

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION TITLE PAGE

CLIENT & PROJECT: Private Fuel Storage, LLC-Private Fuel Storage Facility				PAGE 1 OF 53	
CALCULATION TITLE (Indicative of Objective): PFSF Flood Analysis With Proposed Access Road and Rail Road.				QA CATEGORY <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> - I Nuclear Safety Related <input type="checkbox"/> - II <input type="checkbox"/> - III <input type="checkbox"/> - Non-Safety Related <input type="checkbox"/> - <input type="checkbox"/> - Fossil/Industrial Plant	
CALCULATION IDENTIFICATION NUMBER					
J.O. or W.O. NO.	DIVISION & GROUP	CURRENT CALC NO.	OPTIONAL TASK CODE	OPTIONAL WORK PACKAGE NO.	
0599602	G(B)	17, Rev 1		345W	
APPROVALS - SIGNATURE & DATE				CONFIRMATION REQUIRED <input checked="" type="checkbox"/>	
PREPARER(S)/DATE(S)	REVIEWER(S)/DATE(S)	INDEPENDENT REVIEWER(S)/ DATES(S)	REV. NO. OR NEW CALC. NO.	SUPERCEDES CALC. NO. OR REV. NO.	YES NO
Ven Nan Zeng 03/09/99 <i>Ven Nan Zeng</i>	George H.C. Liang 03/10/99 <i>George H.C. Liang</i>	George H.C. Liang 03/10/99 <i>George H.C. Liang</i>	Original Issue		<input type="checkbox"/> <input checked="" type="checkbox"/>
Ven Nan Zeng 05/17/99 <i>Ven Nan Zeng</i>	George H.C. Liang 05/17/99 <i>George H.C. Liang</i>	George H.C. Liang 05/17/99 <i>George H.C. Liang</i>	1		<input type="checkbox"/> <input checked="" type="checkbox"/>
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Project File		<input checked="" type="checkbox"/>			<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>

9905260297 990518
PDR ADOCK 07200022
C PDR

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RECORD OF CHANGES

Rev No.	Description of Changes	Pages Revised	Pages Added	Pages Replaced
0	Original Issue	N/A	N/A	N/A
1	This version replaces original issue	All pages		All

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1, Objectives

The objective of this calculation is to determine post construction **PMF** flood levels at the following two floodway crossings:

- 1, Access road over the floodway to the east of PFSF.
- 2, The 2.6 mile long east-west railroad over the floodway to the west of PFSF

The 100-year flood event is not included in this calculation.

Flood levels previously determined in Ref. 3 and Ref. 4 were based on the existing natural flood way topography. The effects of the PMF berms and the access road and rail road embankments to flood levels were not considered in the two analyses.

2, References

1. U.S.Army Corps of Engineers, Hydrologic Center, "HEC-RAS, River Analysis System", 1997.
2. Calculation 05996.01-G(B)-10, Rev 0, "HEC-RAS Micro Computer Version 1.2 Software Test", May 20, 1997.
3. Calculation 0599603-G(B)-12, rev 1 "PFSF Flood analysis with Larger Drainage Basin".
4. Calculation 0599603-G(B)-16, "PFSF Flood analysis at 3-mile-long Rail Spur".

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3, Drainage Basins

Figure 1 shows the two drainage basins that contribute flood flow to the PFSF area. Basin runoff to the access road is from basin A. Basin runoff to the east-west railroad adjacent to the PFSF site is from Basin B. The boundary of the basins have been defined in References 3 and 4. The size of the two basins are:

Basin A	Area = 270 mile ² ,
Basin B	Area = 64 mile ² .

There is a ridge characterized by sections of high ground dividing the two basins. Because the basin runoff occurs as sheet flow, the ground ridge is able to prevent cross flow between the two basins. This can be verified from the USGS topographic map, in which the intermittent streams (shown as blue lines in the map) in each basin do not cross the dividing ridge.

4, PMF Flows**4.1, Access Road Flood way**

The PMF passing the access road was determined = 85,000 cfs (see Section 8 of Ref. 3). This conservative flow was calculated based on a CN = 96, and a concentration time $T_c = 11$ hours.

4.2, East-West Rail Road Flood way

The PMF passing the rail road using CN = 70 and $T_c = 4.17$ hours was calculated to be 68,500 cfs (Ref. 4). This analysis assumes a more conservative CN = 96, and the same $T_c = 4.17$ hours. The result of the new PMF = 102,000 cfs. Computer input and output for the the determination of this new PMF computation is included in Attachment 1.

4.3, Summary of PMF Flows

With the access road and the rail road embankments in place, the results of probable maximum flood (PMF) flows are summarized below:

	<u>CN No</u>	<u>Concentration time T_c (hour)</u>	<u>PMF (cfs)</u>
Access Road Crossing	96	11.00	85,000
Rail Road Crossing	96	4.17	102,000

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5, Hydraulic Models and HEC-RAS input data

Figure 2 shows the location of the cross-sections in hydraulic model using HEC-RAS program. Input data can be founded in Attachment 2 for the access road floodway and Attachment 4 for the rail road floodway.

The input data are revised from the models in References 3 and 4.

