Thomas Caliber Engineering
Consultants, LLC
P. O. Box 17082
Fort Worth, TX 76102
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HYDROLOGIC AND HYDRAULIC REPORT

TITAN TCC PAD SITE
ADJACENT TO UNNAMED TRIBUTARY
TO BIG BEAR CREEK

COLLEYVILLE, TEXAS
TARRANT COUNTY

Prepared For:

PELOTON LAND SOLUTIONS
5751 KROGER DRIVE, SUITE 185
KELLER, TEXAS 76244

AUGUST 25, 2010
Revised – JANUARY 4, 2011

PLS002-LS

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- Time of Concentration Calculations
- FEMA Flood Insurance Rate Map
- Drainage Area Map
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  - Existing Conditions
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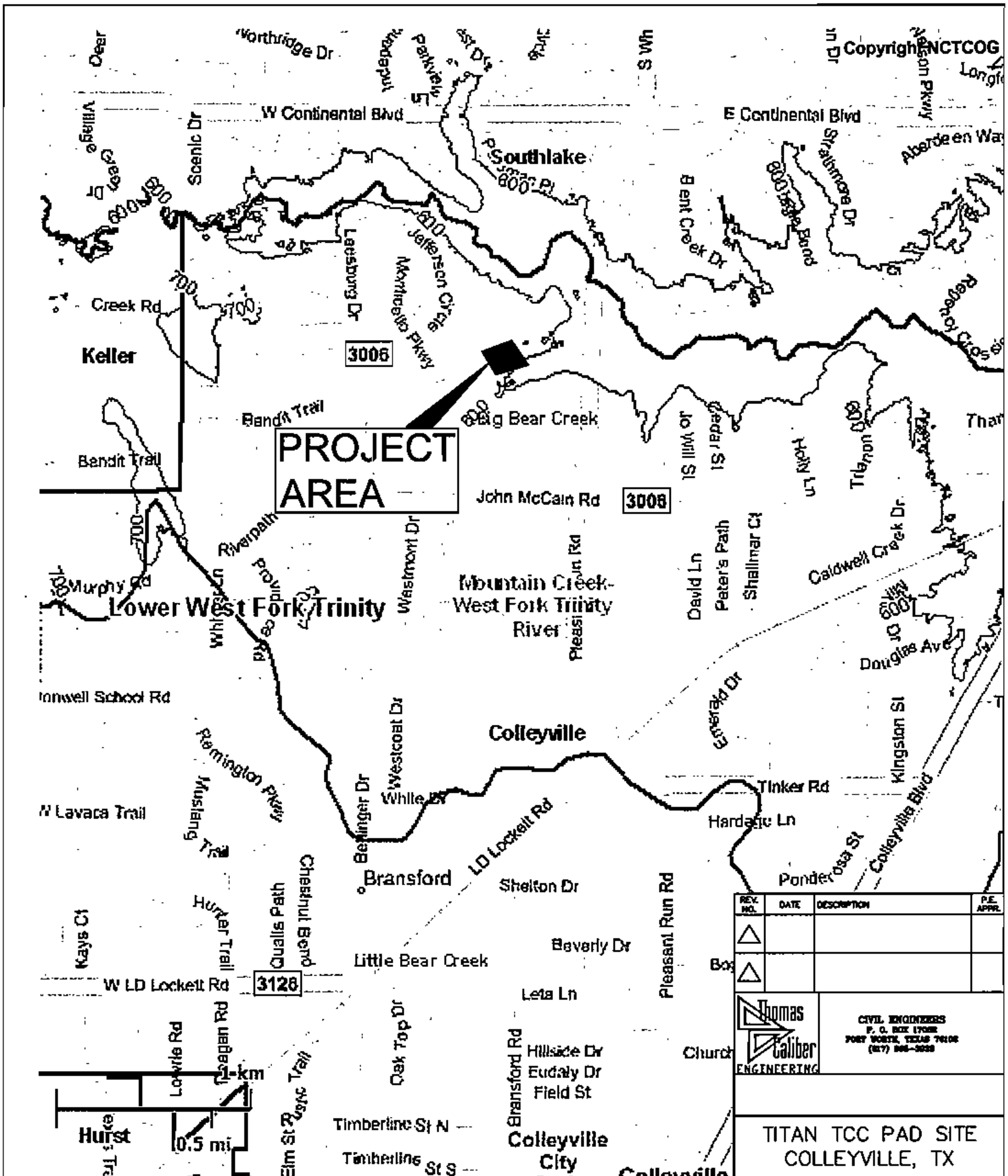
- HEC-RAS Summary Report
  - Existing Conditions
  - Proposed Conditions
- Photographs
- HEC-RAS Diskette



REV. NO.	DATE	DESCRIPTION	P.E. APPR.
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Thomas Caliber Engineering

CIVIL ENGINEERS

TITAN TCC PAD SITE
COLLEYVILLE, TX

LOCATION MAP

JOB NUMBER: PLS002

SHEET NO. 1 OF 1 SHEETS

CITY DWG NO:

CERTIFICATION OF ENGINEER

I Troy O. Thomas a Professional Engineer licensed in the State of Texas have prepared this drainage study and/or plan in compliance with the latest published requirements and criteria of the City of Colleyville, and have verified that the topographic information used in this study and/or plan is in compliance with said requirements and is otherwise suitable for developing this workable plan of drainage which can be implemented through proper subsequent detailed construction planning.

Troy O. Thomas, P.E.

STATE OF TEXAS
TROY O. THOMAS
94189
LICENSED
PROFESSIONAL ENGINEER

01/04/2011
Date

A. PROJECT DESCRIPTION

Description of Proposed Activity – This project involves constructing a drill pad site with frac pond in the Mountain Creek – West Fork Trinity River drainage basin near Big Bear Creek. The proposed site will involve a compacted base material sufficient for drilling adjacent to an unnamed tributary to Big Bear Creek. The proposed pad was designed to provide a hydraulic opening able to pass the 100-year flood.

Purpose of Report – The purpose of this report is to present necessary information to the City of Colleyville, Texas, for obtaining a Building Permit.

Water Dependency – The construction of this pad is not naturally water dependent. Alternative locations are available, but this particular location has been designated as the best possible location for the drill pad site. Alternate engineering designs have been studied to minimize any adverse impacts created by the pad construction. This project has been designed to minimize any encroachment upon the environment and to protect the public natural resources.

Detour – The proposed pad construction will have very little impact on existing traffic patterns. No detours are expected during pad construction.

B. SITE DATA

Existing Type Structure – There is no existing structure at the proposed site. The existing land use is Agriculture.

Existing Upstream and Downstream Structures – The nearest upstream structure (0.32 mile upstream) is a quintuple box culvert spanning approximately 200-ft. This structure is located on Monticello Parkway as a bridge structure.

The nearest downstream structure (0.13 mile downstream) is a concrete single box culvert (approximately 6-ft x 4-ft box). This culvert is located on Pleasant Run Rd./S. White Chapel Blvd.

Stream – The stream involved is an Unnamed Tributary to Big Bear Creek. This tributary joins into Big Bear Creek approximately 0.23 mile downstream of the proposed site construction. This watershed belongs to the Lower West Fork of the Trinity River Basin. The longitudinal slope of the streambed at the project site is approximately 1.57% (0.0157 ft/ft). Existing velocities under the storm studied are on average of 7.67 F.P.S. The normal channel width of the Unnamed Tributary to Big Bear Creek in the vicinity of the project varies moderately between approximately 200 to 300 feet. The earthen banks, of an average 5 feet in height, are moderately covered with vegetation. The stream banks appear to be stable and there is no indication of any problems with erosion at this site.

Factors Affecting Water Stages – The major factors affecting the water stages at the immediate project site are the well-defined channel and very flat overbank areas. There are no flood control structures or local flood protection measures involved within the project area.

Environmental Concerns – The construction of the proposed site pad will not create any major adverse affects on the fish and aquatic habitat. The stream is not listed by the Texas Parks and Wildlife as a fish stocking area. The section of Big Bear Creek that is listed in the Fish Stocking Report is outside of the project area, approximately 3 miles upstream in the main Big Bear Creek tributary (in Keller, Texas). The terms and conditions of an Erosion and Sedimentation Pollution Control Plan determined adequate by the City of Colleyville will be strictly implemented in order to avoid impacts to the sections that are stocked. Sediment traps will be employed during the construction period so as to not create any adverse impacts to the water quality. Silt barrier fence will be used around all earth moving activities. Clean rock fill, sandbags or better will be used to build cofferdams around the proposed construction. An Erosion and Sedimentation Control Plan will be submitted to and approved by the City of Colleyville. With all the erosion control restraints mentioned above, the proposed site pad construction will not cause any adverse impacts to the environment.

C. HYDROLOGIC ANALYSIS

Summary – Below you will find a summary of the Hydrology and Hydraulic results for determining the Base Flood Elevation (B.F.E.) for the Pad site.

1. The 100-yr Discharge (Q) was determined to be 1,567.80 C.F.S. using the following watershed characteristics:

   Drainage Area = 566.87 AC
   Curve Number = 81
   TC = 1.62 HR
   100-yr 24 hr Rainfall = 9.5 IN

2. The Existing and Proposed 100-yr Water Surface Elevations are listed below.

   Cross Section "B" = 610.49(existing); 610.49 (proposed)
   Cross Section "C" = 599.74(existing); 601.19 (proposed)
   Cross Section "D" = 598.98(existing); 600.86 (proposed)
   Cross Section "E" = 596.27(existing); 597.61 (proposed) (Pad Location)
   Cross Section "F" = 595.70 (existing); 595.70 (proposed)
   Cross Section "G" = 593.69 (existing); 593.69 (proposed)

Drainage Area – The drainage area for the Unnamed Tributary to Big Bear Creek upstream of the proposed pad site was delineated from provided lidar topography, and was determined to be 0.85 square mile. The soils present within the drainage area are the Bastsil fine sandy loam, Birome fine sandy loam, Birome-Aubrey-Rayex complex, Crosstell fine sandy loam, Gasil fine sandy loam, Gasil sandy clay loam, Gasil-Urban land complex, Konsil fine sandy loam, Mabank fine sandy loam, Pulexas fine sandy loam, Rader fine sandy loam, Silawa fine sandy loam, Silstid loamy fine sand, and Whitesboro loam. The characteristics of the soils range from moderate infiltration rates to high runoff potential. The addition of more impervious areas in the future within the drainage area may have additional impacts on the discharges, and increased discharges will need to be minimized through the use of stormwater management. A copy of a map showing the drainage area is located in the Attachments section of this report.

Flood Records – Flood records are not available since there are no local gage stations at the watershed.

Design Discharges – The design discharge was developed in accordance with the Colleyville, Texas, Land Development Code, Chapter 14.

FREQUENCY	MAGNITUDE
100-Year	1567 C.F.S.

D. HYDRAULIC ANALYSIS

General – Unnamed Tributary to Big Bear Creek in the area between Monticello Pkwy and S. White Chapel Blvd, north of John McCain Rd. is not included in the detailed study by FEMA. A Flood Insurance Rate Map (FIRM) was obtained and it does exhibit approximate areas of flooding (Zone X) of the Unnamed Tributary to Big Bear Creek. A location map using the FIRM is provided in the Attachments section of this report. The water surface elevations of selected recurrence intervals were computed through the use of the U.S. Army Corps of Engineers HEC-RAS River Analysis System computer program. Cross sections used to model the floodplain characteristics were developed from an actual field survey of the entire site.

To determine the water surface elevations for the existing conditions, the cross sections for the HEC-RAS model were laid out across the entire width of the site. The layout of the cross sections is included in a plan in the Attachments section of this report. Starting water surface elevations were calculated using the slope area method.

A HEC-RAS run for the pad site has been developed by modifying the Existing Conditions HEC-RAS run to account for the proposed pad site. The proposed pad site will be developed to reflect the proposed grading to develop a level pad partially obstructing the bank of the Unnamed Tributary.

Site Plan – A pad site plan will be developed to reflect the changes made to the location and the effects to the water surface elevation. The proposed pad site does not considerably restrict the flow of runoff water through the Unnamed Tributary.

E. RISK MANAGEMENT

Analysis – The project is located between Monticello Pkwy and Pleasant Run Rd./ S. White Chapel Blvd. in Colleyville, Texas. It is south of Big Bear Creek's main Tributary, and north of John McCain Rd. The drainage area is approximately 567 acres (0.89 square mile).

