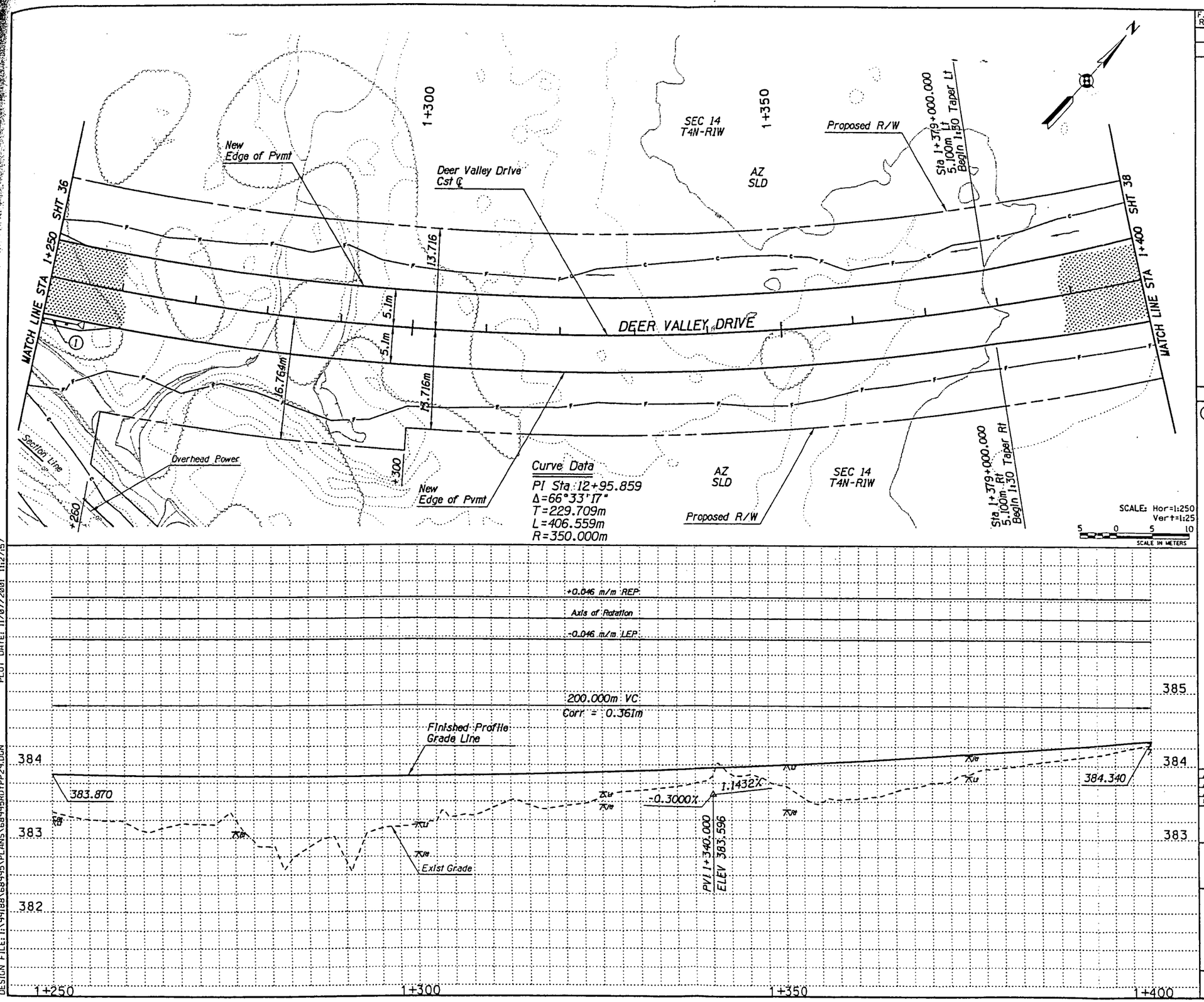
DEER VALLEY DRIVE PLAN AND PROFILE
Sta 1+100 to Sta 1+250

SHEET 36 OF 38

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	49	88	

☐ REMOVAL/RELOCATE ☐



PLOT DATE: 11/07/2001 11:27:57

DESIGN FILE: I:\99188\68995\PLANS\68995RDYPP29.DGN

CONSTRUCTION

(1) ET 2000 PLUS or Approved Equivalent per Detail A and the Manufacturer's most recent Drawings.
Sta 1+240.240 to Sta 1+255.480, Rt

TWO WORKING DAYS BEFORE YOU DIG, CALL
1-800-782-5348
BLUE STAKE

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
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DESIGNED	RAH	11/01
DRAWN	MG	11/01
CHECKED	FST	11/01

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DEER VALLEY DRIVE PLAN AND PROFILE
Sta 1+250 to Sta 1+400

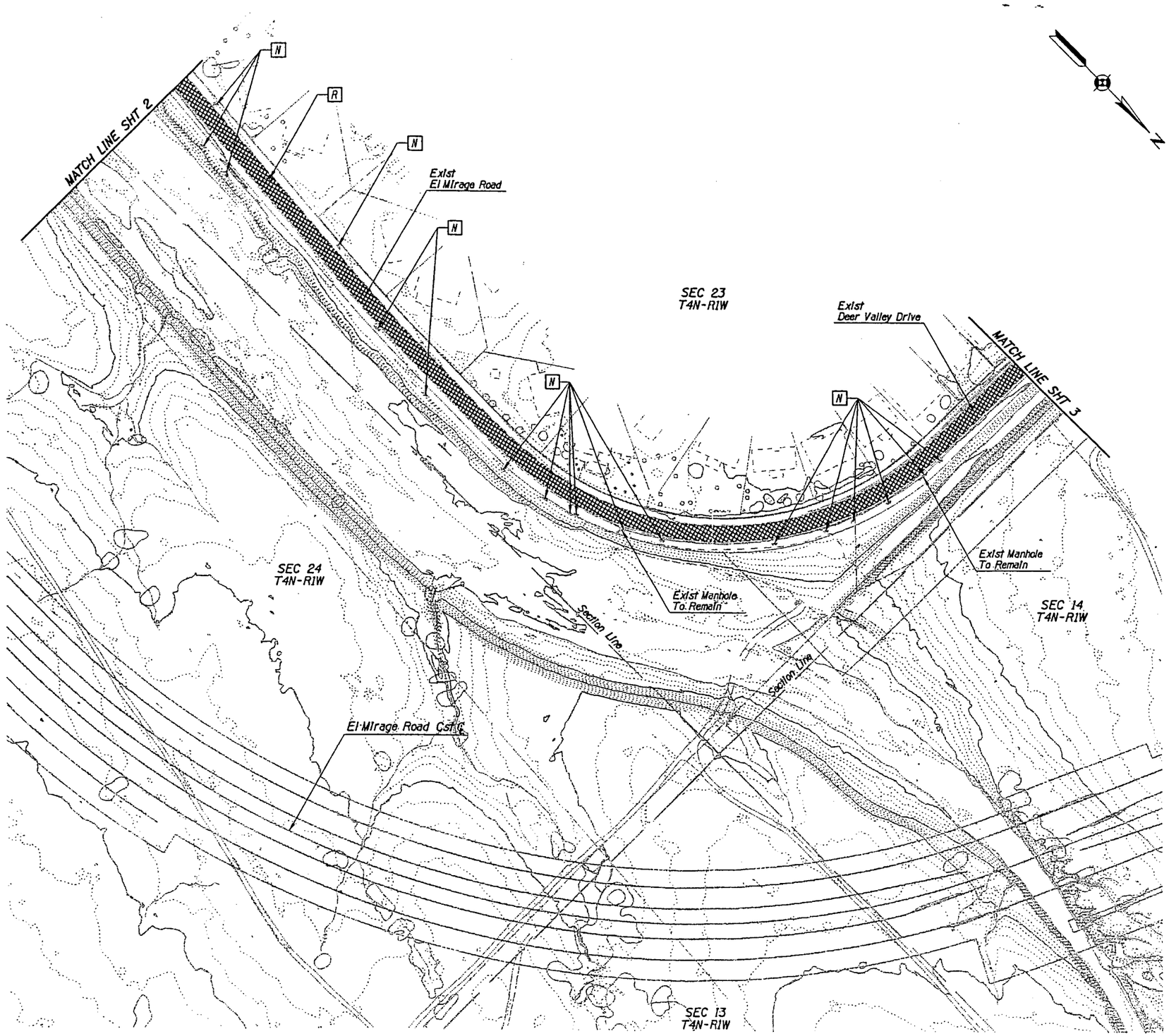
SHEET 37 OF 38

TRACS NO.

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	55	88	

☐ REMOVAL/RELOCATE ☐

R	Remove Exist Pavement	3,806 m²
N	Remove Exist Sign, Post and Foundation	18 Ea



○ CONSTRUCTION ○

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BLUE STAKE

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
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EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

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	BY	DATE
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DRAWN	MG	11/01
CHECKED	FST	11/01

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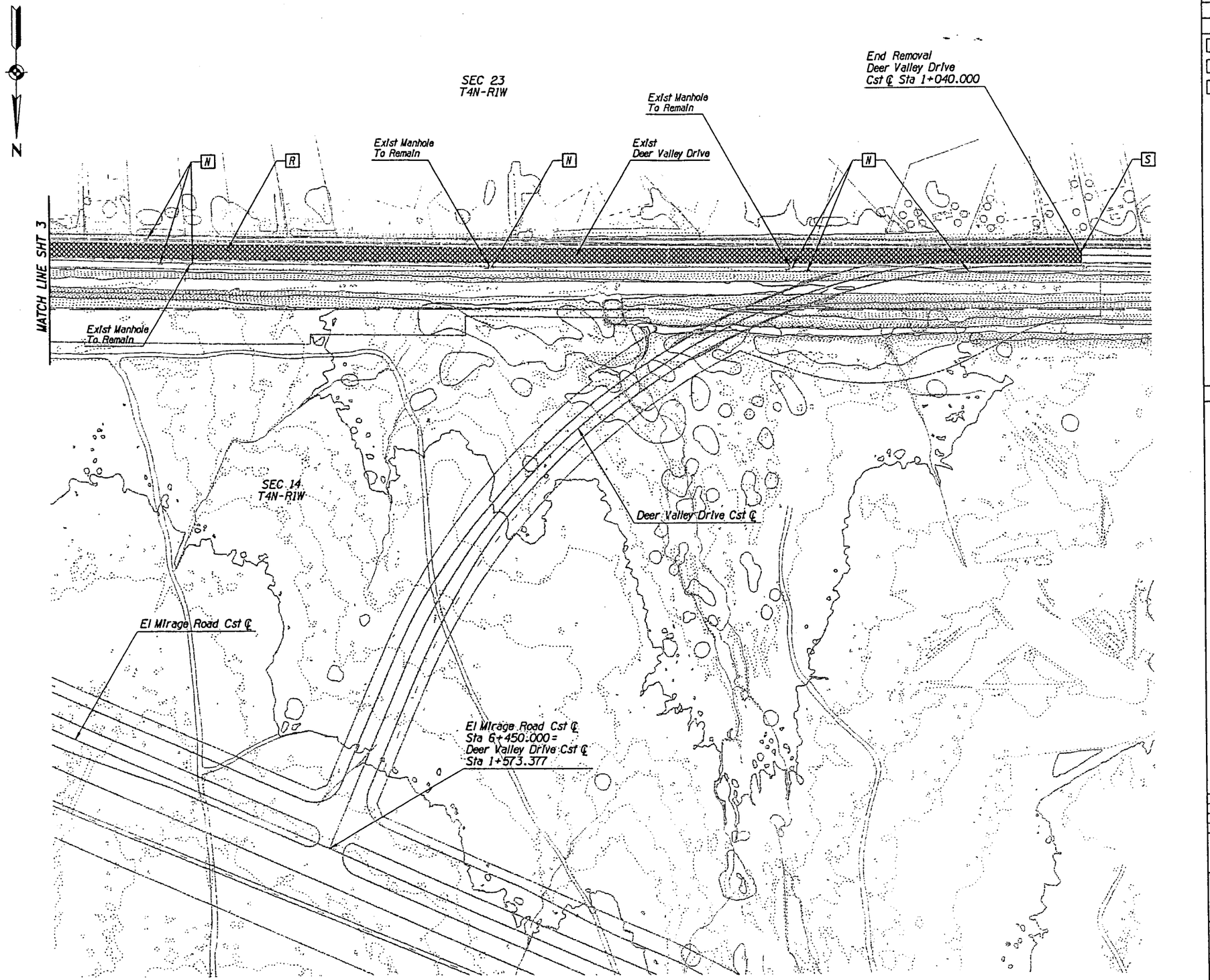
EL MIRAGE ROAD REMOVAL PLAN

SHEET 3 OF 4

DESIGN FILE: I:\99188\68995\PLANS\68995REMPL03.DGN PLOT DATE: 11/07/2001 10:45:02



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SCALE IN METERS

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	56	88	

☐ REMOVAL/RELOCATE ☐

R	Remove Exist Pavement	3,789 m²
N	Remove Exist Sign, Post and Foundation	7 Ea
S	Sawcut Exist AC Pavement (See Paving Sheet)	

◯ CONSTRUCTION ◯

TWO WORKING DAYS BEFORE YOU DIG, CALL
1-800-782-5348
BLUE STAKE

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
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NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	RAH	11/01
DRAWN	MG	11/01
CHECKED	FST	11/01

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DEER VALLEY DRIVE REMOVAL PLAN

SHEET 4 OF 4

TRACS NO.

DESIGN FILE: I:\99188\68995\PLANS\68995REMPL04.DGN PLOT DATE: 11/07/2001 10:45:40

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
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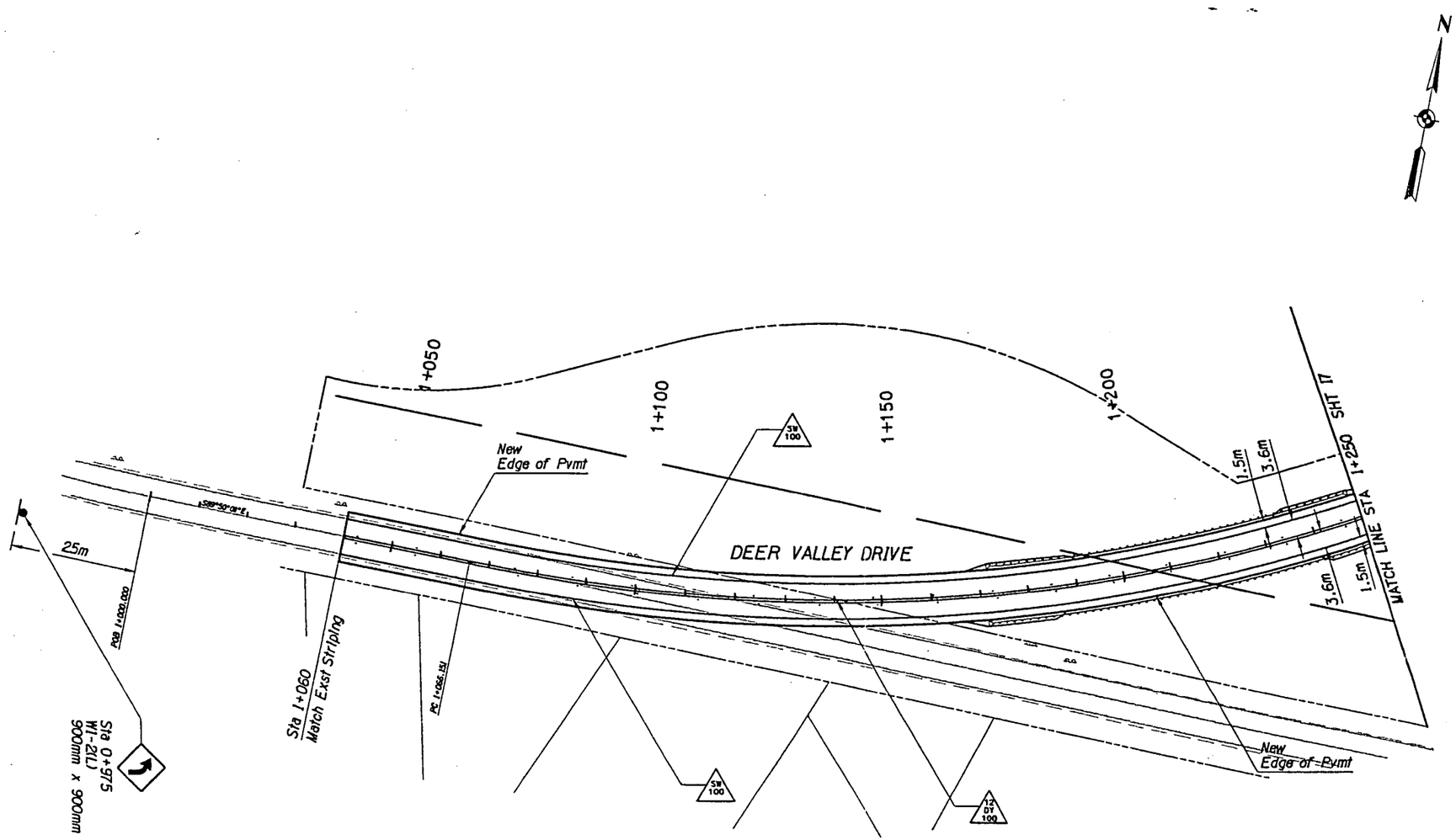


CONTRACTOR's BID QUANTITIES - METRIC UNITS

ALL SHEETS HAVE BEEN COMBINED AND INCREASED BY 10% TO ALLOW FOR FIELD ADJUSTMENTS. REFER TO THE SPEC. FOR TYPE OF MATERIAL TO USE, I.e., PAINT, THERMOPLASTIC, RPM's, TAPE, BARRIER MARKERS, ETC.

STRIPING IS BASED ON A 100 mm LINE

LONG LINE STRIPE

WHITE	470	± m
YELLOW	470	± m
TOTAL	940	± m

SHORT LINE STRIPE

WHITE	N/A	± m
YELLOW	N/A	± m
TOTAL	N/A	± m

GRAND TOTAL 940 ± m

MARKERS RAISED & BARRIER — LEGEND & QUANTITY

STIMSONITE MARKERS - 100 mm WIDTH

TYPE C = CLEAR / RED Reflective	= N/A	± Ea.
TYPE D = YELLOW, 2-WAY Reflective	= 20	± Ea.
TYPE G = CLEAR, 1-WAY Reflective	= N/A	± Ea.
TYPE H = YELLOW, 1-WAY Reflective	= N/A	± Ea.

CERAMIC BUTTON - 100 mm DIAMETER

TYPE A = WHITE Non-Reflective	= N/A	± Ea.
TYPE AY = YELLOW Non-Reflective	= N/A	± Ea.

BARRIER MARKERS BRIDGE & CONCRETE

WHITE = STIMSONITE P/N 965Y	= N/A	± Ea.
YELLOW = STIMSONITE P/N 965W	= N/A	± Ea.

BARRIER MARKERS GUARDRAIL

WHITE = REFER TO ADOT SIGNING & MARKING DRAWING No. 4-M-10.3	= 2	± Ea.
	= N/A	± Ea.

GRAND TOTAL = 22 ± Ea.

PREFORMED TAPE TYPE I - PERMANENT			ARROWS			LEGENDS	SYMBOLS
WHITE	N/A	± m	LEFT	N/A	± Ea.	A LEGEND IS A SINGLE WORD, I.e., SLOW & ONLY. STOP AHEAD IS CONSIDERED AS TWO SEPARATE LEGENDS.	SYMBOLS ARE RxR MARKINGS & BIKE LANE MARKINGS, ETC.
YELLOW	N/A	± m	RIGHT	N/A	± Ea.		
TOTAL	N/A	± m	STRAIGHT	N/A	± Ea.		
			COMBO	N/A	± Ea.		
			TOTAL	N/A	± Ea.	TOTAL N/A ± Ea.	TOTAL N/A ± Ea.

RAISED YELLOW MEDIANS & WHITE ISLANDS

YELLOW N/A ± Ea. TOTAL N/A ± Ea. TOTAL N/A ± Ea.

FOUNDATION FOR SIGN POST (P-2)	= 1	± Ea.
SLIP BASE FOR SIGN POST (P-2)	= 1	± Ea.
SIGN POST (P-2)	= 4	± M
REGULATORY SIGN PANEL	= N/A	± Sm.
WARNING SIGN PANEL	= 0.8	± Sm.
MARKER SIGN PANEL	= N/A	± Sm.

RPM NOTE: MARKERS SHALL BE PLACED SO THAT ITS REFLECTIVE FACE IS PERPENDICULAR TO TRAFFIC.

NPZ NOTE: ALL NO-PASSING ZONES WILL BE LAYED OUT IN THE FIELD BY THE ENGINEER. NPZ ON THESE PLANS ARE SUBJECT TO CHANGE.

SCALE: 1:500

10 0 10 20
SCALE IN METERS

TWO WORKING DAYS BEFORE YOU DIG, CALL
1-800-782-5348
BLUE STAKE

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	GSM	11/01
DRAWN	WBE	11/01
CHECKED	FST	11/01

ENTRANCO
WWW.ENTRANCO.COM

DEER VALLEY DRIVE SIGNING AND STRIPING
Sta 1+250 to Sta 1+030

SHEET 16 OF 17

TRACS NO.

DESIGN FILE: I:\99188\68995\PLANS\68995STRP15.DGN PLOT DATE: 11/07/2001 12:56:37

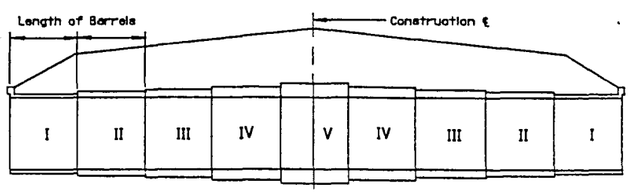
F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	10	88	

REINFORCED CONCRETE BOX CULVERT SUMMARY

DESCRIPTION				STANDARD DRAWINGS REQUIRED	LENGTH OF BARRELS										APPROXIMATE QUANTITIES					REMARKS
					Left of ℄ ▲					Right of ℄ ▲										
STATION	PLAN REF. NO. ◯	STRUC NO.	SIZE		I	II	III	IV	V	V	IV	III	II	I	Struc Exc CM	Class S f'_c=3000psi Concrete CM	Reinforcing Steel Kg.	Structure Backfill CM	Drainage Exc CM	
0+236.460m³ DV	2	2	3-3.0m x 1.8m	B-02.30, B-04.10, B-04.30	23.9									23.8	1578	420.0	40,948	648.0	0.0	Detail D1
Total															1578	420.0	40,948	648.0	0.0	

55 Reference numbers correspond to numbers in circles on PLAN SHEETS.

NOTE:
FOR STRUCTURAL EXCAVATION AND STRUCTURE BACKFILL PLACEMENT AND MEASUREMENT, SEE STANDARD DRAWINGS C-13.35, C-13.45 AND C-13.50.



▲ Construction ℄ (Looking Ahead).

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

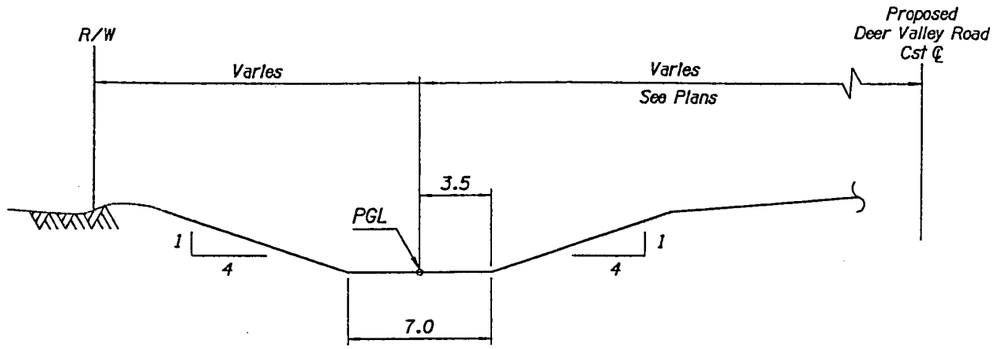
90%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	MAL	11/01
DRAWN	MGR	11/01
CHECKED	JH	11/01

PREMIER

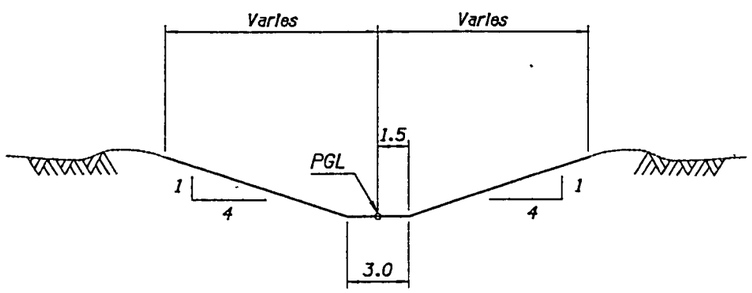
BOX CULVERT SUMMARY SHEET

SHEET OF



DEER VALLEY CHANNEL

Channel Sta 0+080.000 To Sta 0+740.000



EL MIRAGE CHANNEL

Channel Sta 0+079.911 To Sta 0+254.167

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	59	88	

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

TWO WORKING DAYS BEFORE YOU DIG, CALL **263-1100** BLUE STAKE

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	MAL	11/01
DRAWN	MGR	11/01
CHECKED	JH	11/01

PREMIER

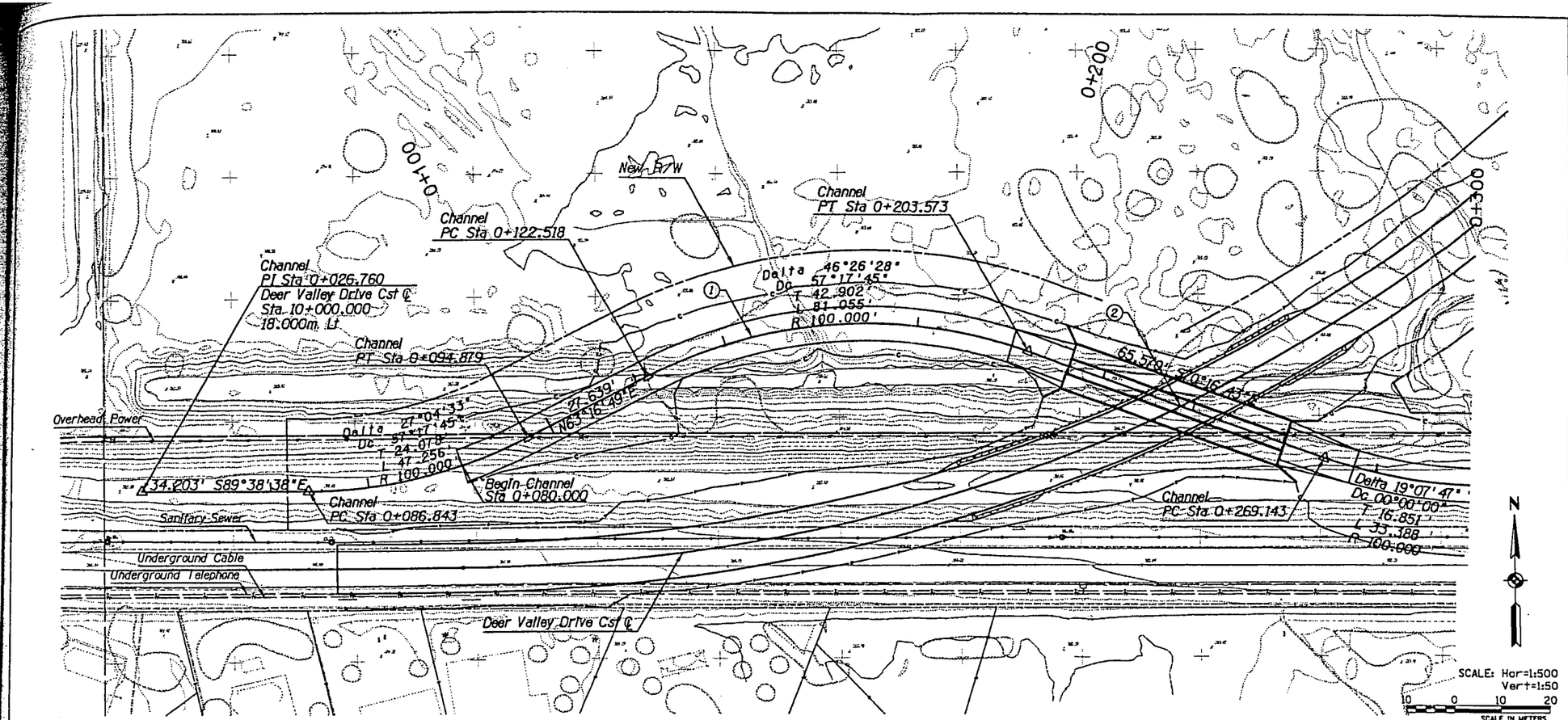
TYPICAL SECTIONS

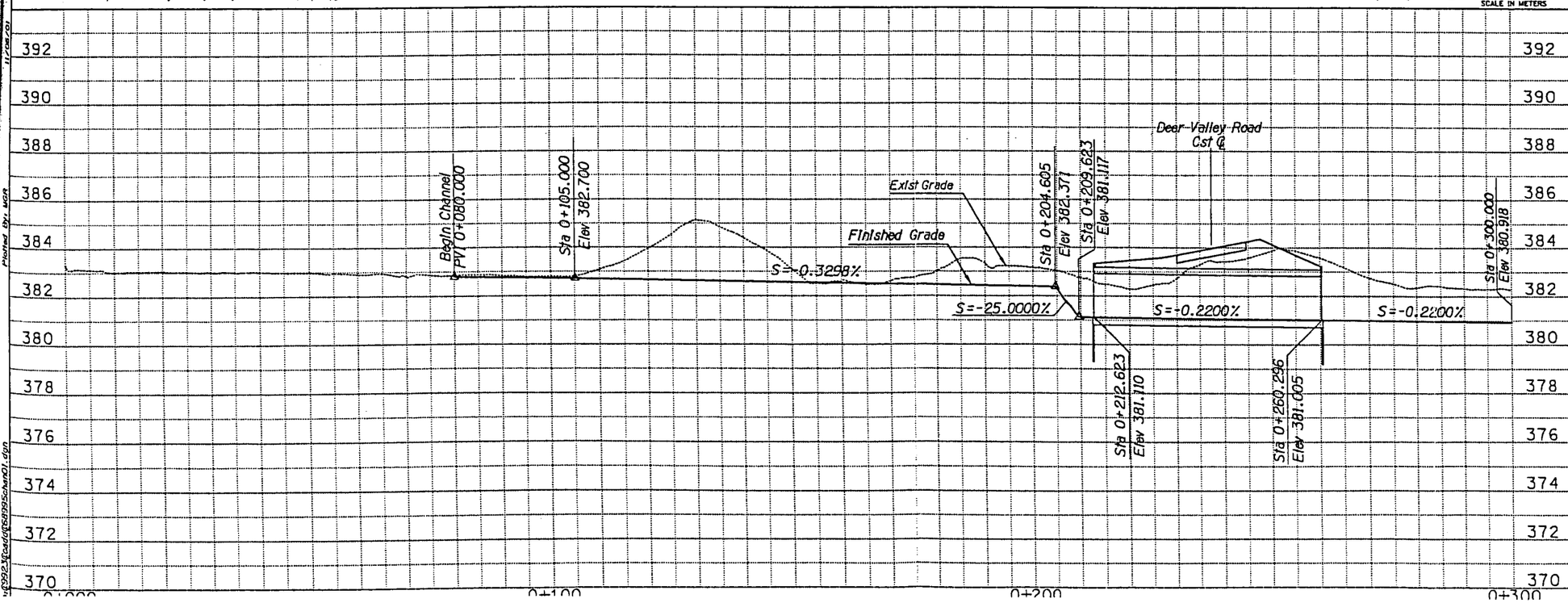
SHEET 1 OF 1

p:\992\3\cadd\68995typ01.dgn Plotted By: MGR 11/08/01

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	60	88	

☐ REMOVAL/RELOCATE ☐





CONSTRUCTION

1. Channel Excavation
2. Channel Sta 0+212.623 to Sta 0+260.296 New 3-3.0m x 1.8m x 47.7m CBC; Skew 45°Lt w/Headwalls ADOT B-02.30; B-04.10 B-04.30; 4:1