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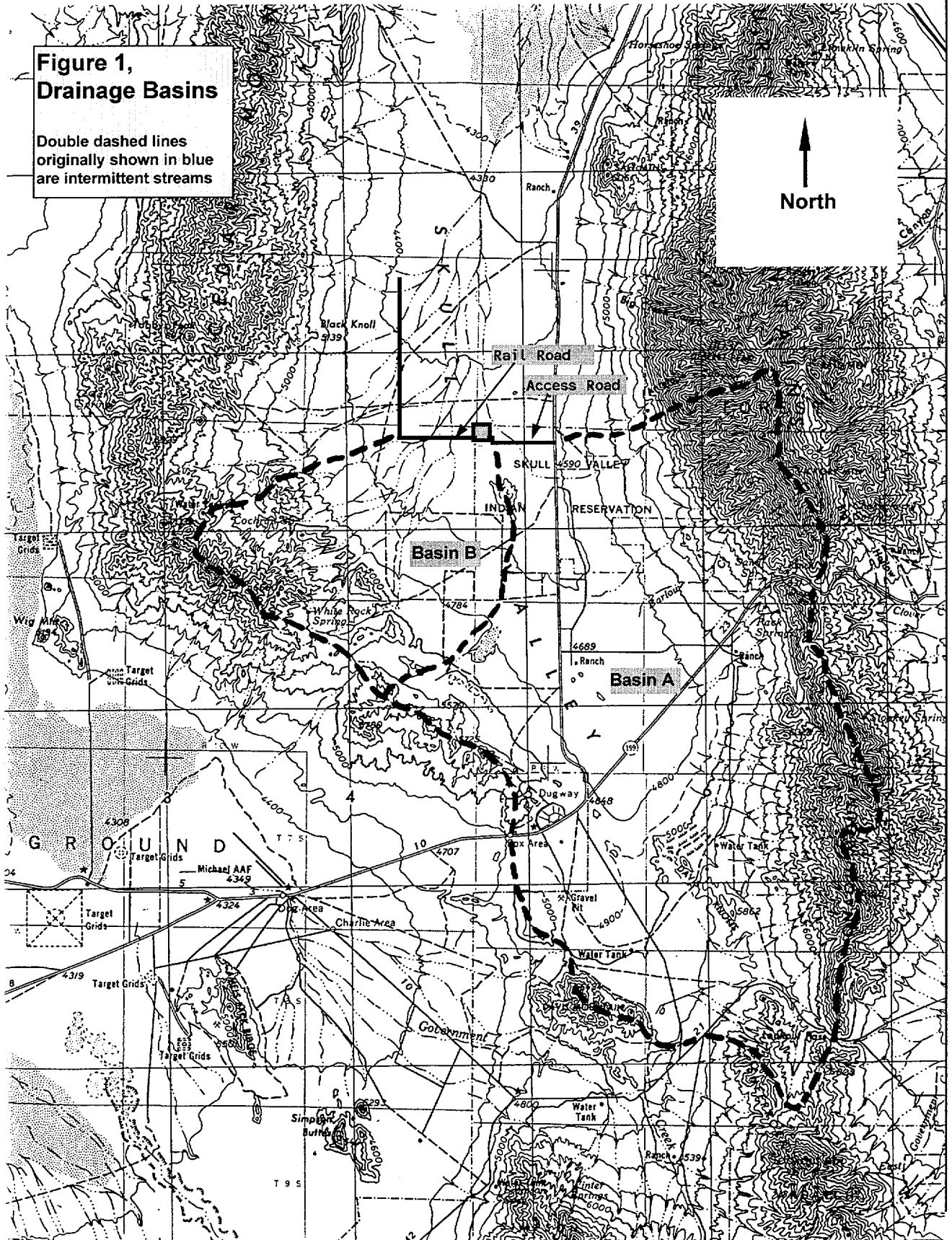
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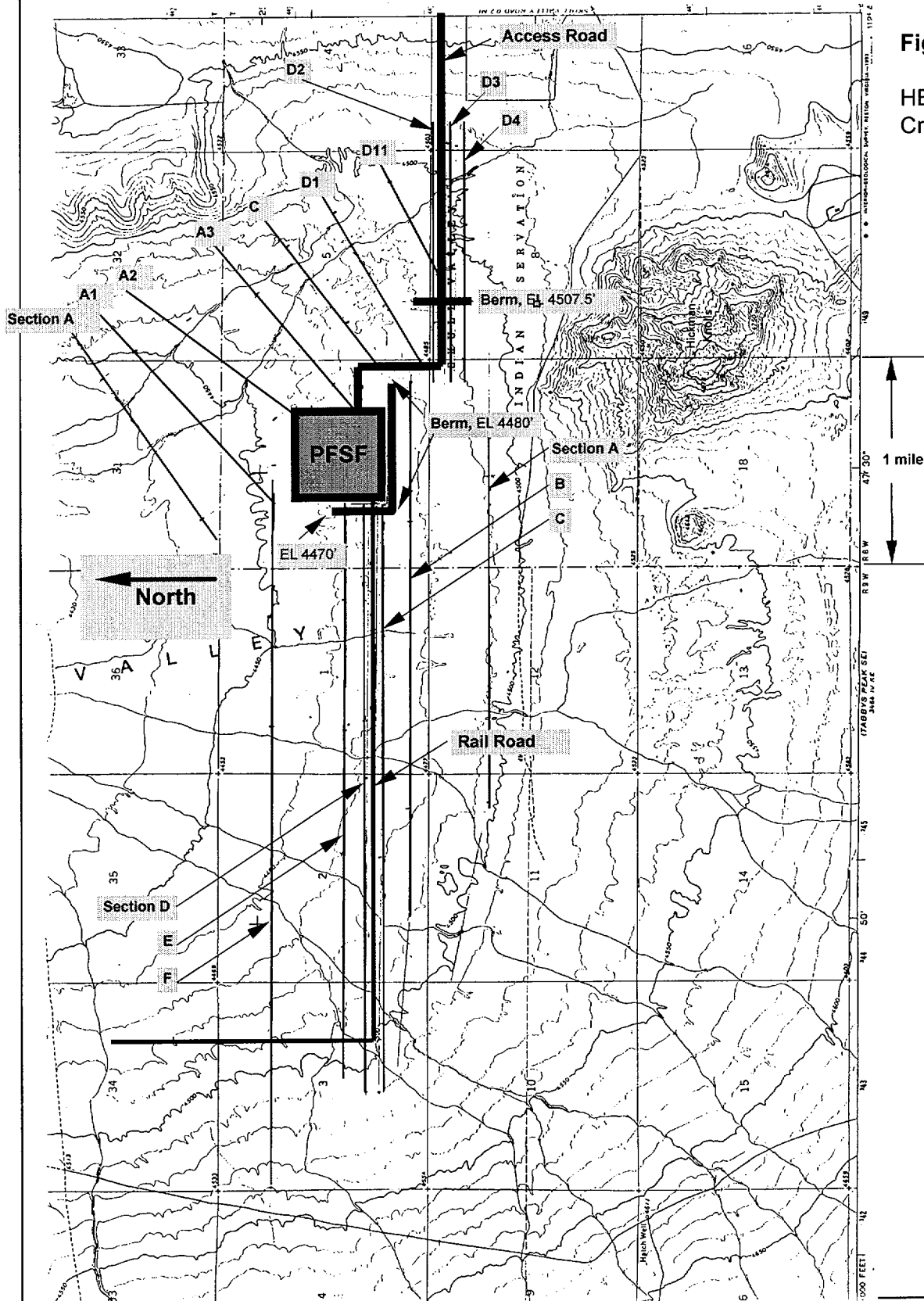
**Figure 1,
Drainage Basins**

Double dashed lines
originally shown in blue
are intermittent streams



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6, Results**6.1, The Access Road Flood way**

Table 1 summarizes the calculated water surface elevations at each cross sections. The water surface profile is plotted in Figure 3.

The water level at the upstream of the embankment is 4506.44 ft. The earth berm (see Figure 2 and 4) which which has a top elevation = 4507.5 ft, will constrain the flood flow within the flood way. The PMF will overtop the low point of access road embankment (elev 4502 ft) by about 4.4 ft. The cask storage pads are located downstream from the embankment where the flood level is about 4.5 ft lower. (Figure 3). Water level adjacent to north east corner of the site is 4456.74 ft (Section A2, Figure 8).

A cross-sectional view of the flood level at the upstream side of the embankment is shown in Figure 4. A downstream cross-section near the site is shown in Figure 5. The boundary of the PMF flood is plotted in Figure 8. The floodway cross section plots are documented in Attachment 3.

The flow is sub-critical as the Froude Numbers are < 1.0 (right column of Table 1). Therefore, the access road embankment would not affect downstream water level near the PFSF site. In case a total breach occurred to the embankment during PMF, flood level near the site would not be changed (in theory). This is similar to the condition analyzed in Reference 3, in which no access road embankment was assumed. There is no significant difference in flood elevations near the site computed in this calculation and in Reference 3 because of the sub-critical flow condition.