The existing 100 year floodplain does not encroach on any residential areas as seen on the Flood Insurance Rate Map in the Attachments Section of the report. Therefore, the proposed pad site will be designed to match or improve the existing field conditions as much as possible without creating any additional adverse effects on the floodplain. The proposed pad site was designed to provide a hydraulic opening to pass the 100-year and a water surface profile that does not increase the 100 year storm profile.

F. RECOMMENDATIONS

The proposed pad site located on the Unnamed Tributary to Big Bear Creek was carefully designed with several controlling factors. Of prime importance was that the pad site will pass the 100-year flood, minimize the effect on the 100-year water surface elevation, and provide an economical site.

Proposed Pad Site – The proposed pad site recommended adjacent to the Unnamed Tributary to Big Bear Creek will be constructed to not considerably restrict the 100-year flow.

Stream – Aside from the changes associated with the pad construction, the stream channel will not be affected in any way. Upstream and downstream of the proposed pad construction, there will be no changes made to the streambed as its existing state is the most desirable condition.

G. SUBSEQUENT APPROVALS

Erosion and Sedimentation Control – An Erosion and Sedimentation Control Plan will be submitted to, and approved by, the City of Colleyville.

Building Permit – As required by the regulations of the City of Colleyville, a Building Permit application may be required by the applicant in order to construct the proposed pad site.

ATTACHMENTS

Thomas Caliber Engineering	SHEET OF	DATE
PROJECT: Titan TCC Pad Site	LOC: Colleyville, TX	07/15/10
SUBJECT: Weighted CN Calculation	CHK'D	

DRAINAGE AREA: **DA-1**

CURVE NUMBER (CN)

Soil Name and Hydrologic Group	COVER DESCRIPTION	CN VALUES	AREA (ACRES)	PRODUCT OF CNxArea
11, Birome fine sandy loam, 1 to 5% slopes, C	Developed, 1/4 acre lots	83	23.76	1972.08
12, Birome-Audrey-Rayex complex, 5 to 15% slopes, C	Developed, 1/4 acre lots	83	5.04	418.32
21, Crosstell fine sandy loam, 1 to 3% slopes, D	Developed, 1/4 acre lots	87	63.85	5554.95
22, Crosstell fine sandy loam, 3 to 6% slopes, D	Developed, 1/4 acre lots	87	64.72	5630.64
29, Gasil fine sandy loam, 1 to 3 % slopes, B	Developed, 1/4 acre lots	75	49.59	3719.25
30, Gasil fine sandy loam, 3 to 8 % slopes, B	Developed, 1/4 acre lots	75	43.68	3276.00
45, Mabank fine sandy loam, 0 to 1% slopes, D	Developed, 1/4 acre lots	87	9.16	796.92
59, Pulexas fine sandy loam, frequently flooded, B	Developed, 1/4 acre lots	75	18.63	1397.25
63, Rader fine sandy loam, 0 to 3% slopes, D	Developed, 1/4 acre lots	87	111.10	9665.70
71, Silstid loamy fine sand, 1 to 5% slopes, A	Developed, 1/4 acre lots	61	105.60	6441.60
	Impervious Surfaces	98	71.74	7030.52
			566.87	45903.23

CN (WEIGHTED) = $\frac{\text{TOTAL PRODUCT}}{\text{TOTAL AREA}}$

$= \frac{45903.23}{566.87}$ = USE CN = **81**

NOTE: Curve Numbers were calculated using fully developed conditions per the City of Colleyville Land Development Code, Chapter 14.

Time of Concentration

Thomas Caliber Engineering

Time of concentration (Tc)

PROJECT: Titan TCC Pad Site
LOCATION: Colleyville, TX

DATE: 07/15/10

Sheet Flow:

Component	Length, (ft)	Slope, (ft/ft)	Manning's n	2-yr, 24-hr Rainfall (in)	Travel Time, T_t, (min)	Surface Description	
1	300.00	0.0060	0.240	3.90	50.39	Dense Grass	
2	0.00	0.0000	0.000	0.00	0.00		
3	0.00	0.0000	0.000	0.00	0.00		
					50.39		0.84 HR

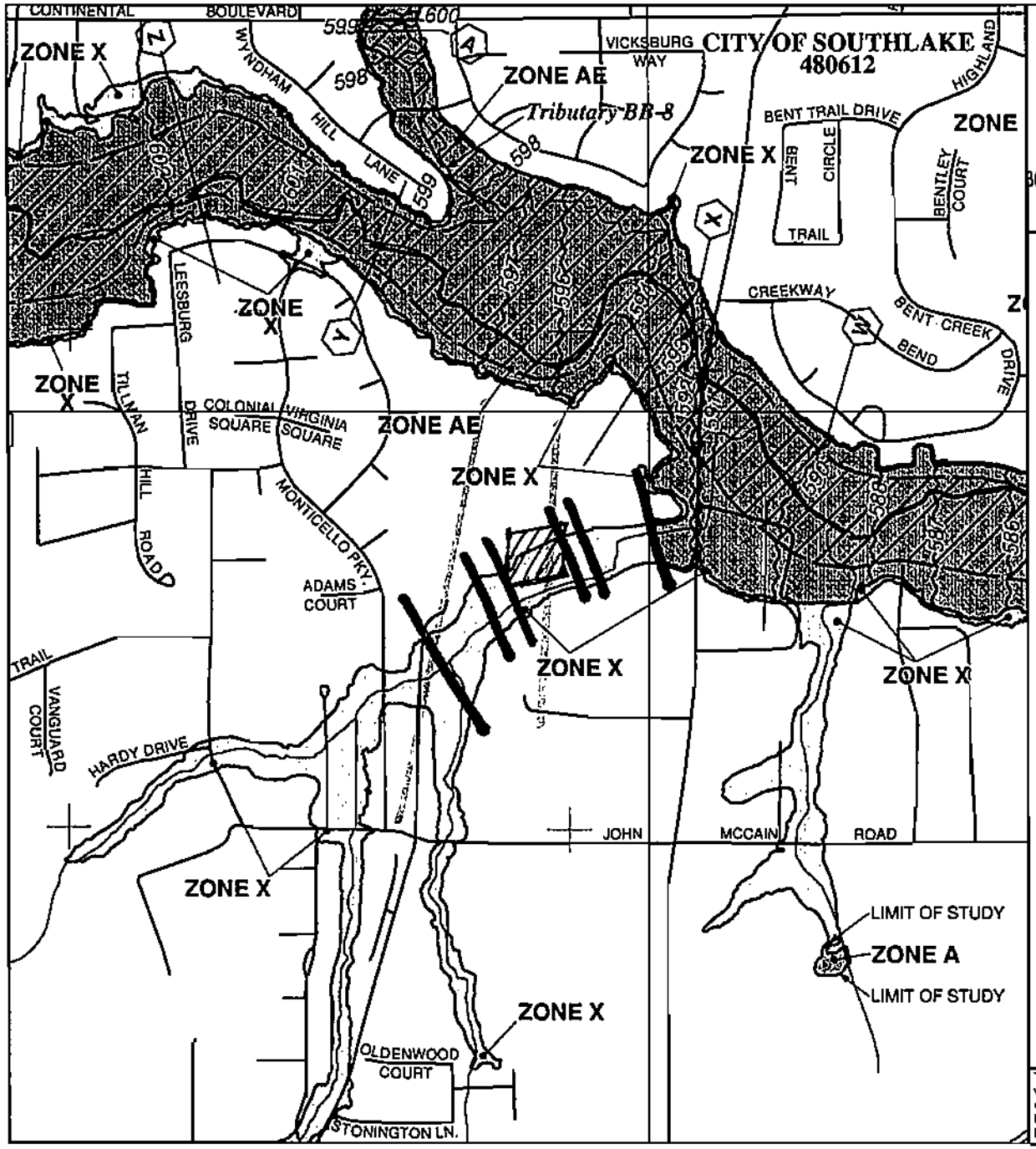
Shallow Concentrated Flow:

Component	Length, (ft)	Slope, (ft/ft)	Velocity, (ft/sec)	Surface	Travel Time, T_t, (min)	
1	1684.00	0.0059	1.20	Unpaved	23.39	
2	0.00	0.0000	0.00	——	0.00	
3	0.00	0.0000	0.00	——	0.00	
					23.39	0.39 HR

Channel Flow:

Component	Length, (ft)	Slope, (ft/ft)	Cross-Sectional Area, (ft^2)	Wetted Perimeter, (ft)	Manning's n	Velocity, (ft/sec)	Travel Time, T_t, (min)	
1	6618.00	0.0157	42.50	65.00	0.030	4.69	23.53	
2	0.00	0.00	0.00	0.00	0.000	0.00	0.00	
3	0.00	0.00	0.00	0.00	0.000	0.00	0.00	
							23.53	0.39 HR

TOTAL TIME OF CONCENTRATION = **1.62 hours**



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 M

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0095K

FIRM

FLOOD INSURANCE RATE MAP

TARRANT COUNTY, TEXAS

AND INCORPORATED AREAS

PANEL 95 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
TARRANT COUNTY	480582	0095	K
COLLEYVILLE, CITY OF	480590	0095	K
GRAPEVINE, CITY OF	480598	0095	K
HURST, CITY OF	480601	0095	K
KELLER, CITY OF	480602	0095	K
NORTH RICHLAND HILLS, CITY OF	480607	0095	K
SOUTHLAKE, CITY OF	480612	0095	K

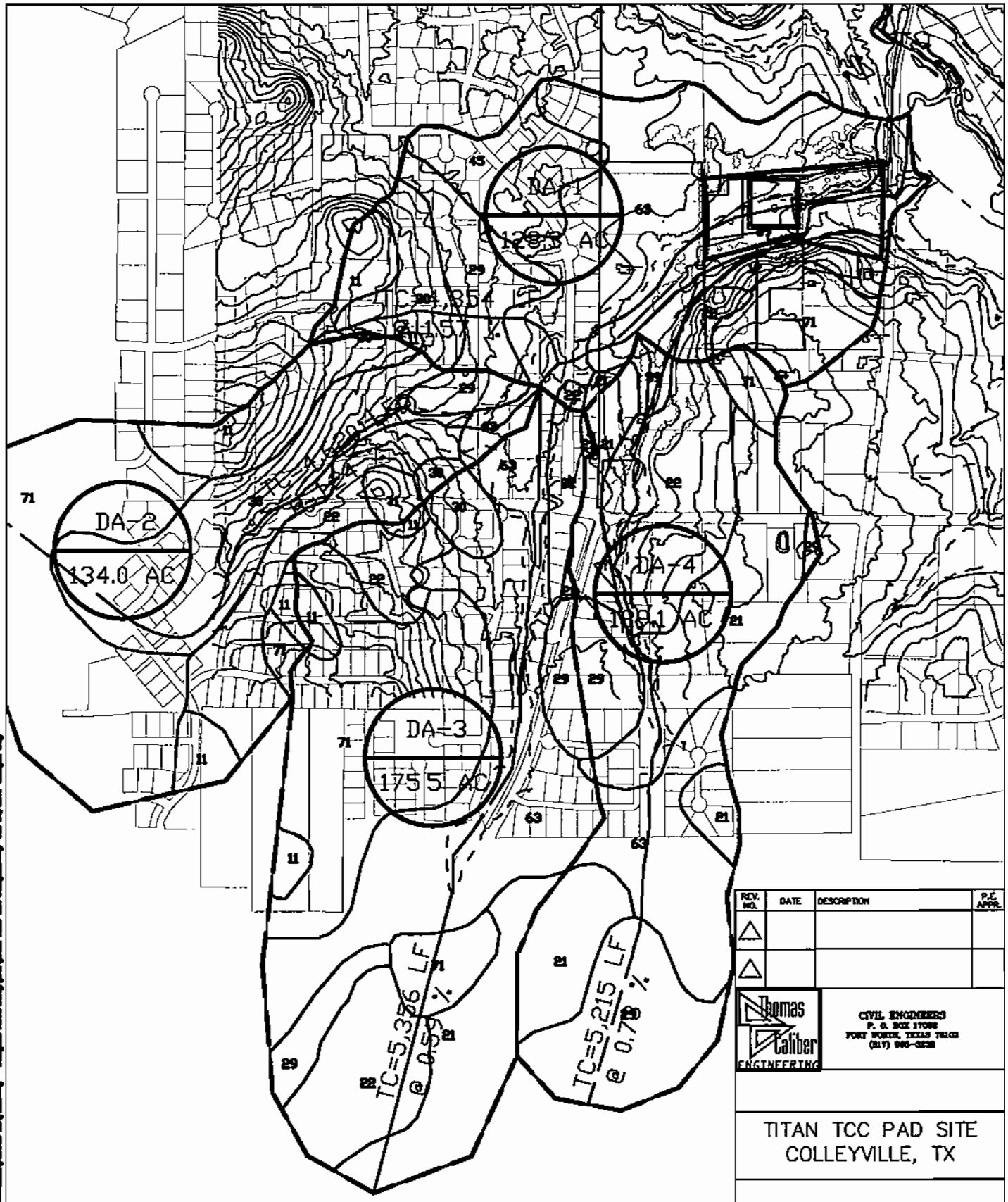
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
48439C0095K