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	MAL	11/01
DRAWN	MGR	11/01
CHECKED	JH	11/01

PREMIER

CHANNEL PLAN AND PROFILE
Sta 0+000 to Sta 0+300

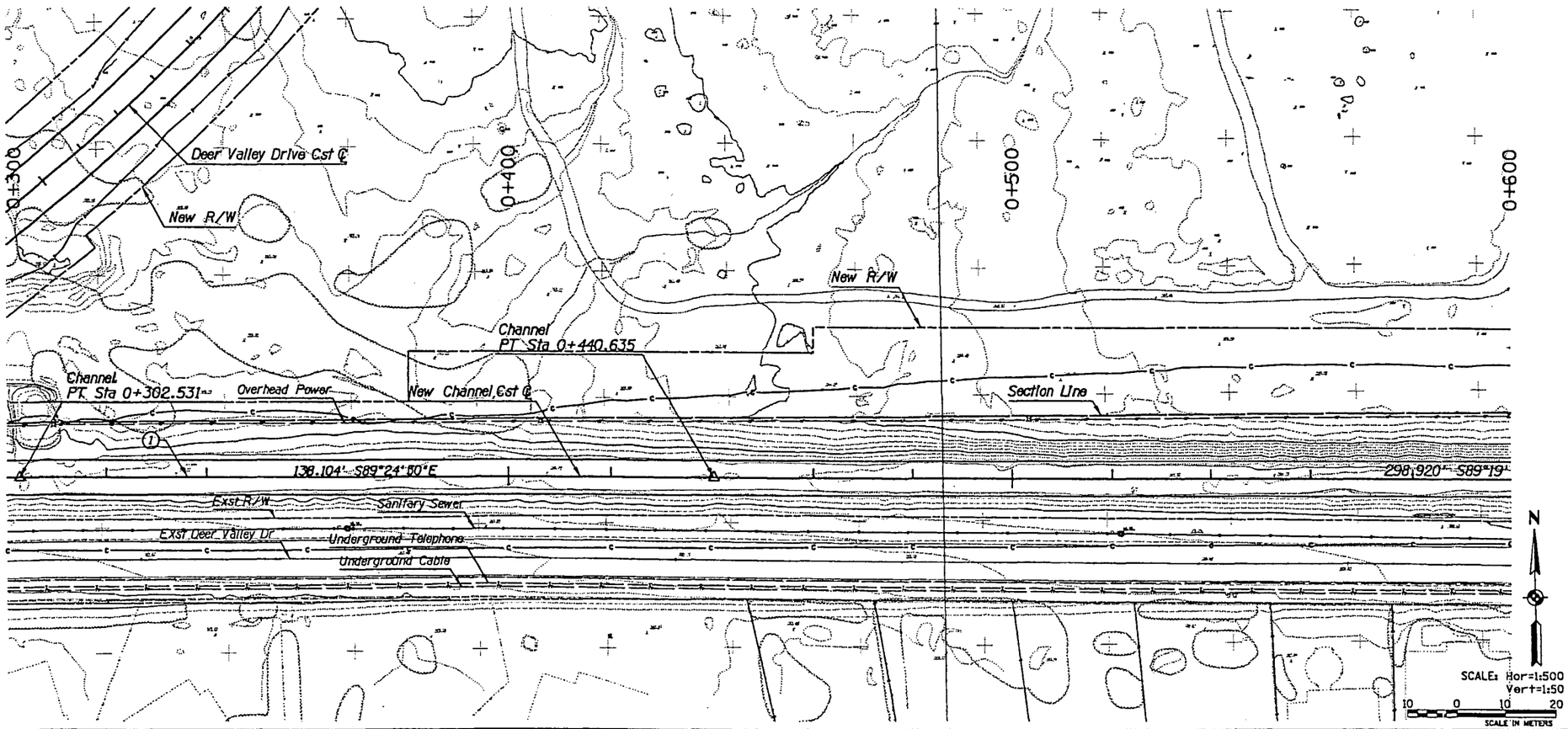
SHEET 1 OF 5

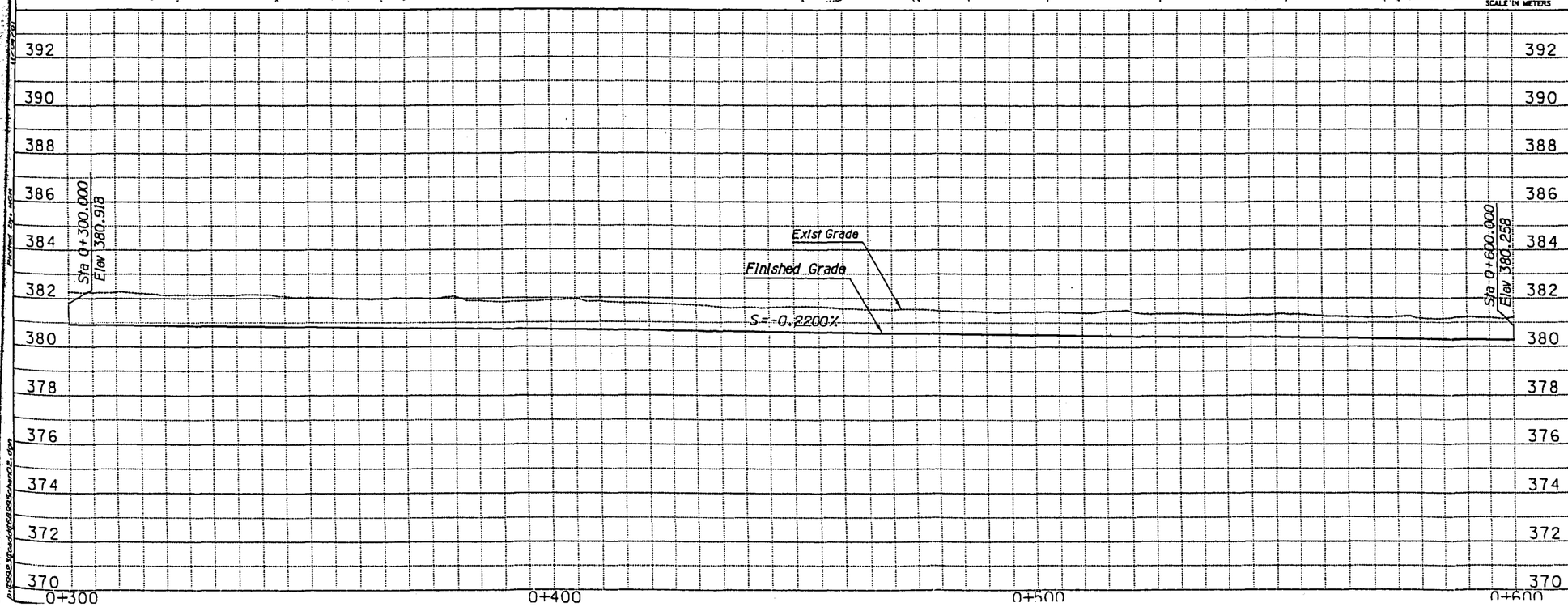
Plotted by: MGR 11/06/01

u:\0992\fpaq\68995chan01.dgn

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	61	88	

☐ REMOVAL/RELOCATE ☐





☐ CONSTRUCTION ☐

(1) Channel Excavation

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	MAL	11/01
DRAWN	MGR	11/01
CHECKED	JH	11/01

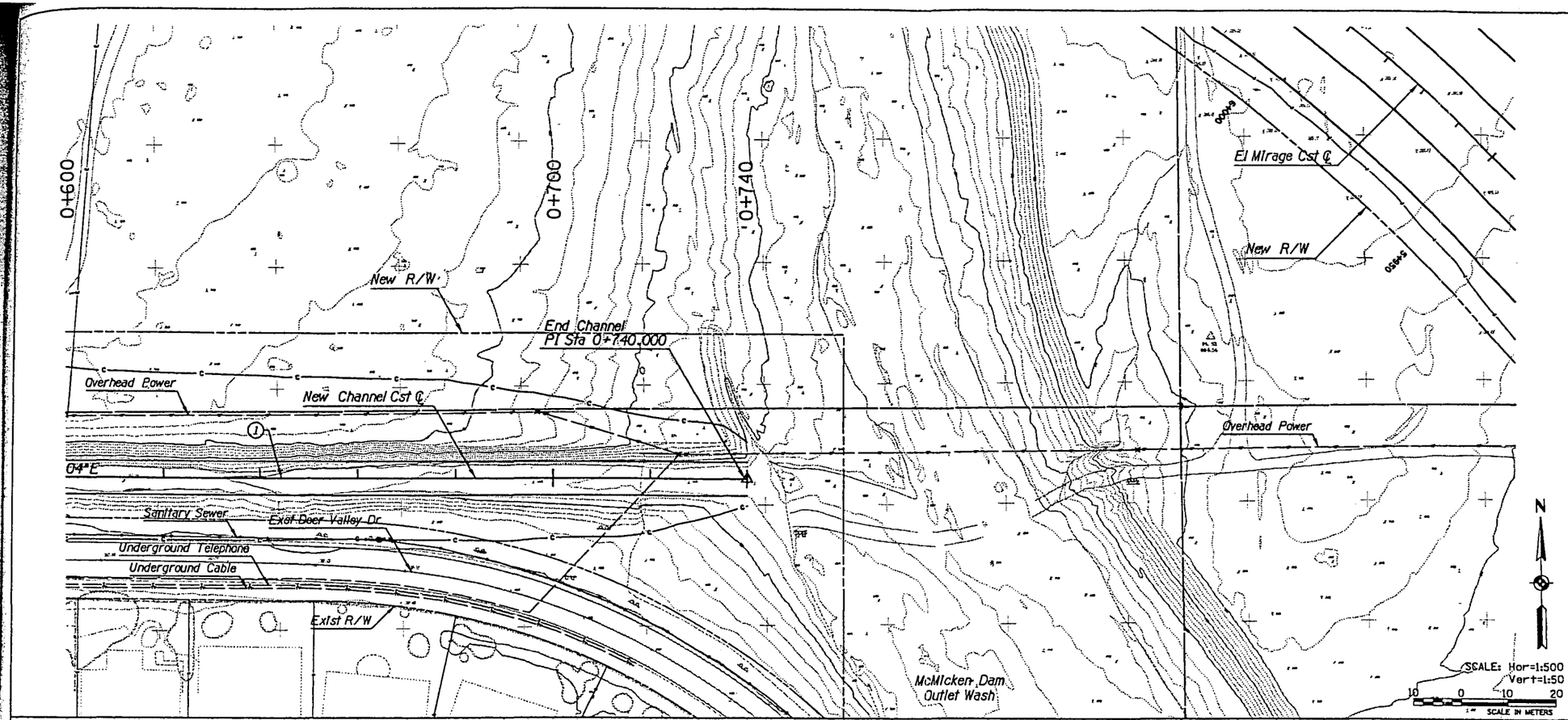
PREMIER

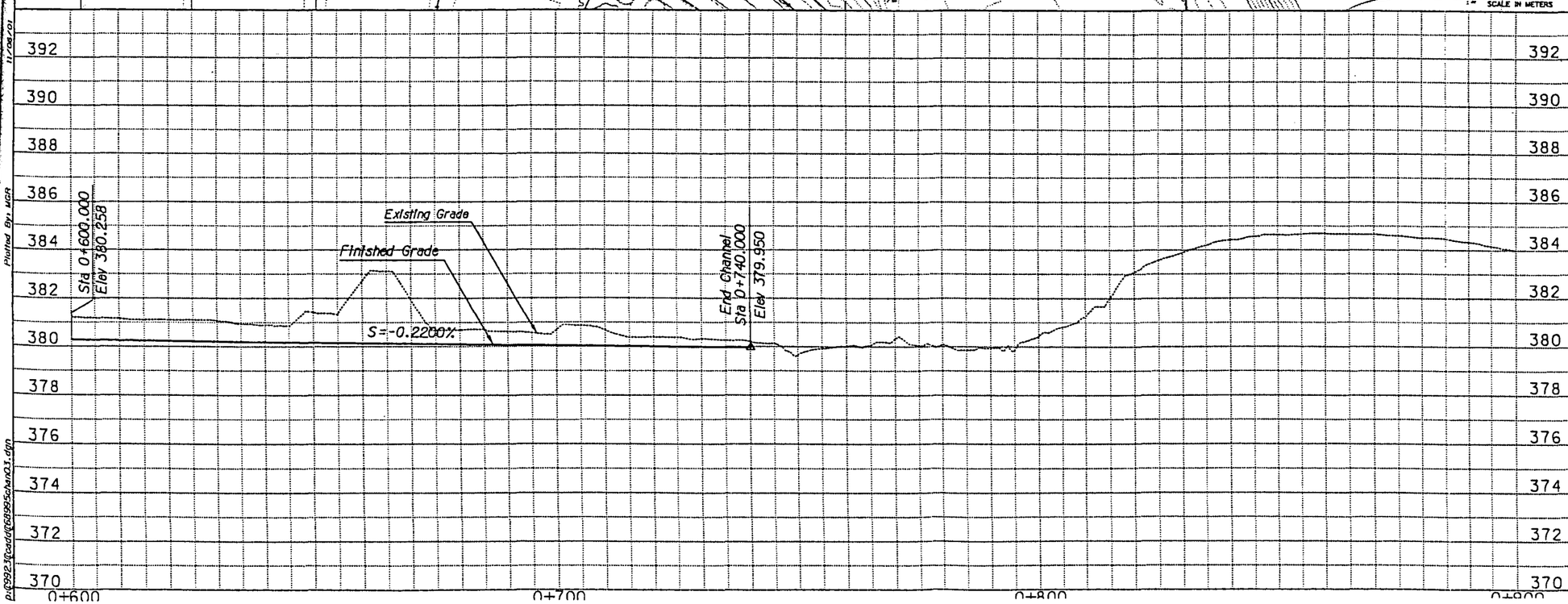
CHANNEL PLAN AND PROFILE
Sta 0+300 to Sta 0+600

SHEET 2 OF 5

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	62	88	

☐ REMOVAL/RELOCATE ☐





(1) Channel Excavation

○ CONSTRUCTION ○

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

	BY	DATE
DESIGNED	MAL	11/01
DRAWN	MGR	11/01
CHECKED	JH	11/01

90%
PRELIMINARY
NOT FOR
CONSTRUCTION

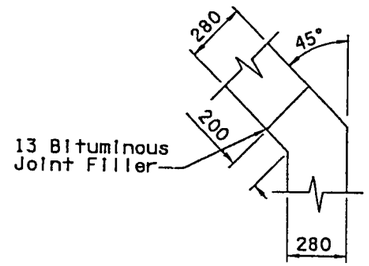
PREMIER

CHANNEL PLAN AND PROFILE
Sta 0+600 to Sta 0+900

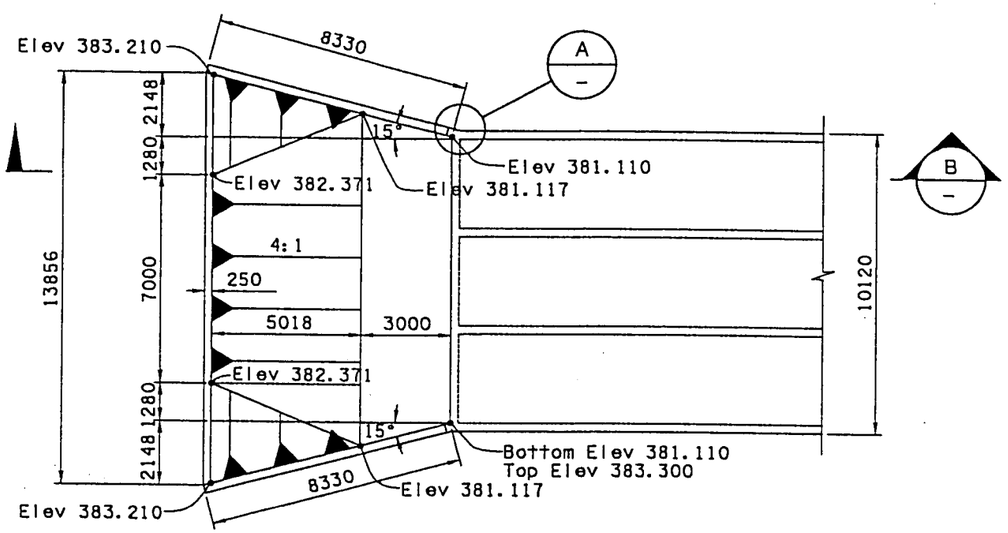
SHEET 3 OF 5

p:\9992.3\road\68995chnr03.dgn Plotted By: MGR 11/08/01

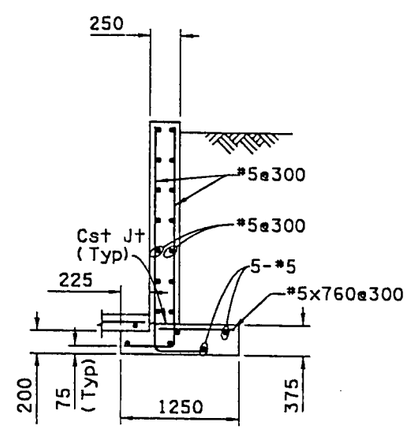
F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.	68995	68	88	



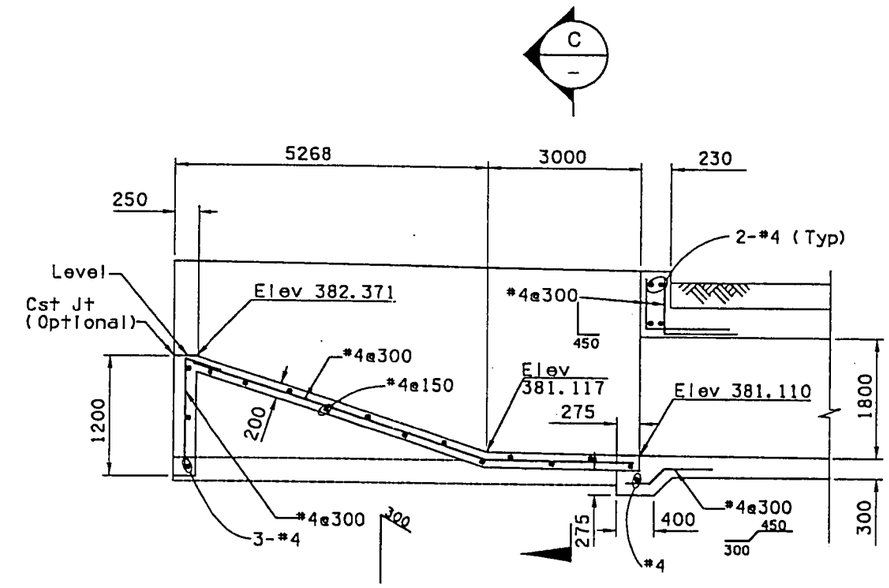
DETAIL A
N. T. S.



INLET PLAN VIEW
N. T. S.



SECTION C
N. T. S.



SECTION B
N. T. S.

DETAIL D1

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

EL MIRAGE ROAD
BEARDSLEY ROAD TO LOOP 303
PROJECT NO. 68995

90%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	MAL	11/01
DRAWN	MGR	11/01
CHECKED	JH	11/01

PREMIER

DROP STRUCTURE DETAIL

SHEET 4 OF 4

p:\6992.3\cadd\68995det01.dgn
Plotted By: MGR
11/28/01

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX A

HEC-RAS Cross-Sections and Hydraulic Data Output Table
for the Deer Valley Drive Drainage Channel
(DeerValleyDriveChnlRev00.prj)

HEC-RAS Plan: exst100yr River: DeerValleyDrChan Reach: Lower Profile: PF 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)	
Lower	0.44	1620.00	1252.28	1257.72	1257.64	1259.48	0.004655	10.64	152.22	41.22	0.98
Lower	.36	1620.00	1250.79	1256.51		1257.74	0.003081	8.90	182.12	47.72	0.80
Lower	.30	1620.00	1249.87	1255.92		1256.84	0.002151	7.68	210.95	52.90	0.68
Lower	.22	1620.00	1249.49	1255.07		1255.93	0.002085	7.43	220.38	67.67	0.67
Lower	.15	1620.00	1247.94	1254.30	1253.07	1255.17	0.001990	7.49	216.35	53.76	0.65
Lower	.06	1620.00	1247.29	1252.00	1252.00	1253.67	0.004997	10.37	156.20	47.23	1.00
Lower	0	1620.00	1246.22	1251.07	1250.35	1251.81	0.002601	6.94	233.59	80.71	0.72

SCT #16392
DEER VALLEY DRIVE CHNL
DEERVALLEYDRIVECHNL,REVOO.PRJ

Deer Valley Drive Drainage Channel
Cross-Sections
SCI #16392

River Station 0.44			River Station 0.36			River Station 0.30		
Station	Elevation	Desc.	Station	Elevation	Desc.	Station	Elevation	Desc.
960.6	1262.13		960.7	1260.72		962.1	1257.54	
970.6	1262.01	TB	969.7	1261.81	TB	971.1	1258.42	TB
992.6	1252.3	TOE	991.7	1250.93	TOE	991.1	1249.87	TOE
1000	1252.29	FL	1000	1250.86	FL	1000	1249.95	FL
1007.4	1252.28	TOE	1008.3	1250.79	TOE	1008.9	1250.02	TOE
1026.4	1259.6	TB	1032.3	1257.72	TB	1031.9	1256.5	TB
1037.4	1260.38		1037.3	1258.27		1039.9	1257.1	

River Station 0.22			River Station 0.15			River Station 0.06		
Station	Elevation	Desc.	Station	Elevation	Desc.	Station	Elevation	Desc.
960.6	1254.83		950.1	1259.47		943.1	1260.26	
971.6	1254.85	TB	961.1	1259.81	TB	954.1	1260.34	TB
989.6	1249.5	TOE	990.1	1248.87	TOE	989.1	1247.66	TOE
1000	1249.5	FL	1000	1248.41	FL	1000	1247.48	FL
1010.4	1249.49	TOE	1009.9	1247.94	TOE	1010.9	1247.29	TOE
1028.4	1255.11	TB	1028.9	1254.27	TB	1024.9	1252.19	TB
1034.8	1255.9		1035.9	1254.61		1032.9	1253.01	

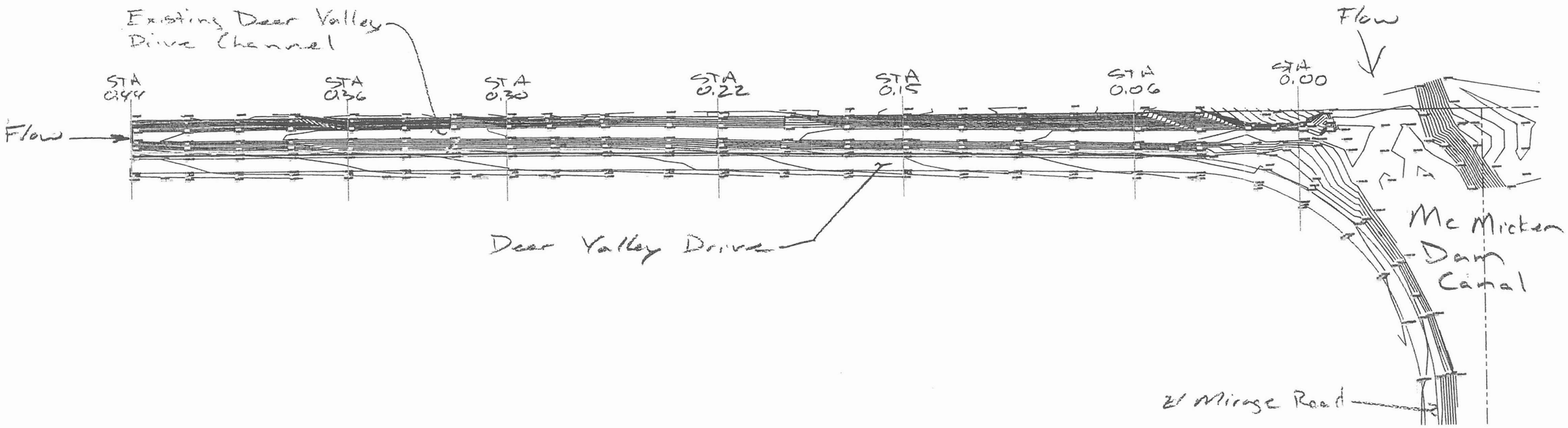
River Station 0.00		
Station	Elevation	Desc.
974.8	1252.44	TB
991.8	1246.33	TOE
1000	1246.28	FL
1008.2	1246.22	TOE
1069.2	1252	TB
1096.2	1253	

Sections from drawing filename Q:\16392\Schalk\AutoCAD\Proposed 7' offset from existing sewer.dwg

CXI # 16892

N

1" = 200'



Notes:
1. Stationing in river miles.

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

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

PROJECT DATA
Project Title: Deer Valley Drive Channel, Rev00
Project File : DeerValleyDriveChnlRev00.prj
Run Date and Time: 12/23/2002 1:58:02 PM

Project in English units

Project Description:
SCI #16392
Pleasant Valley Country Club
Sewer Line Adjacent to Deer Valley
Drive Channel (south side)

Existing geometry based on SCI Survey,
drawing
Q:\16392\Schalk\AutoCAD\Proposed 7' offset from existing sewer.dwg

Flow
based on 1989 Wittmann ADMS 100-yr HEC-1 model, ID #C130, Q = 1620cfs.
HEC-1
called "WTM100YR"

Channel outfalls (Sta 0.00) into Agua Fria River near El
Mirage Road alignment.