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Table 1, Access road floodway - Calculated water surface profile

River Sta	Section	Profile	Q Total (cfs)	W.S. Elev (ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
PFSF 10060	D4	PMF_CN=96	85000.00	4506.45	24992.02	3938.52	0.23
PFSF 9780	D3	PMF_CN=96	85000.00	4506.44	34277.91	4070.09	0.15
PFSF 9740		Culvert					
PFSF 9700	D2	PMF_CN=96	85000.00	4501.25	15535.24	3278.97	0.44
PFSF 8800	D11	PMF_CN=96	85000.00	4496.33	8245.48	2539.15	1.01
PFSF 7200	D1	PMF_CN=96	85000.00	4485.68	14923.24	4590.76	0.55
PFSF 5900	C	PMF_CN=96	85000.00	4477.39	9193.47	2914.24	0.95
PFSF 4500	A3	PMF_CN=96	85000.00	4466.39	10944.07	3488.63	0.77
PFSF 2800	A2	PMF_CN=96	85000.00	4456.74	11871.05	3187.13	0.65
PFSF 1300	A1	PMF_CN=96	85000.00	4450.13	13923.87	4540.63	0.61
PFSF 0	A	PMF_CN=96	85000.00	4444.23	13396.12	4436.82	0.64

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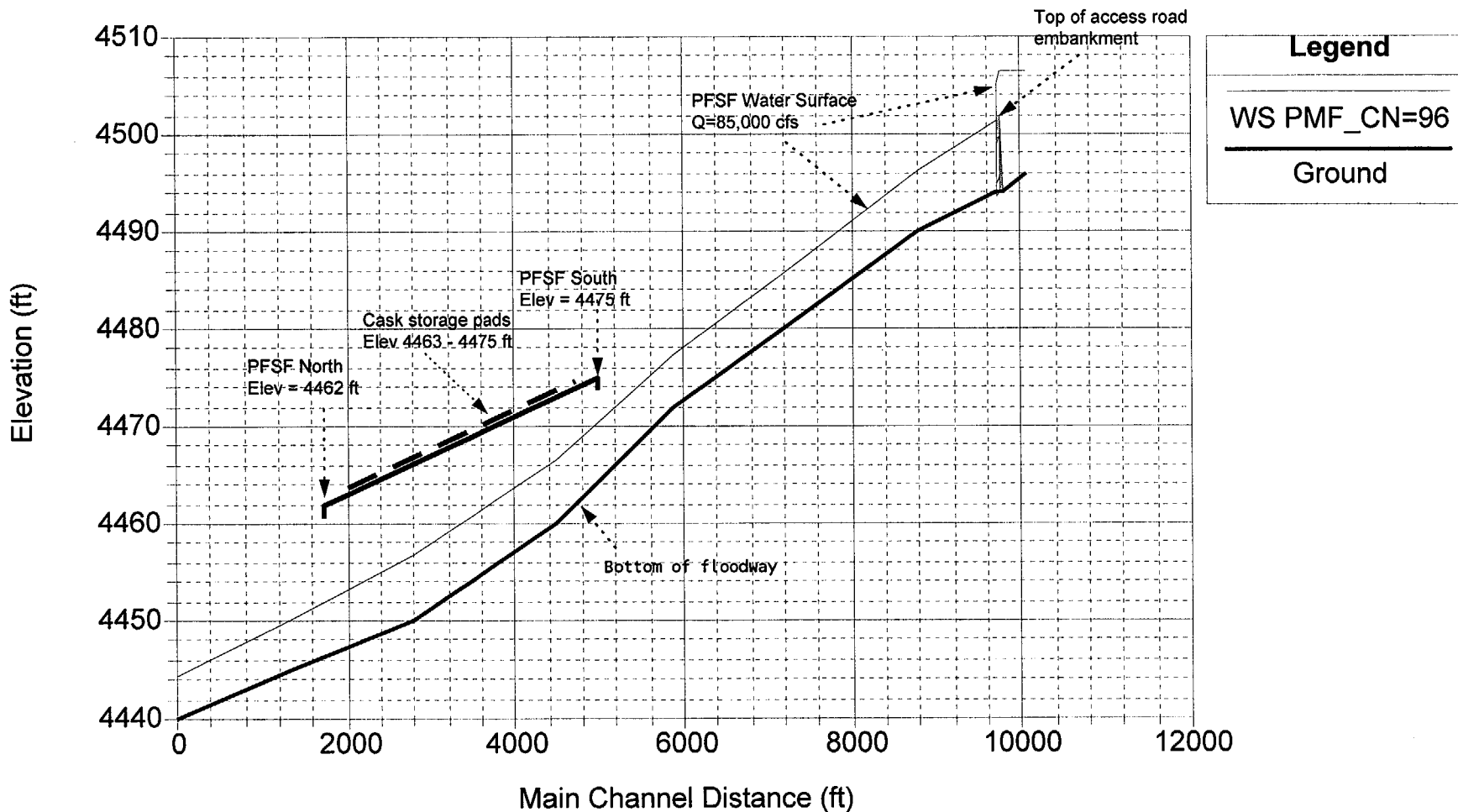
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Figure 3, Water Surface Profile at Access Road Crossing with PMF = 85,000 cfs



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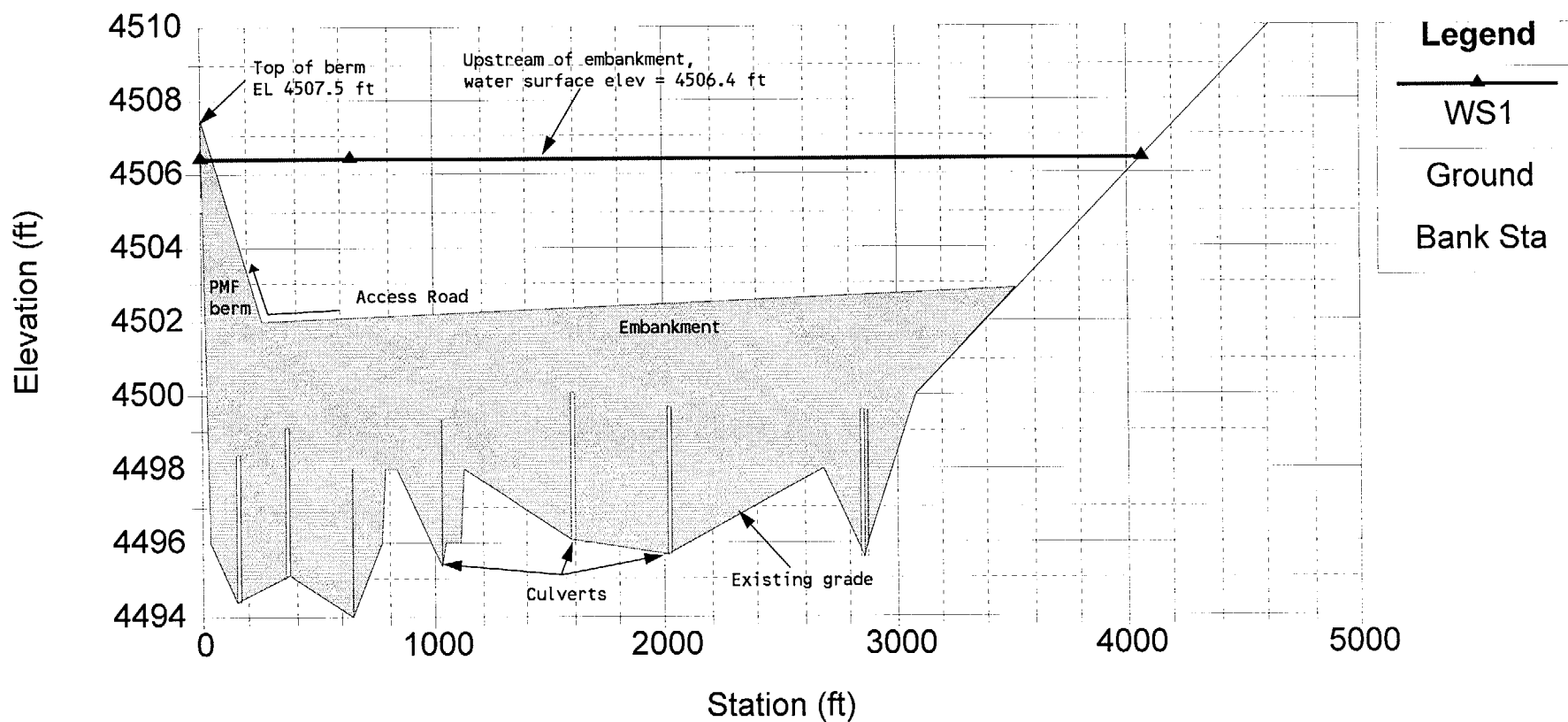
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Figure 4, Cross-section view of water level upstream of embankment