MAP REVISED
SEPTEMBER 25, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



REV. NO.	DATE	DESCRIPTION	P.E. APPR.
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Thomas Caliber ENGINEERING

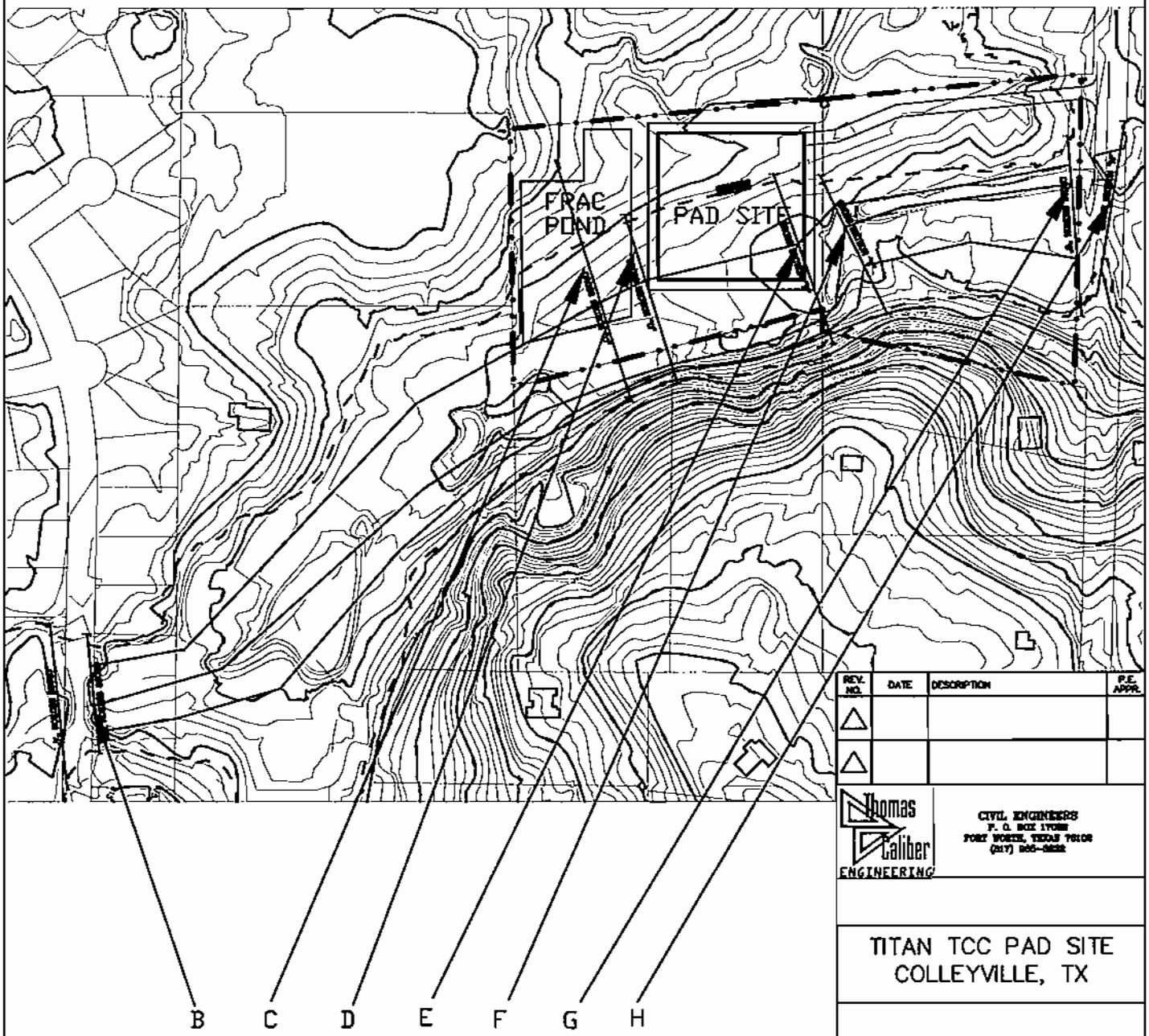
CIVIL ENGINEERS
P. O. BOX 17088
FORT WORTH, TEXAS 76108
(817) 985-3238

TITAN TCC PAD SITE
COLLEYVILLE, TX

DRAINAGE AREA MAP

JOB NUMBER: PLS002

SUBMITTED: THOMAS CALIBER ENGINEERING	DESIGNED BY: TCF
SCALE:	DRAWN BY: TCF
DATE: AUGUST 2010	SHEET NO. 1 OF 1 SHEETS
SURVEY BY:	CITY DWG NO:
F.B. NO.	



REV. NO.	DATE	DESCRIPTION	P.E. APPR.
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Thomas Caliber ENGINEERING

CIVIL ENGINEERS
P. O. BOX 17088
FORT WORTH, TEXAS 76102
(817) 865-[illegible]

TITAN TCC PAD SITE
COLLEYVILLE, TX

ALL CROSS SECTIONS

JOB NUMBER: PLS002

SUBMITTED: THOMAS CALIBER ENGINEERING
SCALE:
DATE: AUGUST 2010
SURVEY BY:
F.B. NO:

DESIGNED BY: TOT
DRAWN BY: TOT
SHEET NO OF 1 SHEETS
CITY DWG NO:

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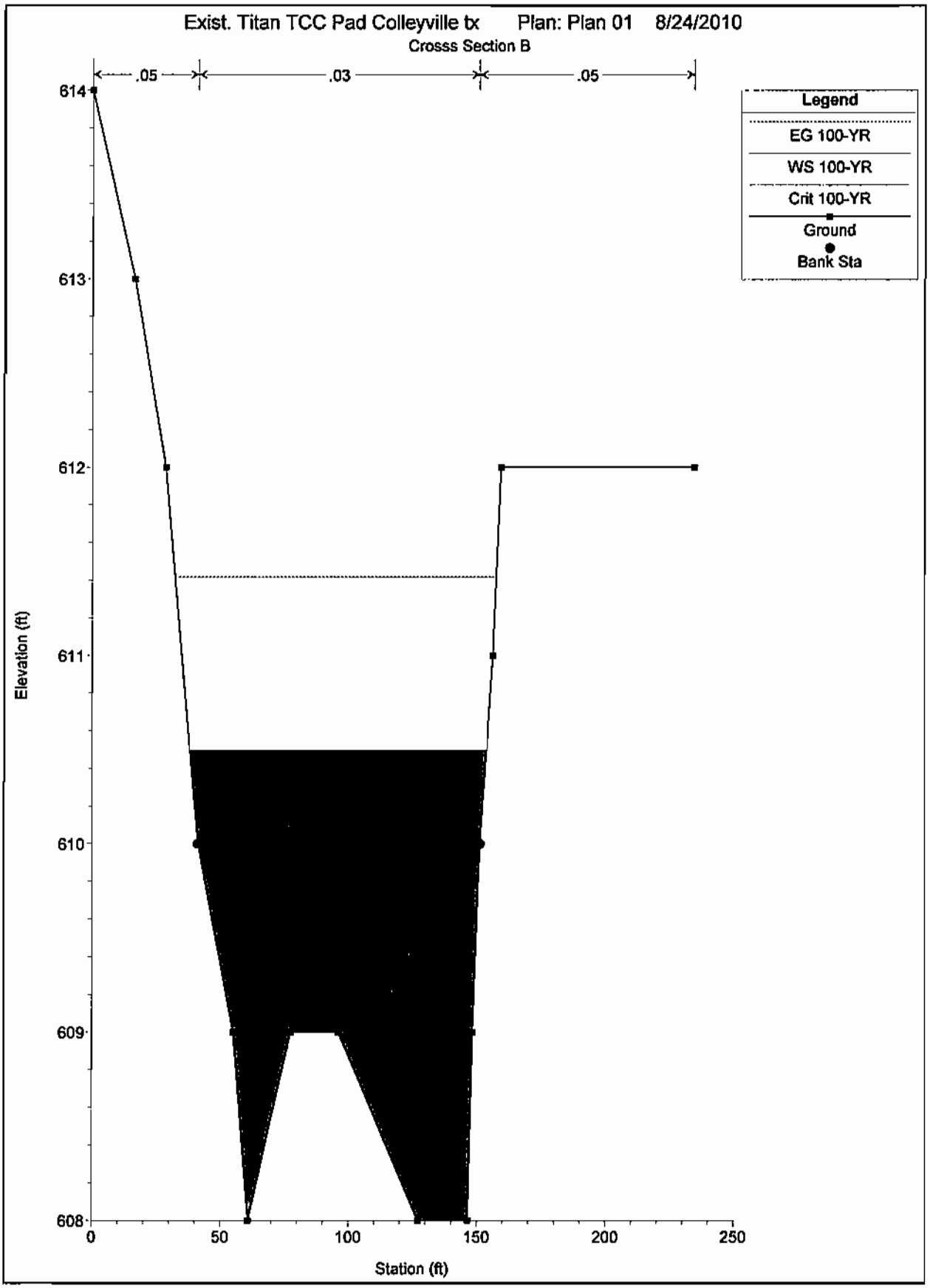
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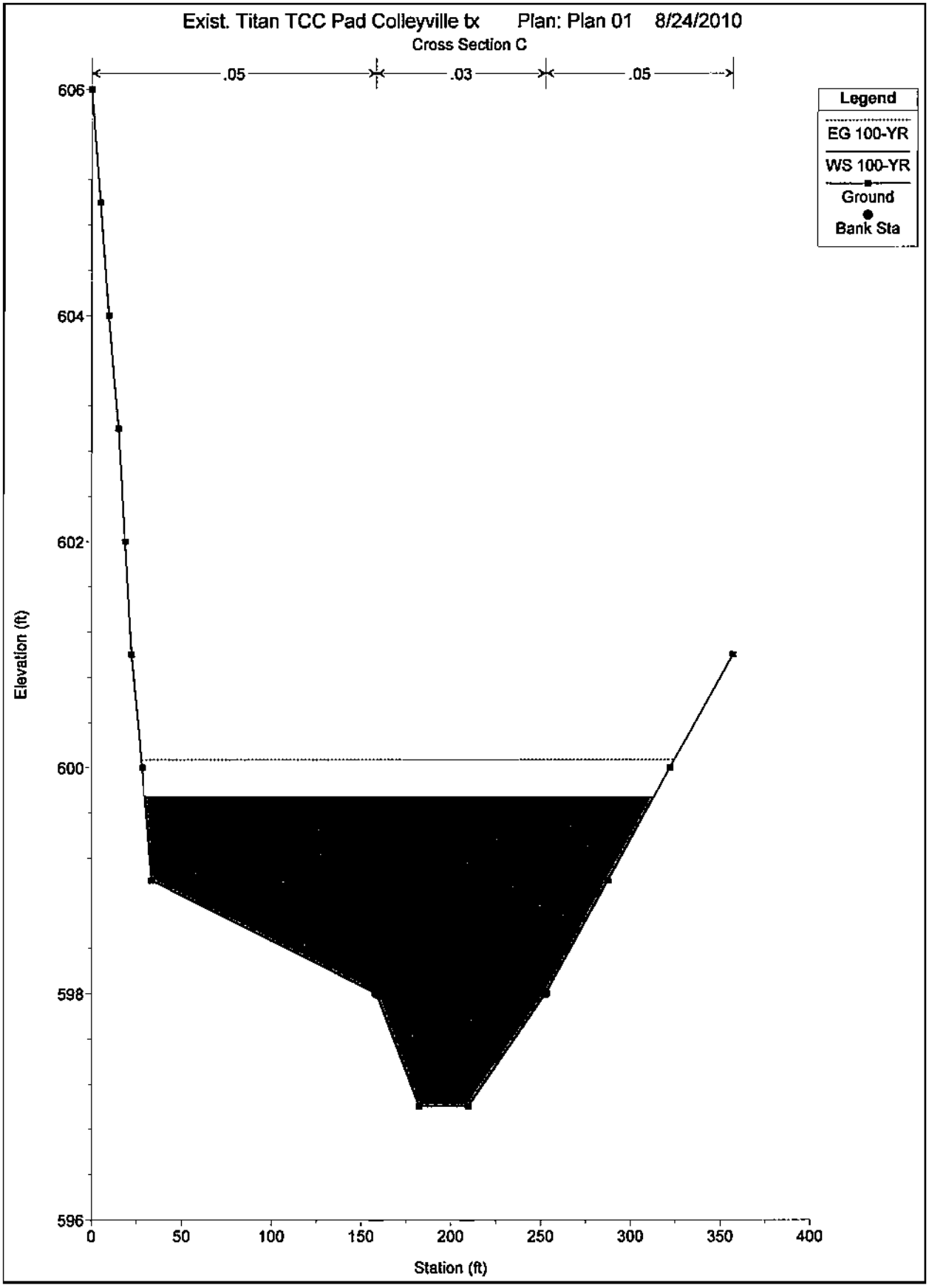
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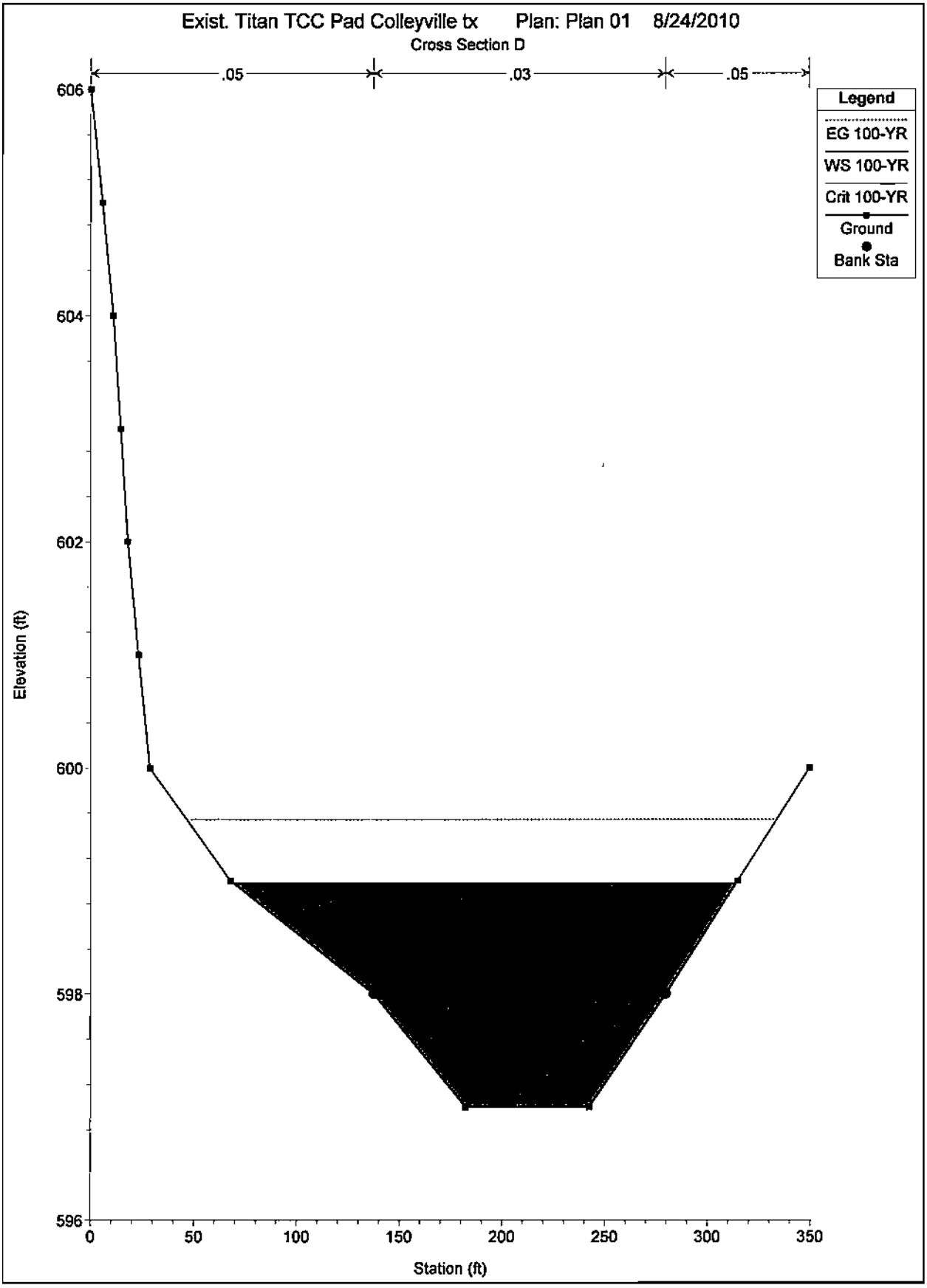
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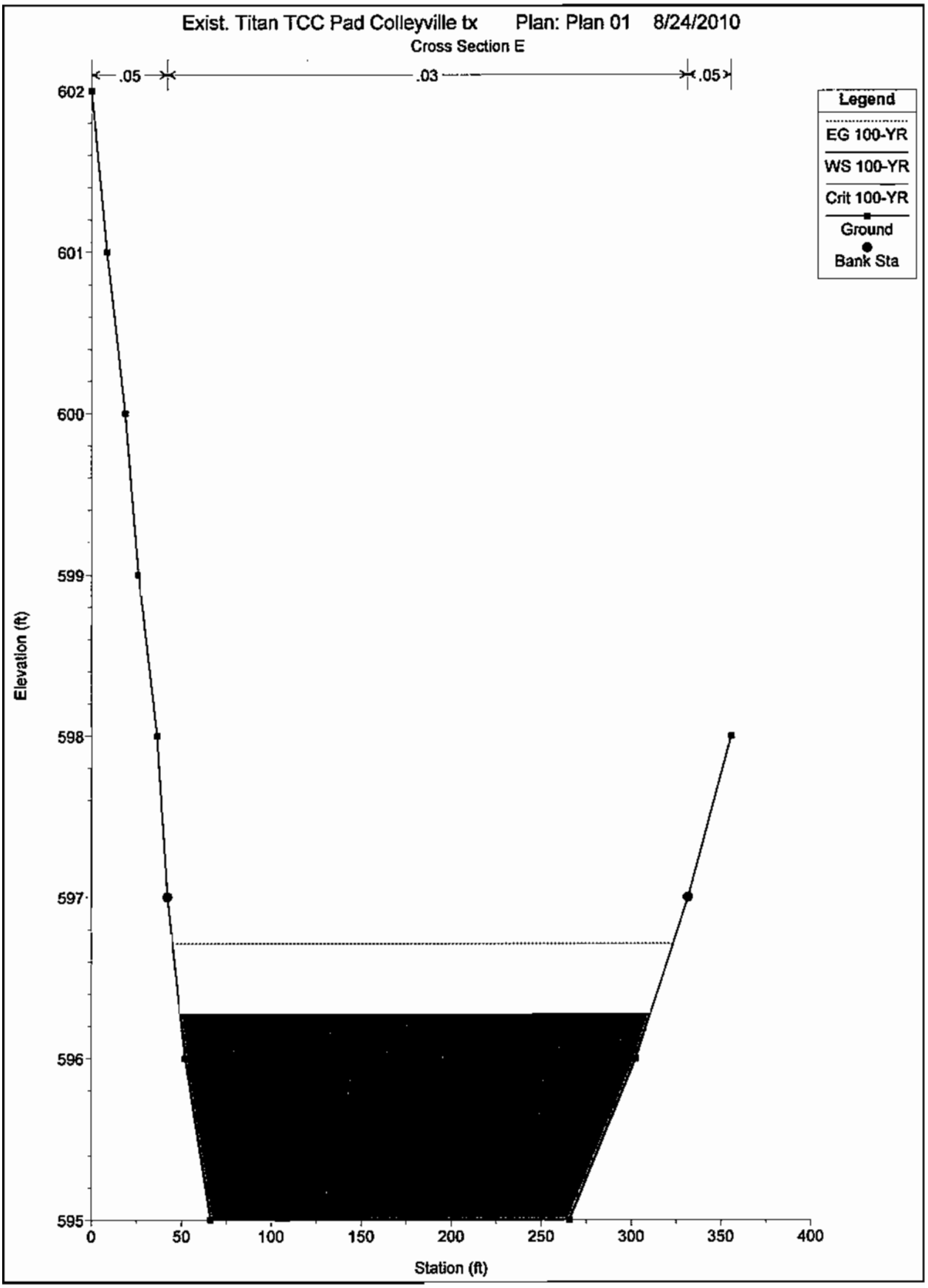