PLAN DATA

Plan Title: Existing, SCI Survey, 1989 ADMS 100YR
Plan File : q:\16392\Drainage\HEC-RAS\DeerValleyDriveChnlRev00.p01

Geometry Title: Deer Valley Channel Existing, SCI Survey
Geometry File : q:\16392\Drainage\HEC-RAS\DeerValleyDriveChnlRev00.g01

Flow Title : 1989 Wittmann ADMS, HEC-1 ID #C130
Flow File : q:\16392\Drainage\HEC-RAS\DeerValleyDriveChnlRev00.f01

Plan Summary Information:

Number of:	Cross Sections =	7	Mulitple Openings =	0
	Culverts =	0	Inline Weirs =	0
	Bridges =	0		

Computational Information
Water surface calculation tolerance = 0.003

```
    Critical depth calculaton tolerance =  0.003
    Maximum number of interations       =  20
    Maximum difference tolerance        =  0.1
    Flow tolerance factor               =  0.001

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



FLOW DATA

Flow Title: 1989 Wittmann ADMS, HEC-1 ID #C130
Flow File : q:\16392\Drainage\HEC-RAS\DeerValleyDriveChnlRev00.f01

Flow Data (cfs)

  River           Reach           RS                  PF 1
  Deer Valley DrivLower           0.44                1620
  DeerValleyDrChanLower           0.44                1620


Boundary Conditions

  River           Reach           Profile                       Upstream                Downstream

  DeerValleyDrChanLower           PF 1                                                Normal S = .0026



GEOMETRY DATA

Geometry Title: Deer Valley Channel Existing, SCI Survey
Geometry File : q:\16392\Drainage\HEC-RAS\DeerValleyDriveChnlRev00.g01

CROSS SECTION          RIVER: DeerValleyDrChan
REACH: Lower              RS: 0.44

INPUT
Description: River Station 0.44
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   960.6 1262.13   970.6 1262.01   992.6  1252.3    1000 1252.29  1007.4 1252.28
  1026.4  1259.6  1037.4 1260.38

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   960.6     .03   970.6    .022  1026.4     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         970.6  1026.4              422     422     422             .1       .3

CROSS SECTION          RIVER: DeerValleyDrChan
REACH: Lower              RS: .36

INPUT
Description: River Station 0.36
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   960.7 1260.72   969.7 1261.81   991.7 1250.93    1000 1250.86  1008.3 1250.79
  1032.3 1257.72  1037.3 1258.27
```

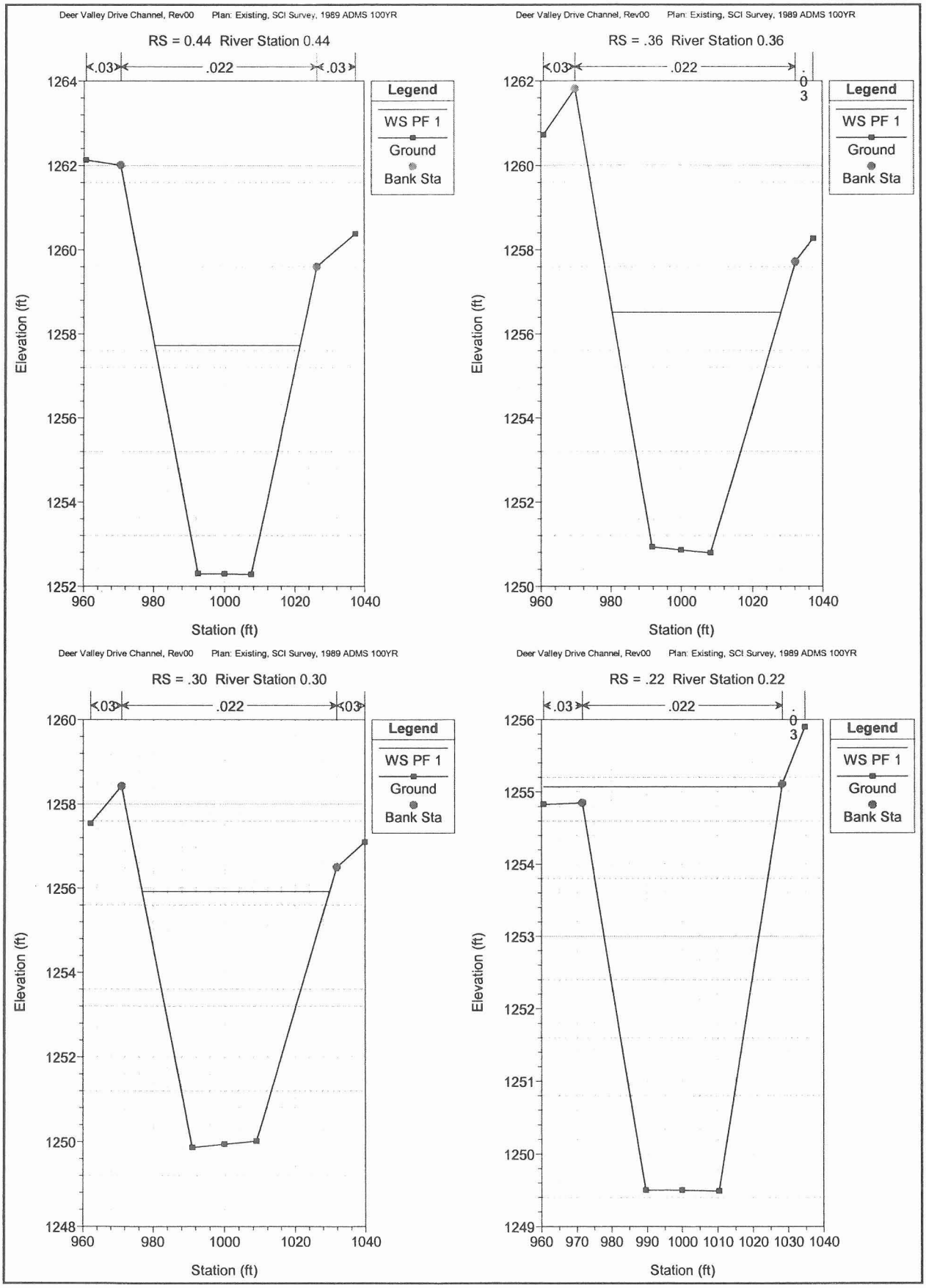
```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   960.7     .03   969.7    .022  1032.3     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         969.7  1032.3              317     317     317             .1       .3

CROSS SECTION          RIVER: DeerValleyDrChan
REACH: Lower              RS: .30

INPUT
Description: River Station 0.30
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   962.1 1257.54   971.1 1258.42   991.1 1249.87    1000 1249.95  1008.9 1250.02
  1031.9  1256.5  1039.9  1257.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   962.1     .03   971.1    .022  1031.9     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         971.1  1031.9              422     422     422             .1       .3

CROSS SECTION          RIVER: DeerValleyDrChan
REACH: Lower              RS: .22

INPUT
Description: River Station 0.22
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   960.6 1254.83   971.6 1254.85   989.6  1249.5    1000  1249.5  1010.4 1249.49
  1028.4 1255.11  1034.8  1255.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   960.6     .03   971.6    .022  1028.4     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         971.6  1028.4              370     370     370             .1       .3

CROSS SECTION          RIVER: DeerValleyDrChan
REACH: Lower              RS: .15

INPUT
Description: River Station 0.15
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   950.1 1259.47   961.1 1259.81   990.1 1248.87    1000 1248.41  1009.9 1247.94
  1028.9 1254.27  1035.9 1254.61

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   950.1     .03   961.1    .022  1028.9     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         961.1  1028.9              475     475     475             .1       .3

CROSS SECTION          RIVER: DeerValleyDrChan
REACH: Lower              RS: .06

INPUT
Description: River Station 0.06
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

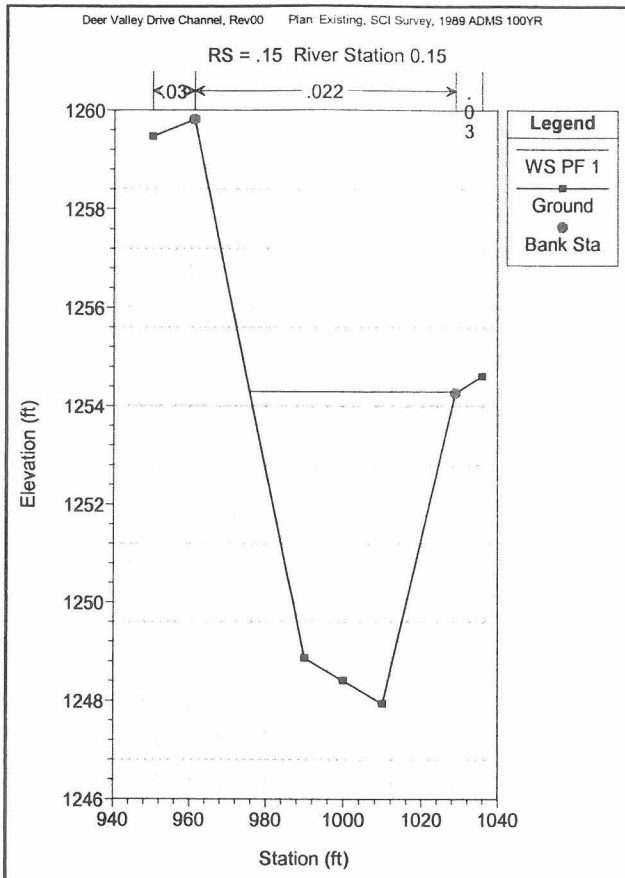
```
   943.1 1260.26   954.1 1260.34   989.1 1247.66    1000 1247.48  1010.9 1247.29
  1024.9 1252.19  1032.9 1253.01

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   943.1     .03   954.1    .022  1024.9     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         954.1  1024.9              317     317     317             .1       .3

CROSS SECTION          RIVER: DeerValleyDrChan
REACH: Lower              RS: 0

INPUT
Description: River Station 0.00
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   974.8 1252.44   991.8 1246.33    1000 1246.28  1008.2 1246.22  1069.2    1252
  1096.2    1253

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   974.8     .03   974.8    .022  1069.2     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         974.8  1069.2                0       0       0             .1       .3


SUMMARY OF MANNING'S N VALUES

River:DeerValleyDrChan

      Reach          River Sta.       n1        n2        n3

 Lower                0.44              .03      .022       .03
 Lower                .36               .03      .022       .03
 Lower                .30               .03      .022       .03
 Lower                .22               .03      .022       .03
 Lower                .15               .03      .022       .03
 Lower                .06               .03      .022       .03
 Lower                0                 .03      .022       .03


SUMMARY OF REACH LENGTHS

River: DeerValleyDrChan

      Reach          River Sta.      Left     Channel    Right

 Lower                0.44              422       422       422
 Lower                .36               317       317       317
 Lower                .30               422       422       422
 Lower                .22               370       370       370
 Lower                .15               475       475       475
 Lower                .06               317       317       317
 Lower                0                   0         0         0


SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: DeerValleyDrChan
```

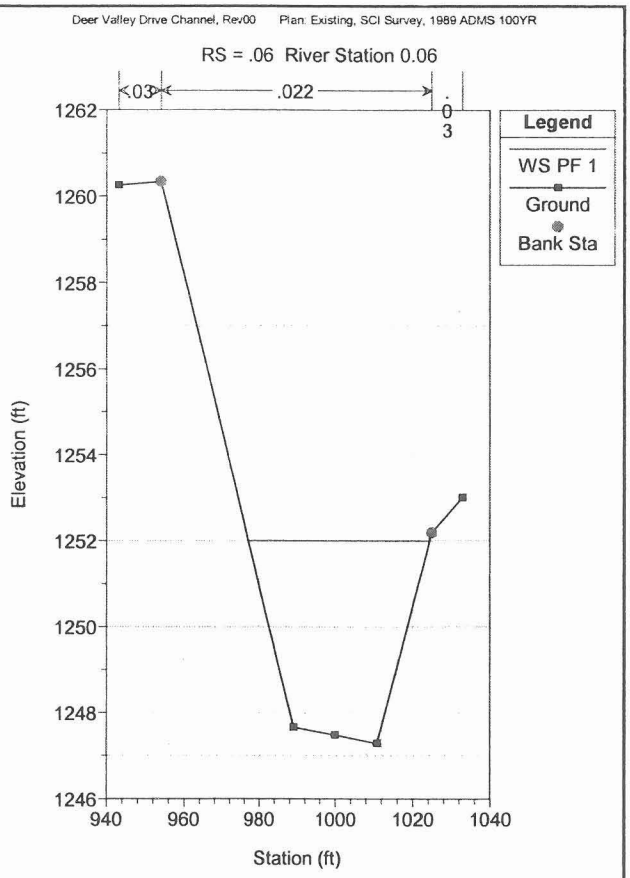
Reach	River Sta.	Contr.	Expan.
Lower	0.44	.1	.3
Lower	.36	.1	.3
Lower	.30	.1	.3
Lower	.22	.1	.3
Lower	.15	.1	.3
Lower	.06	.1	.3
Lower	0	.1	.3

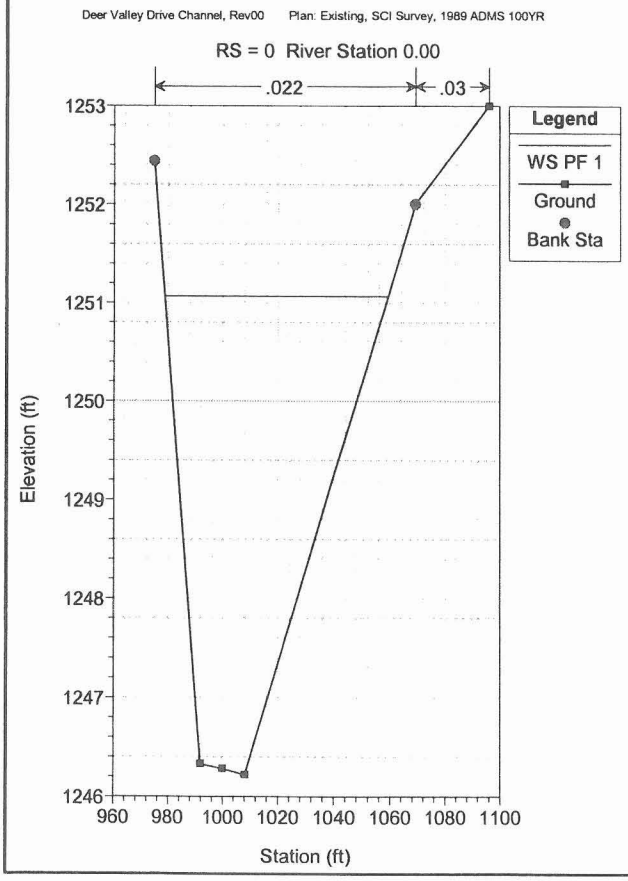
Profile Output Table - Standard Table 1

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	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Lower	0.44	1620.00	1252.28	1257.72	1257.64	1259.48	0.004655	10.64	152.22	41.22	0.98
Lower	.36	1620.00	1250.79	1256.51		1257.74	0.003081	8.90	182.12	47.72	0.80
Lower	.30	1620.00	1249.87	1255.92		1256.84	0.002151	7.68	210.95	52.90	0.68
Lower	.22	1620.00	1249.49	1255.07		1255.93	0.002085	7.43	220.38	67.67	0.67
Lower	.15	1620.00	1247.94	1254.30	1253.07	1255.17	0.001990	7.49	216.35	53.76	0.65
Lower	.06	1620.00	1247.29	1252.00	1252.00	1253.67	0.004997	10.37	156.20	47.23	1.00
Lower	0	1620.00	1246.22	1251.07	1250.35	1251.81	0.002601	6.94	233.59	80.71	0.72


Deer Valley Drive Channel, Rev00 Plan: Existing, SCI Survey, 1989 ADMS 100YR
RS = 0.44 River Station 0.44
.03
.022
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Deer Valley Drive Channel, Rev00 Plan: Existing, SCI Survey, 1989 ADMS 100YR
RS = .36 River Station 0.36
.03
.022
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Deer Valley Drive Channel, Rev00 Plan: Existing, SCI Survey, 1989 ADMS 100YR
RS = .30 River Station 0.30
.03
.022
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Deer Valley Drive Channel, Rev00 Plan: Existing, SCI Survey, 1989 ADMS 100YR
RS = .22 River Station 0.22
.03
.022
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Deer Valley Drive Channel, Rev00 Plan: Existing, SCI Survey, 1989 ADMS 100YR
RS = .15 River Station 0.15
.03
.022
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1260
1258
1256
1254
1252
1250
1248
1246
940
960
980
1000
1020
1040


Deer Valley Drive Channel, Rev00 Plan: Existing, SCI Survey, 1989 ADMS 100YR
RS = .06 River Station 0.06
.03
.022
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1262
1260
1258
1256
1254
1252
1250
1248
1246
940
960
980
1000
1020
1040


Deer Valley Drive Channel, Rev00 Plan: Existing, SCI Survey, 1989 ADMS 100YR
RS = 0 River Station 0.00
.022
.03
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1253
1252
1251
1250
1249
1248
1247
1246
960
980
1000
1020
1040
1060
1080
1100

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX A

Deer Valley Drive Drainage Channel Level I Scour Analysis
Calculations and Supporting Documentation

Stanley Consultants INC.

Project No. 16392 Page No.

Subject Deer Valley Drive Channel Scour Estimate

Computed by B. Schalk Date 12-23-02

Checked by Date

Approved by Date

Sheet No. of

Method Used: Arizona Department of Water Resources - Flood Warning And Dam Safety Section, State Standard for Watercourse System Sediment Balance - Guideline 2, Channel Degradation Estimation for Alluvial Channels in Arizona, Level I

Level I Analysis:

$d_s = d_{gs} + d_{lts}$

d_s = Total scour depth (ft)
d_{gs} = General degradation (ft)
d_{lts} = Long term degradation (ft)

$d_{gs} = 0.157 (Q_{100})^{0.4}$ (straight channel reaches)
$= (0.157)(1{,}620 \text{ cfs})^{0.4}$
$= 3.0$ ft

$d_{lts} = 0.02 (Q_{100})^{0.6}$
$= (0.02)(1{,}620 \text{ cfs})^{0.6}$
$= 1.7$ ft

$d_s = 3.0 \text{ ft} + 1.7 \text{ ft}$
$= 4.7$ ft

$\boxed{\text{Total Scour} = d_s = 5 \text{ ft}}$

Note: Q_{100} = 1,620 cfs based on 1989 Wittmann ADMS, 100-YR HEC-1 Model "WTM100YR", HEC-1 I.D. # C130

SC 3004R4 898

Procedure

General

Three levels of procedures for estimation of channel degradation depth are described in the following paragraphs. The first level of analysis provides an initial estimate of the potential scour depth to consider for design of structures to be placed near a streambed or along the banks of a channel. This first level of analysis is recommended only for channel reaches that are expected to be in general balance with the surrounding system -- i.e. no major disturbances (dams, bridges, encroachments, etc..) are evident in the site vicinity -- and where the desire is to establish a "safe" scour depth to allow for the concentration of flows that can naturally occur within channels composed of erodible material. The Level II procedures provided are methods for demonstrating the site specific limits to erosion potential, involving computations which require local hydraulic information and sediment size distributions, or historical evidence of channel performance. The third level of procedures outlined will provide more definitive determination of channel stability in the reaches under study. This level of analysis is recommended in areas where local flow characteristics are complex, where the channel has been redirected or otherwise modified by acts of man, or where the safety of local paralleling or crossing structures is of high concern.

Level I

This level of analysis requires the following information :

> Peak discharge associated with the 100-year flood (Q_{100}). May be estimated using simplified methodologies such as ADWR State Standard #2 (SS 2-96), USGS regression equations, or other appropriate local or more detailed methods.

The total scour depth, d_s, is the combination of general degradation and long term degradation and can be computed as follows:

$$d_s = d_{gs} + d_{lts}$$

where:

d_s = Total scour depth, in feet
d_{gs} = General degradation, in feet
d_{lts} = Long term degradation, in feet

General degradation can be computed as follows:

$$d_{gs} = 0.157(Q_{100})^{0.4} \quad \text{for straight channel reaches.}$$

and

$$d_{gs} = 0.219(Q_{100})^{0.4} \quad \text{for channel reaches with curvature.}$$

The second equation will give the worst-case scour for channel curvature. and is not recommended unless significant curvature is evident along the channel reach.

Long term degradation can be computed as follows:

$$d_{lts} = 0.02(Q_{100})^{0.6}$$

This equation for long term degradation should only be used when no downstream controls exist within the channel system.

The total scour depth, d_s, should be applied to the lowest point in the local cross section for determination of the elevation to which scour will occur.

For Level I, the minimum total scour depth, d_s, shall be 3 feet.

Level II

The Level II approaches presented below may be used to demonstrate the ability of the existing channel system to resist degradation, and to justify a lesser burial requirement than that computed using the Level I equations.

Erodibility evaluation

Three procedures for determination of the erodibility of local channel material under computed hydraulic conditions are presented in the ADWR's State Standard for Lateral Migration Setback Allowance for Riverine Floodplains in Arizona. These procedures are: (1) the allowable velocity approach; (2) the tractive stress approach; and, (3) the tractive power approach. One or more of these procedures can be used to demonstrate the adequacy of the material of which the channel is composed to resist the erosive action of the flow under 100 year flow conditions.

Armoring potential evaluation.

An evaluation of relative channel stability can be made by evaluating incipient motion parameters and determining armoring potential. The definition of incipient motion is based on the critical or threshold condition where hydrodynamic forces acting on a grain of sediment have reached a value that, if increased even slightly, will move the grain. Under critical conditions, or at the point of incipient motion, the hydrodynamic forces acting on the grain are just balanced by the resisting forces of the particle. For given hydrodynamic forces, or equivalently for a given discharge, incipient motion conditions will exist for a single particle size. Particles smaller than this will be transported downstream and particles equal to or larger than this will remain in place.

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX B

1989 Wittmann ADMS HEC-2 Model Imported Into HEC-RAS
(McMicDamCnlRev00)

McMicDam

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

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

PROJECT DATA
Project Title: McMicken Dam Canal, HEC-2, Rev00
Project File : McMicDamCnlRev00.prj
Run Date and Time: 3/14/2003 9:19:20 AM

Project in English units

Project Description:
HEC-2 FLOODPLAIN AND FLOODWAY ANALYSIS - WITTMANN ADMS
100-YEAR STORM EVENT
(NO ENCROACHMENT)
MCMICKEN DAM OUTLET WASH

The imported HEC-2 model (used
to generate this HEC-RAS model) was given to Stanley, from the FCD. The
original HEC-2 file name is MCWSH.DAT.

Standard Project Flood (SPF) from
Wittmann ADMS results is equal to 16,443 cfs and is used in HEC-RAS Plan and
Steady Flow Data called "Wittmann ADMS Flow Data, 3-10-98".

PLAN DATA

Plan Title: Imported Plan 01
Plan File : q:\16392\Schalk\HEC-RAS\McMicDamCnlRev00.p01

Geometry Title: Imported Geom 01
Geometry File : q:\16392\Schalk\HEC-RAS\McMicDamCnlRev00.g01

Flow Title : Imported Flow 01
Flow File : q:\16392\Schalk\HEC-RAS\McMicDamCnlRev00.f01

Plan Summary Information:
Number of: Cross Sections = 55 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculaton tolerance = 0.003

McMicDam

Maximum number of interations = 20
Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

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

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
0	PF 2	4	1	
0.107	PF 2	4	1	
0.159	PF 2	4	1	
0.238	PF 2	4	1	
0.35	PF 2	4	1	
0.437	PF 2	4	1	
0.527	PF 2	4	1	
0.579	PF 2	4	1	
0.647	PF 2	4	1	
0.746	PF 2	4	1	
0.833	PF 2	4	1	
0.946	PF 2	4	1	
1.058	PF 2	4	1	
1.169	PF 2	4	1	
1.191	PF 2	4	1	
1.213	PF 2	4	1	
1.251	PF 2	4	1	
1.286	PF 2	4	1	
1.307	PF 2	4	1	
1.381	PF 2	4	1	
1.479	PF 2	4	1	
1.593	PF 2	4	1	
1.708	PF 2	4	1	
1.788	PF 2	4	1	
1.858	PF 2	4	1	
1.949	PF 2	4	1	
2.034	PF 2	1	4970	5150
2.118	PF 2	1	4945	5145
2.208	PF 2	1	4835	5050
2.31	PF 2	1	4850	5050
2.395	PF 2	1	4880	5100
2.486	PF 2	1	4900	5085
2.588	PF 2	1	4895	5105
2.691	PF 2	1	4975	5165
2.774	PF 2	1	4950	5130
2.867	PF 2	1	4920	5160
2.937	PF 2	1	4860	5190
3.011	PF 2	1	4930	5280
3.14	PF 2	1	4870	5235
3.247	PF 2	1	4900	5200
3.354	PF 2	1	4830	5140
3.465	PF 2	1	4750	5070
3.563	PF 2	1	4700	5040
3.656	PF 2	1	4650	5100
3.737	PF 2	1	4750	5100
3.816	PF 2	1	4720	5100

			McMicDam	
3.879	PF 2	1	4850	5150
3.945	PF 2	1	4850	5090
4.015	PF 2	1	4957	5099
4.053	PF 2	1	4950	5197
4.148	PF 2	1	4953	5370
4.254	PF 2	1	4960	5303
4.36	PF 2	1	4866	5234
4.457	PF 2	1	4795	5185
4.554	PF 2	1	4890	5162

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
0	PF 3	0	0	0
0.107	PF 3	0	0	0
0.159	PF 3	0	0	0
0.238	PF 3	0	0	0
0.35	PF 3	0	0	0
0.437	PF 3	0	0	0
0.527	PF 3	0	0	0
0.579	PF 3	0	0	0
0.647	PF 3	0	0	0
0.746	PF 3	0	0	0
0.833	PF 3	0	0	0
0.946	PF 3	0	0	0
1.058	PF 3	0	0	0
1.169	PF 3	0	0	0
1.191	PF 3	0	0	0
1.213	PF 3	0	0	0
1.251	PF 3	0	0	0
1.286	PF 3	0	0	0
1.307	PF 3	0	0	0
1.381	PF 3	0	0	0
1.479	PF 3	0	0	0
1.593	PF 3	0	0	0
1.708	PF 3	0	0	0
1.788	PF 3	0	0	0
1.858	PF 3	0	0	0
1.949	PF 3	0	0	0
2.034	PF 3	0	0	0
2.118	PF 3	0	0	0
2.208	PF 3	0	0	0
2.31	PF 3	0	0	0
2.395	PF 3	0	0	0
2.486	PF 3	0	0	0
2.588	PF 3	0	0	0
2.691	PF 3	0	0	0
2.774	PF 3	0	0	0
2.867	PF 3	0	0	0
2.937	PF 3	0	0	0
3.011	PF 3	0	0	0
3.14	PF 3	0	0	0
3.247	PF 3	0	0	0
3.354	PF 3	0	0	0
3.465	PF 3	0	0	0
3.563	PF 3	0	0	0
3.656	PF 3	0	0	0
3.737	PF 3	0	0	0
3.816	PF 3	0	0	0
3.879	PF 3	0	0	0
3.945	PF 3	0	0	0
4.015	PF 3	0	0	0
4.053	PF 3	0	0	0
4.148	PF 3	0	0	0

			McMicDam	
4.254	PF 3	0	0	0
4.36	PF 3	0	0	0
4.457	PF 3	0	0	0
4.554	PF 3	0	0	0

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
0	PF 4	0	0	0
0.107	PF 4	0	0	0
0.159	PF 4	0	0	0
0.238	PF 4	0	0	0
0.35	PF 4	0	0	0
0.437	PF 4	0	0	0
0.527	PF 4	0	0	0
0.579	PF 4	0	0	0
0.647	PF 4	0	0	0
0.746	PF 4	0	0	0
0.833	PF 4	0	0	0
0.946	PF 4	0	0	0
1.058	PF 4	0	0	0
1.169	PF 4	0	0	0
1.191	PF 4	0	0	0
1.213	PF 4	0	0	0
1.251	PF 4	0	0	0
1.286	PF 4	0	0	0
1.307	PF 4	0	0	0
1.381	PF 4	0	0	0
1.479	PF 4	0	0	0
1.593	PF 4	0	0	0
1.708	PF 4	0	0	0
1.788	PF 4	0	0	0
1.858	PF 4	0	0	0
1.949	PF 4	0	0	0
2.034	PF 4	0	0	0
2.118	PF 4	0	0	0
2.208	PF 4	0	0	0
2.31	PF 4	0	0	0
2.395	PF 4	0	0	0
2.486	PF 4	0	0	0
2.588	PF 4	0	0	0
2.691	PF 4	0	0	0
2.774	PF 4	0	0	0
2.867	PF 4	0	0	0
2.937	PF 4	0	0	0
3.011	PF 4	0	0	0
3.14	PF 4	0	0	0
3.247	PF 4	0	0	0
3.354	PF 4	0	0	0
3.465	PF 4	0	0	0
3.563	PF 4	0	0	0
3.656	PF 4	0	0	0
3.737	PF 4	0	0	0
3.816	PF 4	0	0	0
3.879	PF 4	0	0	0
3.945	PF 4	0	0	0
4.015	PF 4	0	0	0
4.053	PF 4	0	0	0
4.148	PF 4	0	0	0
4.254	PF 4	0	0	0
4.36	PF 4	0	0	0
4.457	PF 4	0	0	0
4.554	PF 4	0	0	0

FLOW DATA

Flow Title: Imported Flow 01
Flow File : q:\16392\Schalk\HEC-RAS\McMicDamCnlRev00.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4
RIVER-1	Reach-1	4.554	5087	5087	4279	2613
RIVER-1	Reach-1	3.945	6023	6023	4747	2835
RIVER-1	Reach-1	2.118	6273	6273	4916	2876
RIVER-1	Reach-1	0.946	6522	6522	5085	2917

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	PF 1		Normal S = .00276
RIVER-1	Reach-1	PF 2	Known WS = 1176.98	
RIVER-1	Reach-1	PF 3	Known WS = 1176	
RIVER-1	Reach-1	PF 4	Known WS = 1175	

GEOMETRY DATA

Geometry Title: Imported Geom 01
Geometry File : q:\16392\Schalk\HEC-RAS\McMicDamCnlRev00.g01

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 4.554

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3963	1316	4387	1314	4575	1312	4890	1310	5000	1305.8
5029	1306	5071	1308	5131	1310	5162	1320		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
3963	.08	4890	.035	5162	.035

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          4890    5162              460     510     535              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.457

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    3708    1316    3933    1314    4522    1312    4795    1310    4980    1308
    5000  1305.5    5021    1306    5085    1308    5119    1310    5185    1320

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    3708     .08    4795    .035    5185    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          4795    5185              490     515     525              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.36

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    3740    1316    4080    1314    4450    1312    4866    1310    4977    1308
    5000    1305    5028    1306    5076    1308    5200    1310    5234  1319.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    3740     .08    4866    .035    5234    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          4866    5234              550     560     560              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.254

INPUT
Description:
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    4150    1316    4455    1314    4775    1314    4960    1312    4990    1306
    5000  1304.8    5040    1306    5070    1308    5085    1310    5275    1312
    5303    1319

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    4150     .08    4960    .035    5303    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          4960    5303              560     560     560              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4.148

INPUT
Description:
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    4221    1316    4315    1314    4705    1312    4953    1310    4980    1306
```

5000	1304.5	5050	1306	5080	1306	5350	1310	5370	1319

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4221	.08	4953	.035	5370	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4953	5370	500	500	500	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 4.053

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4408	1316	4630	1314	4950	1312	5000	1303.5	5015	1304
5052	1306	5081	1308	5116	1312	5197	1312	5209	1314
5282	1316	5334	1318						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4408	.08	4950	.035	5197	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4950	5197	250	200	135	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 4.015

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4432	1316	4649	1315.5	4957	1314	4970	1312	5000	1303
5033	1304	5065	1306	5080	1308	5099	1312	5288	1314
5370	1316	5443	1318						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4432	.08	4957	.035	5099	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4957	5099	560	370	260	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.945

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4232	1317	4300	1316	4340	1314	4387	1312	4603	1310
4790	1308	4798	1308	4830	1308	4854	1308	4883	1308
4930	1309	4970	1308	5000	1302	5020	1304	5060	1306
5079	1308	5090	1310	5160	1312	5200	1312	5285	1311
5350	1312	5390	1314	5440	1316	5495	1318		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4232	.08	4970	.035	5090	.035

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

4970	5090	520	350	280	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.879

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3430	1318	3520	1316	3550	1316	3791	1316	4019	1314
4104	1312	4330	1310	4485	1309	4622	1310	4762	1311
4858	1310	4909	1308	4960	1306	5000	1299	5011	1302
5029	1302	5061	1304	5100	1306	5222	1308	5251	1310
5279	1312	5314	1314	5423	1316	5548	1318		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
3430	.07	4960	.05	5100	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4960	5100	380	330	260	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.816

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3921	1314	4017	1312	4091	1310	4207	1308	4546	1306
4765	1307	4921	1306	4950	1306	4970	1304	5000	1296.5
5035	1304	5200	1306	5241	1308	5289	1310	5320	1312
5370	1314	5429	1316	5504	1317				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
3921	.07	4970	.05	5035	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4970	5035	470	420	400	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.737

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3980	1310	4121	1308	4240	1306	4466	1304	4608	1303.5
4736	1304	4820	1304.5	4890	1304	4970	1302	5000	1294.5
5020	1302	5047	1302	5185	1304	5203	1306	5265	1308
5327	1308	5393	1310	5543	1312	5651	1314.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
3980	.07	4970	.05	5020	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4970	5020	460	425	390	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.656

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4109	1309	4225	1308	4368	1306	4417	1304	4480	1302
4942	1300	4970	1298	5000	1292	5020	1300	5060	1300
5100	1300	5203	1302	5291	1304	5331	1306	5416	1308
5648	1310								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4109	.07	4942	.05	5020	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4942	5020	490	490	490	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.563

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4110	1308	4206	1306	4327	1302	4404	1300	4550	1298
4740	1298	4820	1300	4873	1301.5	4930	1300	4960	1298
4975	1292	5000	1290.5	5018	1296	5080	1298	5230	1300
5300	1302	5405	1304	5457	1304	5530	1305		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4110	.07	4960	.05	5018	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4960	5018	460	520	540	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.465