RS = 9740 Culv U



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GB(B)

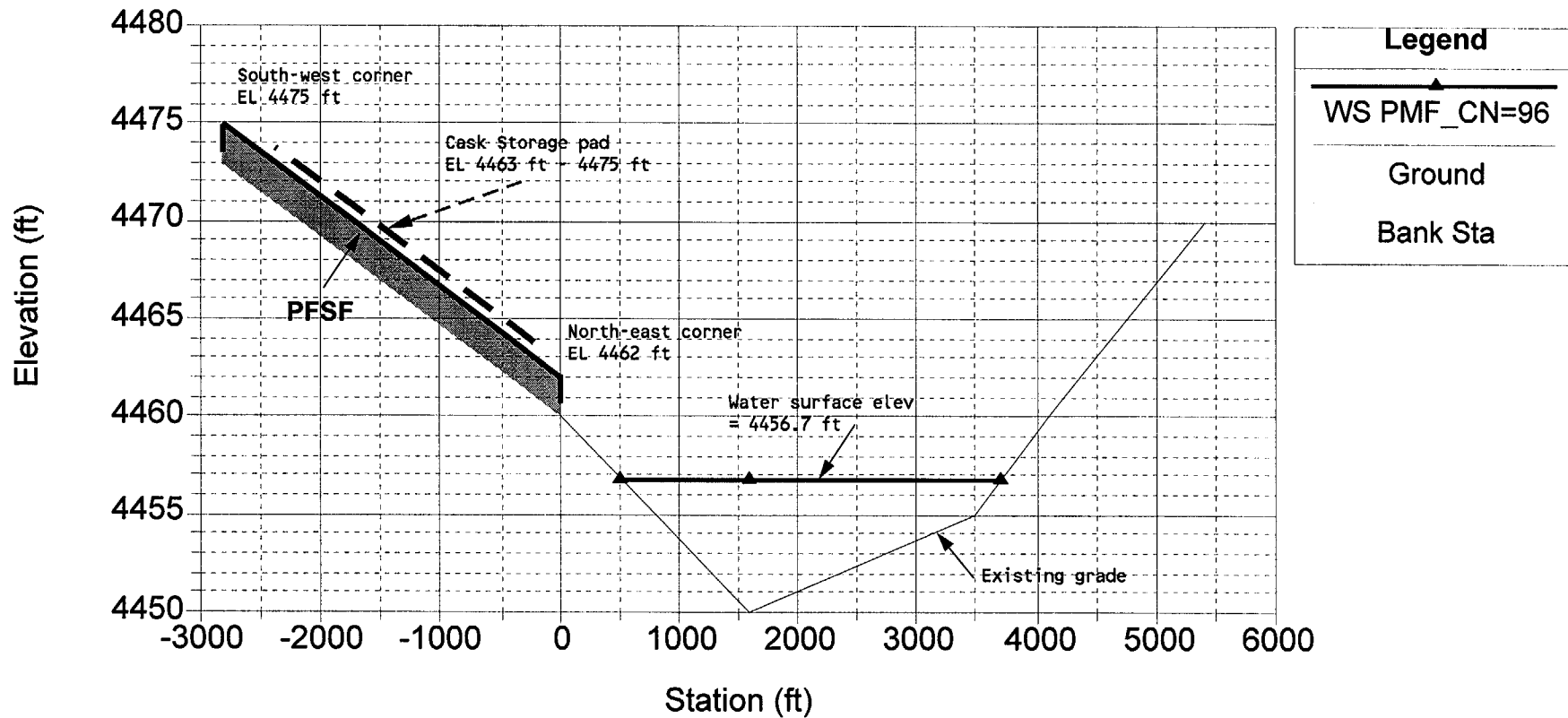
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Figure 5, Cross-section view of water level near PFSF site

Section A2 RS = 2800



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CODEPAGE **14**
of 53**6.2, The Rail Road Flood way**

Table 2 lists the calculated water surface elevations at the cross sections. The water surface profile is plotted in Figure 6.

The PMF will overtop the rail road embankment by 3.2 ft. The water level at the upstream of embankment is 4478.2 ft. As shown in Figure 6, the earth berm which has top elevation = 4480.0 ft will protect the PFSF site and the cask storage pad from flooding. Downstream from the rail road, the water level near the site is about 4 ft below the lowest grade of the site (at the north side). A cross-sectional view of the water level is shown in Figure 7. The floodway cross section plots are shown in Attachment 5.

Similar to the access road, If the railroad embankment is breached, water level near the PFSF site would not change because of the sub-critical flow condition.

The boundary of the PMF flood way is plotted in Figure 8.