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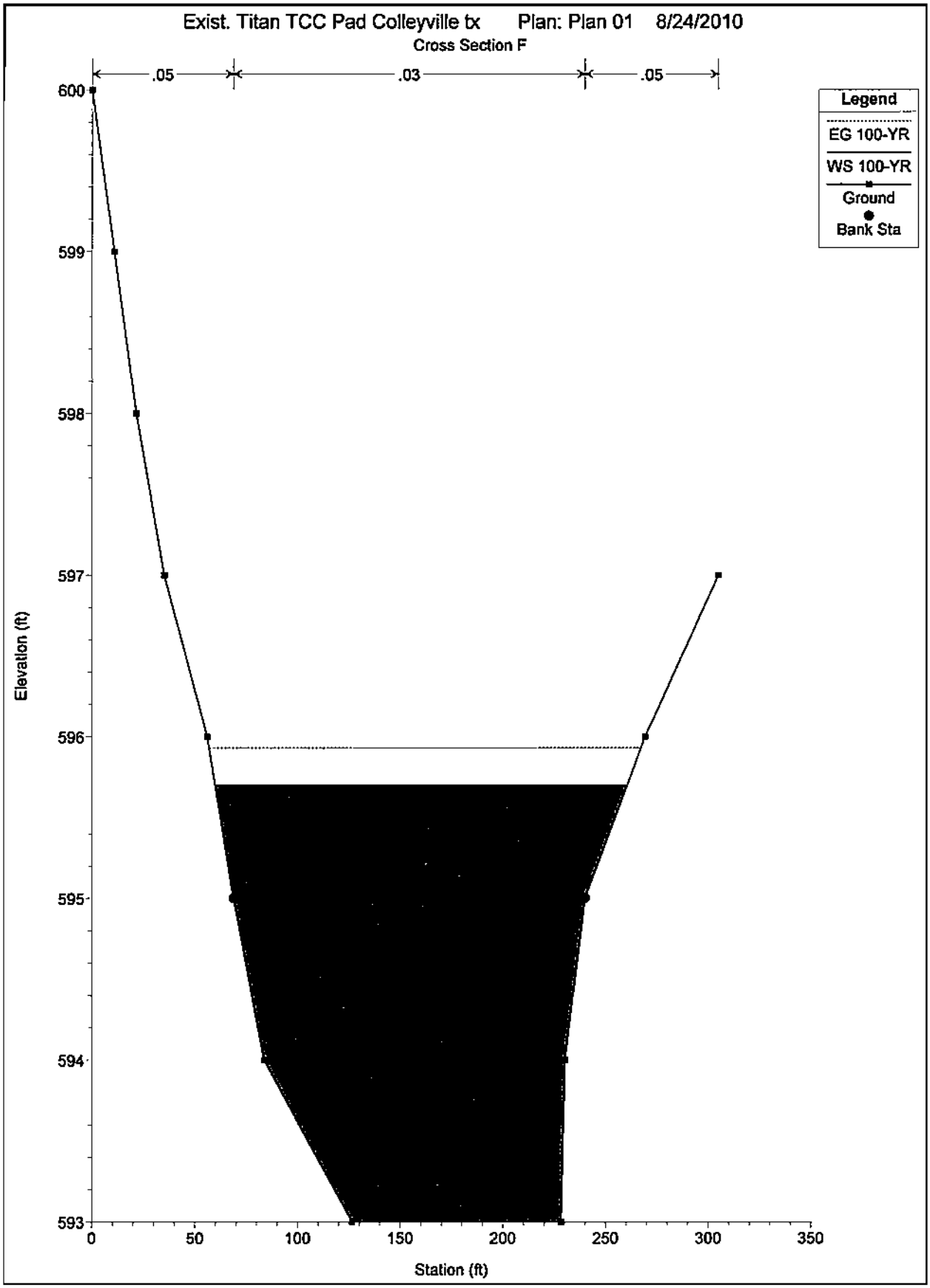
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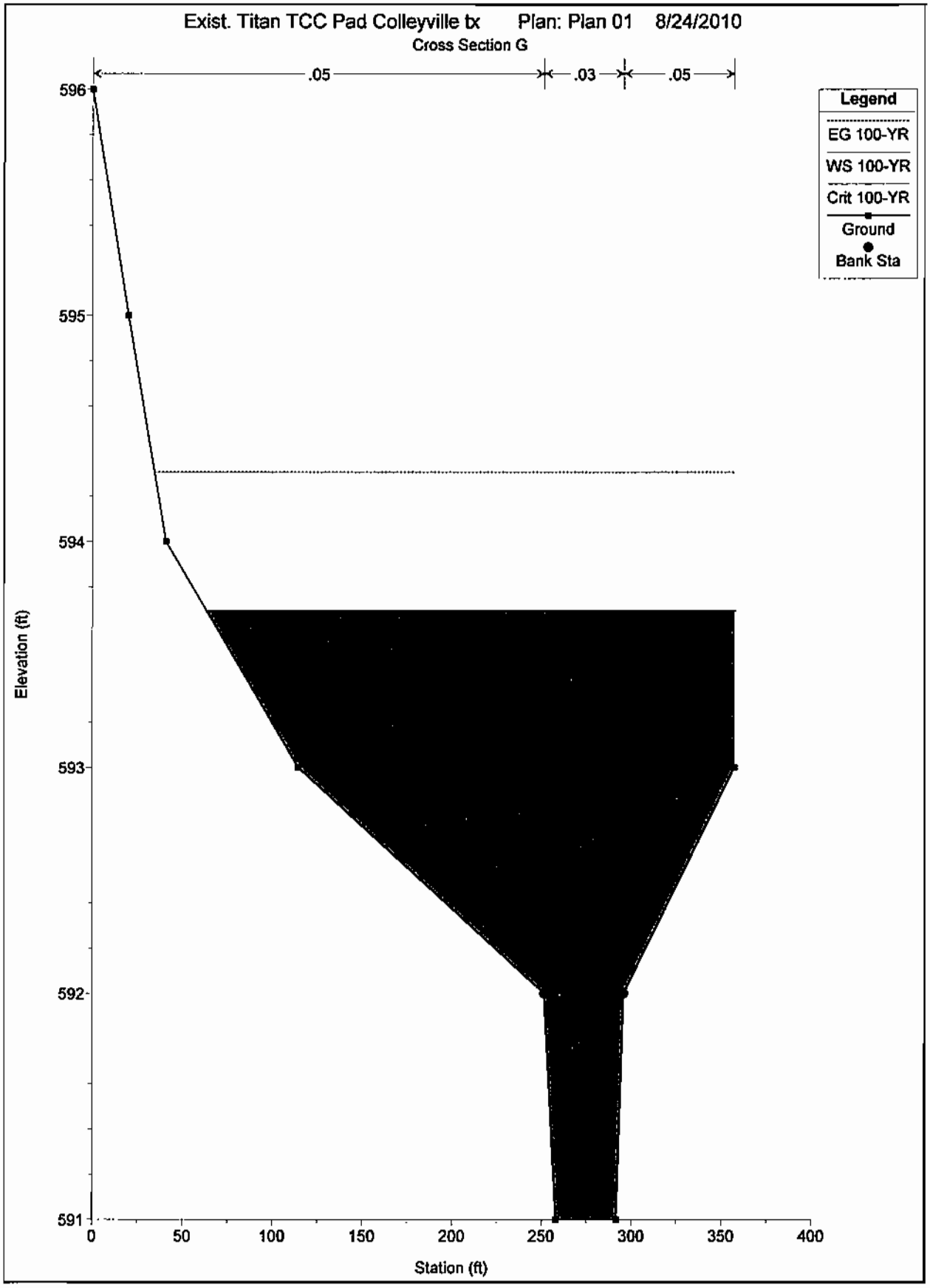
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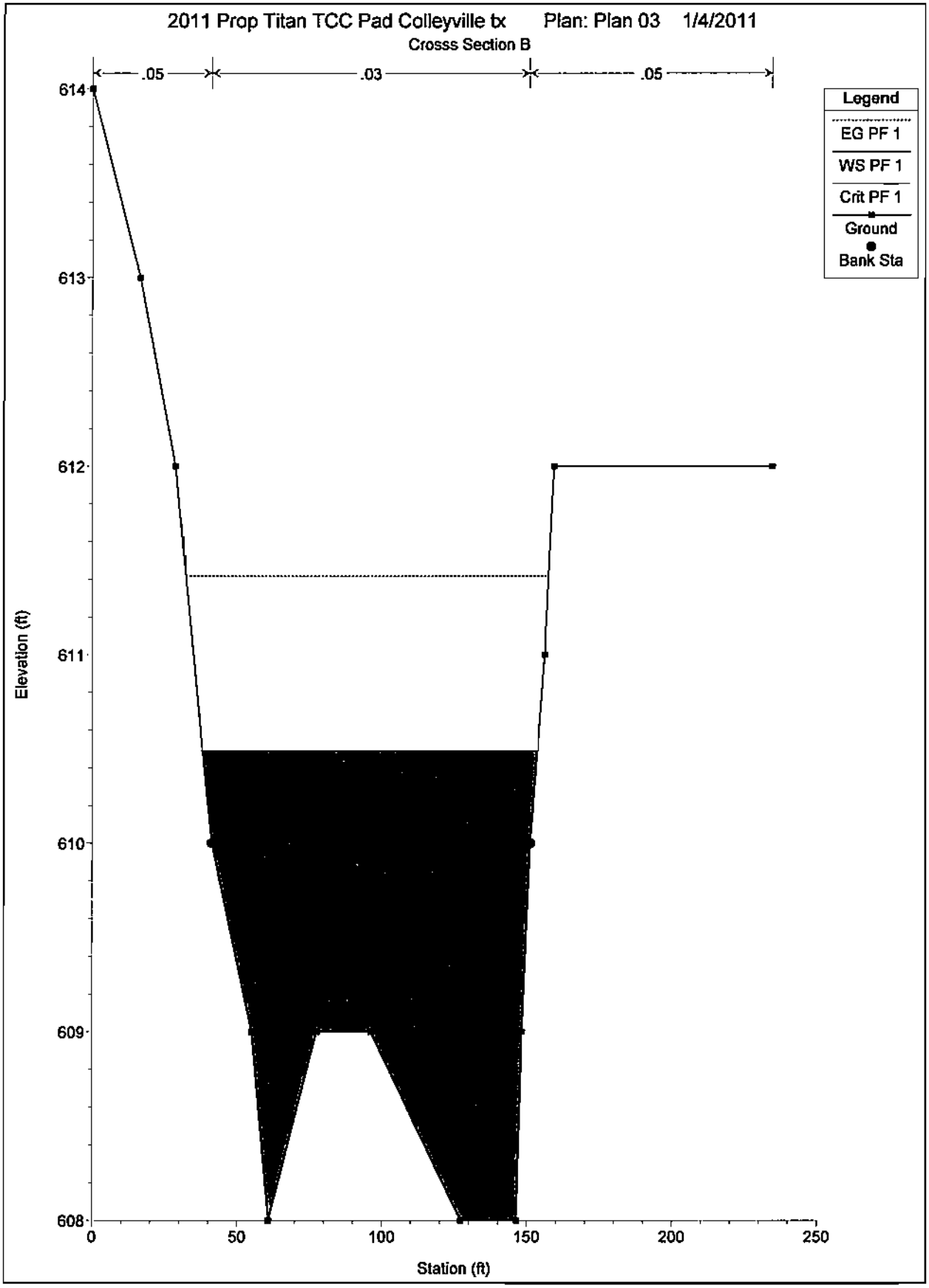
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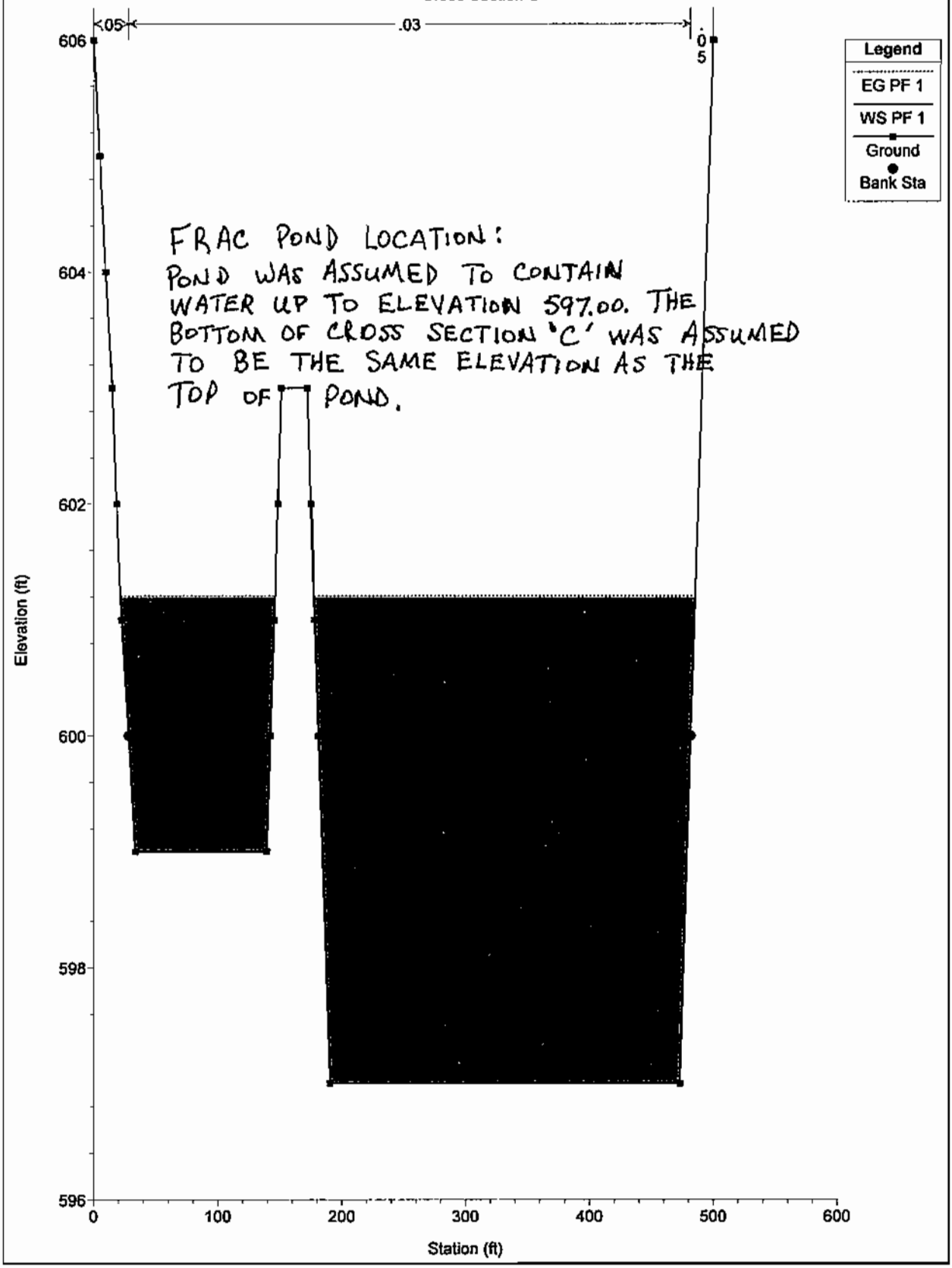
2011 Prop Titan TCC Pad Colleyville tx Plan: Plan 03 1/4/2011