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4059	1303	4084	1302	4163	1300	4315	1298	4476	1296
4590	1296.5	4653	1296	4687	1294	4717	1294	4815	1296
4845	1296.5	4875	1296	4960	1294	5000	1288.5	5030	1294
5176	1300	5207	1302	5279	1303				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4059	.07	4960	.05	5030	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4960	5030	600	585	600	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.354

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4630	1298	4675	1296	4725	1294	4760	1292	4790	1291
4870	1292	4905	1292.5	4940	1292	4960	1288	5000	1286.3

5020	1288	5035	1292	5215	1294	5370	1296	5435	1298

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4630	.07	4940	.05	5035	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4940	5035	550	565	565	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.247

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4700	1294	4840	1292	4870	1290	4960	1288	4970	1284
5000	1282.3	5020	1288	5100	1290	5250	1291	5460	1292
5530	1294								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4700	.07	4960	.05	5020	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4960	5020	550	565	600	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.14

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4820	1290	4870	1288	4960	1286	4975	1282	5000	1280.3
5010	1282	5030	1286	5235	1287.5	5440	1286	5455	1286
5540	1286	5670	1290						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4820	.07	4960	.05	5030	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4960	5030	715	680	590	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3.011

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4640	1289.5	4750	1288	4809	1286	4851	1286	4968	1284
5000	1277	5021	1282	5171	1283	5370	1282	5400	1284
5425	1286	5498	1288	5679	1289				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4640	.07	4968	.05	5021	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4968	5021	370	393	430	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.937

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4640	1286	4740	1282	4837	1282	4940	1282	4960	1280
5000	1276	5025	1280	5050	1282	5100	1280	5110	1277
5121	1280	5260	1282	5307	1284	5360	1286	5423	1286.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4640	.07	4960	.05	5025	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4960	5025	290	370	540	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.867

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4293	1286	4406	1284	4551	1282	4638	1281	4788	1280
4832	1280	4880	1281	4960	1280	5000	1274	5030	1276
5050	1278	5070	1276	5080	1275.5	5090	1278	5117	1280
5160	1282	5265	1283.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4293	.07	4960	.05	5117	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4960	5117	465	490	410	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.774

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4695	1283	4800	1282	4900	1280	4953	1278	5000	1270.5
5050	1276	5160	1278	5220	1278.5	5265	1278	5317	1278
5553	1280								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4695	.07	4953	.05	5050	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4953	5050	415	440	490	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.691

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4780	1279.5	4873	1278	4935	1276	4983	1274	5000	1270

5040	1272.2	5089	1270	5106	1269	5129	1274	5232	1276
5298	1278								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4780	.07	4983	.05	5129	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4983	5129	550	540	520	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.588

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4605	1277	4675	1276	4760	1274	4951	1272	4980	1270
5000	1265.5	5020	1266	5040	1268	5050	1270	5150	1272
5190	1274	5280	1275.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4605	.07	4980	.05	5050	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4980	5050	540	540	530	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.486

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4752	1274	4803	1272	4825	1270	4925	1268	4940	1266
4981	1264	5000	1263	5013	1266	5052	1266	5070	1268
5105	1268	5135	1268	5230	1270	5280	1272	5400	1273

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4752	.07	4925	.05	5070	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4925	5070	450	480	525	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.395

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4575	1271	4790	1270	4860	1266	4967	1264	4990	1260
5000	1258.5	5010	1260	5030	1262	5050	1264	5110	1266
5170	1268	5200	1270						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4575	.07	4967	.05	5050	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4967	5050	430	450	475	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.31

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4661	1270	4710	1268	4740	1266	4780	1264	4970	1262
4980	1260	5000	1255.5	5030	1262	5088	1264	5127	1268
5360	1269.5								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4661	.07	4970	.05	5030	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4970	5030	540	540	540	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.208

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4432	1270	4780	1268	4819	1266	4853	1260	4885	1258
4903	1258	4969	1258	5000	1253	5030	1260	5150	1264
5266	1264	5310	1266						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4432	.07	4969	.05	5030	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4969	5030	525	475	435	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.118

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4400	1270	4630	1268	4829	1266	4909	1264	4940	1262
4956	1260	5000	1251	5020	1256	5040	1258	5148	1258.5
5272	1260	5320	1260	5350	1262	5550	1264	5740	1266
5825	1265								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4400	.07	4940	.05	5040	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4940	5040	505	440	370	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2.034

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

4535	1265	4893	1264	4952	1262	4963	1260	4985	1250
5000	1247.5	5010	1250	5020	1254	5170	1256	5220	1260
5275	1262	5590	1264	5780	1264.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4535	.07	4963	.05	5020	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4963	5020	420	450	460	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.949

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4600	1263	4700	1262	4863	1260	4900	1256	4925	1248
4960	1248	5000	1247	5031	1248	5060	1252	5104	1254
5238	1260	5450	1262	5630	1263				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4600	.07	4900	.05	5104	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4900	5104	400	480	550	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.858

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4833	1260	4882	1258	4930	1246	4980	1244	5000	1243.8
5029	1244	5067	1245	5105	1244	5135	1250	5155	1252
5188	1253								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4833	.06	4882	.04	5155	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4882	5155	425	370	320	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.788

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4560	1258	4767	1256	4813	1254	4860	1250	4880	1250
4900	1244	5000	1242	5080	1244	5104	1250	5138	1251

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4560	.06	4880	.04	5104	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4880	5104	485	425	390	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.708

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4803	1256	4850	1254	4882	1250	4910	1240	5000	1240
5082	1242	5110	1248	5145	1249				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4803	.06	4882	.04	5110	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4882	5110	605	605	605	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.593

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4697	1255	4870	1250	4910	1238	5000	1237.5	5081	1238
5118	1246	5142	1247						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4697	.06	4870	.04	5118	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4870	5118	603	603	603	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.479

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4741	1251	4800	1250	4819	1248	4882	1240	4900	1236
5000	1235.5	5072	1236	5090	1240	5110	1244	5135	1245

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4741	.06	4882	.04	5110	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4882	5110	475	516	550	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.381

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4750	1247	4792	1246	4875	1240	4914	1234	5000	1233.5
5079	1234	5100	1240	5120	1242	5150	1242.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4750	.06	4875	.04	5100	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4875	5100	395	392	380	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.307

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4865	1240	4875	1238	4885	1236	4895	1234	5000	1232.3
5095	1234	5100	1236	5130	1238	5145	1240		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4865	.06	4885	.04	5100	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4885	5100	113	113	113	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.286

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4597	1248	4728	1246	4800	1244	4840	1242	4860	1240
4882	1234	4906	1232	5000	1231	5063	1232	5099	1234
5121	1236	5174	1238						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4597	.06	4860	.04	5121	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4860	5121	180	180	180	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.251

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4840	1240	4870	1230	4900	1220	5000	1219	5080	1220
5130	1230	5150	1234						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4840	.05	4870	.02	5130	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4870	5130	190	190	190	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.213

INPUT
Description:

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4633	1244	4724	1242	4810	1240	4850	1230	4880	1220
4900	1212	4969	1210	5000	1209	5031	1210	5090	1212
5122	1220	5150	1230	5165	1234	5190	1235.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4633	.05	4880	.02	5122	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4880	5122	117	117	117	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.191

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4811	1244	4830	1240	4860	1230	4890	1220	4910	1214
4973	1212.5	4995	1212	5000	1208.5	5012	1212	5030	1212.5
5091	1214	5120	1220	5152	1230	5170	1234	5185	1235

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4811	.05	4890	.02	5120	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4890	5120	115	115	115	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.169

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4787	1244	4820	1240	4850	1230	4880	1220	4915	1212
4933	1210	4975	1208	5000	1207.5	5055	1208	5080	1210
5120	1220	5150	1230	5161	1234	5188	1235		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4787	.05	4880	.02	5120	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4880	5120	585	585	585	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1.058

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4820	1240	4831	1230	4853	1220	4885	1218	4910	1210
4920	1208	4978	1206	5000	1205	5015	1206	5065	1208
5105	1210	5140	1220	5160	1230	5178	1234		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4820	.06	4853	.04	5140	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4853	5140	591	591	591	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.946

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4550	1238.5	4620	1238	4719	1230	4810	1220	4833	1214
4870	1214	4900	1206	4952	1204	5000	1202.5	5025	1204
5069	1206	5090	1210	5121	1220	5150	1228		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4550	.06	4870	.04	5090	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4870	5090	640	600	600	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.833

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4470	1234	4510	1230	4510	1220	4565	1214	4660	1212
4714	1212	4870	1212	4882	1210	4909	1204	4945	1202
5000	1200	5050	1202	5090	1204	5116	1210	5150	1220
5160	1222								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4470	.06	4882	.04	5116	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4882	5116	475	457	457	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.746

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4400	1226	4566	1225	4732	1224	4780	1220	4803	1212
4830	1210	4880	1210	4930	1200	5000	1198.5	5043	1200
5075	1202	5109	1210	5140	1220	5159	1226		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4400	.06	4880	.04	5109	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4880	5109	250	521	690	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.647

INPUT

Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4290	1225	4370	1224	4515	1222	4544	1220	4610	1218
4632	1216	4658	1214	4686	1217	4748	1202	4805	1202
4900	1204	4950	1200	5000	1196	5140	1198	5165	1200
5228	1210	5260	1220	5285	1224				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4290	.06	4686	.04	5228	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4686	5228	265	360	398	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.579

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4355	1220	4465	1216	4517	1202	4565	1200	4715	1198.5
4800	1198	4825	1197	4848	1198	4895	1199	4941	1198
4980	1194	5000	1192.5	5030	1200	5040	1210	5062	1220
5103	1222	5190	1223						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4355	.06	4465	.04	5062	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4465	5062	435	273	150	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.527

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4440	1220	4568	1210	4603	1200	4659	1198	4740	1197
4793	1198	4842	1199	4900	1198	4922	1194	5000	1193
5080	1194	5090	1196	5120	1196	5175	1198	5185	1200
5200	1210	5228	1220	5265	1222	5322	1223		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4440	.06	4603	.04	5200	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4603	5200	525	480	150	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.437

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4648	1220	4750	1210	4788	1200	4820	1199	4845	1200
4865	1202	4900	1207	4940	1204	4970	1200	4985	1190
5000	1188	5018	1188	5030	1190	5050	1192	5082	1191

5100	1192	5273	1193	5331	1192	5350	1192	5400	1194
5420	1194	5432	1193	5450	1200	5470	1210	5500	1220
5580	1222								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4648	.06	4970	.04	5450	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4970	5450	470	459	450	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.35

INPUT
Description:
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4390	1220	4412	1210	4428	1200	4495	1190	4500	1190
4505	1192	4540	1194	4564	1194	4704	1192	4785	1190
4855	1192.5	4915	1190	4925	1188	4975	1186	5000	1184.5
5010	1188	5045	1188	5065	1186	5080	1188	5109	1189
5221	1189.5	5258	1190	5270	1192	5408	1194	5428	1200
5447	1210	5480	1214	5539	1214	5603	1216.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4390	.06	4855	.04	5428	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4855	5428	480	590	760	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.238

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4470	1230	4500	1210	4538	1190	4560	1184	4572	1184
4606	1185	4652	1184	4678	1180	4698	1180	4710	1182
4780	1184	4835	1185	4880	1184	4950	1182.5	5000	1183
5040	1186	5200	1186	5300	1186	5360	1188	5422	1190
5503	1200	5530	1210	5595	1214				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4470	.06	4500	.04	5503	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4500	5503	140	418	575	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.159

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4355	1210	4400	1190	4459	1180	4473	1180	4482	1178
4502	1180	4535	1182	4560	1180	4575	1179	4585	1180
4612	1182	4670	1182.5	4739	1182	4755	1181	4767	1182
4820	1182	4848	1182	4900	1182	4960	1182	5000	1181

5032	1182	5099	1182	5122	1184	5150	1190	5170	1198

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4355	.06	4355	.04	5150	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4355	5150	130	274	350	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0.107

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
4282	1200	4309	1190	4340	1184	4422	1182	4432	1180
4464	1176	4480	1180	4536	1180.5	4650	1180	4696	1179
4728	1180	4790	1180	4845	1180	4895	1180	4920	1178.5
4940	1180	4965	1180	5000	1179	5010	1180	5181	1180
5215	1178.5	5230	1180	5268	1190	5325	1196		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
4282	.06	4282	.04	5268	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4282	5268	950	564	510	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
3930	1180.5	4010	1180	4028	1176	4150	1175	4282	1176
4368	1176	4420	1174	4500	1173	4566	1174	4768	1175.5
4892	1174	4920	1172	5000	1172	5021	1174	5047	1180
5062	1200	5180	1210	5210	1210.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
3930	.06	4010	.04	5062	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
4010	5062	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	4.554	.08	.035	.035
Reach-1	4.457	.08	.035	.035
Reach-1	4.36	.08	.035	.035
Reach-1	4.254	.08	.035	.035
Reach-1	4.148	.08	.035	.035
Reach-1	4.053	.08	.035	.035
Reach-1	4.015	.08	.035	.035

McMicDam

Reach-1	3.945	.08	.035	.035
Reach-1	3.879	.07	.05	.07
Reach-1	3.816	.07	.05	.07
Reach-1	3.737	.07	.05	.07
Reach-1	3.656	.07	.05	.07
Reach-1	3.563	.07	.05	.07
Reach-1	3.465	.07	.05	.07
Reach-1	3.354	.07	.05	.07
Reach-1	3.247	.07	.05	.07
Reach-1	3.14	.07	.05	.07
Reach-1	3.011	.07	.05	.07
Reach-1	2.937	.07	.05	.07
Reach-1	2.867	.07	.05	.07
Reach-1	2.774	.07	.05	.07
Reach-1	2.691	.07	.05	.07
Reach-1	2.588	.07	.05	.07
Reach-1	2.486	.07	.05	.07
Reach-1	2.395	.07	.05	.07
Reach-1	2.31	.07	.05	.07
Reach-1	2.208	.07	.05	.07
Reach-1	2.118	.07	.05	.07
Reach-1	2.034	.07	.05	.07
Reach-1	1.949	.07	.05	.07
Reach-1	1.858	.06	.04	.06
Reach-1	1.788	.06	.04	.06
Reach-1	1.708	.06	.04	.06
Reach-1	1.593	.06	.04	.06
Reach-1	1.479	.06	.04	.06
Reach-1	1.381	.06	.04	.06
Reach-1	1.307	.06	.04	.06
Reach-1	1.286	.06	.04	.06
Reach-1	1.251	.05	.02	.05
Reach-1	1.213	.05	.02	.05
Reach-1	1.191	.05	.02	.05
Reach-1	1.169	.05	.02	.05
Reach-1	1.058	.06	.04	.06
Reach-1	0.946	.06	.04	.06
Reach-1	0.833	.06	.04	.06
Reach-1	0.746	.06	.04	.06
Reach-1	0.647	.06	.04	.06
Reach-1	0.579	.06	.04	.06
Reach-1	0.527	.06	.04	.06
Reach-1	0.437	.06	.04	.06
Reach-1	0.35	.06	.04	.06
Reach-1	0.238	.06	.04	.06
Reach-1	0.159	.06	.04	.06
Reach-1	0.107	.06	.04	.06
Reach-1	0	.06	.04	.06

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	4.554	460	510	535
Reach-1	4.457	490	515	525
Reach-1	4.36	550	560	560
Reach-1	4.254	560	560	560
Reach-1	4.148	500	500	500

McMicDam

Reach-1	4.053	250	200	135
Reach-1	4.015	560	370	260
Reach-1	3.945	520	350	280
Reach-1	3.879	380	330	260
Reach-1	3.816	470	420	400
Reach-1	3.737	460	425	390
Reach-1	3.656	490	490	490
Reach-1	3.563	460	520	540
Reach-1	3.465	600	585	600
Reach-1	3.354	550	565	565
Reach-1	3.247	550	565	600
Reach-1	3.14	715	680	590
Reach-1	3.011	370	393	430
Reach-1	2.937	290	370	540
Reach-1	2.867	465	490	410
Reach-1	2.774	415	440	490
Reach-1	2.691	550	540	520
Reach-1	2.588	540	540	530
Reach-1	2.486	450	480	525
Reach-1	2.395	430	450	475
Reach-1	2.31	540	540	540
Reach-1	2.208	525	475	435
Reach-1	2.118	505	440	370
Reach-1	2.034	420	450	460
Reach-1	1.949	400	480	550
Reach-1	1.858	425	370	320
Reach-1	1.788	485	425	390
Reach-1	1.708	605	605	605
Reach-1	1.593	603	603	603
Reach-1	1.479	475	516	550
Reach-1	1.381	395	392	380
Reach-1	1.307	113	113	113
Reach-1	1.286	180	180	180
Reach-1	1.251	190	190	190
Reach-1	1.213	117	117	117
Reach-1	1.191	115	115	115
Reach-1	1.169	585	585	585
Reach-1	1.058	591	591	591
Reach-1	0.946	640	600	600
Reach-1	0.833	475	457	457
Reach-1	0.746	250	521	690
Reach-1	0.647	265	360	398
Reach-1	0.579	435	273	150
Reach-1	0.527	525	480	150
Reach-1	0.437	470	459	450
Reach-1	0.35	480	590	760
Reach-1	0.238	140	418	575
Reach-1	0.159	130	274	350
Reach-1	0.107	950	564	510
Reach-1	0	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	4.554	.1	.3
Reach-1	4.457	.1	.3
Reach-1	4.36	.1	.3

		McMicDam	
Reach-1	4.254	.1	.3
Reach-1	4.148	.1	.3
Reach-1	4.053	.1	.3
Reach-1	4.015	.1	.3
Reach-1	3.945	.1	.3
Reach-1	3.879	.1	.3
Reach-1	3.816	.1	.3
Reach-1	3.737	.1	.3
Reach-1	3.656	.1	.3
Reach-1	3.563	.1	.3
Reach-1	3.465	.1	.3
Reach-1	3.354	.1	.3
Reach-1	3.247	.1	.3
Reach-1	3.14	.1	.3
Reach-1	3.011	.1	.3
Reach-1	2.937	.1	.3
Reach-1	2.867	.1	.3
Reach-1	2.774	.1	.3
Reach-1	2.691	.1	.3
Reach-1	2.588	.1	.3
Reach-1	2.486	.1	.3
Reach-1	2.395	.1	.3
Reach-1	2.31	.1	.3
Reach-1	2.208	.1	.3
Reach-1	2.118	.1	.3
Reach-1	2.034	.1	.3
Reach-1	1.949	.1	.3
Reach-1	1.858	.1	.3
Reach-1	1.788	.1	.3
Reach-1	1.708	.1	.3
Reach-1	1.593	.1	.3
Reach-1	1.479	.1	.3
Reach-1	1.381	.1	.3
Reach-1	1.307	.1	.3
Reach-1	1.286	.1	.3
Reach-1	1.251	.1	.3
Reach-1	1.213	.1	.3
Reach-1	1.191	.1	.3
Reach-1	1.169	.1	.3
Reach-1	1.058	.1	.3
Reach-1	0.946	.1	.3
Reach-1	0.833	.1	.3
Reach-1	0.746	.1	.3
Reach-1	0.647	.1	.3
Reach-1	0.579	.1	.3
Reach-1	0.527	.1	.3
Reach-1	0.437	.1	.3
Reach-1	0.35	.1	.3
Reach-1	0.238	.1	.3
Reach-1	0.159	.1	.3
Reach-1	0.107	.1	.3
Reach-1	0	.1	.3

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	Froude # Chl
		(cfs)		(ft)		(ft)		(ft)			
(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)							

Reach-1	4.554		5087.00	1305.80	1314.24
1314.34	0.000361	2.73	2842.76	807.31	0.19
Reach-1	4.554		5087.00	1305.80	1314.50
1314.64	0.000449	3.08	1650.60	254.94	0.21
Reach-1	4.554		4279.00	1305.80	1313.65
1313.74	0.000368	2.59	2400.07	722.57	0.19
Reach-1	4.554		2613.00	1305.80	1312.38
1312.45	0.000355	2.18	1557.41	598.72	0.18
Reach-1	4.457		5087.00	1305.50	1314.10
1314.17	0.000291	2.27	3438.18	1223.76	0.17
Reach-1	4.457		5087.00	1305.50	1314.33
1314.43	0.000344	2.51	2030.33	352.58	0.18
Reach-1	4.457		4279.00	1305.50	1313.50
1313.56	0.000319	2.22	2748.05	1060.31	0.17
Reach-1	4.457		2613.00	1305.50	1312.21
1312.26	0.000344	1.93	1632.48	672.65	0.17
Reach-1	4.36		5087.00	1305.00	1313.95
1314.02	0.000279	2.22	3516.13	1125.64	0.17
Reach-1	4.36		5087.00	1305.00	1314.15
1314.25	0.000356	2.54	2001.62	348.84	0.19
Reach-1	4.36		4279.00	1305.00	1313.34
1313.40	0.000311	2.18	2858.67	1009.50	0.17
Reach-1	4.36		2613.00	1305.00	1312.03
1312.08	0.000362	1.94	1696.87	762.18	0.18
Reach-1	4.254		5087.00	1304.80	1313.46
1313.70	0.001396	3.96	1369.29	456.22	0.35
Reach-1	4.254		5087.00	1304.80	1313.68
1313.90	0.001210	3.80	1338.84	321.71	0.33
Reach-1	4.254		4279.00	1304.80	1312.78
1313.04	0.001860	4.06	1080.21	390.31	0.39
Reach-1	4.254		2613.00	1304.80	1311.34
1311.62	0.002952	4.22	618.72	248.94	0.47
Reach-1	4.148		5087.00	1304.50	1313.34
1313.40	0.000213	2.02	3141.24	913.93	0.15
Reach-1	4.148		5087.00	1304.50	1313.55
1313.62	0.000215	2.06	2469.28	404.89	0.15
Reach-1	4.148		4279.00	1304.50	1312.62
1312.68	0.000241	1.97	2536.24	772.42	0.15
Reach-1	4.148		2613.00	1304.50	1311.12
1311.17	0.000290	1.74	1570.90	538.51	0.16
Reach-1	4.053		5087.00	1303.50	1312.71
1313.12	0.002341	5.15	1025.58	364.00	0.45
Reach-1	4.053		5087.00	1303.50	1312.98
1313.34	0.001906	4.83	1052.70	247.00	0.41
Reach-1	4.053		4279.00	1303.50	1311.94
1312.38	0.001956	5.35	799.48	165.05	0.43
Reach-1	4.053		2613.00	1303.50	1310.54
1310.85	0.001751	4.48	583.00	144.59	0.39
Reach-1	4.015		5087.00	1303.00	1311.82
1312.58	0.002688	6.97	729.73	127.56	0.51
Reach-1	4.015		5087.00	1303.00	1312.26

1312.91	0.002173	6.47	785.96	130.67	0.47	
Reach-1	4.015		4279.00	1303.00	1311.26	
1311.91	0.002540	6.49	659.30	123.02	0.49	
Reach-1	4.015		2613.00	1303.00	1310.09	
1310.48	0.001866	5.02	520.62	113.54	0.41	
Reach-1	3.945		6023.00	1302.00	1310.40	
1311.25	0.004269	8.12	1268.55	544.41	0.64	
Reach-1	3.945		6023.00	1302.00	1310.70	
1311.71	0.004311	8.45	923.31	240.00	0.64	
Reach-1	3.945		4747.00	1302.00	1309.80	
1310.61	0.004505	7.72	967.19	467.43	0.64	
Reach-1	3.945		2835.00	1302.00	1308.62	
1309.35	0.005048	6.96	488.48	316.43	0.65	
Reach-1	3.879		6023.00	1299.00	1309.09	
1309.62	0.004109	6.25	1225.20	381.65	0.45	
Reach-1	3.879		6023.00	1299.00	1309.89	
1310.32	0.002710	5.53	1320.28	289.30	0.37	
Reach-1	3.879		4747.00	1299.00	1308.64	
1309.07	0.003515	5.49	1069.31	338.63	0.41	
Reach-1	3.879		2835.00	1299.00	1307.68	
1307.95	0.002681	4.23	764.37	285.20	0.35	
Reach-1	3.816		6023.00	1296.50	1307.81	
1308.29	0.003995	7.11	1860.92	996.89	0.46	
Reach-1	3.816		6023.00	1296.50	1308.88	1307.36
1309.37	0.003049	6.78	1473.20	380.00	0.41	
Reach-1	3.816		4747.00	1296.50	1307.42	
1307.88	0.003750	6.65	1489.84	923.46	0.44	
Reach-1	3.816		2835.00	1296.50	1306.48	
1306.93	0.003514	5.86	758.22	550.67	0.41	
Reach-1	3.737		6023.00	1294.50	1305.12	
1305.90	0.008095	9.38	1466.64	855.12	0.63	
Reach-1	3.737		6023.00	1294.50	1304.96	
1306.77	0.015018	12.58	806.28	350.00	0.86	
Reach-1	3.737		4747.00	1294.50	1304.72	
1305.57	0.008328	9.14	1140.04	807.18	0.63	
Reach-1	3.737		2835.00	1294.50	1303.90	
1304.76	0.008000	8.19	575.04	501.78	0.61	
Reach-1	3.656		6023.00	1292.00	1302.90	
1303.28	0.004398	6.53	1819.52	790.88	0.46	
Reach-1	3.656		6023.00	1292.00	1303.89	
1304.16	0.002484	5.42	1822.47	450.00	0.36	
Reach-1	3.656		4747.00	1292.00	1302.41	
1302.82	0.004718	6.41	1441.71	753.95	0.47	
Reach-1	3.656		2835.00	1292.00	1301.47	1300.75
1301.92	0.005266	6.00	794.70	572.89	0.48	
Reach-1	3.563		6023.00	1290.50	1300.28	
1300.90	0.005302	8.06	1595.63	757.53	0.52	
Reach-1	3.563		6023.00	1290.50	1301.05	
1302.20	0.006675	9.66	968.17	307.19	0.59	
Reach-1	3.563		4747.00	1290.50	1299.92	
1300.48	0.004765	7.39	1327.83	698.95	0.49	

Reach-1	3.563		2835.00	1290.50	1298.91	
1299.47	0.004691	6.62	726.57	494.39	0.47	
Reach-1	3.465		6023.00	1288.50	1297.41	
1297.99	0.006310	7.87	1550.99	750.22	0.56	
Reach-1	3.465		6023.00	1288.50	1297.94	
1298.72	0.006562	8.47	1112.19	320.00	0.58	
Reach-1	3.465		4747.00	1288.50	1296.89	
1297.55	0.007122	7.88	1178.77	696.26	0.58	
Reach-1	3.465		2835.00	1288.50	1295.91	
1296.53	0.007158	6.96	627.10	354.20	0.57	
Reach-1	3.354		6023.00	1286.30	1295.03	
1295.40	0.003083	5.90	1722.44	595.55	0.40	
Reach-1	3.354		6023.00	1286.30	1295.06	
1295.63	0.004138	6.85	1241.13	310.00	0.46	
Reach-1	3.354		4747.00	1286.30	1294.39	
1294.75	0.003215	5.64	1359.88	529.49	0.40	
Reach-1	3.354		2835.00	1286.30	1293.07	
1293.44	0.003858	5.26	752.89	389.64	0.42	
Reach-1	3.247		6023.00	1282.30	1291.67	1291.39
1292.74	0.007647	9.68	1140.04	545.71	0.63	
Reach-1	3.247		6023.00	1282.30	1292.32	
1293.06	0.004975	8.25	1164.09	300.00	0.51	
Reach-1	3.247		4747.00	1282.30	1291.23	1290.66
1292.16	0.006747	8.73	923.54	447.62	0.58	
Reach-1	3.247		2835.00	1282.30	1290.33	
1290.96	0.004950	6.81	597.02	284.24	0.49	
Reach-1	3.14		6023.00	1280.30	1288.71	
1289.10	0.004801	6.83	1783.56	775.82	0.49	
Reach-1	3.14		6023.00	1280.30	1289.48	
1290.10	0.005247	7.72	1265.84	365.00	0.52	
Reach-1	3.14		4747.00	1280.30	1288.25	
1288.67	0.005084	6.67	1435.63	749.59	0.49	
Reach-1	3.14		2835.00	1280.30	1287.40	
1287.88	0.005757	6.37	819.97	660.32	0.51	
Reach-1	3.011		6023.00	1277.00	1285.91	
1286.20	0.004332	6.21	1714.65	567.61	0.45	
Reach-1	3.011		6023.00	1277.00	1286.45	
1286.85	0.004680	6.85	1415.75	350.00	0.48	
Reach-1	3.011		4747.00	1277.00	1285.44	
1285.70	0.004204	5.79	1456.05	534.29	0.44	
Reach-1	3.011		2835.00	1277.00	1284.60	
1284.80	0.003835	4.93	1033.48	474.82	0.41	
Reach-1	2.937		6023.00	1276.00	1283.96	
1284.33	0.004772	6.71	1679.84	615.06	0.48	
Reach-1	2.937		6023.00	1276.00	1284.56	
1285.00	0.004325	6.82	1378.24	330.00	0.47	
Reach-1	2.937		4747.00	1276.00	1283.46	
1283.82	0.004962	6.45	1375.27	590.55	0.49	
Reach-1	2.937		2835.00	1276.00	1282.50	
1282.88	0.005724	6.09	831.04	544.02	0.51	