Table 2, Rail road floodway - Calculated water surface profile

	River Sta	Section	Profile	Q Total (cfs)	W.S. Elev (ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
3-mile rail	5500	A	PMF CN=96	102000.00	4492.84	19583.81	7987.43	0.58
3-mile rail	3500	B	PMF CN=96	102000.00	4477.86	13327.80	7563.03	1.02
3-mile rail	2750	C	PMF CN=96	102000.00	4478.22	90767.65	12503.82	0.08
3-mile rail	2575		Culvert					
3-mile rail	2400	D	PMF CN=96	102000.00	4471.14	15167.15	8727.33	0.90
3-mile rail	1800	E	PMF CN=96	102000.00	4464.83	14668.17	4636.43	0.69
3-mile rail	0	F	PMF CN=96	102000.00	4453.81	15971.96	6674.19	0.71

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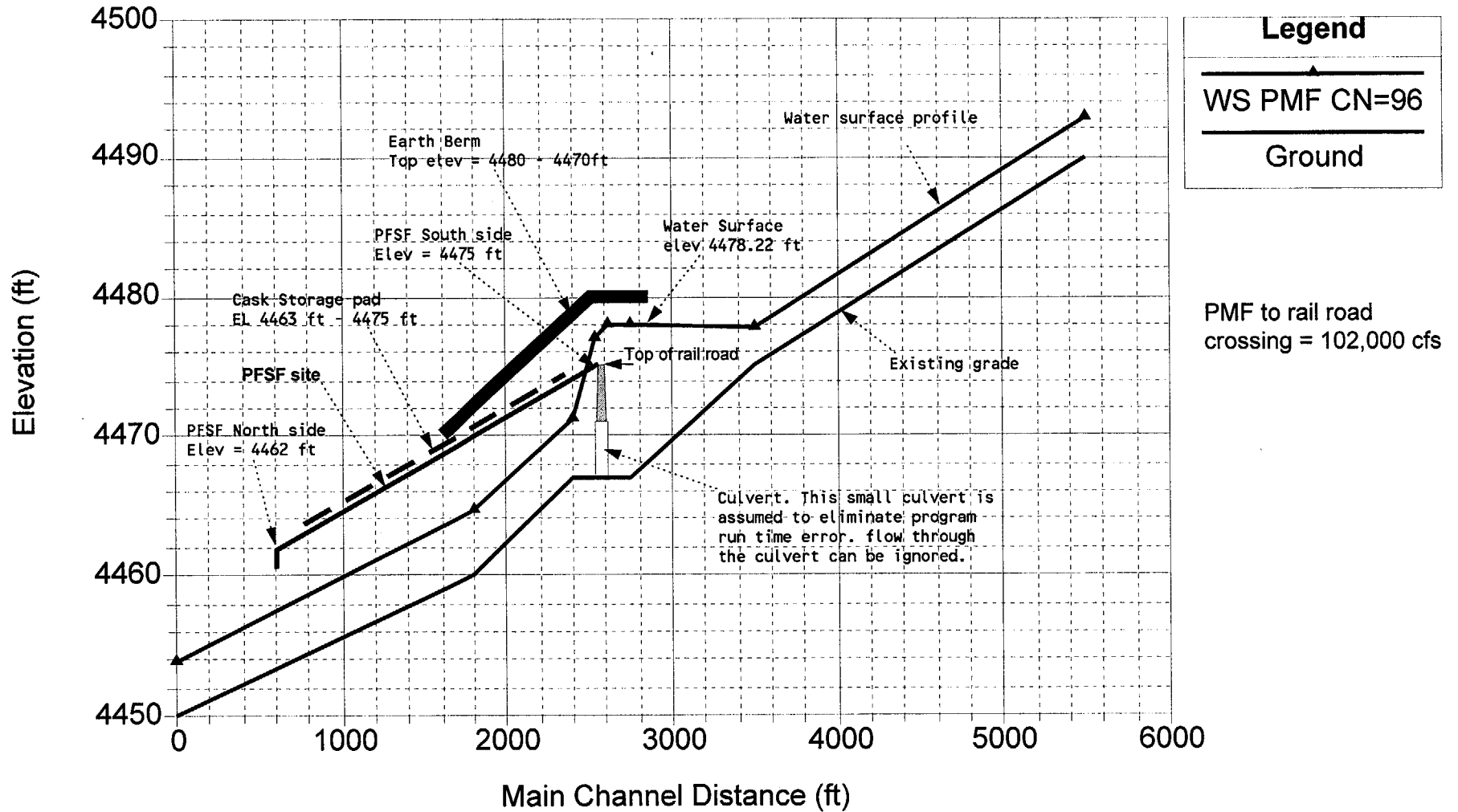
DIVISION AND GROUP
NP(F)

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Figure 6, Water surface profile at the rail road flood way



CALCULATION IDENTIFICATION NUMBER

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0599602

DIVISION AND GROUP
NP(F)

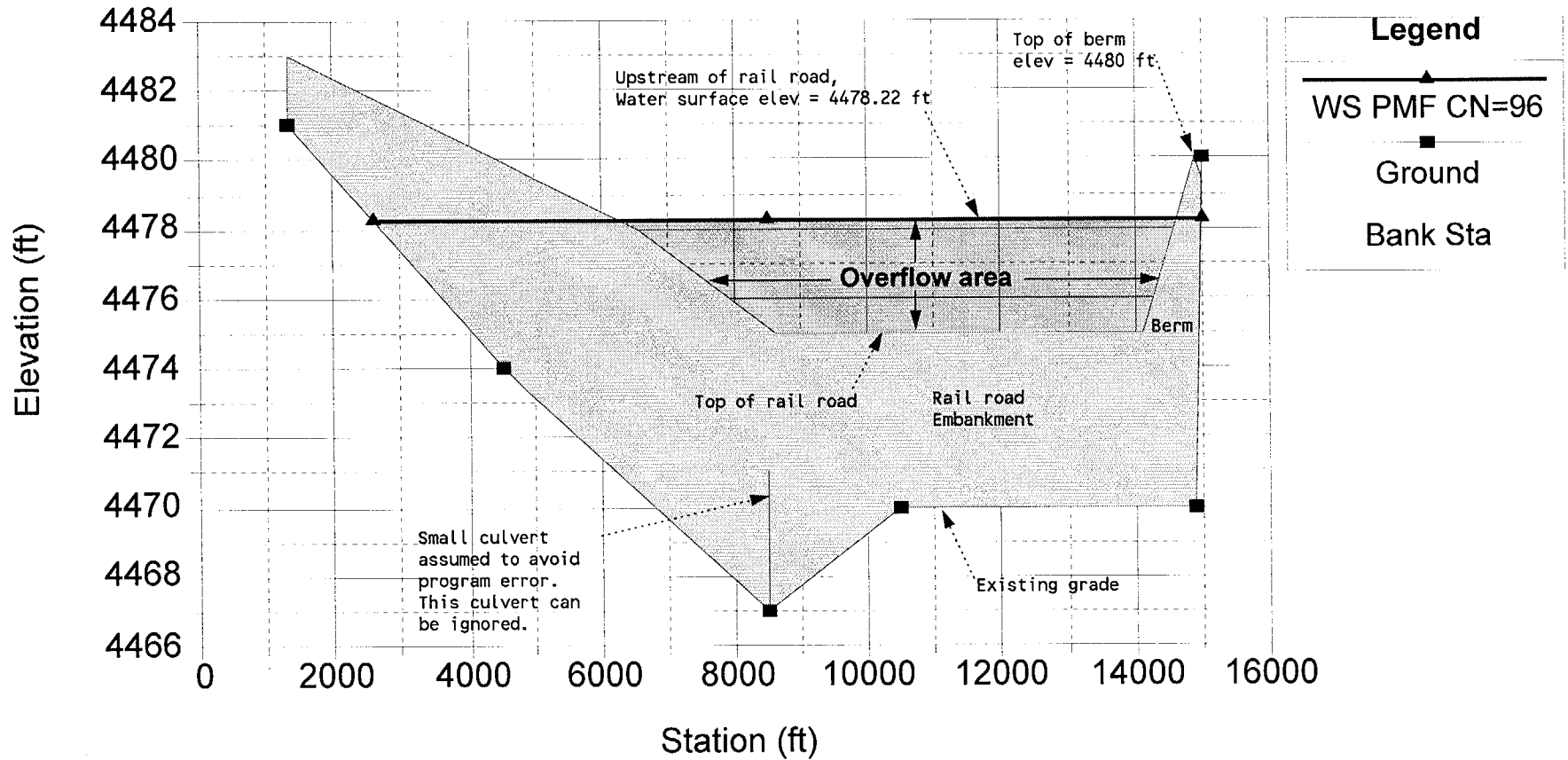
CALCULATION NUMBER
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**Figure 7, Cross-sectional view upstream
of rail road embankment**
Q = 102,000 cfs