Cross Section C



FRAC POND LOCATION:
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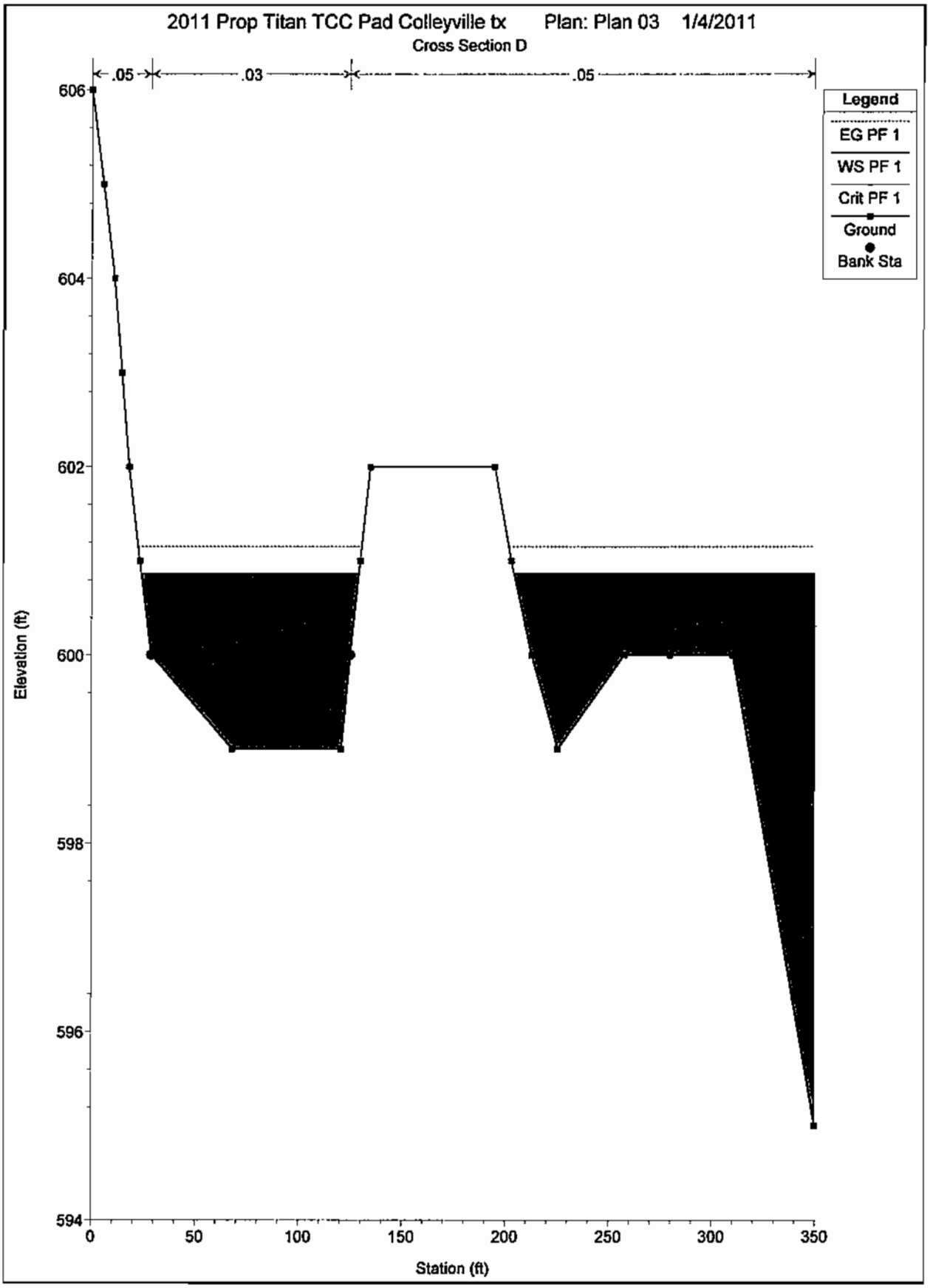
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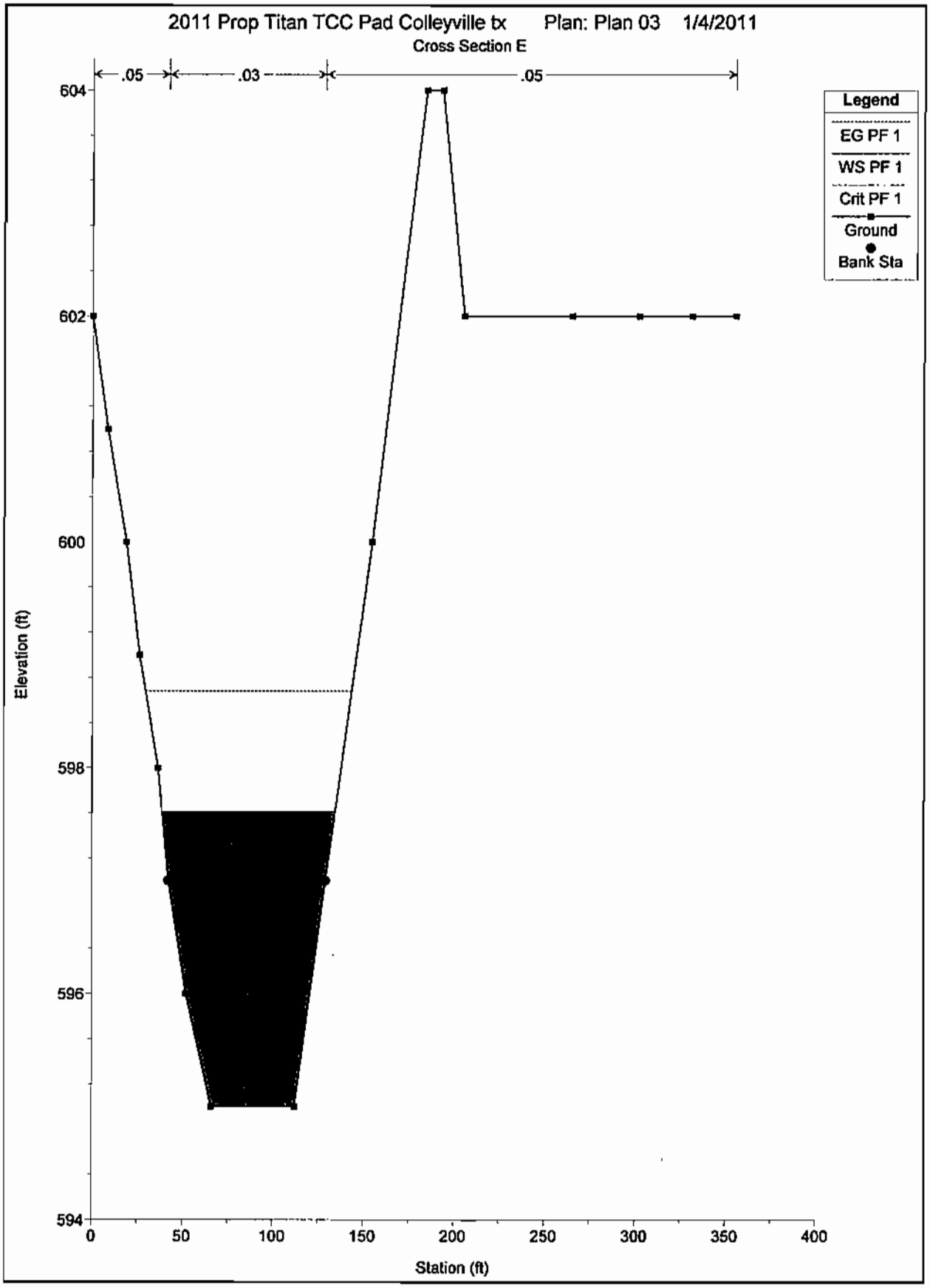
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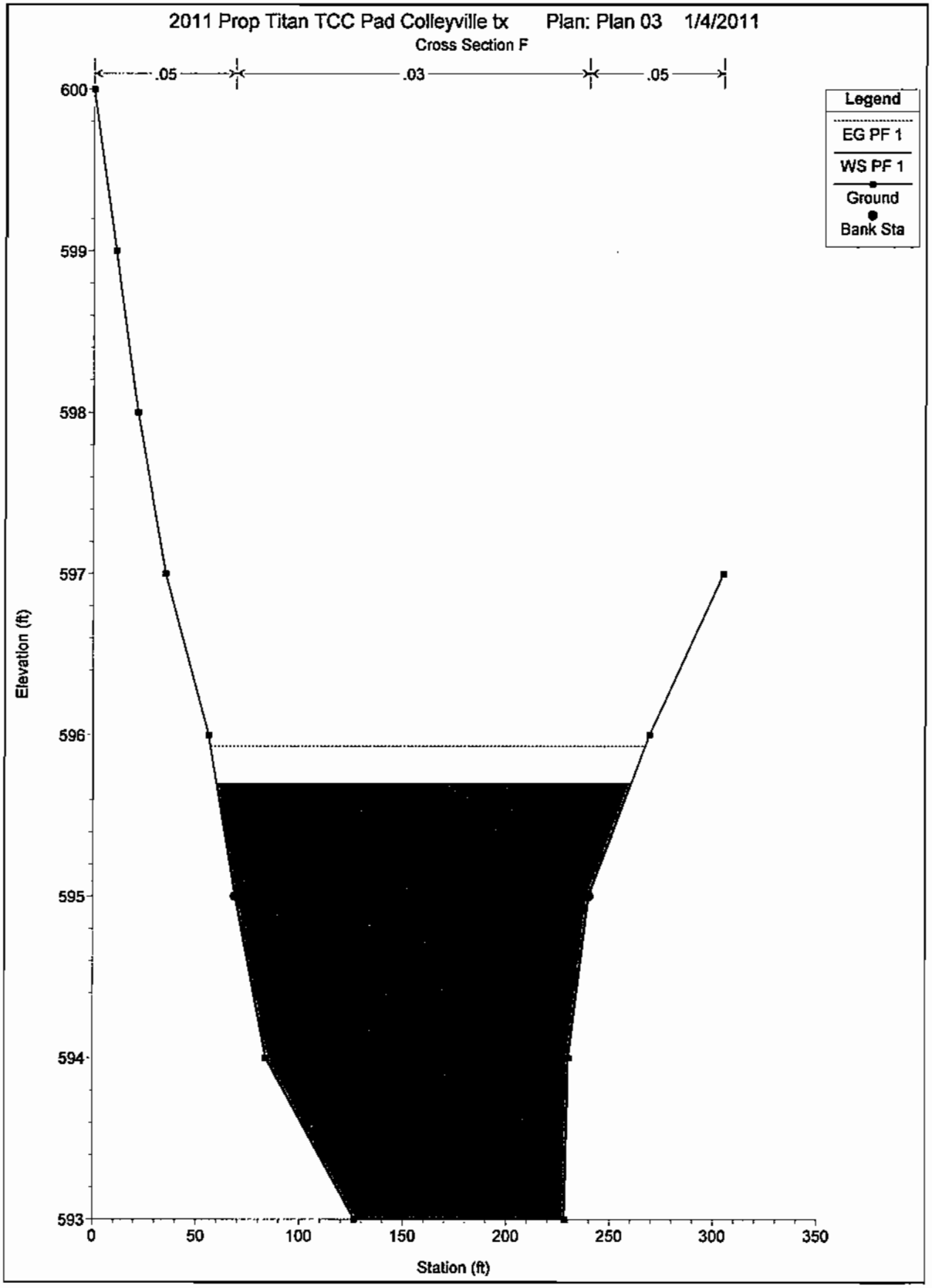
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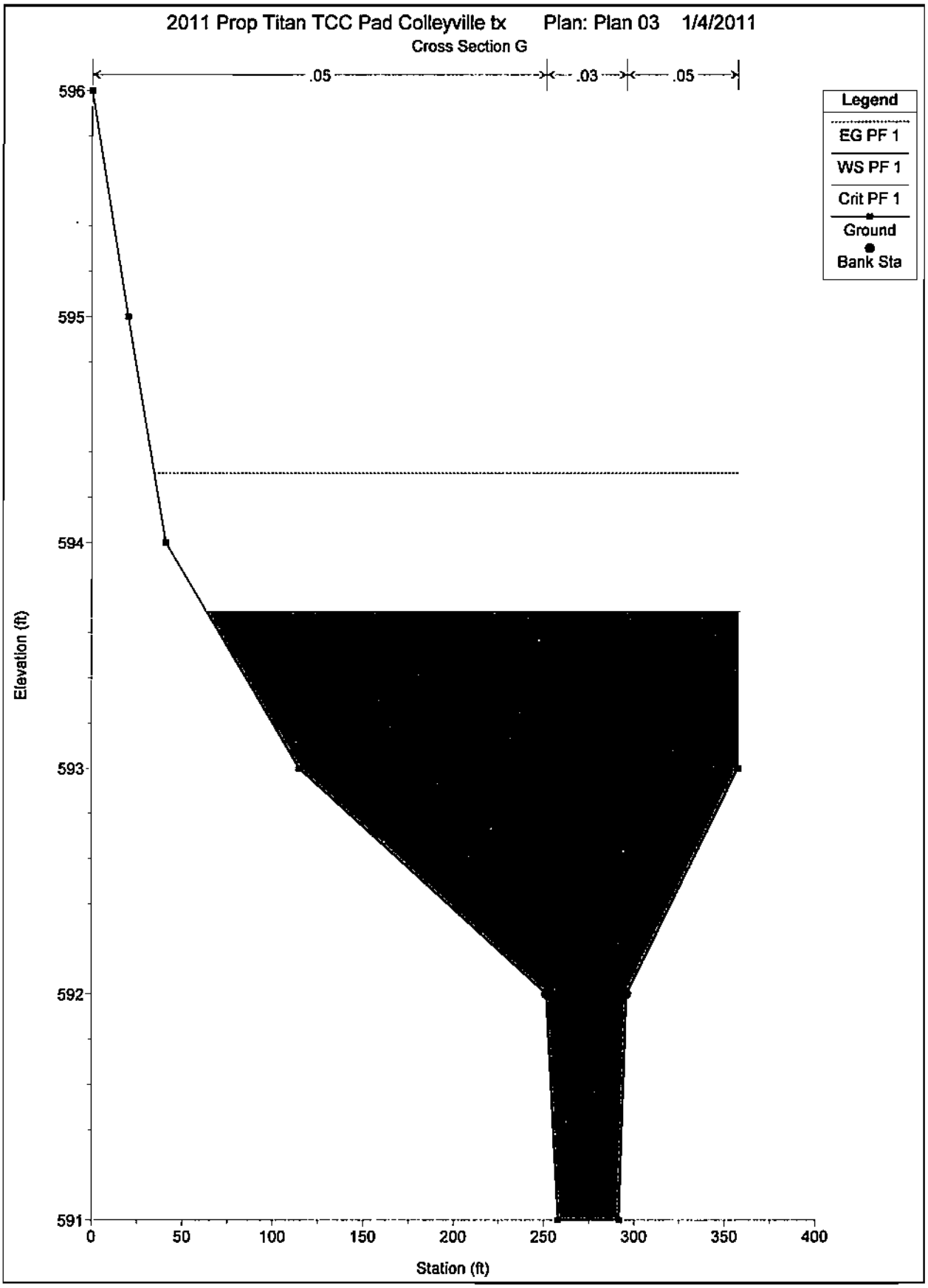
350
Station (ft)