Reach-1	2.867		6023.00	1274.00	1282.43	
1282.79	0.003336	5.36	1672.83	670.34	0.40	
Reach-1	2.867		6023.00	1274.00	1282.89	
1283.40	0.003685	5.94	1131.75	240.00	0.43	
Reach-1	2.867		4747.00	1274.00	1282.00	
1282.31	0.003047	4.86	1397.20	608.95	0.38	
Reach-1	2.867		2835.00	1274.00	1280.84	
1281.13	0.003450	4.36	768.37	453.81	0.39	
Reach-1	2.774		6023.00	1270.50	1279.30	1279.12
1280.26	0.008985	8.79	1092.02	551.65	0.66	
Reach-1	2.774		6023.00	1270.50	1279.48	
1280.64	0.009478	9.22	781.31	180.00	0.68	
Reach-1	2.774		4747.00	1270.50	1278.64	1278.11
1279.72	0.010762	8.84	759.45	456.29	0.70	
Reach-1	2.774		2835.00	1270.50	1277.43	1276.64
1278.30	0.011031	7.62	415.20	171.89	0.68	
Reach-1	2.691		6023.00	1269.00	1277.26	
1277.74	0.003516	5.90	1293.35	377.51	0.42	
Reach-1	2.691		6023.00	1269.00	1277.43	
1277.98	0.003653	6.13	1063.69	190.00	0.43	
Reach-1	2.691		4747.00	1269.00	1276.58	
1277.01	0.003485	5.44	1052.97	334.28	0.41	
Reach-1	2.691		2835.00	1269.00	1275.23	
1275.55	0.003612	4.59	663.49	239.09	0.40	
Reach-1	2.588		6023.00	1265.50	1273.79	
1274.89	0.008442	9.58	1011.16	406.00	0.65	
Reach-1	2.588		6023.00	1265.50	1274.27	
1275.29	0.006935	9.10	909.34	210.00	0.60	
Reach-1	2.588		4747.00	1265.50	1273.29	
1274.25	0.007823	8.75	820.72	347.63	0.62	
Reach-1	2.588		2835.00	1265.50	1272.27	
1272.97	0.006461	7.05	527.23	230.33	0.55	
Reach-1	2.486		6023.00	1263.00	1270.72	
1271.24	0.005083	6.37	1281.34	430.95	0.49	
Reach-1	2.486		6023.00	1263.00	1270.94	
1271.70	0.006129	7.19	902.39	185.00	0.54	
Reach-1	2.486		4747.00	1263.00	1270.09	
1270.59	0.005544	6.11	1015.59	408.15	0.50	
Reach-1	2.486		2835.00	1263.00	1268.88	
1269.33	0.006757	5.50	587.45	295.76	0.53	
Reach-1	2.395		6023.00	1258.50	1268.36	
1268.95	0.004438	7.21	1273.60	356.54	0.48	
Reach-1	2.395		6023.00	1258.50	1268.79	
1269.37	0.003788	6.94	1162.97	220.00	0.45	
Reach-1	2.395		4747.00	1258.50	1267.77	
1268.29	0.004156	6.59	1071.52	334.16	0.46	
Reach-1	2.395		2835.00	1258.50	1266.73	
1267.10	0.003329	5.24	750.37	284.88	0.40	
Reach-1	2.31		6023.00	1255.50	1265.98	
1266.68	0.005831	8.32	1227.08	366.78	0.55	

Reach-1	2.31		6023.00	1255.50	1266.19	
1267.13	0.006682	9.08	947.51	200.00	0.59	
Reach-1	2.31		4747.00	1255.50	1265.23	
1265.97	0.006530	8.19	962.93	344.69	0.57	
Reach-1	2.31		2835.00	1255.50	1263.78	
1264.70	0.009265	8.23	496.16	280.91	0.65	
Reach-1	2.208		6023.00	1253.00	1263.87	
1264.30	0.003227	6.60	1395.65	314.93	0.41	
Reach-1	2.208		6023.00	1253.00	1264.43	
1264.83	0.002604	6.20	1361.76	215.00	0.38	
Reach-1	2.208		4747.00	1253.00	1263.23	
1263.59	0.002922	5.93	1201.01	292.05	0.39	
Reach-1	2.208		2835.00	1253.00	1261.97	
1262.21	0.002417	4.75	861.28	247.10	0.34	
Reach-1	2.118		6273.00	1251.00	1261.87	
1262.35	0.005292	6.78	1389.70	406.94	0.50	
Reach-1	2.118		6273.00	1251.00	1262.13	
1262.91	0.006461	7.87	991.33	200.00	0.56	
Reach-1	2.118		4916.00	1251.00	1261.19	
1261.69	0.005591	6.66	1119.66	391.38	0.51	
Reach-1	2.118		2876.00	1251.00	1259.93	
1260.45	0.005976	6.25	648.94	310.11	0.51	
Reach-1	2.034		6273.00	1247.50	1258.61	1257.81
1259.62	0.008173	9.74	978.39	236.58	0.64	
Reach-1	2.034		6273.00	1247.50	1258.61	1257.78
1259.77	0.008596	10.24	877.18	180.00	0.65	
Reach-1	2.034		4916.00	1247.50	1257.81	1257.24
1258.80	0.008475	9.40	792.56	224.73	0.64	
Reach-1	2.034		2876.00	1247.50	1256.36	1256.06
1257.32	0.008831	8.58	482.11	203.42	0.63	
Reach-1	1.949		6273.00	1247.00	1252.47	1252.18
1254.09	0.019726	10.22	613.78	159.18	0.92	
Reach-1	1.949		6273.00	1247.00	1252.47	1252.18
1254.09	0.019726	10.22	613.78	159.18	0.92	
Reach-1	1.949		4916.00	1247.00	1251.82	
1253.23	0.019181	9.53	515.99	145.62	0.89	
Reach-1	1.949		2876.00	1247.00	1250.73	
1251.70	0.018849	7.90	363.92	134.35	0.85	
Reach-1	1.858		6273.00	1243.80	1249.50	
1250.13	0.004008	6.41	978.65	216.46	0.53	
Reach-1	1.858		6273.00	1243.80	1249.50	
1250.13	0.004008	6.41	978.65	216.46	0.53	
Reach-1	1.858		4916.00	1243.80	1248.85	
1249.38	0.003948	5.85	839.87	210.61	0.52	
Reach-1	1.858		2876.00	1243.80	1247.70	
1248.05	0.003789	4.76	603.88	200.28	0.48	
Reach-1	1.788		6273.00	1242.00	1247.52	
1248.35	0.005779	7.30	859.41	205.83	0.63	
Reach-1	1.788		6273.00	1242.00	1247.52	
1248.35	0.005779	7.30	859.41	205.83	0.63	
Reach-1	1.788		4916.00	1242.00	1246.89	

1247.59	0.005894	6.72	731.22	201.21	0.62	
Reach-1	1.788		2876.00	1242.00	1245.80	
1246.28	0.006085	5.57	516.34	193.22	0.60	
Reach-1	1.708		6273.00	1240.00	1245.39	
1246.13	0.004642	6.87	913.22	202.94	0.57	
Reach-1	1.708		6273.00	1240.00	1245.39	
1246.13	0.004642	6.87	913.22	202.94	0.57	
Reach-1	1.708		4916.00	1240.00	1244.71	
1245.33	0.004721	6.33	776.84	197.85	0.56	
Reach-1	1.708		2876.00	1240.00	1243.52	
1243.95	0.004934	5.27	545.24	188.91	0.55	
Reach-1	1.593		6273.00	1237.50	1243.09	
1243.68	0.003436	6.17	1016.02	211.50	0.50	
Reach-1	1.593		6273.00	1237.50	1243.10	
1243.69	0.003422	6.17	1017.36	211.55	0.50	
Reach-1	1.593		4916.00	1237.50	1242.40	
1242.89	0.003389	5.64	871.94	206.01	0.48	
Reach-1	1.593		2876.00	1237.50	1241.17	
1241.50	0.003298	4.60	624.67	196.22	0.45	
Reach-1	1.479		6273.00	1235.50	1240.99	
1241.59	0.003506	6.20	1015.52	220.76	0.50	
Reach-1	1.479		6273.00	1235.50	1241.00	
1241.59	0.003520	6.19	1012.75	212.98	0.50	
Reach-1	1.479		4916.00	1235.50	1240.30	
1240.80	0.003559	5.69	864.90	211.80	0.49	
Reach-1	1.479		2876.00	1235.50	1239.03	
1239.38	0.003735	4.75	605.33	199.26	0.48	
Reach-1	1.381		6273.00	1233.50	1239.35	
1239.89	0.003040	5.88	1067.51	218.52	0.47	
Reach-1	1.381		6273.00	1233.50	1239.36	
1239.89	0.003030	5.87	1068.71	218.57	0.47	
Reach-1	1.381		4916.00	1233.50	1238.69	
1239.13	0.002883	5.31	925.41	211.92	0.45	
Reach-1	1.381		2876.00	1233.50	1237.51	
1237.79	0.002525	4.22	681.98	200.10	0.40	
Reach-1	1.307		6273.00	1232.30	1236.69	1236.26
1237.82	0.010398	8.56	736.95	228.70	0.82	
Reach-1	1.307		6273.00	1232.30	1236.69	1236.25
1237.83	0.010457	8.55	733.31	215.00	0.82	
Reach-1	1.307		4916.00	1232.30	1236.26	1235.80
1237.17	0.009959	7.67	641.87	220.23	0.78	
Reach-1	1.307		2876.00	1232.30	1235.46	1235.01
1236.04	0.009328	6.11	470.37	210.96	0.72	
Reach-1	1.286		6273.00	1231.00	1234.90	1234.90
1236.33	0.016555	9.58	654.59	230.25	1.00	
Reach-1	1.286		6273.00	1231.00	1234.90	1234.90
1236.33	0.016555	9.58	654.59	230.25	1.00	
Reach-1	1.286		4916.00	1231.00	1234.44	1234.44
1235.68	0.017415	8.93	550.34	223.52	1.00	
Reach-1	1.286		2876.00	1231.00	1233.64	1233.64
1234.55	0.019155	7.66	375.25	206.04	1.00	

Reach-1	1.251		6273.00	1219.00	1222.80	1222.80
1224.36	0.004068	10.03	625.49	202.41	1.01	
Reach-1	1.251		6273.00	1219.00	1222.80	1222.80
1224.36	0.004068	10.03	625.49	202.41	1.01	
Reach-1	1.251		4916.00	1219.00	1222.33	1222.33
1223.66	0.004226	9.27	530.06	198.60	1.00	
Reach-1	1.251		2876.00	1219.00	1221.48	1221.48
1222.44	0.004774	7.87	365.23	191.84	1.01	
Reach-1	1.213		6273.00	1209.00	1217.59	
1217.88	0.000291	4.34	1445.85	226.31	0.30	
Reach-1	1.213		6273.00	1209.00	1217.59	
1217.88	0.000291	4.34	1445.85	226.31	0.30	
Reach-1	1.213		4916.00	1209.00	1216.92	
1217.14	0.000250	3.79	1296.16	221.97	0.28	
Reach-1	1.213		2876.00	1209.00	1215.74	
1215.86	0.000171	2.77	1038.93	214.31	0.22	
Reach-1	1.191		6273.00	1208.50	1216.08	1216.08
1217.67	0.004079	10.10	621.30	198.00	1.00	
Reach-1	1.191		6273.00	1208.50	1216.08	1216.08
1217.67	0.004079	10.10	621.30	198.00	1.00	
Reach-1	1.191		4916.00	1208.50	1215.59	1215.59
1216.95	0.004272	9.36	524.95	193.99	1.00	
Reach-1	1.191		2876.00	1208.50	1214.73	1214.73
1215.72	0.004809	7.95	361.83	187.00	1.01	
Reach-1	1.169		6273.00	1207.50	1213.29	
1214.25	0.001600	7.88	796.45	183.77	0.67	
Reach-1	1.169		6273.00	1207.50	1213.29	
1214.25	0.001600	7.88	796.45	183.77	0.67	
Reach-1	1.169		4916.00	1207.50	1212.64	
1213.45	0.001607	7.24	678.78	178.33	0.65	
Reach-1	1.169		2876.00	1207.50	1211.49	
1212.05	0.001578	5.98	481.03	166.41	0.62	
Reach-1	1.058		6273.00	1205.00	1212.09	
1212.75	0.004048	6.52	961.85	208.82	0.54	
Reach-1	1.058		6273.00	1205.00	1212.09	
1212.75	0.004048	6.52	961.85	208.82	0.54	
Reach-1	1.058		4916.00	1205.00	1211.38	
1211.95	0.004163	6.02	816.26	204.15	0.53	
Reach-1	1.058		2876.00	1205.00	1210.15	
1210.55	0.004450	5.04	570.28	196.01	0.52	
Reach-1	0.946		6522.00	1202.50	1209.53	
1210.26	0.004347	6.88	948.62	200.74	0.56	
Reach-1	0.946		6522.00	1202.50	1209.53	
1210.26	0.004347	6.88	948.62	200.74	0.56	
Reach-1	0.946		5085.00	1202.50	1208.80	
1209.42	0.004373	6.32	804.53	194.17	0.55	
Reach-1	0.946		2917.00	1202.50	1207.49	
1207.92	0.004445	5.22	559.17	182.44	0.53	
Reach-1	0.833		6522.00	1200.00	1207.26	

1207.89	0.003520	6.34	1028.51	209.82	0.50	
Reach-1	0.833		6522.00	1200.00	1207.26	
1207.89	0.003520	6.34	1028.51	209.82	0.50	
Reach-1	0.833		5085.00	1200.00	1206.53	
1207.05	0.003489	5.80	876.83	203.33	0.49	
Reach-1	0.833		2917.00	1200.00	1205.21	
1205.56	0.003433	4.73	616.24	191.68	0.47	
Reach-1	0.746		6522.00	1198.50	1204.81	
1205.78	0.006041	7.91	824.63	180.98	0.65	
Reach-1	0.746		6522.00	1198.50	1204.81	
1205.78	0.006040	7.91	824.65	180.98	0.65	
Reach-1	0.746		5085.00	1198.50	1203.91	
1204.81	0.007063	7.65	664.75	172.62	0.69	
Reach-1	0.746		2917.00	1198.50	1202.63	
1203.27	0.007666	6.46	451.43	160.78	0.68	
Reach-1	0.647		6522.00	1196.00	1202.49	
1202.97	0.004379	5.56	1172.84	344.13	0.53	
Reach-1	0.647		6522.00	1196.00	1202.49	
1202.97	0.004382	5.56	1172.50	344.06	0.53	
Reach-1	0.647		5085.00	1196.00	1201.83	
1202.25	0.003274	5.25	969.07	249.34	0.47	
Reach-1	0.647		2917.00	1196.00	1200.93	
1201.16	0.002273	3.87	753.12	232.49	0.38	
Reach-1	0.579		6522.00	1192.50	1200.49	1199.80
1200.98	0.007158	5.65	1154.11	477.20	0.64	
Reach-1	0.579		6522.00	1192.50	1200.49	1199.80
1200.99	0.007135	5.65	1155.27	477.26	0.64	
Reach-1	0.579		5085.00	1192.50	1200.07	1199.45
1200.51	0.007889	5.31	956.78	466.75	0.65	
Reach-1	0.579		2917.00	1192.50	1199.10	1198.78
1199.54	0.012363	5.34	546.59	371.04	0.77	
Reach-1	0.527		6522.00	1193.00	1198.14	
1198.77	0.009168	6.36	1025.90	428.69	0.72	
Reach-1	0.527		6522.00	1193.00	1198.13	
1198.76	0.009244	6.38	1022.19	427.47	0.73	
Reach-1	0.527		5085.00	1193.00	1197.56	
1198.18	0.009066	6.32	804.41	336.12	0.72	
Reach-1	0.527		2917.00	1193.00	1196.49	
1196.98	0.007345	5.58	523.17	225.29	0.64	
Reach-1	0.437		6522.00	1188.00	1194.67	
1195.14	0.006201	5.50	1186.44	458.29	0.60	
Reach-1	0.437		6522.00	1188.00	1194.68	
1195.14	0.006117	5.47	1191.31	458.33	0.60	
Reach-1	0.437		5085.00	1188.00	1194.37	
1194.74	0.005602	4.83	1052.24	457.09	0.56	
Reach-1	0.437		2917.00	1188.00	1193.67	
1193.91	0.005362	3.94	739.63	421.95	0.52	
Reach-1	0.35		6522.00	1184.50	1190.91	
1191.62	0.009560	6.80	987.66	445.62	0.75	
Reach-1	0.35		6522.00	1184.50	1190.92	
1191.64	0.009620	6.83	954.51	370.46	0.75	

Reach-1	0.35		5085.00	1184.50	1190.36	
1191.07	0.012057	6.74	760.54	386.85	0.81	
Reach-1	0.35		2917.00	1184.50	1189.58	
1190.13	0.013947	5.95	490.52	309.72	0.83	
Reach-1	0.238		6522.00	1180.00	1186.21	1185.26
1186.57	0.007425	4.76	1370.10	754.50	0.62	
Reach-1	0.238		6522.00	1180.00	1186.21	1185.26
1186.57	0.007425	4.76	1370.10	754.50	0.62	
Reach-1	0.238		5085.00	1180.00	1185.66	
1186.02	0.006158	4.87	1043.11	481.46	0.58	
Reach-1	0.238		2917.00	1180.00	1185.11	
1185.32	0.005152	3.73	782.24	472.16	0.51	
Reach-1	0.159		6522.00	1178.00	1183.83	1183.00
1184.12	0.004659	4.31	1514.95	683.65	0.51	
Reach-1	0.159		6522.00	1178.00	1183.83	1183.00
1184.12	0.004659	4.31	1514.95	683.65	0.51	
Reach-1	0.159		5085.00	1178.00	1183.51	
1183.75	0.004679	3.92	1298.85	678.13	0.50	
Reach-1	0.159		2917.00	1178.00	1182.88	
1183.05	0.005680	3.34	872.22	667.10	0.52	
Reach-1	0.107		6522.00	1176.00	1181.03	1181.03
1181.68	0.022404	6.45	1010.65	807.05	1.02	
Reach-1	0.107		6522.00	1176.00	1181.03	1181.03
1181.68	0.022404	6.45	1010.65	807.05	1.02	
Reach-1	0.107		5085.00	1176.00	1180.89	1180.84
1181.39	0.020260	5.67	896.56	805.80	0.95	
Reach-1	0.107		2917.00	1176.00	1180.74	1180.49
1180.96	0.010808	3.76	775.08	804.48	0.68	
Reach-1	0		6522.00	1172.00	1176.64	1175.49
1176.79	0.002765	3.15	2067.84	1007.30	0.39	
Reach-1	0		6522.00	1172.00	1176.98	1175.49
1177.09	0.001660	2.70	2413.02	1010.32	0.31	
Reach-1	0		5085.00	1172.00	1176.00	1175.19
1176.20	0.005094	3.56	1427.17	915.67	0.50	
Reach-1	0		2917.00	1172.00	1175.00	1174.57
1175.29	0.009358	4.28	680.83	522.67	0.66	

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E
Loss	Q Left	Q Channel	Q Right	Top Width		
(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)
Reach-1	4.554		1314.34	1314.24	0.10	0.16
0.01	767.38	4319.62		807.31		
Reach-1	4.554		1314.64	1314.50	0.15	0.20
0.02		5087.00		254.94		
Reach-1	4.554		1313.74	1313.65	0.09	0.17
0.01	554.01	3724.99		722.57		
Reach-1	4.554		1312.45	1312.38	0.07	0.18

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0.00      179.43     2433.57                598.72

  Reach-1        4.457              1314.17     1314.10        0.07        0.15
0.00      674.47     4412.53                1223.76
  Reach-1        4.457              1314.43     1314.33        0.10        0.18
0.00                 5087.00                352.58
  Reach-1        4.457              1313.56     1313.50        0.07        0.16
0.00      422.94     3856.06                1060.31
  Reach-1        4.457              1312.26     1312.21        0.06        0.18
0.00      116.17     2496.83                672.65

  Reach-1        4.36               1314.02     1313.95        0.07        0.30
0.02      788.68     4298.32                1125.64
  Reach-1        4.36               1314.25     1314.15        0.10        0.33
0.01                 5087.00                348.84
  Reach-1        4.36               1313.40     1313.34        0.06        0.35
0.02      533.98     3745.02                1009.50
  Reach-1        4.36               1312.08     1312.03        0.06        0.44
0.02      152.46     2460.54                762.18

  Reach-1        4.254              1313.70     1313.46        0.24        0.25
0.05       55.81     5031.19                456.22
  Reach-1        4.254              1313.90     1313.68        0.22        0.24
0.05                 5087.00                321.71
  Reach-1        4.254              1313.04     1312.78        0.25        0.29
0.06       12.05     4266.95                390.31
  Reach-1        4.254              1311.62     1311.34        0.28        0.38
0.07                 2613.00                248.94

  Reach-1        4.148              1313.40     1313.34        0.06        0.25
0.03      266.81     4820.20                913.93
  Reach-1        4.148              1313.62     1313.55        0.07        0.24
0.03                 5087.00                404.89
  Reach-1        4.148              1312.68     1312.62        0.06        0.26
0.04      142.67     4136.34                772.42
  Reach-1        4.148              1311.17     1311.12        0.05        0.29
0.03       16.75     2596.25                538.51

  Reach-1        4.053              1313.12     1312.71        0.41        0.50
0.03       17.82     5067.67        1.51    364.00
  Reach-1        4.053              1313.34     1312.98        0.36        0.41
0.03                 5087.00                247.00
  Reach-1        4.053              1312.38     1311.94        0.44        0.44
0.02                 4279.00                165.05
  Reach-1        4.053              1310.85     1310.54        0.31        0.36
0.01                 2613.00                144.59

  Reach-1        4.015              1312.58     1311.82        0.75        1.32
0.01                 5087.00                127.56
  Reach-1        4.015              1312.91     1312.26        0.65        1.16
0.04                 5087.00                130.67
  Reach-1        4.015              1311.91     1311.26        0.65        1.29
0.02                 4279.00                123.02
  Reach-1        4.015              1310.48     1310.09        0.39        1.10
0.03                 2613.00                113.54
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  Reach-1        3.945            1311.25    1310.40        0.84        1.53
0.09    1098.17    4922.15        2.68      544.41
  Reach-1        3.945            1311.71    1310.70        1.01        1.22
0.17     595.00    5428.00                   240.00
  Reach-1        3.945            1310.61    1309.80        0.81        1.43
0.11     623.34    4123.66                   467.43
  Reach-1        3.945            1309.35    1308.62        0.73        1.26
0.14      71.12    2763.88                   316.43

  Reach-1        3.879            1309.62    1309.09        0.54        1.32
0.02     220.75    5251.34      550.91      381.65
  Reach-1        3.879            1310.32    1309.89        0.42        0.95
0.01     333.02    5264.78      425.21      289.30
  Reach-1        3.879            1309.07    1308.64        0.43        1.18
0.00     134.61    4270.41      341.98      338.63
  Reach-1        3.879            1307.95    1307.68        0.27        0.99
0.02      35.12    2715.85       84.04      285.20

  Reach-1        3.816            1308.29    1307.81        0.48        2.36
0.03    1321.40    3489.99     1211.61      996.89
  Reach-1        3.816            1309.37    1308.88        0.49        2.46
0.13    1327.22    3804.08      891.70      380.00
  Reach-1        3.816            1307.88    1307.42        0.47        2.28
0.04     737.27    3097.86      911.88      923.46
  Reach-1        3.816            1306.93    1306.48        0.45        2.13
0.04      70.43    2374.11      390.46      550.67

  Reach-1        3.737            1305.90    1305.12        0.78        2.50
0.12    1579.05    3218.46     1225.49      855.12
  Reach-1        3.737            1306.77    1304.96        1.81        2.15
0.46     724.92    4222.43     1075.65      350.00
  Reach-1        3.737            1305.57    1304.72        0.84        2.62
0.13     879.75    2959.01      908.23      807.18
  Reach-1        3.737            1304.76    1303.90        0.86        2.72
0.12     161.47    2314.02      359.51      501.78

  Reach-1        3.656            1303.28    1302.90        0.38        2.36
0.02    1864.60    3163.09      995.31      790.88
  Reach-1        3.656            1304.16    1303.89        0.27        1.88
0.09    2194.90    3040.27      787.83      450.00
  Reach-1        3.656            1302.82    1302.41        0.41        2.32
0.02    1180.33    2857.14      709.53      753.95
  Reach-1        3.656            1301.92    1301.47        0.45        2.43
0.01     312.33    2236.65      286.02      572.89

  Reach-1        3.563            1300.90    1300.28        0.61        2.90
0.01    1637.41    3480.04      905.55      757.53
  Reach-1        3.563            1302.20    1301.05        1.14        3.37
0.11     976.17    4601.08      445.75      307.19
  Reach-1        3.563            1300.48    1299.92        0.56        2.92
0.01    1089.91    3032.69      624.41      698.95
  Reach-1        3.563            1299.47    1298.91        0.56        2.94
0.00     268.13    2329.15      237.72      494.39

  Reach-1        3.465            1297.99    1297.41        0.58        2.52
0.06    2293.36    3390.04      339.60      750.22
  Reach-1        3.465            1298.72    1297.94        0.79        3.03
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0.07    1617.71    3965.46     439.83     320.00
  Reach-1       3.465              1297.55    1296.89       0.66        2.71
0.09    1399.86    3113.99     233.15     696.26
  Reach-1       3.465              1296.53    1295.91       0.61        3.02
0.07     485.05    2272.29      77.66     354.20


  Reach-1       3.354              1295.40    1295.03       0.37        2.59
0.07    1550.96    3826.46     645.58     595.55
  Reach-1       3.354              1295.63    1295.06       0.57        2.55
0.02     913.81    4466.53     642.66     310.00
  Reach-1       3.354              1294.75    1294.39       0.36        2.53
0.06    1085.03    3312.29     349.68     529.49
  Reach-1       3.354              1293.44    1293.07       0.37        2.45
0.03     357.40    2433.23      44.37     389.64


  Reach-1       3.247              1292.74    1291.67       1.07        3.43
0.20     837.13    4283.52     902.35     545.71
  Reach-1       3.247              1293.06    1292.32       0.75        2.92
0.04     752.36    3974.35    1296.28     300.00
  Reach-1       3.247              1292.16    1291.23       0.93        3.34
0.15     579.59    3635.16     532.26     447.62
  Reach-1       3.247              1290.96    1290.33       0.63        3.03
0.04     210.63    2466.94     157.44     284.24


  Reach-1       3.14               1289.10    1288.71       0.39        2.88
0.03     306.86    2932.24    2783.90     775.82
  Reach-1       3.14               1290.10    1289.48       0.62        3.19
0.07     621.50    3732.35    1669.15     365.00
  Reach-1       3.14               1288.67    1288.25       0.41        2.92
0.05     192.00    2652.89    1902.11     749.59
  Reach-1       3.14               1287.88    1287.40       0.49        3.00
0.09      55.73    2149.93     629.34     660.32


  Reach-1       3.011              1286.20    1285.91       0.29        1.86
0.01     144.57    1912.29    3966.15     567.61
  Reach-1       3.011              1286.85    1286.45       0.40        1.84
0.00     188.05    2305.62    3529.33     350.00
  Reach-1       3.011              1285.70    1285.44       0.25        1.87
0.01      67.14    1637.01    3042.85     534.29
  Reach-1       3.011              1284.80    1284.60       0.20        1.90
0.02       6.29    1176.32    1652.39     474.82


  Reach-1       2.937              1284.33    1283.96       0.37        1.54
0.00    1105.09    2600.53    2317.37     615.06
  Reach-1       2.937              1285.00    1284.56       0.44        1.59
0.01     746.61    2907.77    2368.62     330.00
  Reach-1       2.937              1283.82    1283.46       0.36        1.49
0.02     695.20    2287.85    1763.96     590.55
  Reach-1       2.937              1282.88    1282.50       0.39        1.72
0.03     145.44    1780.01     909.55     544.02