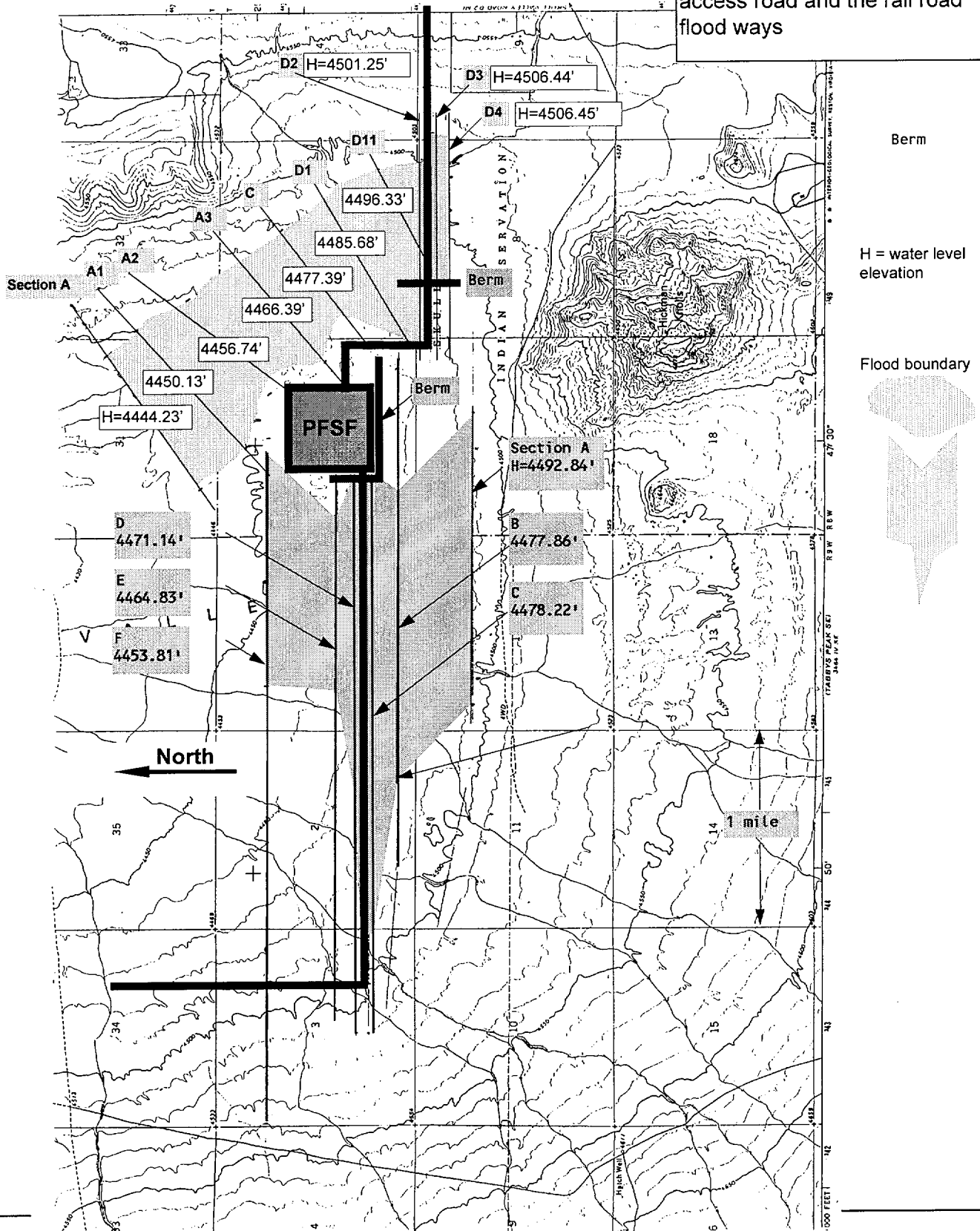
RS = 2575 Culv U



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Figure 8, Flood boundaries of the access road and the rail road flood ways



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**ATTACHMENT 1 - Rail road floodway, Determine PMF using CN = 96 and Tc = 4.17 hours
(HEC-1 Program)**

The input file is revised from Attachment 3 of Calculation 0599602-G(B)-16, rev 0. The CN=96 is reflected in the LS card, and Tc=4.17 is in UD card.

Note that in the UD card the lag time is input. Lag time = $0.6 \times T_c = 2.5$
The result of peak hydrograph = 102,302 (say 102,000) cfs is taken as the PMF. It is shown in the last part of output file.

HEC-1, Input File

```
ID  PFSF (Private Fuel Storage Facility Project)
ID  LOCAL PMF AT 3-MILE-LONG RAIL SPUR
ID
ID
IT   5                200
IO   2
PG   60
IN   15
PI  0.10  0.12  0.13  0.15  0.14  0.16  0.17  0.23  0.60  1.50
PI  4.20  0.60  0.40  0.35  0.35  0.30  0.12  0.11  0.09  0.08
PI  0.09  0.09  0.07  0.05
KK   010
KM  SCS DIMENSIONLESS UNIT HYDROGRAPH
BA  64.0
BF   -1            1.06
PR   60
LS   0            96            1
UD  2.5
ZZ
```

HEC-1, Output File

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1*****
*
*  FLOOD HYDROGRAPH PACKAGE (HEC-1)
*  SEPTEMBER 1990
*  VERSION 4.0
*
```

```
*****
*
*  U.S. ARMY CORPS OF ENGINEERS
*  HYDROLOGIC ENGINEERING CENTER
*  609 SECOND STREET
*  DAVIS, CALIFORNIA 95616
*
```

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* RUN DATE 05/06/1999 TIME 10:57:32 *
*

* (916) 756-1104 *
*

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

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

1

HEC-1 INPUT

PAGE 1

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1	ID PFSF (Private Fuel Storage Facility Project)
2	ID LOCAL PMF AT 3-MILE-LONG RAIL SPUR
3	ID
4	ID
5	IT 5 200
6	IO 2
7	PG 60
8	IN 15
9	PI 0.10 0.12 0.13 0.15 0.14 0.16 0.17 0.23 0.60 1.50
10	PI 4.20 0.60 0.40 0.35 0.35 0.30 0.12 0.11 0.09 0.08
11	PI 0.09 0.09 0.07 0.05
12	KK 010
13	KM SCS DIMENSIONLESS UNIT HYDROGRAPH
14	BA 64.0

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17	LS	0	96	1
18	UD	2.5		
19	ZZ			

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* SEPTEMBER 1990 *
* VERSION 4.0 *
* RUN DATE 05/06/1999 TIME 10:57:32 *
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*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
*****