2011 Prop Titan TCC Pad Colleyville tx Plan: Plan 03 1/4/2011
Cross Section G
.05
.03
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
596
595
594
593
592
591
Elevation (ft)
0
50
100
150
200
250
300
350
400
Station (ft)

HEC-RAS CROSS SECTION OUTPUT
EXIST STA. 1+00.00

Plan: Plan 01 Big Bear Creek DA-1 RS: 100 Profile: 100-YR

E.G. Elev (ft)	594.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	593.69	Reach Len. (ft)			
Crit W.S. (ft)	593.69	Flow Area (sq ft)	181.08	114.29	73.59
E.G. Slope (ft/ft)	0.007345	Area (sq ft)	181.08	114.29	73.59
Q Total (cfs)	1567.80	Flow (cfs)	449.97	908.46	209.37
Top Width (ft)	293.93	Top Width (ft)	187.89	44.41	61.63
Vel Total (ft/s)	4.25	Avg. Vel. (ft/s)	2.48	7.95	2.85
Max Chl Dpth (ft)	2.69	Hydr. Depth (ft)	0.96	2.57	1.19
Conv. Total (cfs)	18294.0	Conv. (cfs)	5250.5	10600.4	2443.1
Length Wtd. (ft)		Wetted Per. (ft)	187.89	44.61	62.33
Min Ch El (ft)	591.00	Shear (lb/sq ft)	0.44	1.17	0.54
Alpha	2.19	Stream Power (lb/ft s)	357.28	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

HEC-RAS CROSS SECTION OUTPUT
EXIST. STA. 5+65.08

Plan: Plan 01 Big Bear Creek DA-1 RS: 565.08 Profile: 100-YR

E.G. Elev (ft)	595.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	595.70	Reach Len. (ft)	480.20	465.08	436.89
Crit W.S. (ft)		Flow Area (sq ft)	3.10	401.97	7.10
E.G. Slope (ft/ft)	0.001973	Area (sq ft)	3.10	401.97	7.10
Q Total (cfs)	1567.80	Flow (cfs)	2.02	1561.14	4.64
Top Width (ft)	200.31	Top Width (ft)	8.90	171.03	20.38
Vel Total (ft/s)	3.80	Avg. Vel. (ft/s)	0.65	3.88	0.65
Max Chl Dpth (ft)	2.70	Hydr. Depth (ft)	0.35	2.35	0.35
Conv. Total (cfs)	35297.9	Conv. (cfs)	45.5	35148.0	104.4
Length Wtd. (ft)	465.34	Wetted Per. (ft)	8.93	171.38	20.39
Min Ch El (ft)	593.00	Shear (lb/sq ft)	0.04	0.29	0.04
Alpha	1.04	Stream Power (lb/ft s)	304.82	0.00	0.00
Frctn Loss (ft)	1.59	Cum Volume (acre-ft)	1.02	2.76	0.40
C & E Loss (ft)	0.04	Cum SA (acres)	1.08	1.15	0.41

HEC-RAS CROSS SECTION OUTPUT
EXIST. STA. 7+57.06

Plan: Plan 01 Big Bear Creek DA-1 RS: 757.06 Profile: 100-YR

E.G. Elev (ft)	596.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.030	
W.S. Elev (ft)	596.27	Reach Len. (ft)	105.83	191.98	191.98
Crit W.S. (ft)	596.17	Flow Area (sq ft)		295.21	
E.G. Slope (ft/ft)	0.009771	Area (sq ft)		295.21	
Q Total (cfs)	1567.80	Flow (cfs)		1567.80	
Top Width (ft)	261.24	Top Width (ft)		261.24	
Vel Total (ft/s)	5.31	Avg. Vel. (ft/s)		5.31	
Max Chl Dpth (ft)	1.27	Hydr. Depth (ft)		1.13	
Conv. Total (cfs)	15860.3	Conv. (cfs)		15860.3	
Length Wtd. (ft)	191.92	Wetted Per. (ft)		261.31	
Min Ch El (ft)	595.00	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)	355.97	0.00	0.00
Frctn Loss (ft)	0.72	Cum Volume (acre-ft)	1.02	4.29	0.42
C & E Loss (ft)	0.06	Cum SA (acres)	1.10	2.10	0.46

HEC-RAS CROSS SECTION OUTPUT
EXIST STA 10+79.62

Plan: Plan 01 Big Bear Creek DA-1 RS: 1079.62 Profile: 100-YR

E.G. Elev (ft)	599.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	598.98	Reach Len. (ft)	317.04	322.56	324.83
Crit W.S. (ft)	598.86	Flow Area (sq ft)	33.30	240.38	16.70
E.G. Slope (ft/ft)	0.007745	Area (sq ft)	33.30	240.38	16.70
Q Total (cfs)	1567.80	Flow (cfs)	54.05	1486.65	27.10
Top Width (ft)	244.48	Top Width (ft)	68.11	142.22	34.16
Vel Total (ft/s)	5.40	Avg. Vel. (ft/s)	1.62	6.18	1.62
Max Chl Dpth (ft)	1.98	Hydr. Depth (ft)	0.49	1.69	0.49
Conv. Total (cfs)	17814.5	Conv. (cfs)	614.1	16892.5	307.9
Length Wtd. (ft)	322.48	Wetted Per. (ft)	68.11	142.24	34.17
Min Ch El (ft)	597.00	Shear (lb/sq ft)	0.24	0.82	0.24
Alpha	1.25	Stream Power (lb/ft s)	349.72	0.00	0.00
Frctn Loss (ft)	2.80	Cum Volume (acre-ft)	1.14	6.28	0.48
C & E Loss (ft)	0.04	Cum SA (acres)	1.34	3.60	0.58

HEC-RAS CROSS SECTION OUTPUT
EXIST STA. 11+79.62

Plan: Plan 01 Big Bear Creek DA-1 RS: 1179.62 Profile: 100-YR

E.G. Elev (ft)	600.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	599.74	Reach Len. (ft)	101.48	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	156.14	224.71	52.29
E.G. Slope (ft/ft)	0.003492	Area (sq ft)	156.14	224.71	52.29
Q Total (cfs)	1567.80	Flow (cfs)	311.41	1172.68	83.70
Top Width (ft)	283.35	Top Width (ft)	128.94	94.35	60.06
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)	1.99	5.22	1.60
Max Chl Dpth (ft)	2.74	Hydr. Depth (ft)	1.21	2.38	0.87
Conv. Total (cfs)	26530.8	Conv. (cfs)	5269.9	19844.5	1416.5
Length Wtd. (ft)	100.17	Wetted Per. (ft)	129.02	94.38	60.09
Min Ch El (ft)	597.00	Shear (lb/sq ft)	0.26	0.52	0.19
Alpha	1.63	Stream Power (lb/ft s)	357.09	0.00	0.00
Frctn Loss (ft)	0.50	Cum Volume (acre-ft)	1.36	6.81	0.56
C & E Loss (ft)	0.02	Cum SA (acres)	1.57	3.87	0.69

HEC-RAS CROSS SECTION OUTPUT
EXIST STA. 24+52.87

Plan: Plan 01 Big Bear Creek DA-1 RS: 2452.87 Profile: 100-YR

E.G. Elev (ft)	611.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.92	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	610.49	Reach Len. (ft)	1293.10	1273.25	1309.91
Crit W.S. (ft)	610.49	Flow Area (sq ft)	0.77	203.03	0.61
E.G. Slope (ft/ft)	0.010785	Area (sq ft)	0.77	203.03	0.61
Q Total (cfs)	1567.80	Flow (cfs)	0.92	1566.14	0.74
Top Width (ft)	115.58	Top Width (ft)	3.10	109.99	2.49
Vel Total (ft/s)	7.67	Avg. Vel. (ft/s)	1.21	7.71	1.20
Max Chl Dpth (ft)	2.49	Hydr. Depth (ft)	0.25	1.85	0.25
Conv. Total (cfs)	15096.4	Conv. (cfs)	8.9	15080.3	7.1
Length Wtd. (ft)	1276.21	Wetted Per. (ft)	3.14	110.56	2.53
Min Ch El (ft)	608.00	Shear (lb/sq ft)	0.16	1.24	0.16
Alpha	1.01	Stream Power (lb/ft s)	234.82	0.00	0.00
Frctn Loss (ft)	7.24	Cum Volume (acre-ft)	3.69	13.06	1.36
C & E Loss (ft)	0.18	Cum SA (acres)	3.53	6.85	1.63

HEC-RAS SUMMARY REPORT
EXISTING

HEC-RAS Plan: Plan 01 River: Big Bear Creek Reach: DA-1 Profile: 100-YR

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
DA-1	2452.87	100-YR	1567.80	608.00	610.49	610.49	611.42	0.010785	7.71	204.42	115.58	1.00
DA-1	1179.62	100-YR	1567.80	597.00	599.74		600.07	0.003492	5.22	433.14	283.35	0.60
DA-1	1079.62	100-YR	1567.80	597.00	598.98	598.86	599.54	0.007745	6.18	290.38	244.48	0.84
DA-1	757.06	100-YR	1567.80	595.00	596.27	596.17	596.71	0.009771	5.31	295.21	261.24	0.88
DA-1	565.08	100-YR	1567.80	593.00	595.70		595.93	0.001973	3.88	412.17	200.31	0.45
DA-1	100	100-YR	1567.80	591.00	593.69	593.69	594.31	0.007345	7.95	368.97	293.93	0.87

HEC-RAS SUMMARY REPORT
PROPOSED

HEC-RAS Plan: Plan 03 River: Big Bear Creek Reach: DA-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
DA-1	2452.87	PF 1	1567.80	608.00	610.49	610.49	611.42	0.010882	7.73	203.85	115.52	1.00
DA-1	1179.62	PF 1	1567.80	597.00	601.19		601.20	0.000086	1.06	1487.79	432.19	0.10
DA-1	1079.62	PF 1	1567.80	599.00	600.86	600.31	601.15	0.005687	5.18	404.55	250.59	0.71
DA-1	757.06	PF 1	1567.80	595.00	597.61	597.61	598.68	0.010078	8.31	191.02	95.80	0.99
DA-1	565.08	PF 1	1567.80	593.00	595.70		595.93	0.001973	3.88	412.17	200.31	0.45
DA-1	100	PF 1	1567.80	591.00	593.69	593.69	594.31	0.007345	7.95	368.97	293.93	0.87