  Reach-1       2.867              1282.79    1282.43       0.36        2.47
0.06    1257.44    4686.19      79.37     670.34
  Reach-1       2.867              1283.40    1282.89       0.52        2.70
0.06     249.49    5616.19     157.31     240.00
  Reach-1       2.867              1282.31    1282.00       0.31        2.51
0.08     781.10    3915.58      50.31     608.95
```

Reach-1		2.867		1281.13	1280.84	0.28	2.77
0.06	105.69	2723.94		5.37	453.81		
Reach-1		2.774		1280.26	1279.30	0.96	2.38
0.14	33.69	4744.65		1244.65	551.65		
Reach-1		2.774		1280.64	1279.48	1.16	2.47
0.18	8.67	5136.75		877.58	180.00		
Reach-1		2.774		1279.72	1278.64	1.08	2.51
0.20	5.56	4207.53		533.91	456.29		
Reach-1		2.774		1278.30	1277.43	0.87	2.58
0.16		2735.32		99.68	171.89		
Reach-1		2.691		1277.74	1277.26	0.48	2.80
0.06	221.79	5321.32		479.89	377.51		
Reach-1		2.691		1277.98	1277.43	0.55	2.64
0.05	59.20	5677.09		286.71	190.00		
Reach-1		2.691		1277.01	1276.58	0.43	2.70
0.05	116.76	4368.45		261.79	334.28		
Reach-1		2.691		1275.55	1275.23	0.32	2.55
0.04	16.85	2781.99		36.17	239.09		
Reach-1		2.588		1274.89	1273.79	1.09	3.47
0.17	507.63	4460.11		1055.26	406.00		
Reach-1		2.588		1275.29	1274.27	1.02	3.51
0.08	646.35	4539.70		836.96	210.00		
Reach-1		2.588		1274.25	1273.29	0.97	3.52
0.14	265.04	3763.37		718.59	347.63		
Reach-1		2.588		1272.97	1272.27	0.69	3.56
0.07	56.09	2530.85		248.07	230.33		
Reach-1		2.486		1271.24	1270.72	0.52	2.29
0.01	365.24	4839.04		818.72	430.95		
Reach-1		2.486		1271.70	1270.94	0.77	2.28
0.06	202.95	5686.67		133.38	185.00		
Reach-1		2.486		1270.59	1270.09	0.51	2.30
0.00	180.70	4076.85		489.45	408.15		
Reach-1		2.486		1269.33	1268.88	0.45	2.21
0.03	19.52	2710.81		104.68	295.76		
Reach-1		2.395		1268.95	1268.36	0.60	2.27
0.01	1130.76	4201.36		690.88	356.54		
Reach-1		2.395		1269.37	1268.79	0.58	2.21
0.04	1108.96	4292.64		621.40	220.00		
Reach-1		2.395		1268.29	1267.77	0.52	2.30
0.02	783.21	3518.16		445.63	334.16		
Reach-1		2.395		1267.10	1266.73	0.36	2.34
0.06	317.11	2348.77		169.13	284.88		
Reach-1		2.31		1266.68	1265.98	0.70	2.29
0.08	1868.02	3586.55		568.43	366.78		
Reach-1		2.31		1267.13	1266.19	0.94	2.13
0.16	1698.26	4030.88		293.86	200.00		
Reach-1		2.31		1265.97	1265.23	0.73	2.27
0.11	1215.48	3164.52		367.00	344.69		
Reach-1		2.31		1264.70	1263.78	0.92	2.29
0.20	285.15	2462.83		87.02	280.91		

Reach-1	2.208		1264.30	1263.87	0.44	1.94		
0.00	2434.80	3168.55	419.65	314.93				
Reach-1	2.208		1264.83	1264.43	0.40	1.89		
0.04	2626.72	3193.75	202.53	215.00				
Reach-1	2.208		1263.59	1263.23	0.36	1.89		
0.01	1883.63	2617.14	246.22	292.05				
Reach-1	2.208		1262.21	1261.97	0.25	1.74		
0.03	1045.14	1730.11	59.75	247.10				
Reach-1	2.118		1262.35	1261.87	0.49	2.68		
0.05		3786.81	2486.19	406.94				
Reach-1	2.118		1262.91	1262.13	0.77	3.10		
0.04		4588.71	1684.29	200.00				
Reach-1	2.118		1261.69	1261.19	0.49	2.84		
0.05		3286.00	1630.00	391.38				
Reach-1	2.118		1260.45	1259.93	0.51	3.08		
0.05		2388.28	487.72	310.11				
Reach-1	2.034		1259.62	1258.61	1.01	5.47		
0.06		3840.03	2432.97	236.58				
Reach-1	2.034		1259.77	1258.61	1.16	5.64		
0.05		3997.95	2275.05	180.00				
Reach-1	2.034		1258.80	1257.81	0.99	5.52		
0.04		3304.91	1611.09	224.73				
Reach-1	2.034		1257.32	1256.36	0.96	5.61		
0.00		2386.07	489.93	203.42				
Reach-1	1.949		1254.09	1252.47	1.62	3.66		
0.30		6273.00		159.18				
Reach-1	1.949		1254.09	1252.47	1.62	3.66		
0.30		6273.00		159.18				
Reach-1	1.949		1253.23	1251.82	1.41	3.59		
0.26		4916.00		145.62				
Reach-1	1.949		1251.70	1250.73	0.97	3.47		
0.19		2876.00		134.35				
Reach-1	1.858		1250.13	1249.50	0.64	1.77		
0.02		6273.00		216.46				
Reach-1	1.858		1250.13	1249.50	0.64	1.77		
0.02		6273.00		216.46				
Reach-1	1.858		1249.38	1248.85	0.53	1.77		
0.02		4916.00		210.61				
Reach-1	1.858		1248.05	1247.70	0.35	1.75		
0.01		2876.00		200.28				
Reach-1	1.788		1248.35	1247.52	0.83	2.19		
0.03		6273.00		205.83				
Reach-1	1.788		1248.35	1247.52	0.83	2.19		
0.03		6273.00		205.83				
Reach-1	1.788		1247.59	1246.89	0.70	2.23		
0.02		4916.00		201.21				
Reach-1	1.788		1246.28	1245.80	0.48	2.32		
0.01		2876.00		193.22				
Reach-1	1.708		1246.13	1245.39	0.73	2.40		
0.04		6273.00		202.94				

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  Reach-1        1.708              1246.13    1245.39        0.73        2.40
0.04                 6273.00                   202.94
  Reach-1        1.708              1245.33    1244.71        0.62        2.40
0.04                 4916.00                   197.85
  Reach-1        1.708              1243.95    1243.52        0.43        2.42
0.03                 2876.00                   188.91

  Reach-1        1.593              1243.68    1243.09        0.59        2.09
0.00                 6273.00                   211.50
  Reach-1        1.593              1243.69    1243.10        0.59        2.09
0.00                 6273.00                   211.55
  Reach-1        1.593              1242.89    1242.40        0.49        2.09
0.00                 4916.00                   206.01
  Reach-1        1.593              1241.50    1241.17        0.33        2.11
0.00                 2876.00                   196.22

  Reach-1        1.479              1241.59    1240.99        0.60        1.68
0.02       3.54      6269.47                   220.76
  Reach-1        1.479              1241.59    1241.00        0.60        1.68
0.02                 6273.00                   212.98
  Reach-1        1.479              1240.80    1240.30        0.50        1.65
0.02       0.14      4915.86                   211.80
  Reach-1        1.479              1239.38    1239.03        0.35        1.57
0.02                 2876.00                   199.26

  Reach-1        1.381              1239.89    1239.35        0.54        2.01
0.06                 6273.00                   218.52
  Reach-1        1.381              1239.89    1239.36        0.53        2.01
0.06                 6273.00                   218.57
  Reach-1        1.381              1239.13    1238.69        0.44        1.91
0.05                 4916.00                   211.92
  Reach-1        1.381              1237.79    1237.51        0.28        1.71
0.03                 2876.00                   200.10

  Reach-1        1.307              1237.82    1236.69        1.14        1.46
0.03       1.43      6267.23       4.34        228.70
  Reach-1        1.307              1237.83    1236.69        1.14        1.47
0.03                 6273.00                   215.00
  Reach-1        1.307              1237.17    1236.26        0.91        1.46
0.03       0.11      4915.57       0.33        220.23
  Reach-1        1.307              1236.04    1235.46        0.58        1.46
0.03                 2876.00                   210.96

  Reach-1        1.286              1236.33    1234.90        1.43        1.31
0.01                 6273.00                   230.25
  Reach-1        1.286              1236.33    1234.90        1.43        1.31
0.01                 6273.00                   230.25
  Reach-1        1.286              1235.68    1234.44        1.24        1.37
0.01                 4916.00                   223.52
  Reach-1        1.286              1234.55    1233.64        0.91        1.53
0.01                 2876.00                   206.04

  Reach-1        1.251              1224.36    1222.80        1.56        0.14
0.38                 6273.00                   202.41
  Reach-1        1.251              1224.36    1222.80        1.56        0.14
0.38                 6273.00                   202.41
  Reach-1        1.251              1223.66    1222.33        1.34        0.12
```

0.33		4916.00		198.60		
Reach-1	1.251		1222.44	1221.48	0.96	0.09
0.25		2876.00		191.84		
Reach-1	1.213		1217.88	1217.59	0.29	0.08
0.13		6273.00		226.31		
Reach-1	1.213		1217.88	1217.59	0.29	0.08
0.13		6273.00		226.31		
Reach-1	1.213		1217.14	1216.92	0.22	0.08
0.11		4916.00		221.97		
Reach-1	1.213		1215.86	1215.74	0.12	0.06
0.09		2876.00		214.31		
Reach-1	1.191		1217.67	1216.08	1.58	0.28
0.19		6273.00		198.00		
Reach-1	1.191		1217.67	1216.08	1.58	0.28
0.19		6273.00		198.00		
Reach-1	1.191		1216.95	1215.59	1.36	0.28
0.16		4916.00		193.99		
Reach-1	1.191		1215.72	1214.73	0.98	0.29
0.13		2876.00		187.00		
Reach-1	1.169		1214.25	1213.29	0.96	1.41
0.09		6273.00		183.77		
Reach-1	1.169		1214.25	1213.29	0.96	1.41
0.09		6273.00		183.77		
Reach-1	1.169		1213.45	1212.64	0.81	1.43
0.08		4916.00		178.33		
Reach-1	1.169		1212.05	1211.49	0.56	1.45
0.05		2876.00		166.41		
Reach-1	1.058		1212.75	1212.09	0.66	2.48
0.01		6273.00		208.82		
Reach-1	1.058		1212.75	1212.09	0.66	2.48
0.01		6273.00		208.82		
Reach-1	1.058		1211.95	1211.38	0.56	2.52
0.01		4916.00		204.15		
Reach-1	1.058		1210.55	1210.15	0.39	2.63
0.00		2876.00		196.01		
Reach-1	0.946		1210.26	1209.53	0.73	2.34
0.03		6522.00		200.74		
Reach-1	0.946		1210.26	1209.53	0.73	2.34
0.03		6522.00		200.74		
Reach-1	0.946		1209.42	1208.80	0.62	2.34
0.03		5085.00		194.17		
Reach-1	0.946		1207.92	1207.49	0.42	2.33
0.02		2917.00		182.44		
Reach-1	0.833		1207.89	1207.26	0.62	2.07
0.03		6522.00		209.82		
Reach-1	0.833		1207.89	1207.26	0.62	2.07
0.03		6522.00		209.82		
Reach-1	0.833		1207.05	1206.53	0.52	2.20
0.04		5085.00		203.33		
Reach-1	0.833		1205.56	1205.21	0.35	2.25
0.03		2917.00		191.68		

Reach-1		0.746		1205.78	1204.81	0.97	2.66
0.15		6522.00			180.98		
Reach-1		0.746		1205.78	1204.81	0.97	2.66
0.15		6522.00			180.98		
Reach-1		0.746		1204.81	1203.91	0.91	2.41
0.14		5085.00			172.62		
Reach-1		0.746		1203.27	1202.63	0.65	1.99
0.12		2917.00			160.78		
Reach-1		0.647		1202.97	1202.49	0.48	1.99
0.00		6522.00			344.13		
Reach-1		0.647		1202.97	1202.49	0.48	1.98
0.00		6522.00			344.06		
Reach-1		0.647		1202.25	1201.83	0.43	1.74
0.00		5085.00			249.34		
Reach-1		0.647		1201.16	1200.93	0.23	1.60
0.02		2917.00			232.49		
Reach-1		0.579		1200.98	1200.49	0.50	2.20
0.01		6522.00			477.20		
Reach-1		0.579		1200.99	1200.49	0.49	2.21
0.01		6522.00			477.26		
Reach-1		0.579		1200.51	1200.07	0.44	2.31
0.02		5085.00			466.75		
Reach-1		0.579		1199.54	1199.10	0.44	2.56
0.00		2917.00			371.04		
Reach-1		0.527		1198.77	1198.14	0.63	3.58
0.05		6522.00			428.69		
Reach-1		0.527		1198.76	1198.13	0.63	3.57
0.05		6522.00			427.47		
Reach-1		0.527		1198.18	1197.56	0.62	3.37
0.08		5085.00			336.12		
Reach-1		0.527		1196.98	1196.49	0.48	2.99
0.07		2917.00			225.29		
Reach-1		0.437		1195.14	1194.67	0.47	3.49
0.02		6522.00			458.29		
Reach-1		0.437		1195.14	1194.68	0.47	3.48
0.03		6522.00			458.33		
Reach-1		0.437		1194.74	1194.37	0.36	3.64
0.03		5085.00			457.09		
Reach-1		0.437		1193.91	1193.67	0.24	3.75
0.03		2917.00			421.95		
Reach-1		0.35		1191.62	1190.91	0.71	4.95
0.11	54.69	6467.31			445.62		
Reach-1		0.35		1191.64	1190.92	0.72	4.97
0.11		6522.00			370.46		
Reach-1		0.35		1191.07	1190.36	0.70	4.94
0.10	6.70	5078.30			386.85		
Reach-1		0.35		1190.13	1189.58	0.55	4.70
0.10		2917.00			309.72		
Reach-1		0.238		1186.57	1186.21	0.35	2.43

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0.02                6522.00                754.50
  Reach-1       0.238              1186.57    1186.21       0.35        2.43
0.02                6522.00                754.50
  Reach-1       0.238              1186.02    1185.66       0.37        2.23
0.04                5085.00                481.46
  Reach-1       0.238              1185.32    1185.11       0.22        2.26
0.01                2917.00                472.16


  Reach-1       0.159              1184.12    1183.83       0.29        2.41
0.04                6522.00                683.65
  Reach-1       0.159              1184.12    1183.83       0.29        2.41
0.04                6522.00                683.65
  Reach-1       0.159              1183.75    1183.51       0.24        2.34
0.03                5085.00                678.13
  Reach-1       0.159              1183.05    1182.88       0.17        2.09
0.00                2917.00                667.10


  Reach-1       0.107              1181.68    1181.03       0.65        3.42
0.15                6522.00                807.05
  Reach-1       0.107              1181.68    1181.03       0.65        2.31
0.16                6522.00                807.05
  Reach-1       0.107              1181.39    1180.89       0.50        5.10
0.09                5085.00                805.80
  Reach-1       0.107              1180.96    1180.74       0.22        5.66
0.01                2917.00                804.48


  Reach-1       0                  1176.79    1176.64       0.15
                 6522.00                1007.30
  Reach-1       0                  1177.09    1176.98       0.11
                 6522.00                1010.32
  Reach-1       0                  1176.20    1176.00       0.20
                 5085.00                 915.67
  Reach-1       0                  1175.29    1175.00       0.29
                 2917.00                 522.67
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CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX B

McMicken Dam Outfall Wash Geotechnical Survey Data

2137 West 7th Street
Tempe, Arizona 85281-7227
(480) 446-9876 (Office)
(480) 966-3347 (Fax)

CONSTRUCTION INSPECTION & TESTING CO.

Engineering Dept.

Fax

To:	Steve VanDyke	From:	Cari Ritter (Ext. 33)
Fax:	623-546-7103	Pages:	9 (Including Cover Page)
Phone:		Date:	3/13/03
Re:	Corte Bella – Off-Site Sewer	CC:	Scott Buchanan w/ Stanley Consultants – 602-912-6599

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Comments: **Steve here is a copy of the Off-Site Sewer Line (Revised) for Corte Bella. If you have any questions or comments please call the office 480-446-9876.**

CONSTRUCTION INSPECTION & TESTING CO.

2137 WEST 7TH STREET
TEMPE, ARIZONA 85281-7227
(480) 446-9876 FAX (480) 446-7680

March 13, 2003

Sun City Grand by Del Webb
14780 W. Mountain View Boulevard
Sun City West, Arizona 85376

Re: **Off-Site Sewer Line (Revised)**

Project: Corte Bella (Formerly Pleasant Valley Country Club)
– Off-Site Sewer
Deer Valley Road and McMicken Canal/
Rose Garden Lane and Agua Fria River
Surprise, Arizona

CIT Project No.: 53796

Attention: Steve VanDyke

As requested this firm has completed two test holes for the purpose of scour design. The first test hole (B1) was advanced to a depth of 15 feet in the McMicken Flood channel at the Deer Valley Road alignment. The second test hole (B2) was advanced to a depth of 60 feet north of Rose Garden Lane in the Agua Fria River. The soils encountered at each test boring location were visually classified and logged (refer to the attached Boring Logs).

Representative samples were retrieved during drilling. The samples were tested for particle-sized distribution. Due to the use of a drill rig to advance test holes estimated percentages of cobbles and size of cobbles were made during drilling operations and further verified by evaluation of a nearby gravel pit. The attached grain size distribution curves reflect the estimated cobbles percentage and size. The D50 from the grain-sized distribution curves are as follows.

Corta Bella (Pleasant Valley Country Club)
Deer Valley Road, West of El Mirage Road
Peoria, Arizona
CIT Project No. 52664

Location	D50
B1 (1-5')	10.3
B2 (0-5')	7.0
B2 (10-15')	10.3
B2 (35-46.5')	3.0

In addition to grain size distribution curves estimated unit weights are provided on the attached boring logs.

If there are any questions, please call the undersigned.

Respectfully submitted,
Construction Inspection & Testing Co.

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
35917
DELBERT A.
RAPIER
Date Signed 3/3/03
ARIZONA U.S.A.

Delbert A. Rapier, M.S.E., P.E.

Fax: (1) Addresse
(1)Scott Buchanan/Stanley Consultants

CONSTRUCTION INSPECTION & TESTING CO.

Boring Log

For:	Sun City Grand by Del Webb	**Date:**	01/29/2003	**Project No.**	53796
Project:	Corta Bella	**Type of Boring:**	8" Auger		
Location of Project:	Deer Valley Road and McMicken Canal; Rose Garden Lane and Agua Fria River	**Field Party:**	J. Cowell		
Boring No.	B1	**Boring No.**			
Location:	See Site Plan	**Location:**			

1-		GM: Silty Sand and Gravel with some Cobbles Gray-Tan, Moist, Non Plastic
2-		GC-GM: Cobblely, Clayey Sand Gravel. Light Brown, Moist, Low PI, Trace of Cementation (Estimated 30 % cobbles 3 to 10 inches in size with an average size of 3 to 4 inches)
3-		Estimated Unit Weight: 130lb/ft³
4-		
5-		
6-	81	
7-	N	
8-		
9-		
10-		
11-	50/ 4"	Increase in % Cobbles Below 10' (Estimated 35 to 40% cobbles ranging From 6 to 12 inches in size with an average size of 8 inches)
12-	N	Estimated Unit Weight: 135lb/ft³
13-		
14-		
15-		Bottom at 15'

1-		
2-		
3-		
4-		
5-		
6-		
7-		
8-		
9-		
10-		
11-		
12-		
13-		
14-		
15-		

CONSTRUCTION INSPECTION & TESTING CO.

Boring Log

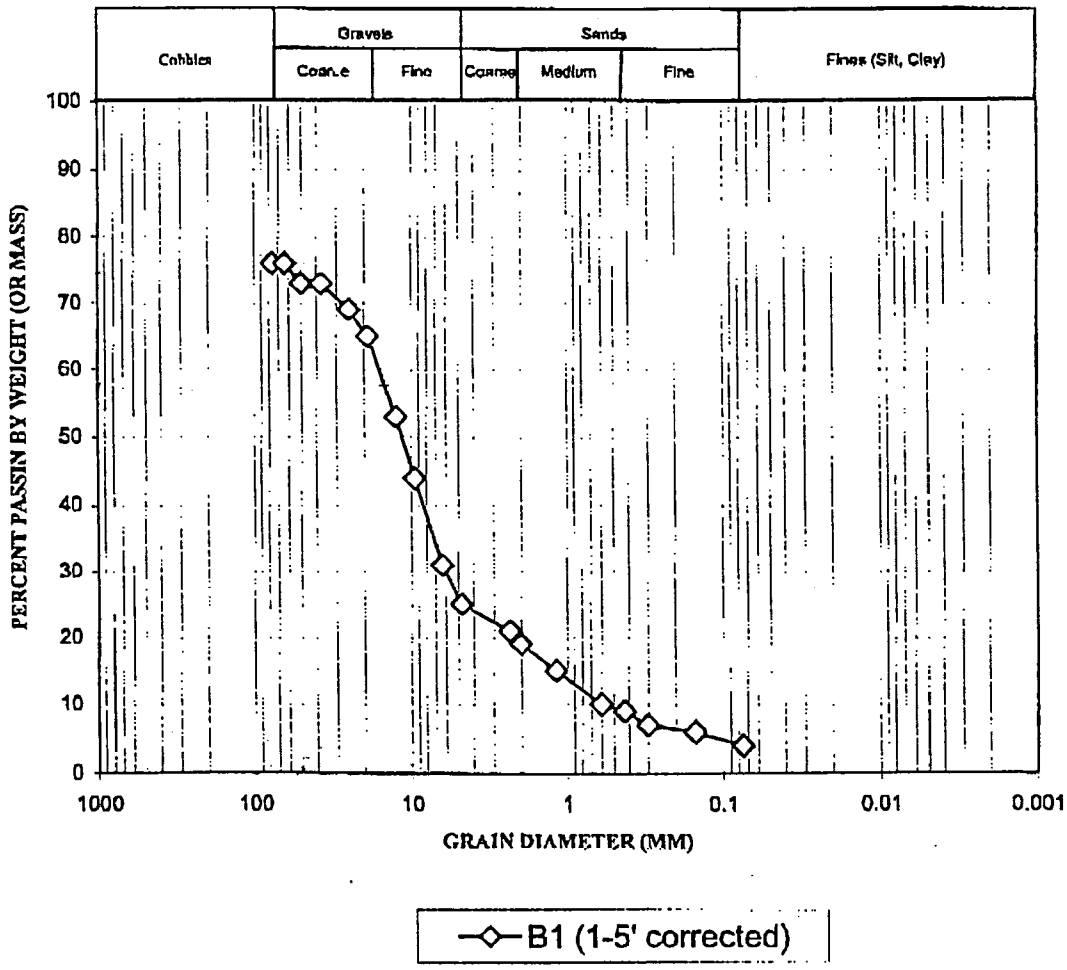
For: Sun City Grand by Del Webb **Date:** 01/29/2003 **Project No.** 53796
Project: Corta Bella **Type of Boring:** 8" Auger
Location of Project: Deer Valley Road and McMicken Canal; Rose Garden Lane and Agua Fria River
Boring No. B2 **Field Party:** J. Cowell
Location: See Site Plan

Depth	Blows	Description
2		GM: Silty Sand and Gravel with some Small Cobbles, Gray-Tan, Damp, Non Plastic (Estimated 30 % cobbles ranging in size 3 to 8 inches with an average of 4 inches)
		Estimated Unit Weight: 125 lb/ft³
4		
6		GC-GM: Cobblely Clayey Sandy Gravel, Light, Brown, Moist, Low PI (Estimated 35% cobbles 8 to 12 inches inches in size with an average size of 10 inches)
8		Estimated Unit Weight: 135 lb/ft³
10		
12	68 N	
14		
16		
18		
20		
22	87 N	SC-SM: Gravelly Clayey Sand, Light Brown, Moist, Trace of Cementation, Low-Medium PI (Estimated 15% cobbles with an averaged size of 3 to 4 inches)
24		
26	54 N	Estimated Unit Weight: 130 lb/ft³
28		SC-SM:Clayey Sand with some Gravel, Light Brown, Moist, Low PI, Trace of Cementation
30		
32	37 N	(Estimated 10 to 15% cobbles with an average size of 3 to 4 inches)
		Estimated Unit Weight: 120lb/ft³
34		Increase in % Gravel Below 33'
36	50/5" N	SC-SM: Clayey Gravelly Sand, Weak Cementation, Moist, Tan, Low PI (Estimated 10 to 15% cobbles with an average size of 3 to 4 inches)
38		Estimated Unit Weight: 125lb/ft³
40		
42	81 N	
44		
46	85 N	
48		
50		
52	50/5" N	SC-SM: Clayey Gravelly Sand, Trace of Cementation, Tan,Moist, Low-Medium PI
		Estimated Unit Weight: 125lb/ft³
54		GC-GM: Clayey Sandy Gravel, with some Cobbles, Weak Cementation, Tan, Moist, Low-Medium PI (Estimated 10 to 15% cobbles with an average size of 3 to 4 inches)
56	50/5" N	Estimated Unit Weight: 135lb/ft³
58		
60		Bottom of Test Hole at 60.6'

CONSTRUCTION INSPECTION & TESTING CO.

GRAIN SIZE DISTRIBUTION CURVE (USCS)

Date: 1/29/2003
Project No.: 53796
Project: Corta Bella (Formerly Pleasant Valley C.C.)
Location: Off Site Sewer Line



CONSTRUCTION INSPECTION & TESTING CO.

GRAIN SIZE DISTRIBUTION CURVE (USCS)

Date: 1/29/2003
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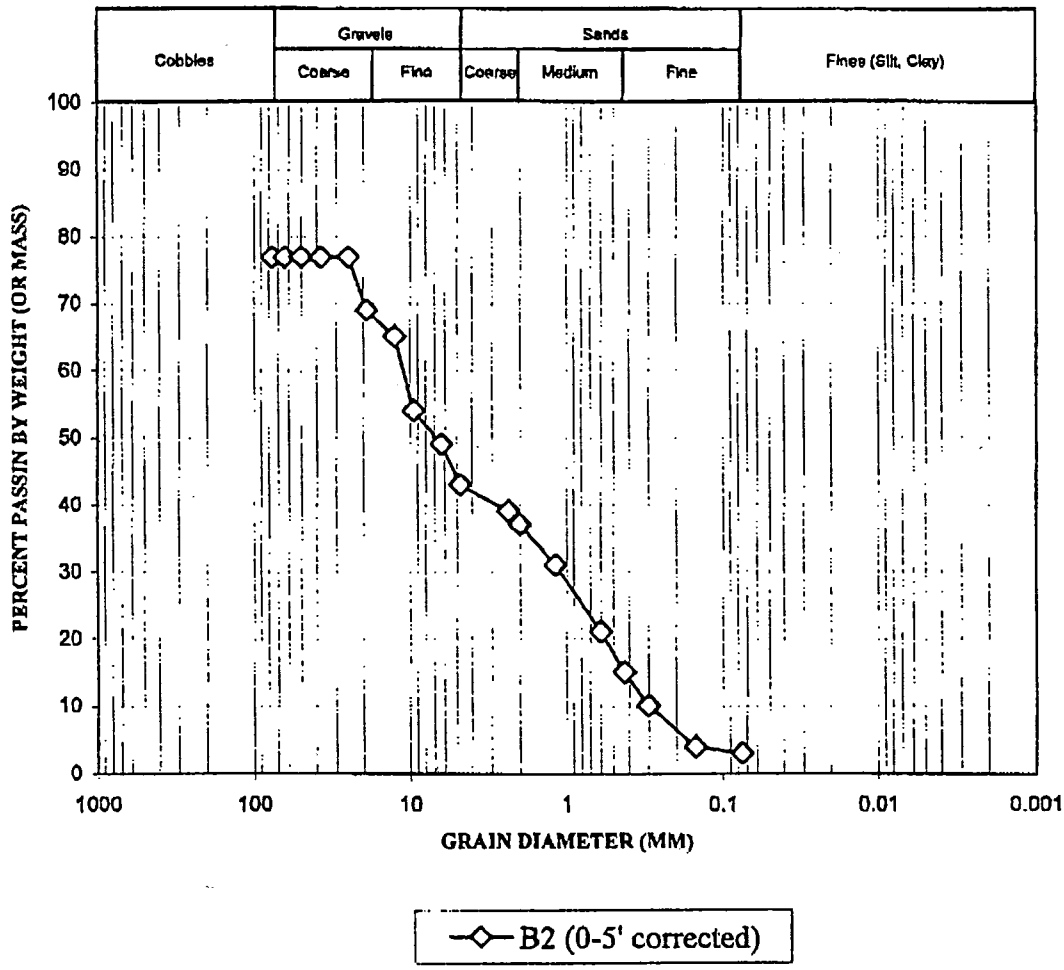

CONSTRUCTION INSPECTION & TESTING CO.

GRAIN SIZE DISTRIBUTION CURVE (USCS)

Date: 1/29/2003
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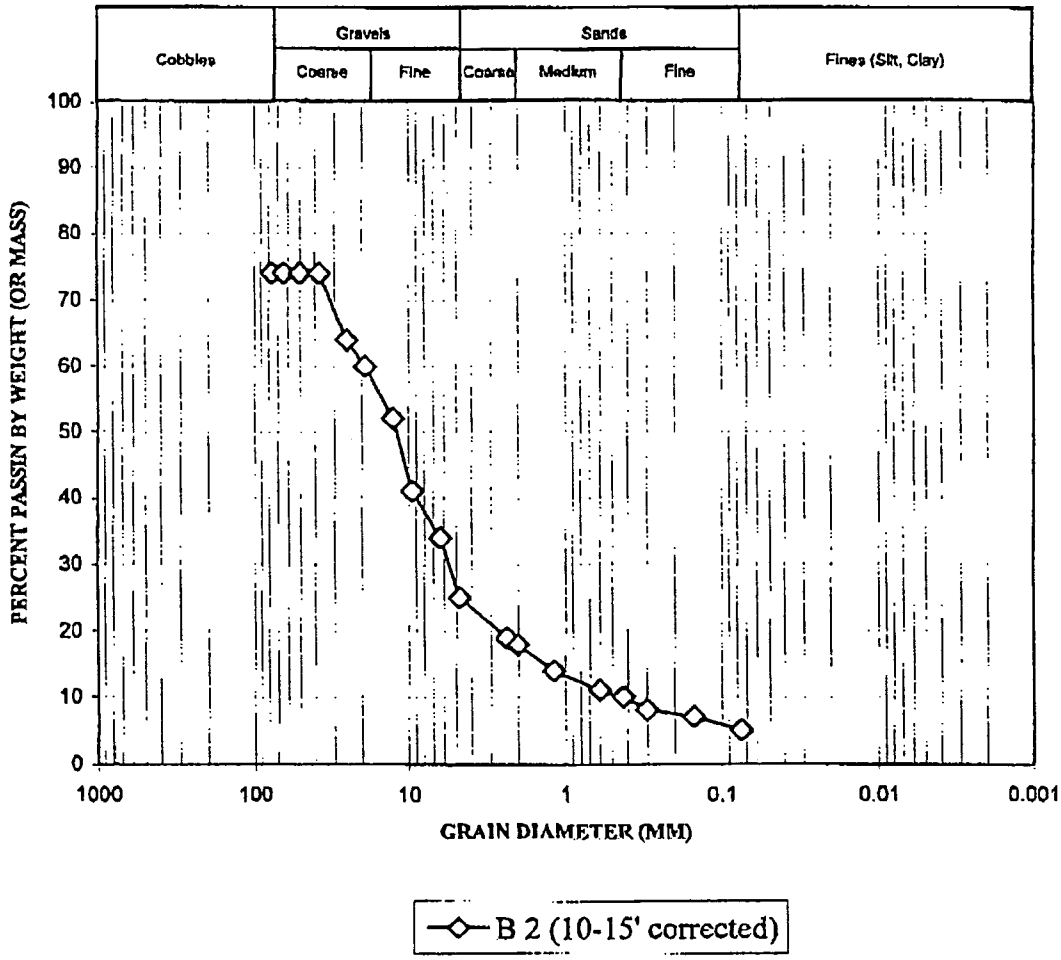
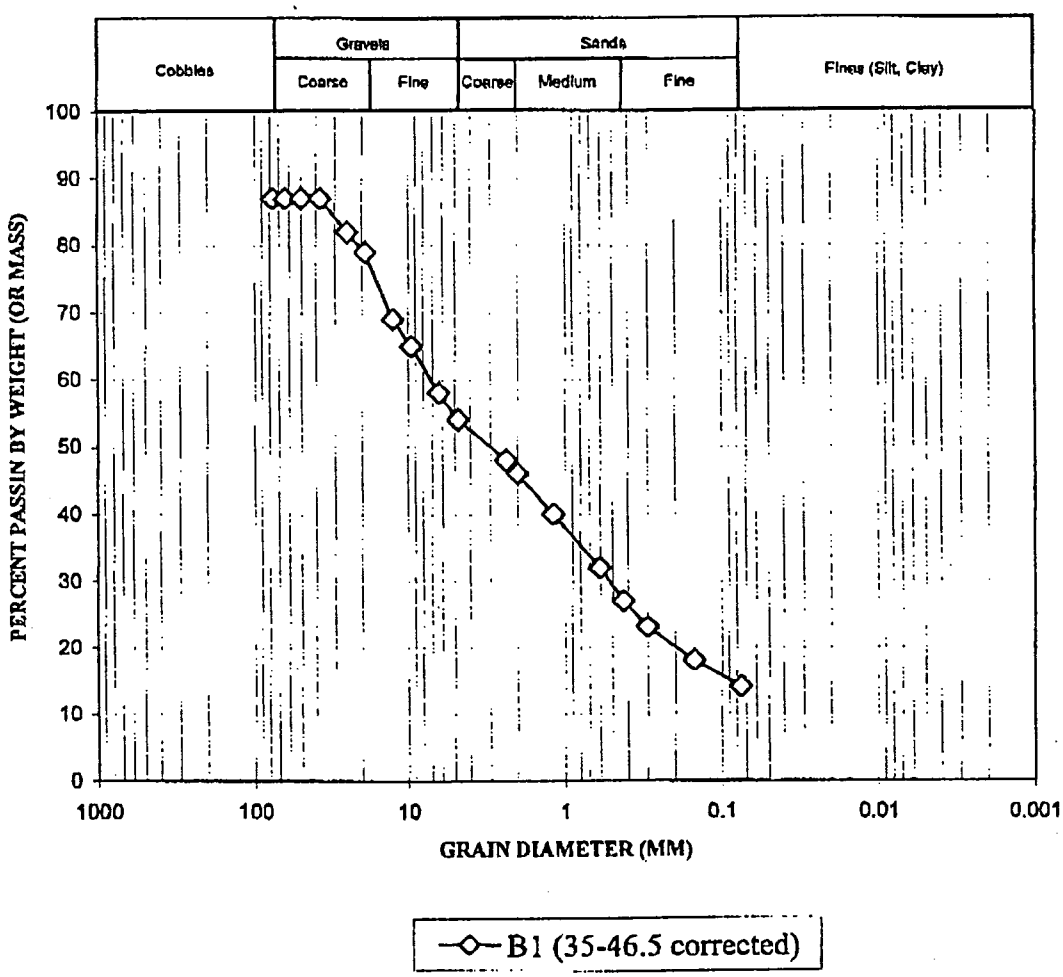


CONSTRUCTION INSPECTION & TESTING CO.