```

PFSF (Private Fuel Storage Facility Project)
LOCAL PMF AT 3-MILE-LONG RAIL SPUR

6 IO OUTPUT CONTROL VARIABLES

IPRNT	2	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

8 IN TIME DATA FOR INPUT TIME SERIES

JXMIN	15	TIME INTERVAL IN MINUTES
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JXTIME	0	STARTING TIME

IT HYDROGRAPH TIME DATA

NMIN	5	MINUTES IN COMPUTATION INTERVAL
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ITIME	0000	STARTING TIME
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NDTIME	1635	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL	.08 HOURS
TOTAL TIME BASE	16.58 HOURS

ENGLISH UNITS

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

*** **

 * *
 12 KK * 010 *
 * *

SCS DIMENSIONLESS UNIT HYDROGRAPH

SUBBASIN RUNOFF DATA

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 TAREA 64.00 SUBBASIN AREA

15 BF BASE FLOW CHARACTERISTICS
 STRTQ 64.00 INITIAL FLOW
 QRCSN .00 BEGIN BASE FLOW RECESSION
 RTIOR 1.06000 RECESSION CONSTANT

PRECIPITATION DATA

16 PR RECORDING STATIONS 60
 0 PW WEIGHTS 1.00

17 LS SCS LOSS RATE
 STRTL .08 INITIAL ABSTRACTION
 CRVNBR 96.00 CURVE NUMBER
 RTIMP 1.00 PERCENT IMPERVIOUS AREA

18 UD SCS DIMENSIONLESS UNITGRAPH
 TLAG 2.50 LAG

PRECIPITATION STATION DATA

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STATION 60 TOTAL 10.20 AVG. ANNUAL .00 WEIGHT 1.00

TEMPORAL DISTRIBUTIONS

STATION 60, WEIGHT = 1.00

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1.40	1.40	1.40	.20	.20	.20	.13	.13	.13	.12
.12	.12	.12	.12	.12	.10	.10	.10	.04	.04
.04	.04	.04	.04	.03	.03	.03	.03	.03	.03
.03	.03	.03	.03	.03	.03	.02	.02	.02	.02
.02	.02								

UNIT HYDROGRAPH

152 END-OF-PERIOD ORDINATES

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3197.	3675.	4282.	4920.	5558.	6286.	7044.	7802.	8476.	9114.
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12145.	12105.	12066.	11936.	11697.	11457.	11202.	10923.	10644.	10350.
10031.	9712.	9369.	8970.	8572.	8153.	7674.	7195.	6733.	6334.
5935.	5554.	5275.	4996.	4721.	4481.	4242.	4005.	3805.	3606.
3406.	3261.	3115.	2970.	2824.	2678.	2533.	2411.	2291.	2171.
2052.	1932.	1812.	1724.	1645.	1565.	1485.	1405.	1326.	1260.
1200.	1140.	1080.	1020.	961.	910.	867.	823.	779.	735.
691.	654.	624.	594.	564.	534.	505.	478.	456.	434.
412.	390.	368.	348.	332.	316.	300.	284.	268.	253.
241.	229.	217.	205.	193.	182.	174.	166.	158.	150.
142.	134.	129.	124.	119.	115.	110.	105.	100.	96.
91.	86.	81.	76.	72.	67.	62.	58.	54.	50.
46.	42.	38.	34.	30.	26.	22.	18.	14.	10.
6.	2.								

HYDROGRAPH AT STATION 010

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	*	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1	0000	1		.00	.00	.00	64.	*	1	0820	101		.00	.00	.00	27786.
1	0005	2		.03	.03	.00	64.	*	1	0825	102		.00	.00	.00	26457.
1	0010	3		.03	.03	.00	64.	*	1	0830	103		.00	.00	.00	25164.
1	0015	4		.03	.03	.00	63.	*	1	0835	104		.00	.00	.00	23910.
1	0020	5		.04	.03	.01	64.	*	1	0840	105		.00	.00	.00	22720.

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER														PAGE 23 of 53
J.O. OR W.O NUMBER 0599602			DIVISION AND GROUP G(B)			CALCULATION NUMBER 17, rev 1			OPTIONAL TASK CODE 345W					
1	0025	6	.04	.03	.01	66.	*	1	0845	106	.00	.00	.00	21604.
1	0030	7	.04	.02	.02	70.	*	1	0850	107	.00	.00	.00	20561.
1	0035	8	.04	.02	.02	78.	*	1	0855	108	.00	.00	.00	19557.
1	0040	9	.04	.02	.02	91.	*	1	0900	109	.00	.00	.00	18583.
1	0045	10	.04	.02	.03	109.	*	1	0905	110	.00	.00	.00	17641.
1	0050	11	.05	.02	.03	135.	*	1	0910	111	.00	.00	.00	16738.
1	0055	12	.05	.01	.04	169.	*	1	0915	112	.00	.00	.00	15881.
1	0100	13	.05	.01	.04	214.	*	1	0920	113	.00	.00	.00	15071.
1	0105	14	.05	.01	.04	270.	*	1	0925	114	.00	.00	.00	14293.
1	0110	15	.05	.01	.04	340.	*	1	0930	115	.00	.00	.00	13542.
1	0115	16	.05	.01	.04	424.	*	1	0935	116	.00	.00	.00	12820.
1	0120	17	.05	.01	.04	525.	*	1	0940	117	.00	.00	.00	12134.
1	0125	18	.05	.01	.05	645.	*	1	0945	118	.00	.00	.00	11489.
1	0130	19	.05	.01	.05	784.	*	1	0950	119	.00	.00	.00	10887.
1	0135	20	.06	.01	.05	947.	*	1	0955	120	.00	.00	.00	10316.
1	0140	21	.06	.01	.05	1135.	*	1	1000	121	.00	.00	.00	9771.
1	0145	22	.06	.01	.05	1350.	*	1	1005	122	.00	.00	.00	9252.
1	0150	23	.08	.01	.07	1595.	*	1	1010	123	.00	.00	.00	8762.
1	0155	24	.08	.01	.07	1872.	*	1	1015	124	.00	.00	.00	8305.
1	0200	25	.08	.01	.07	2180.	*	1	1020	125	.00	.00	.00	7882.
1	0205	26	.20	.01	.19	2537.	*	1	1025	126	.00	.00	.00	7482.
1	0210	27	.20	.01	.19	2942.	*	1	1030	127	.00	.00	.00	7099.
1	0215	28	.20	.01	.19	3396.	*	1	1035	128	.00	.00	.00	6733.
1	0220	29	.50	.02	.48	3950.	*	1	1040	129	.00	.00	.00	6384.
1	0225	30	.50	.01	.49	4605.	*	1	1045	130	.00	.00	.00	6056.
1	0230	31	.50	.01	.49	5362.	*	1	1050	131	.00	.00	.00	5749.
1	0235	32	1.40	.01	1.39	6379.	*	1	1055	132	.00	.00	.00	5458.
1	0240	33	1.40	.01	1.39	7660.	*	1	1100	133	.00	.00	.00	5179.
1	0245	34	1.40	.00	1.40	9204.	*	1	1105	134	.00	.00	.00	4912.
1	0250	35	.20	.00	.20	11036.	*	1	1110	135	.00	.00	.00	4656.
1	0255	36	.20	.00	.20	13169.	*	1	1115	136	.00	.00	.00	4416.
1	0300	37	.20	.00	.20	15601.	*	1	1120	137	.00	.00	.00	4191.
1	0305	38	.13	.00	.13	18252.	*	1	1125	138	.00	.00	.00	3978.
1	0310	39	.13	.00	.13	21125.	*	1	1130	139	.00	.00	.00	3774.
1	0315	40	.13	.00	.13	24221.	*	1	1135	140	.00	.00	.00	3579.
1	0320	41	.12	.00	.12	27576.	*	1	1140	141	.00	.00	.00	3392.
1	0325	42	.12	.00	.12	31207.	*	1	1145	142	.00	.00	.00	3216.
1	0330	43	.12	.00	.12	35114.	*	1	1150	143	.00	.00	.00	3051.
1	0335	44	.12	.00	.12	39295.	*	1	1155	144	.00	.00	.00	2895.
1	0340	45	.12	.00	.12	43756.	*	1	1200	145	.00	.00	.00	2746.
1	0345	46	.12	.00	.12	48498.	*	1	1205	146	.00	.00	.00	2603.
1	0350	47	.10	.00	.10	53395.	*	1	1210	147	.00	.00	.00	2467.
1	0355	48	.10	.00	.10	58412.	*	1	1215	148	.00	.00	.00	2340.
1	0400	49	.10	.00	.10	63548.	*	1	1220	149	.00	.00	.00	2222.
1	0405	50	.04	.00	.04	68545.	*	1	1225	150	.00	.00	.00	2112.
1	0410	51	.04	.00	.04	73298.	*	1	1230	151	.00	.00	.00	2007.
1	0415	52	.04	.00	.04	77805.	*	1	1235	152	.00	.00	.00	1907.