HEC-RAS CROSS SECTION
OUTPUT PROP. STA. 24+52.87

Plan: Plan 03 Big Bear Creek DA-1 RS: 2452.87 Profile: PF 1

E.G. Elev (ft)	611.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	610.49	Reach Len. (ft)	1293.10	1273.25	1309.91
Crit W.S. (ft)	610.49	Flow Area (sq ft)	0.75	202.50	0.60
E.G. Slope (ft/ft)	0.010882	Area (sq ft)	0.75	202.50	0.60
Q Total (cfs)	1567.80	Flow (cfs)	0.90	1566.18	0.72
Top Width (ft)	115.52	Top Width (ft)	3.07	109.99	2.46
Vel Total (ft/s)	7.69	Avg. Vel. (ft/s)	1.20	7.73	1.20
Max Chl Dpth (ft)	2.49	Hydr. Depth (ft)	0.24	1.84	0.24
Conv. Total (cfs)	15029.5	Conv. (cfs)	8.7	15013.9	6.9
Length Wtd. (ft)	1273.27	Wetted Per. (ft)	3.11	110.56	2.51
Min Ch El (ft)	608.00	Shear (lb/sq ft)	0.16	1.24	0.16
Alpha	1.01	Stream Power (lb/ft s)	234.82	0.00	0.00
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	1.11	31.83	1.67
C & E Loss (ft)	0.27	Cum SA (acres)	1.29	10.77	1.31

HEC-RAS CROSS SECTION OUTPUT
PROP. STA 11+79.62

Plan: Plan 03 Big Bear Creek DA-1 RS: 1179.62 Profile: PF 1

E.G. Elev (ft)	601.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	601.19	Reach Len. (ft)	101.48	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	4.11	1481.52	2.17
E.G. Slope (ft/ft)	0.000086	Area (sq ft)	4.11	1481.52	2.17
Q Total (cfs)	1567.80	Flow (cfs)	0.82	1566.58	0.41
Top Width (ft)	432.19	Top Width (ft)	6.58	421.95	3.65
Vel Total (ft/s)	1.05	Avg. Vel. (ft/s)	0.20	1.06	0.19
Max Chl Dpth (ft)	4.19	Hydr. Depth (ft)	0.62	3.51	0.59
Conv. Total (cfs)	169216.2	Conv. (cfs)	88.1	169084.1	44.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)	6.69	423.57	3.84
Min Ch El (ft)	597.00	Shear (lb/sq ft)	0.00	0.02	0.00
Alpha	1.01	Stream Power (lb/ft s)	500.07	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	1.04	7.22	1.63
C & E Loss (ft)	0.03	Cum SA (acres)	1.14	2.99	1.22

HEC-RAS CROSS SECTION OUTPUT
PROP. STA. 10+79.62

Plan: Plan 03 Big Bear Creek DA-1 RS: 1079.62 Profile: PF 1

E.G. Elev (ft)	601.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	600.86	Reach Len. (ft)	317.04	322.56	324.83
Crit W.S. (ft)	600.31	Flow Area (sq ft)	2.09	157.55	244.91
E.G. Slope (ft/ft)	0.005687	Area (sq ft)	2.09	157.55	244.91
Q Total (cfs)	1567.80	Flow (cfs)	2.65	816.64	748.51
Top Width (ft)	250.59	Top Width (ft)	4.85	96.25	149.49
Vel Total (ft/s)	3.88	Avg. Vel. (ft/s)	1.27	5.18	3.06
Max Chl Dpth (ft)	5.86	Hydr. Depth (ft)	0.43	1.64	1.64
Conv. Total (cfs)	20790.4	Conv. (cfs)	35.2	10829.4	9925.9
Length Wtd. (ft)	323.10	Wetted Per. (ft)	4.92	96.37	155.86
Min Ch El (ft)	599.00	Shear (lb/sq ft)	0.15	0.58	0.56
Alpha	1.23	Stream Power (lb/ft s)	349.72	0.00	0.00
Frctn Loss (ft)	2.40	Cum Volume (acre-ft)	1.03	5.34	1.34
C & E Loss (ft)	0.08	Cum SA (acres)	1.13	2.40	1.04

HEC-RAS CROSS SECTION OUTPUT
PROP. STA. 7+57.06

Plan: Plan 03 Big Bear Creek DA-1 RS: 757.06 Profile: PF 1

E.G. Elev (ft)	598.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	597.61	Reach Len. (ft)	105.83	191.98	191.98
Crit W.S. (ft)	597.61	Flow Area (sq ft)	1.07	188.34	1.61
E.G. Slope (ft/ft)	0.010078	Area (sq ft)	1.07	188.34	1.61
Q Total (cfs)	1567.80	Flow (cfs)	1.43	1564.21	2.17
Top Width (ft)	95.80	Top Width (ft)	3.49	87.05	5.26
Vel Total (ft/s)	8.21	Avg. Vel. (ft/s)	1.34	8.31	1.35
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)	0.31	2.16	0.31
Conv. Total (cfs)	15617.4	Conv. (cfs)	14.2	15581.6	21.6
Length Wtd. (ft)	191.89	Wetted Per. (ft)	3.54	87.25	5.29
Min Ch El (ft)	595.00	Shear (lb/sq ft)	0.19	1.36	0.19
Alpha	1.02	Stream Power (lb/ft s)	355.97	0.00	0.00
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	1.02	4.06	0.42
C & E Loss (ft)	0.25	Cum SA (acres)	1.10	1.72	0.47

HEC-RAS CROSS SECTION OUTPUT
PROP. STA. 5+65.08

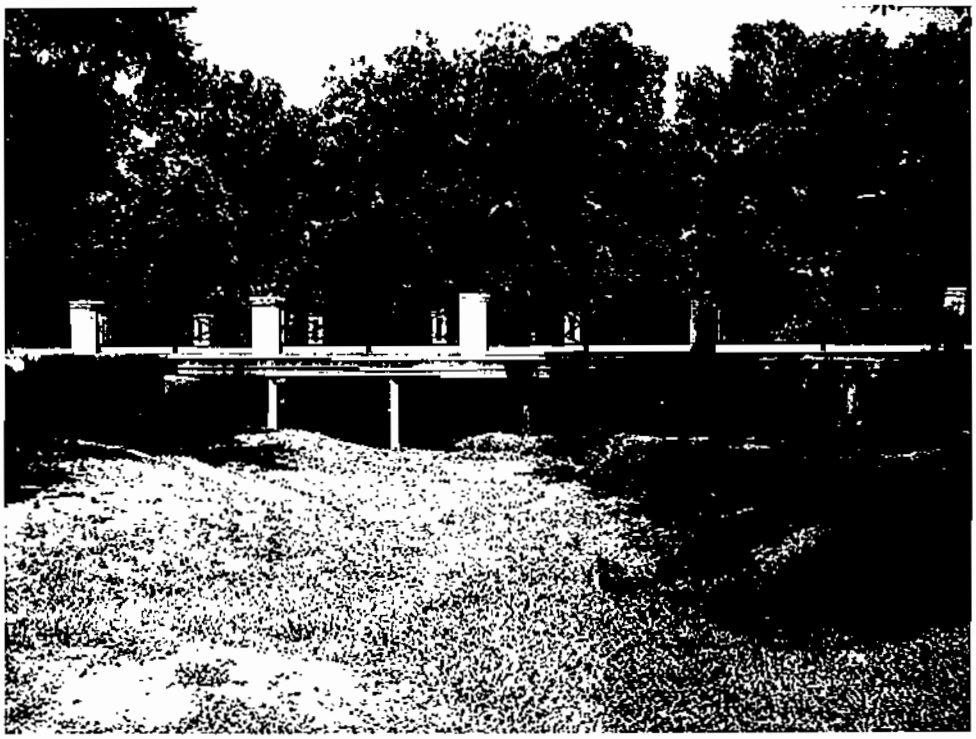
Plan: Plan 03 Big Bear Creek DA-1 RS: 565.08 Profile: PF 1

E.G. Elev (ft)	595.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	595.70	Reach Len. (ft)	480.20	465.08	436.89
Crit W.S. (ft)		Flow Area (sq ft)	3.10	401.97	7.10
E.G. Slope (ft/ft)	0.001973	Area (sq ft)	3.10	401.97	7.10
Q Total (cfs)	1567.80	Flow (cfs)	2.02	1561.14	4.64
Top Width (ft)	200.31	Top Width (ft)	8.90	171.03	20.38
Vel Total (ft/s)	3.80	Avg. Vel. (ft/s)	0.65	3.88	0.65
Max Chl Dpth (ft)	2.70	Hydr. Depth (ft)	0.35	2.35	0.35
Conv. Total (cfs)	35297.9	Conv. (cfs)	45.5	35148.0	104.4
Length Wtd. (ft)	465.34	Wetted Per. (ft)	8.93	171.38	20.39
Min Ch El (ft)	593.00	Shear (lb/sq ft)	0.04	0.29	0.04
Alpha	1.04	Stream Power (lb/ft s)	304.82	0.00	0.00
Frctn Loss (ft)	1.59	Cum Volume (acre-ft)	1.02	2.76	0.40
C & E Loss (ft)	0.04	Cum SA (acres)	1.08	1.15	0.41

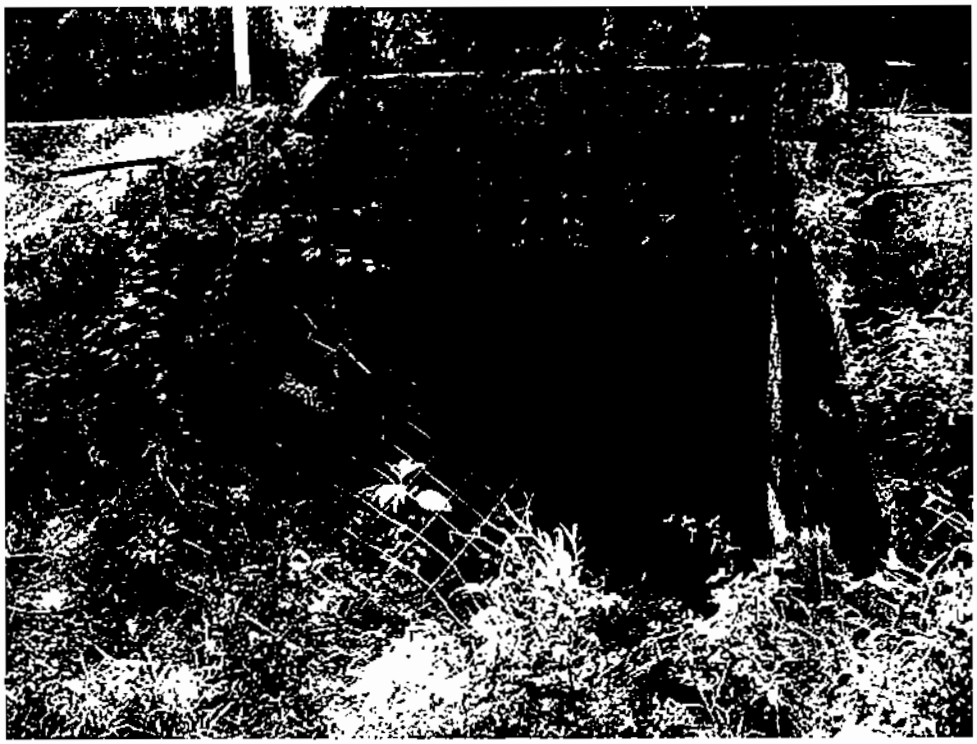
HEC-RAS CROSS SECTION OUTPUT
PROP. STA. 1+00.00

Plan: Plan 03 Big Bear Creek DA-1 RS: 100 Profile: PF 1

E.G. Elev (ft)	594.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.61	Wt. n-Val.	0.050	0.030	0.050
W.S. Elev (ft)	593.69	Reach Len. (ft)			
Crit W.S. (ft)	593.69	Flow Area (sq ft)	181.08	114.29	73.59
E.G. Slope (ft/ft)	0.007345	Area (sq ft)	181.08	114.29	73.59
Q Total (cfs)	1567.80	Flow (cfs)	449.97	908.46	209.37
Top Width (ft)	293.93	Top Width (ft)	187.89	44.41	61.63
Vel Total (ft/s)	4.25	Avg. Vel. (ft/s)	2.48	7.95	2.85
Max Chl Dpth (ft)	2.69	Hydr. Depth (ft)	0.96	2.57	1.19
Conv. Total (cfs)	18294.0	Conv. (cfs)	5250.5	10600.4	2443.1
Length Wtd. (ft)		Wetted Per. (ft)	187.89	44.61	62.33
Min Ch El (ft)	591.00	Shear (lb/sq ft)	0.44	1.17	0.54
Alpha	2.19	Stream Power (lb/ft s)	357.28	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			



Upstream from Pad Site at Monticello Parkway



Downstream from Pad Site at Pleasant Run Road

Main Tributary of Big Bear Creek at Pleasant Run Road/ S. White Chapel Blvd.