GRAIN SIZE DISTRIBUTION CURVE (USCS)

Date: 1/29/2003
Project No.: 53796
Project: Corta Bella (Formerly Pleasant Valley C.C.)
Location: Off Site Sewer Line



CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX B

McMicken Dam Outfall Wash Scour and Lateral Migration Calculations
and Supporting Documentation

Watercourse: McMicken Dam Canal @ Deer Valley Drive
Source: HEC-RAS Model: McMicDamCnlRev00.prj
Computed by: _____ Date: _____
Checked by: _____ Date: _____
Approved by: _____ Date: _____

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Design Discharge (Q100) Hydraulics

HEC-2 Section	Q100 (cfs)	d_m (ft)	V_m (ft/s)	w (ft)	q (cfs/ft)	S (ft/ft)
1.858	6273	5.70	6.41	216.46	29	0.0040
1.788	6273	5.52	7.30	205.83	30	0.0058
Average Values:	6273	5.61	6.86	-	29.73	0.00490

Dominant Discharge (Q10) Hydraulics

HEC-2 Section	Q10 (cfs)	d_m' (ft)	V_m' (ft/s)	w (ft)	q (cfs/ft)	S' (ft/ft)
1.858	2876	3.90	4.76	200.28	14	0.0038
1.788	2876	3.80	5.57	193.22	15	0.0061
Average Values:	2876	3.85	5.17	-	14.62	0.00495

Percent Passing	Partical Size (mm)
D_{50}	10.3
D_{75}	55
D_{90}	90

Notes:
HEC-RAS Model: Q:\16392\Schalk\HEC-RAS\McMicDamCnlRev00.prj
V_m: Channel velocity at design discharge, ft/s
d_m: Channel flow depth at design discharge, ft
S: Energe grade at design discharge, ft/ft
w: Top channel width at design discharge, ft
q: Unit design discharge per top width, cfs/ft

V_m': Channel velocity at dominant discharge, ft/s
d_m': Channel flow depth at dominant discharge, ft
S': Energe grade at dominant discharge, ft/ft

Scour Depth Analysis

17-Mar-2003

Project Name:	Pleasant Valley Country Club Off-Site Sewer	**Computed by:**	
SCI Project No:	16392	**Checked by:**	
Location:	McMicken Dam Canal @ Deer Valley Drive	**Approved by:**	

Known Parameters:

Hydrology Parameters:

Design Discharge (Q_{100}):	6273	cfs	
Dominant Discharge (Q_{10}):	2876	cfs	(estimated)

Hydraulics Parameters:

Manning's Roughness (n):	0.04		(at design discharge)
Mean Channel Velocity (V_m):	6.86	fps	(at design discharge)
Mean Channel Velocity (V_m'):	5.17	fps	(at dominant discharge)
Mean Water Depth (d_m):	5.61	ft	(at design discharge)
Mean Water Depth (d_m'):	3.85	ft	(at dominant discharge)
Energy Slope (S):	0.00490	ft/ft	(at design discharge)
Energy Slope (S'):	0.00495	ft/ft	(at dominant discharge)
Unit Discharge (q):	29.73	cfs/ft	(at design discharge)

Soil Parameters:

D_{50}	10.3	mm	0.406	in	0.0338	ft
D_{90}	90	mm	3.543	in	0.2953	ft
Soil Specific Weight (Y_s):	130	lb/ft^3				

Constants:

Water Specific Weight (Y_w):	62.4	lb/ft^3

Calculated Parameters:

Blench's "zero bed factor", F_{bo}	3.5	ft/s^2	(from Figure 9, USBR 1984)
Competent Velocity, V_c	4.6	ft/s	($V_c = 1.46\ D_{50}^{2/7} q^{1/7}$)

General Scour, D_{gs} (Based on Design Discharge)

US Bureau of Reclamation (USBR):		$D_{gs} = 2.45\ q^{0.24}$	*D_{gs} =	5.53	ft
Lacey Equation:	Z= 0.5	$D_{gs} = Z\ 0.47\ (Q_{100}/(1.76 D_{50}^{1/2}))^{1/3}$	D_{gs} =	2.43	ft
Blench Equation:	Z= 0.6	$D_{gs} = Z\ 1.67\ q^{2/3} / F_{bo}^{1/3}$	D_{gs} =	3.79	ft
Competent Velocity Approach:		$D_{gs} = d_m\ (V_m/V_c - 1)$	D_{gs} =	2.73	ft
			Average D_{gs} =	2.98	ft

Long Term Scour, D_{lts} (Based on Dominant Discharge)

Armor Particle Size, D_c

Bedload Transport (Meyer-Peter, Muller):

$$D_c = \frac{d_m' S'}{0.19 \left(\frac{n_s}{D_{90}^{1/6}}\right)^{3/2}}$$

D_c = 38.62 mm = 0.13 ft

Competent Bottom Velocity:	$D_c = 1.88\ V_m'^2$	D_c =	50.25	mm	=	0.16 ft
Shields Diagram:	$D_c = Y_w d_m' S' / (Ys - Yw) / 0.06$	*D_c =	89.37	mm	=	0.29 ft
Yang Incipient Motion:	$D_c = 0.00659\ V_m'^2$	D_c =	53.69	mm	=	0.18 ft
		Average D_c =	47.52	mm	=	0.16 ft

Decimal percentage of original bed material larger than D_c,		Δ_p =	0.27	
Long Term Scour Depth, D_{lts}	$D_{lts} = 2\ D_c\ (1/\Delta_p - 1)$	**Total D_{lts} =**	0.84	ft

Bed-Form Scour, D_{bfs}

Dune Scour (Simons 1977)	$D_{ds} = 0.033\ d_m^{1.209}$	D_{ds} =	0.27	ft
Antidune Scour (SLA 1985)	$D_{ads} = 0.0135\ V_m^2$	D_{ads} =	0.64	ft
		Maximum D_{bfs} =	0.64	ft

Total Scour, D_s

Total Computed Scour Depth, Ds = $D_{gs} + D_{lts} + D_{bfs}$ — **D_s =** 4.5 ft

Design D_s = 5.8 ft (Safety Factor = 1.3)

*Not Applicable

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Designed by: Frank Gu, P.E.

Lateral Migration Analysis

18-Mar-2003

Project Name:	Pleasant Valley Country Club Off-Site Sewer	**Computed by:**	
SCI Project No:	16392	**Checked by:**	
Location:	McMicken Dam Canal @ Deer Valley Drive	**Approved by:**	

Known Parameters:

Hydrology Parameters:

Total Discharge (Q_{100}): 6273 cfs

Hydraulics Parameters:

Manning's Roughness (n):	0.040	
Mean Channel Velocity (V_m):	6.86	fps (at design discharge)
Mean Water Depth (d_m):	5.61	ft (at design discharge)
Energy Slope (S):	0.00490	ft/ft (at design discharge)
Channel side Slope (Z):	3.3	ft/ft (horizontal/vertical)
Channel bottom (b):	160	ft

Soil Parameters:

D_{75} 55 mm 2.165 in 0.1804 ft

Constants:

Water Specific Weight (Y_w): 62.4 lb/ft^3

Level I

Equation:

--> setback = $1.0(Q_{100})^{0.5}$ Straight channel reaches or with minor curvature

setback = $2.5(Q_{100})^{0.5}$ Channels with obvious curvature or channel bend

Setback = 79.2 ft

Level II - Allowable Velocity Analysis

Equation: $V_a = V_b \times C_a \times C_b \times C_d$

V_a = Maximum allowable flow velocity, ft/s

V_b = Basic maximum allowable flow velocity obtained from Fig 1, ft/s

C_a, C_b, C_d = Correction factors for channel alignment, bank slope and flow depth, respectively, (Fig 2 thru 4)

Figure Look-Up:

V_b =	6.70	ft/s, (Figure 1)	(Sediment Laden)
C_a =	1.00	(Figure 2)	
C_b =	0.84	(Figure 3)	
C_d =	1.14	(Figure 4)	

V_a = 6.4 ft/s **Bank Not Stable**

Level II - Tractive Stress Analysis

Equation:

$t = Y_w d_m [D_{75}^{1/6} / 39 n]^2 S$

$t_{st} = C_{st} \times (C_{sc} C_s t - C_s t) + C_s t$ Actual tractive stress, lbs/ft^2

$t_{ls} = 0.4 [(Z^2 - Cot^2 \Phi R) / (1+Z^2)]^{1/2} D_{75}$ Allowable tractive stress, lbs/ft^2

Figure Look-Up:

C_s =	0.80	(Figure 5)	b/d_m = 28.5
C_{sc} =	1.0	(Figure 6)	r_c/b > 10
C_{st} =	0.15	(Figure 7)	L_c/b > 10
ΦR =	38.1	(Figure 8)	Slightly Rounded

t = 0.91 lbs/ft^2

t_{st} = 0.73 lbs/ft^2

t_{ls} = 0.76 lbs/ft^2

$t_{st} < t_{ls}$ **Bank Stable**

Lateral Setback:

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Designed by: Frank Gu, P.E.

SCI # 16392
Pleasant Valley Country
Club Off-Site Sewer
McMicken Dam Canal
@ Dear Valley Dr.

100-YR PROFILE

Plan: Imported Pla RIVER-1 Reach-1 RS: 1.788 Profile: PF 1

	E.G. Elev (ft)	1248.35	Element	Left OB	Channel	Right OB
	Vel Head (ft)	0.83	Wt. n-Val.		0.040	
	W.S. Elev (ft)	1247.52	Reach Len. (ft)	485.00	425.00	390.00
	Crit W.S. (ft)		Flow Area (sq ft)		859.41	
*	E.G. Slope (ft/ft)	0.005779	Area (sq ft)		859.41	
0-YR *	Q Total (cfs)	6273.00	Flow (cfs)		6273.00	
	Top Width (ft)	205.83	Top Width (ft)		205.83	*
	Vel Total (ft/s)	7.30	Avg. Vel. (ft/s)		7.30	*
*	Max Chl Dpth (ft)	5.52	Hydr. Depth (ft)		4.18	
	Conv. Total (cfs)	82516.4	Conv. (cfs)		82516.4	
	Length Wtd. (ft)	425.00	Wetted Per. (ft)		206.82	
	Min Ch El (ft)	1242.00	Shear (lb/sq ft)		1.50	
	Alpha	1.00	Stream Power (lb/ft s)		10.94	
	Frctn Loss (ft)	2.19	Cum Volume (acre-ft)	0.45	227.48	0.02
	C & E Loss (ft)	0.03	Cum SA (acres)	0.94	75.66	0.06

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.

SCI # 16392
Pleasant Valley Country Club
Off-Site Sewer
McMicken Dam Canal
@ Dear Valley Dr

100-YR PROFILE

Plan: Imported Pla RIVER-1 Reach-1 RS: 1.858 Profile: PF 1

	E.G. Elev (ft)	1250.13	Element	Left OB	Channel	Right OB
	Vel Head (ft)	0.64	Wt. n-Val.		0.040	
	W.S. Elev (ft)	1249.50	Reach Len. (ft)	425.00	370.00	320.00
	Crit W.S. (ft)		Flow Area (sq ft)		978.65	
*	E.G. Slope (ft/ft)	0.004008	Area (sq ft)		978.65	
100-YR *	Q Total (cfs)	6273.00	Flow (cfs)		6273.00	
	Top Width (ft)	216.46	Top Width (ft)		216.46	*
	Vel Total (ft/s)	6.41	Avg. Vel. (ft/s)		6.41	*
*	Max Chl Dpth (ft)	5.70	Hydr. Depth (ft)		4.52	
	Conv. Total (cfs)	99083.4	Conv. (cfs)		99083.4	
	Length Wtd. (ft)	370.00	Wetted Per. (ft)		217.51	
	Min Ch El (ft)	1243.80	Shear (lb/sq ft)		1.13	
	Alpha	1.00	Stream Power (lb/ft s)		7.22	
	Frctn Loss (ft)	1.77	Cum Volume (acre-ft)	0.45	235.29	0.02
	C & E Loss (ft)	0.02	Cum SA (acres)	0.94	77.46	0.06

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.

SC# 16392
Pleasant Valley Country Club
Off-Site Sewer
McMicken Dam Canal
@ Deer Valley Dr

10-YR PROFILE

Plan: Imported Pla RIVER-1 Reach-1 RS: 1.858 Profile: PF 4

	E.G. Elev (ft)	1248.05	Element	Left OB	Channel	Right OB
	Vel Head (ft)	0.35	Wt. n-Val.		0.040	
	W.S. Elev (ft)	1247.70	Reach Len. (ft)	425.00	370.00	320.00
	Crit W.S. (ft)		Flow Area (sq ft)		603.88	
*	E.G. Slope (ft/ft)	0.003789	Area (sq ft)		603.88	
	Q Total (cfs)	2876.00	Flow (cfs)		2876.00	*
	Top Width (ft)	200.28	Top Width (ft)		200.28	*
	Vel Total (ft/s)	4.76	Avg. Vel. (ft/s)		4.76	*
*	Max Chl Dpth (ft)	3.90	Hydr. Depth (ft)		3.02	
	Conv. Total (cfs)	46720.3	Conv. (cfs)		46720.3	
	Length Wtd. (ft)	370.00	Wetted Per. (ft)		200.92	
	Min Ch El (ft)	1243.80	Shear (lb/sq ft)		0.71	
	Alpha	1.00	Stream Power (lb/ft s)		3.39	
	Frctn Loss (ft)	1.75	Cum Volume (acre-ft)		137.01	
	C & E Loss (ft)	0.01	Cum SA (acres)		63.96	

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.

SCI # 16392
Pleasant Valley Country Club
Off-Site Sewer
McMicken Dam Canal
@ Deer Valley Dr

10-YR PROFILE

Plan: Imported Pla RIVER-1 Reach-1 RS: 1.788 Profile: PF 4

	E.G. Elev (ft)	1246.28	Element	Left OB	Channel	Right OB
	Vel Head (ft)	0.48	Wt. n-Val.		0.040	
	W.S. Elev (ft)	1245.80	Reach Len. (ft)	485.00	425.00	390.00
	Crit W.S. (ft)		Flow Area (sq ft)		516.34	
*	E.G. Slope (ft/ft)	0.006085	Area (sq ft)		516.34	
	Q Total (cfs)	2876.00	Flow (cfs)		2876.00	*
	Top Width (ft)	193.22	Top Width (ft)		193.22	*
	Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)		5.57	*
*	Max Chl Dpth (ft)	3.80	Hydr. Depth (ft)		2.67	
	Conv. Total (cfs)	36869.3	Conv. (cfs)		36869.3	
	Length Wtd. (ft)	425.00	Wetted Per. (ft)		193.75	
	Min Ch El (ft)	1242.00	Shear (lb/sq ft)		1.01	
	Alpha	1.00	Stream Power (lb/ft s)		5.64	
	Frctn Loss (ft)	2.32	Cum Volume (acre-ft)		132.25	
	C & E Loss (ft)	0.01	Cum SA (acres)		62.29	

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.

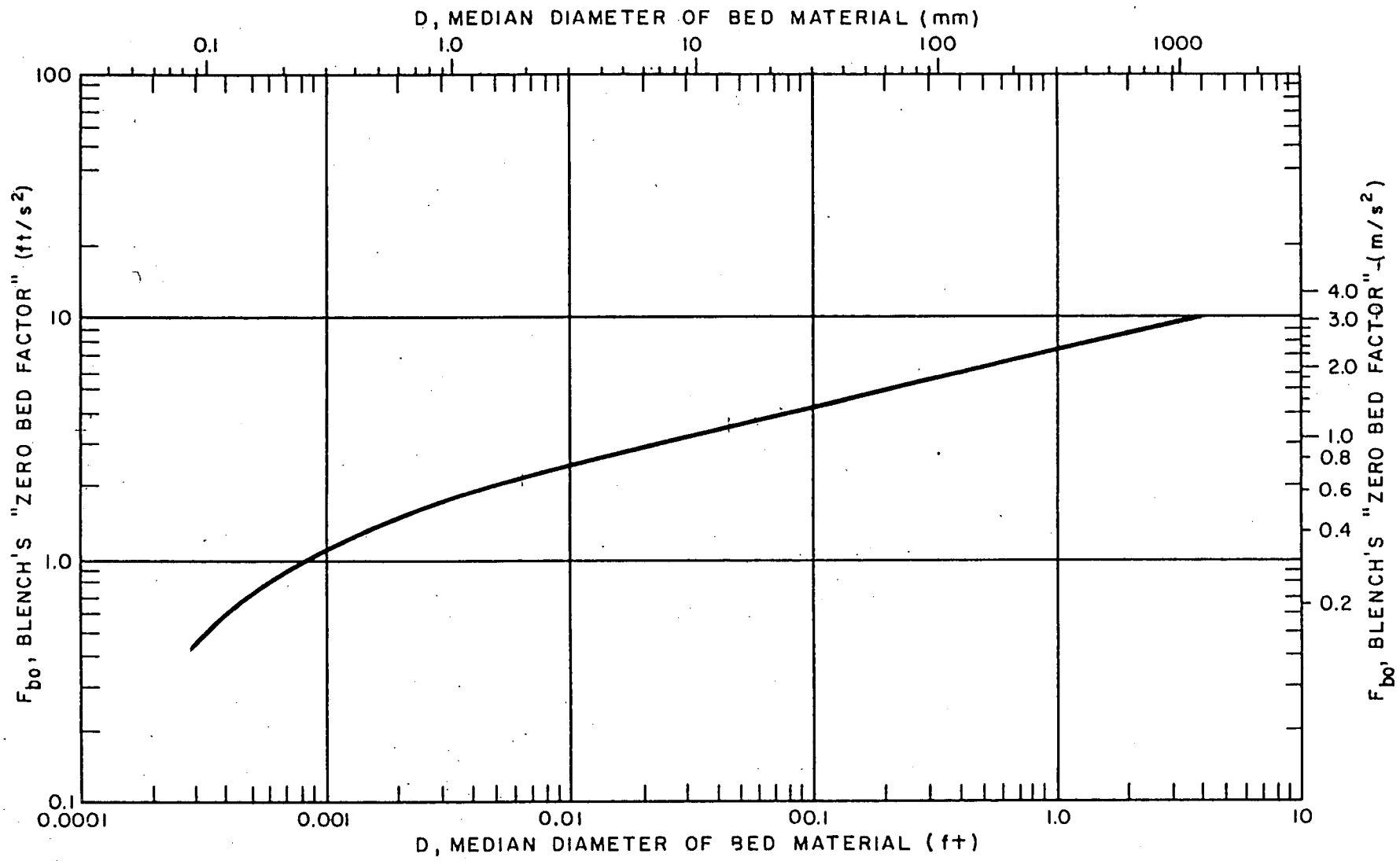
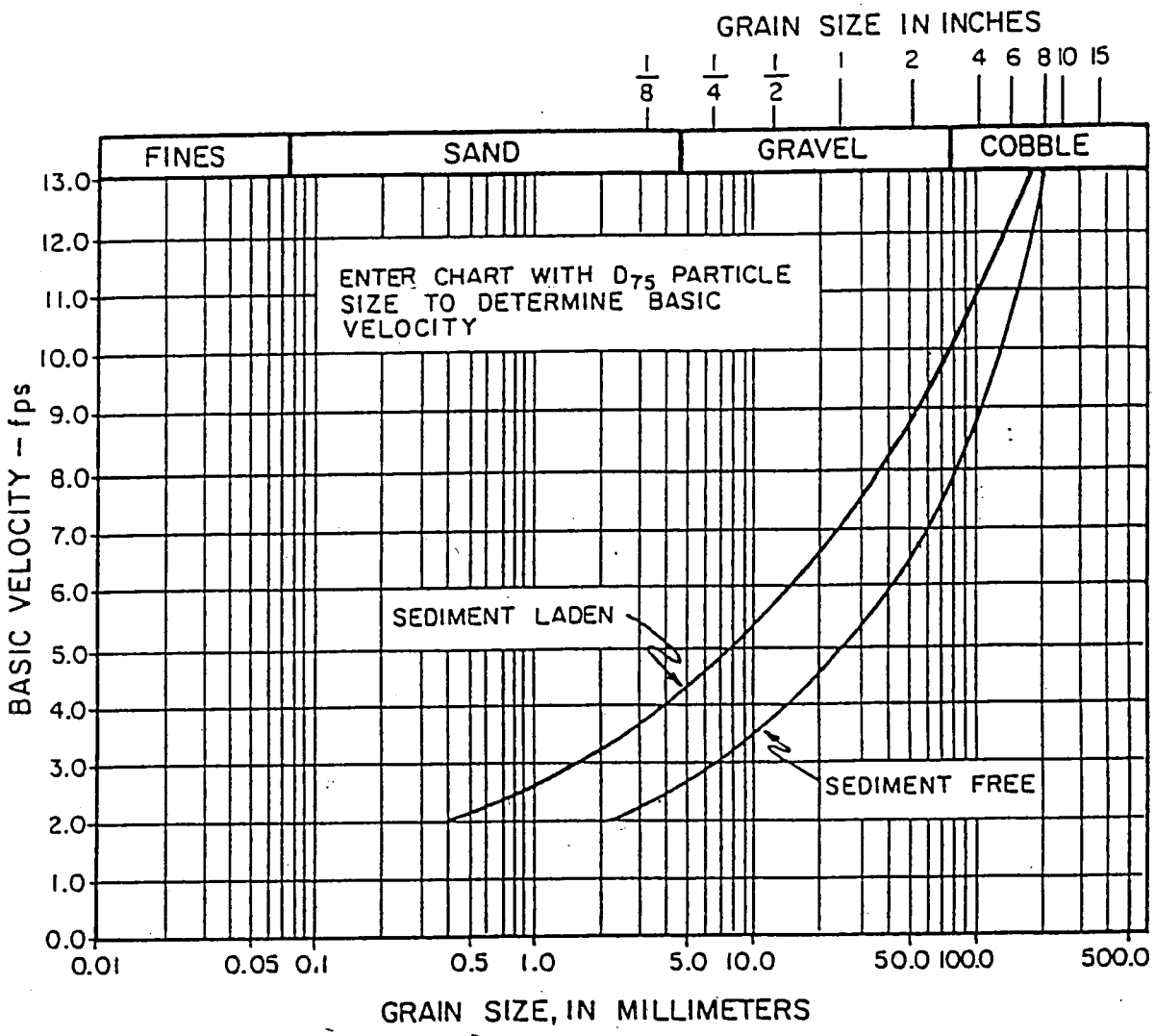


CHART FOR ESTIMATING F_{bo} (AFTER BLENCH)

Figure 9. - Chart for estimating F_{bo} (after Blench, 1969).



$D_{75} = 55$ mm

FIGURE 1

BASIC ALLOWABLE VELOCITY FOR EARTHEN CHANNELS

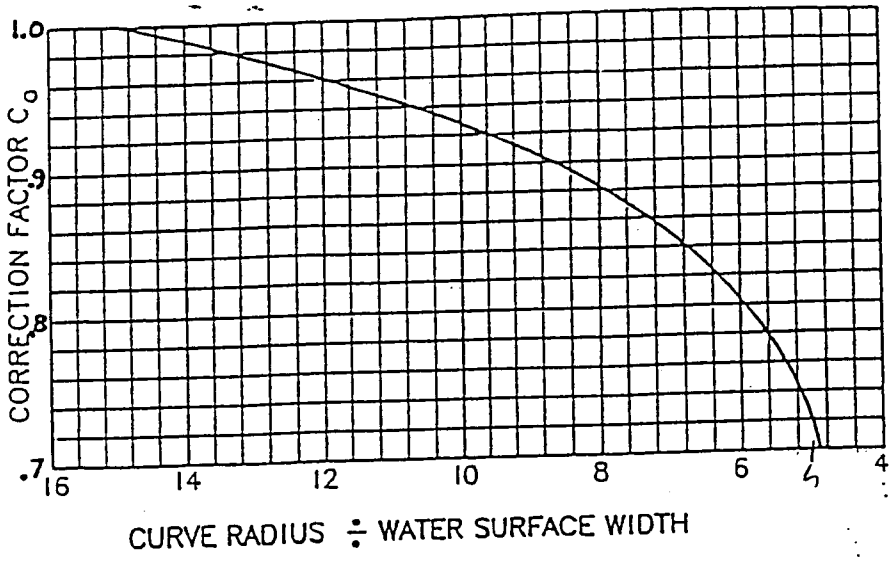


FIGURE 2

CORRECTION FACTOR C_a FOR CHANNEL ALIGNMENT

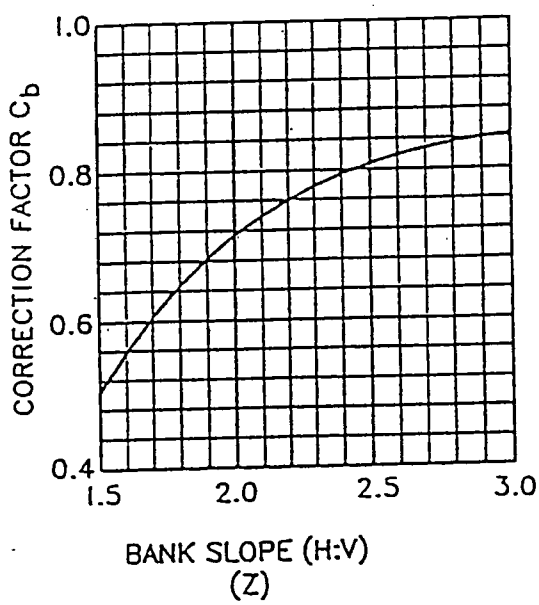


FIGURE 3

CORRECTION FACTOR C_b FOR BANK SLOPE

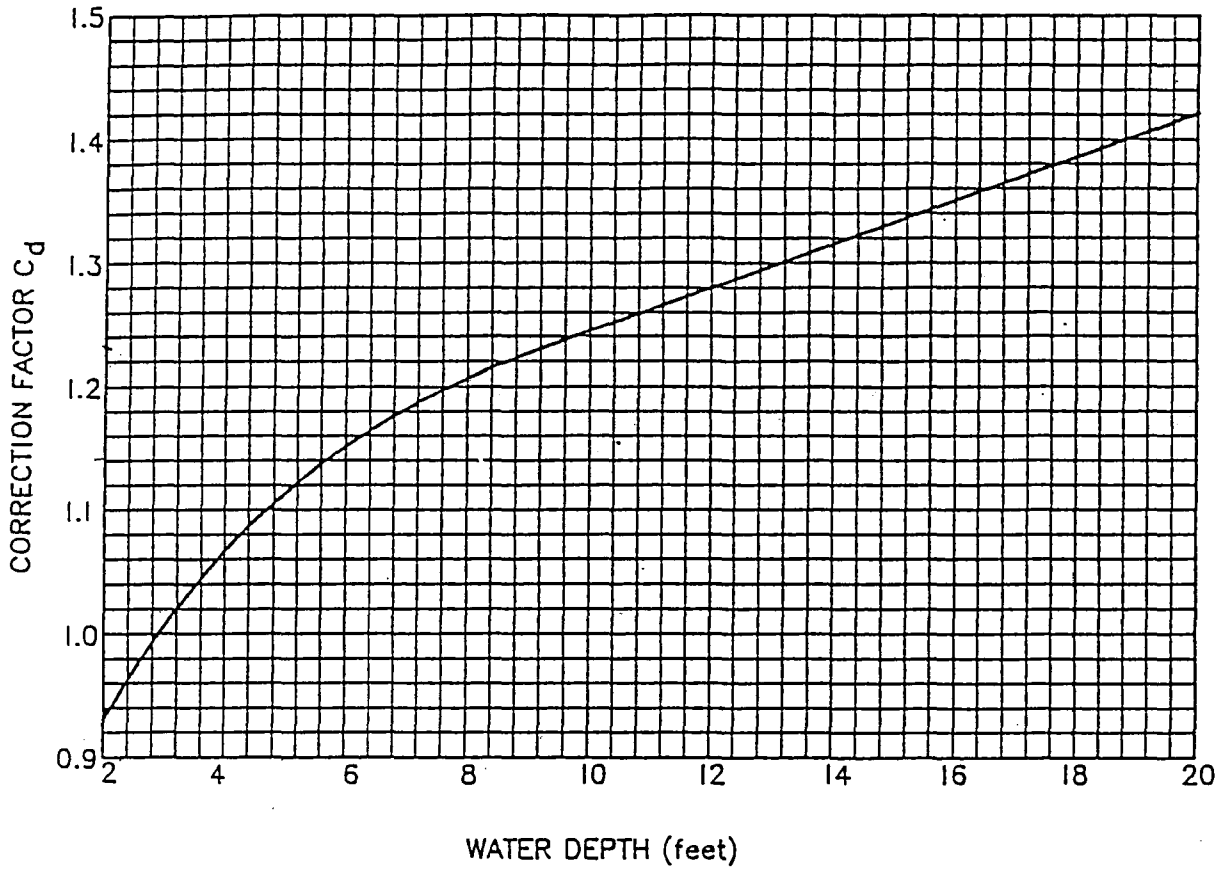


FIGURE 4

CORRECTION FACTOR C_d FOR DEPTH OF FLOW

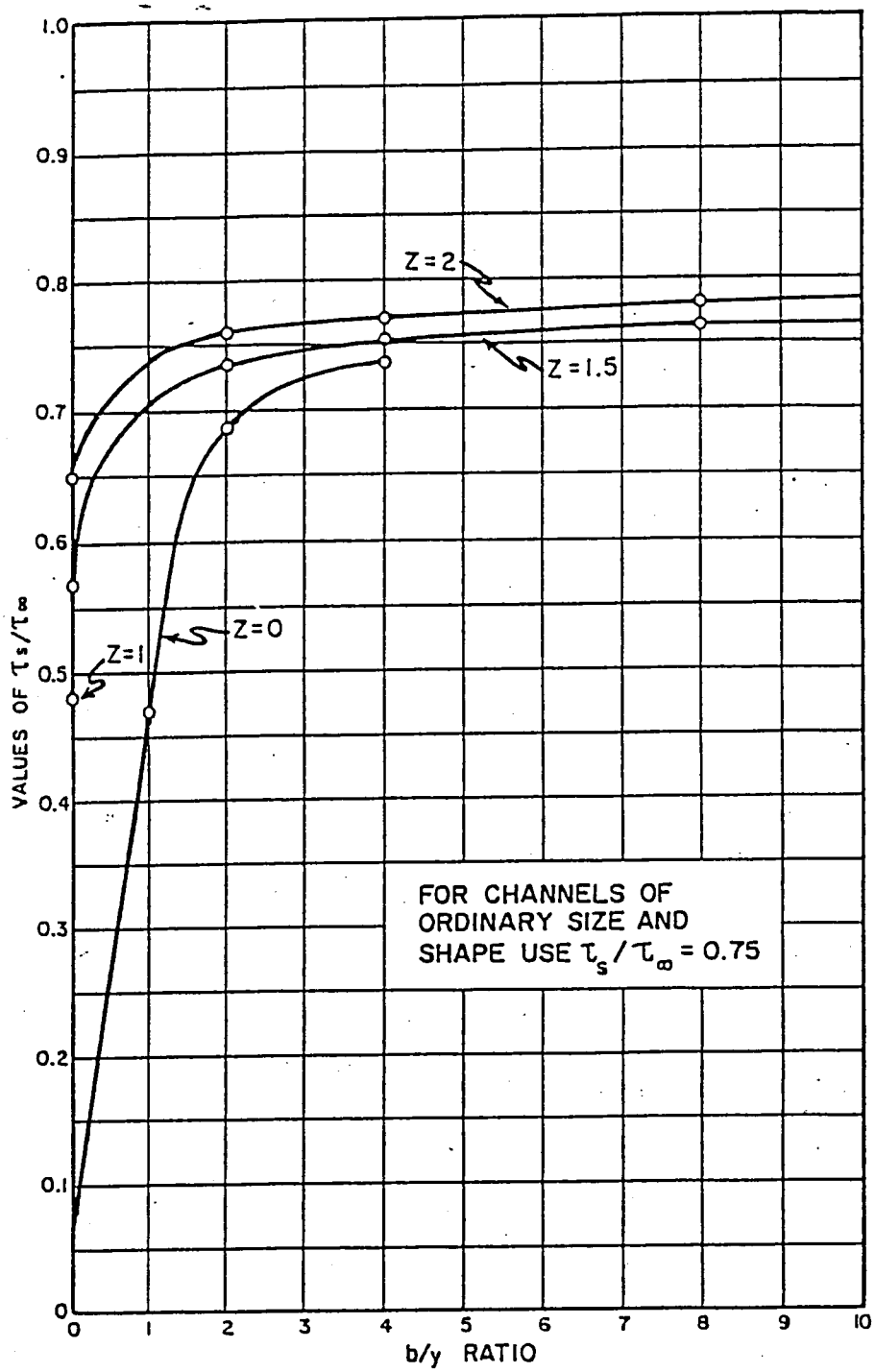


FIGURE 5

ACTUAL MAXIMUM TRACTIVE STRESS, τ_s, ON SIDES OF STRAIGHT TRAPEZOIDAL CHANNELS

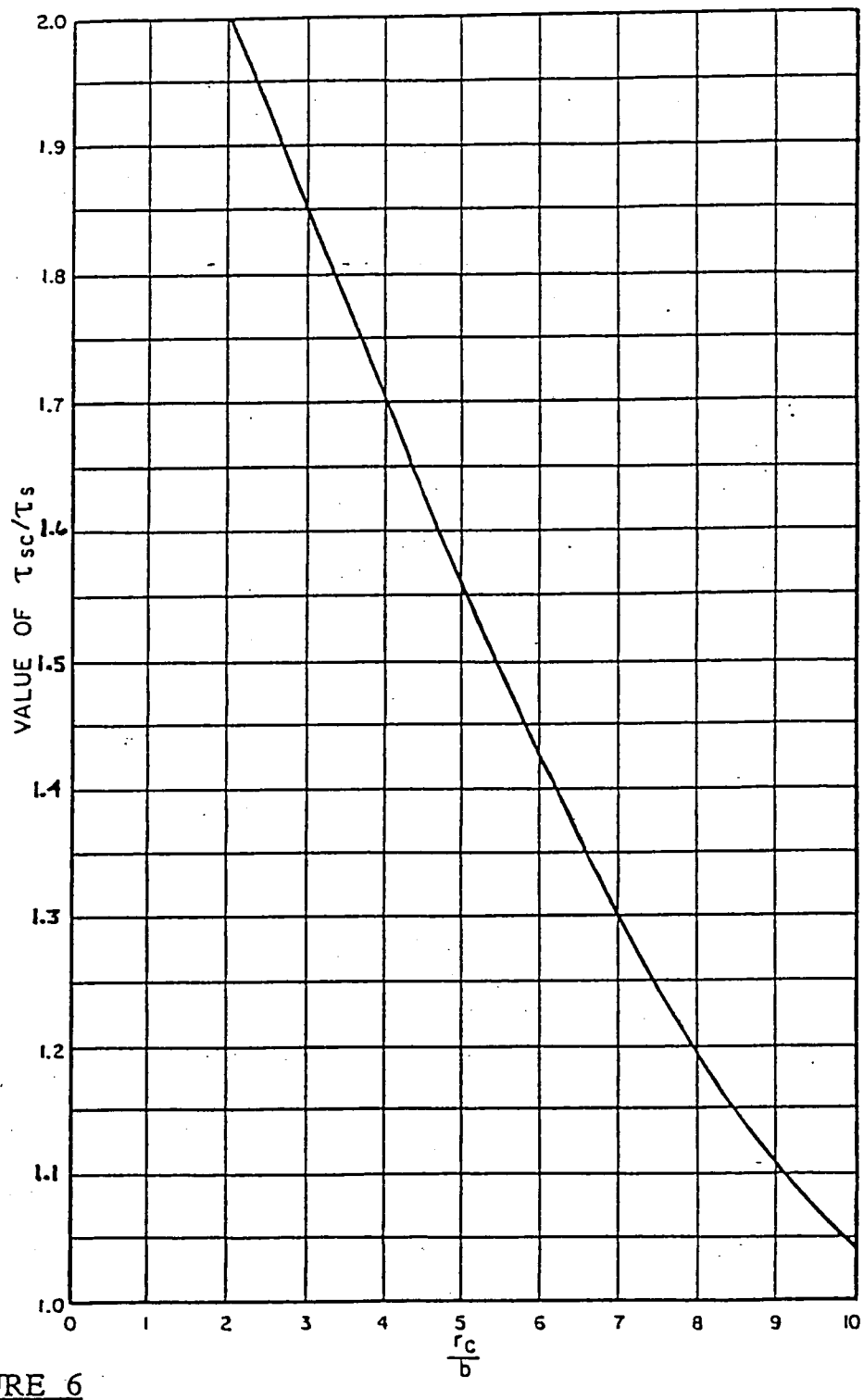


FIGURE 6

ACTUAL MAXIMUM TRACTIVE STRESS, τ_{sc}, ON SIDES OF TRAPEZOIDAL CHANNELS WITHIN A CURVED REACH

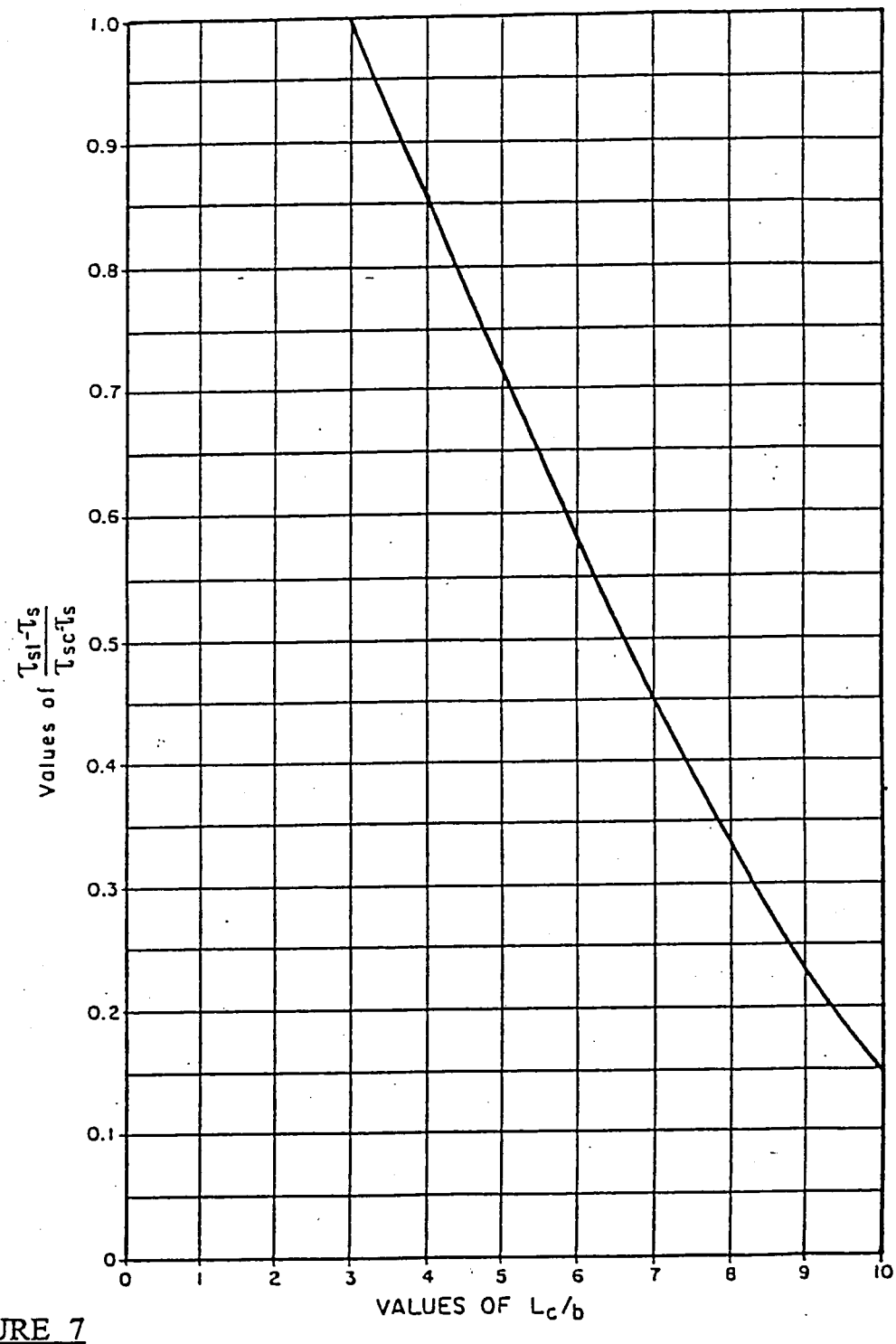


FIGURE 7

ACTUAL MAXIMUM TRACTIVE STRESS, τ_{st}, ON SIDES OF TRAPEZOIDAL CHANNELS IN STRAIGHT REACHES IMMEDIATELY DOWNSTREAM FROM CURVED REACHES

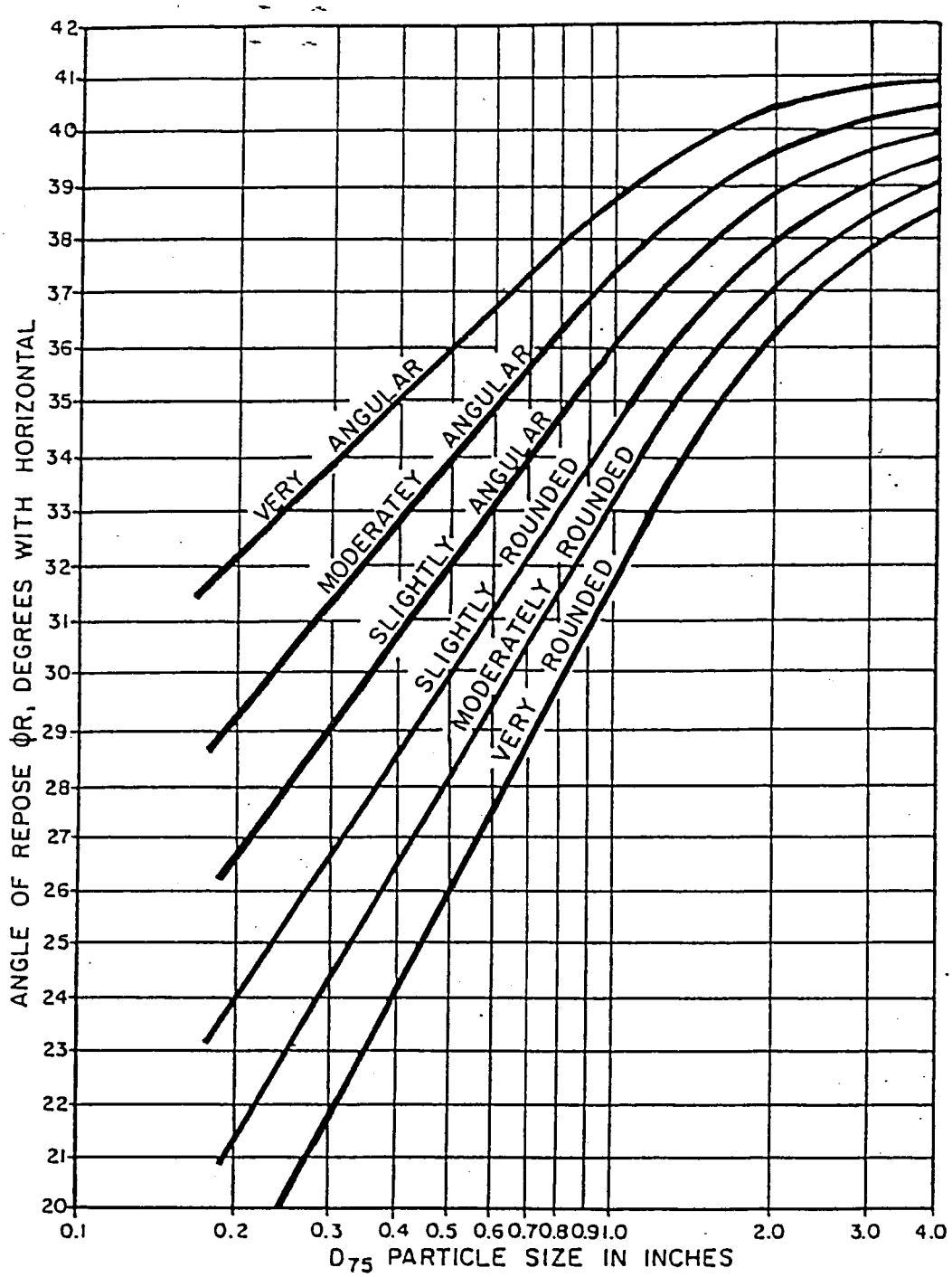


FIGURE 8

ANGLE OF REPOSE, ΦR, FOR NON-COHESIVE MATERIALS

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

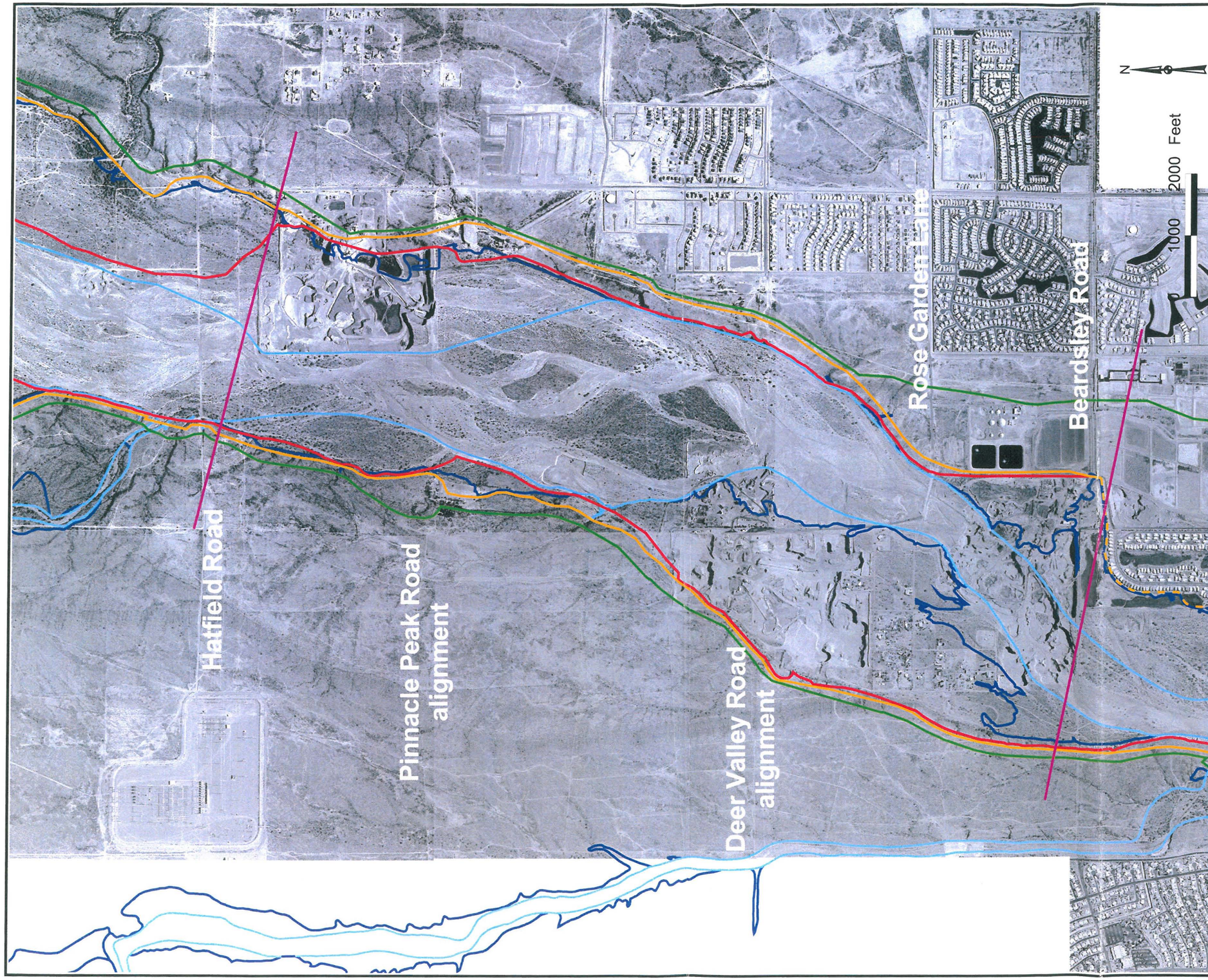
PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX C

Open-Pit Mining Operation Locations
&
Floodway, Floodplain and Erosion Hazard Limits

(Agua Fria Watercourse Master Plan Lateral Migration Report,
JE Fuller Hydrology and Geomorphology, June 2001)



Flood Control District of Maricopa County

Agua Fria River
Watercourse Master Plan

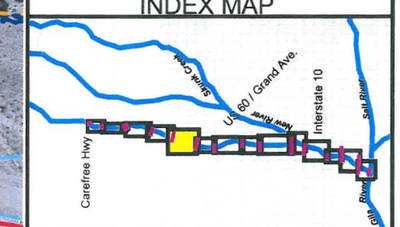
Erosion Hazard Zones
Reach 6

LEGEND

- Reach Boundaries
- Long Term Erosion Hazard Zone
- Lateral Migration Erosion Hazard Zone
- Severe Erosion Hazard Zone
- 1996 Floodplain
- 1996 Floodway

Erosion hazard lines dashed where coincident with engineered levee or bank protection measures.

INDEX MAP



JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

PRELIMINARY SCOUR ANALYSIS

SCI #16392

CD-ROM TABLE OF CONTENTS

1989 Wittmann ADMS 100-year HEC-1 model (WTM100YR)

HEC-RAS Model deer5.prj

Agua Fria River Oblique Aerial Photographs

CORTE BELLA
OFF-SITE SEWER, FORCE MAIN AND LIFT STATION

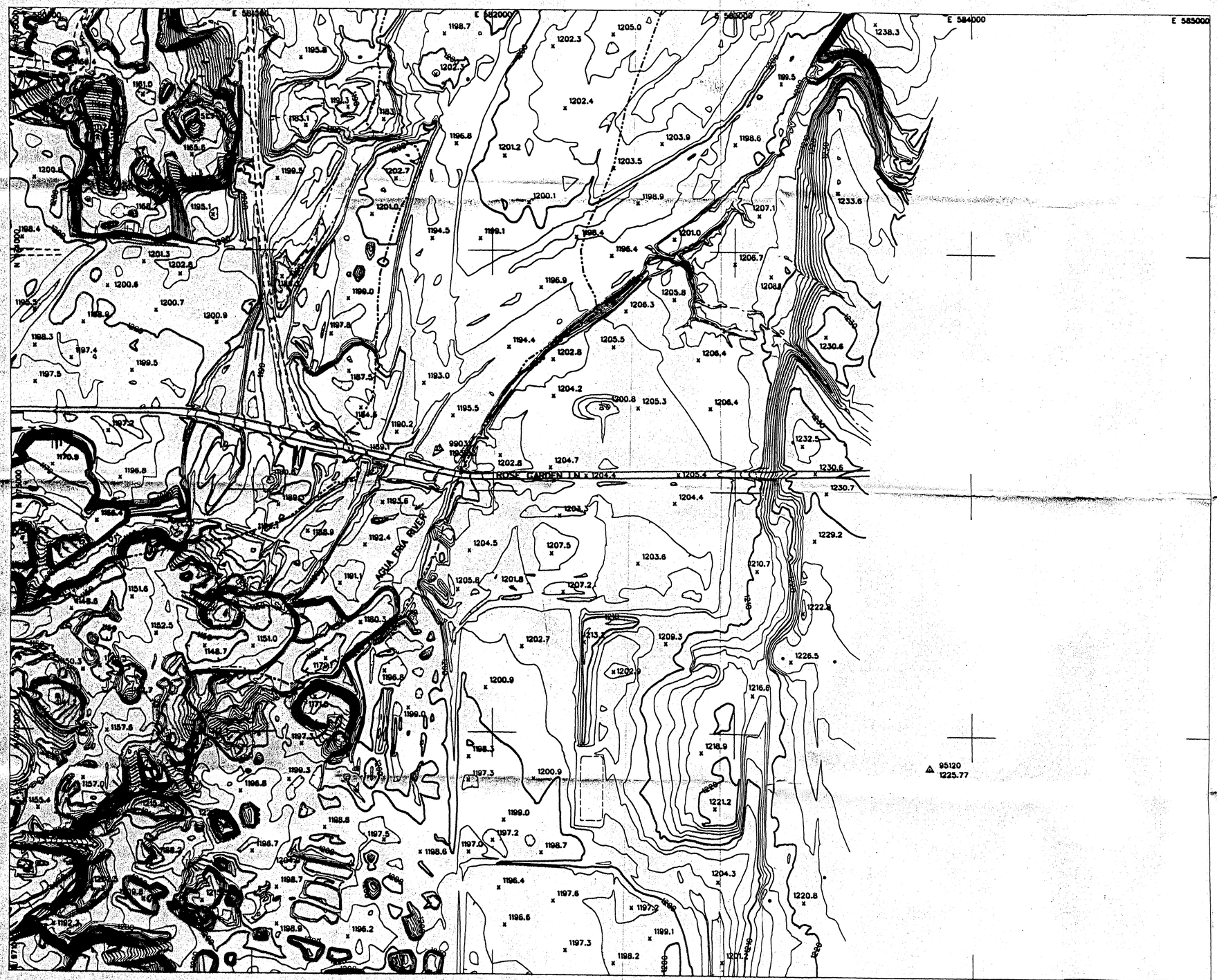
PRELIMINARY SCOUR ANALYSIS

SCI #16392

APPENDIX D

CD-ROM

Agua Fria River Crossing Topography



LEGEND

ELEVATION REFERENCE MARK
AERIAL CONTROL POINTS
ROADS
DIRT ROADS
BRIDGE
UTILITY POLES
WASH
RIVER
POND
CANAL
TRANSMISSION TOWERS
BUILDINGS

ELEVATION REFERENCE MARKS

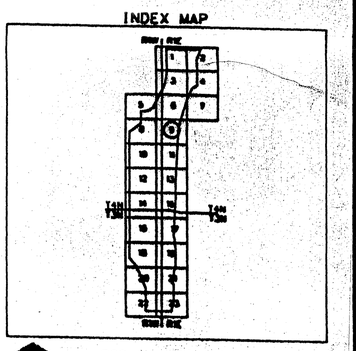
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
CONVERSION FACTOR 1929 NGVD TO 1988 NAVD=± 1.907 (FEET)

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

PHOTOGRAMMETRIC CONTROL POINTS

POINT #	X	Y	Z
99031	581777.07	973190.63	1163.80
95120	583625.24	971054.84	1225.77

INDEX MAP



200 0' 200 400

SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: 11-28-2000

NO.		BY	DATE
1			
2			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

AGUA FRIA FLOODPLAIN DELINEATION AND SEDIMENT TRANSPORT STUDY

CONTRACT NO. FCD 1999 C048

DRC INC.
1575 E. FT. LOWELL ROAD
TUCSON, AZ. 85719

REGISTERED LAND SURVEYOR
ARIZONA U.S.A.

	BY	DATE
DESIGN		
DESIGN CHK.		
PLANS		
PLANS CHK.		

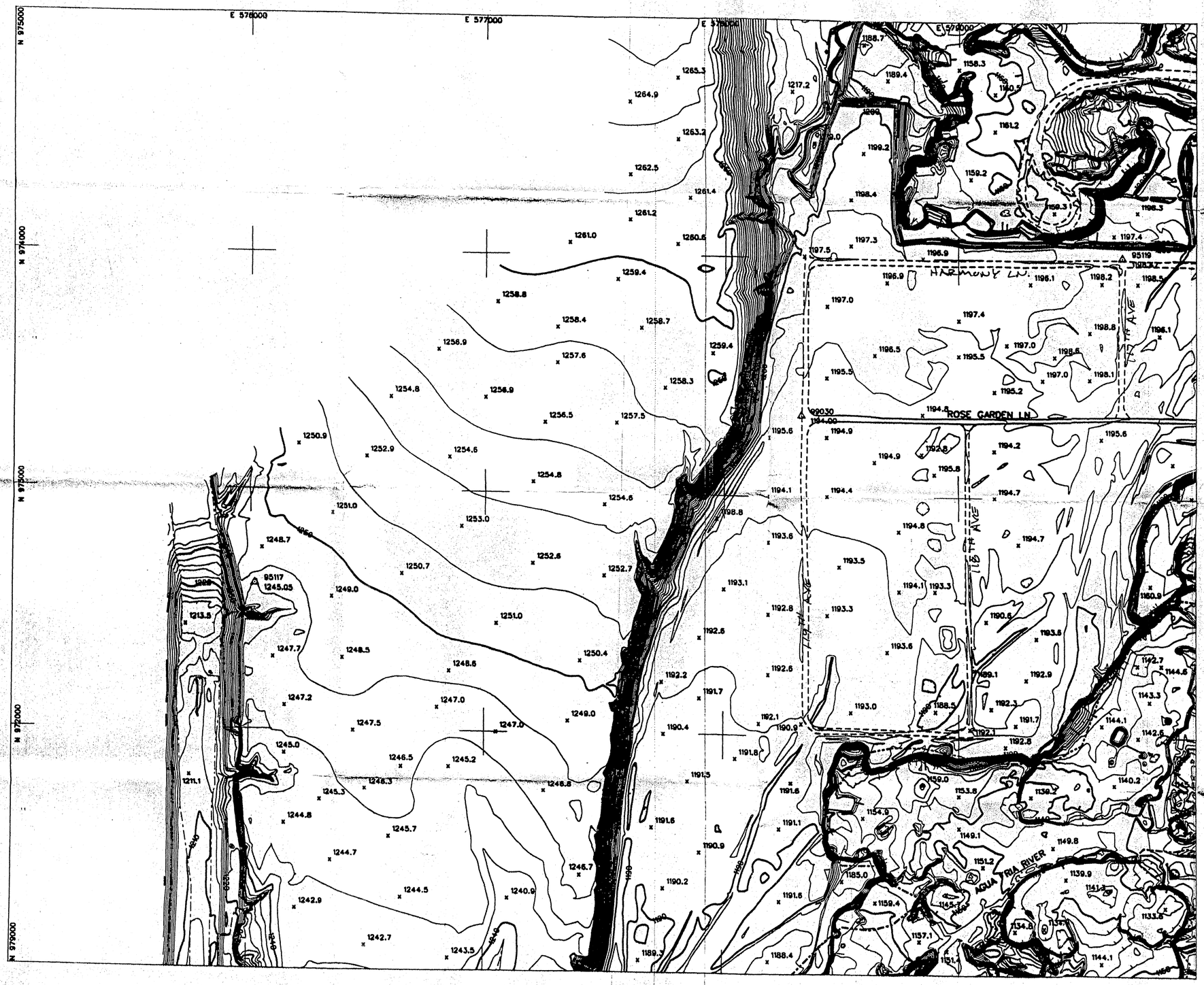
SHEET 60 OF 23

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

PHOTOGRAMMETRY PROVIDED BY: DATABASED TERRAIN MAPPING, INC.

GROUND CONTROL SURVEY DATA PROVIDED BY: DATABASED TERRAIN MAPPING, INC.

T4N, R1W
T4N, R1E



LEGEND

ELEVATION REFERENCE MARK
AERIAL CONTROL POINTS
ROADS
DIRT ROADS
BRIDGE
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WASH
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TRANSMISSION TOWERS
BUILDINGS

ELEVATION REFERENCE MARKS

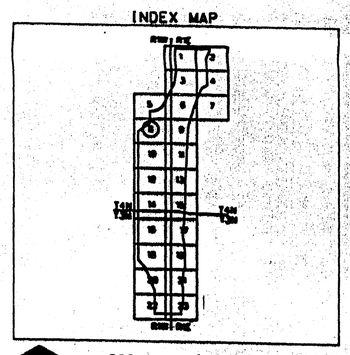
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
CONVERSION FACTOR 1929 NGVD TO 1988 NAVD= 1.907 (FEET)

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

PHOTOGRAMMETRIC CONTROL POINTS

POINT #	X	Y	Z
95119	579686.27	974608.84	1188.47
99030	578343.21	973342.19	1194.00
95117	579031.88	972604.65	1245.05

INDEX MAP



200 0' 200 400
SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: 11-28-2000

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

AGUA FRIA FLOODPLAIN DELINEATION AND SEDIMENT TRANSPORT STUDY

CONTRACT NO.
FCD 1999 C048

REGISTERED LAND SURVEYOR
CERTIFICATE NO. 35-9
ARIZONA U.S.A.

DTM INC.
1075 E. FT. LOWELL ROAD
TUCSON, AZ. 85719

	BY	DATE
DESIGN		
DESIGN CHK.		
PLANS		
PLANS CHK.		

SHEET 06 OF 23

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T4N, R1W