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER

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J.O. OR W.O NUMBER			DIVISION AND GROUP			CALCULATION NUMBER			OPTIONAL TASK CODE			PAGE 24 of 53		
0599602			G(B)			17, rev 1			345W					
1	0420	53	.04	.00	.04	81979.	*	1	1240	153	.00	.00	.00	1812.
1	0425	54	.04	.00	.04	85762.	*	1	1245	154	.00	.00	.00	1723.
1	0430	55	.04	.00	.04	89152.	*	1	1250	155	.00	.00	.00	1641.
1	0435	56	.03	.00	.03	92154.	*	1	1255	156	.00	.00	.00	1566.
1	0440	57	.03	.00	.03	94747.	*	1	1300	157	.00	.00	.00	1494.
1	0445	58	.03	.00	.03	96930.	*	1	1305	158	.00	.00	.00	1424.
1	0450	59	.03	.00	.03	98725.	*	1	1310	159	.00	.00	.00	1356.
1	0455	60	.03	.00	.03	100127.	*	1	1315	160	.00	.00	.00	1291.
1	0500	61	.03	.00	.03	101133.	*	1	1320	161	.00	.00	.00	1227.
1	0505	62	.03	.00	.03	101811.	*	1	1325	162	.00	.00	.00	1166.
1	0510	63	.03	.00	.03	102201.	*	1	1330	163	.00	.00	.00	1106.
1	0515	64	.03	.00	.03	102302.	*	1	1335	164	.00	.00	.00	1048.
1	0520	65	.03	.00	.03	102079.	*	1	1340	165	.00	.00	.00	991.
1	0525	66	.03	.00	.03	101477.	*	1	1345	166	.00	.00	.00	936.
1	0530	67	.03	.00	.03	100494.	*	1	1350	167	.00	.00	.00	883.
1	0535	68	.02	.00	.02	99228.	*	1	1355	168	.00	.00	.00	831.
1	0540	69	.02	.00	.02	97780.	*	1	1400	169	.00	.00	.00	781.
1	0545	70	.02	.00	.02	96150.	*	1	1405	170	.00	.00	.00	734.
1	0550	71	.02	.00	.02	94351.	*	1	1410	171	.00	.00	.00	688.
1	0555	72	.02	.00	.02	92380.	*	1	1415	172	.00	.00	.00	644.
1	0600	73	.02	.00	.02	90236.	*	1	1420	173	.00	.00	.00	600.
1	0605	74	.00	.00	.00	87920.	*	1	1425	174	.00	.00	.00	557.
1	0610	75	.00	.00	.00	85416.	*	1	1430	175	.00	.00	.00	515.
1	0615	76	.00	.00	.00	82723.	*	1	1435	176	.00	.00	.00	474.
1	0620	77	.00	.00	.00	79865.	*	1	1440	177	.00	.00	.00	434.
1	0625	78	.00	.00	.00	76897.	*	1	1445	178	.00	.00	.00	395.
1	0630	79	.00	.00	.00	73820.	*	1	1450	179	.00	.00	.00	356.
1	0635	80	.00	.00	.00	70681.	*	1	1455	180	.00	.00	.00	319.
1	0640	81	.00	.00	.00	67654.	*	1	1500	181	.00	.00	.00	284.
1	0645	82	.00	.00	.00	64740.	*	1	1505	182	.00	.00	.00	251.
1	0650	83	.00	.00	.00	61943.	*	1	1510	183	.00	.00	.00	220.
1	0655	84	.00	.00	.00	59306.	*	1	1515	184	.00	.00	.00	193.
1	0700	85	.00	.00	.00	56831.	*	1	1520	185	.00	.00	.00	173.
1	0705	86	.00	.00	.00	54499.	*	1	1525	186	.00	.00	.00	157.
1	0710	87	.00	.00	.00	52238.	*	1	1530	187	.00	.00	.00	146.
1	0715	88	.00	.00	.00	50047.	*	1	1535	188	.00	.00	.00	135.
1	0720	89	.00	.00	.00	47926.	*	1	1540	189	.00	.00	.00	125.
1	0725	90	.00	.00	.00	45876.	*	1	1545	190	.00	.00	.00	116.
1	0730	91	.00	.00	.00	43899.	*	1	1550	191	.00	.00	.00	108.
1	0735	92	.00	.00	.00	41997.	*	1	1555	192	.00	.00	.00	100.
1	0740	93	.00	.00	.00	40178.	*	1	1600	193	.00	.00	.00	93.
1	0745	94	.00	.00	.00	38443.	*	1	1605	194	.00	.00	.00	87.
1	0750	95	.00	.00	.00	36797.	*	1	1610	195	.00	.00	.00	81.
1	0755	96	.00	.00	.00	35184.	*	1	1615	196	.00	.00	.00	75.
1	0800	97	.00	.00	.00	33607.	*	1	1620	197	.00	.00	.00	70.
1	0805	98	.00	.00	.00	32066.	*	1	1625	198	.00	.00	.00	65.
1	0810	99	.00	.00	.00	30581.	*	1	1630	199	.00	.00	.00	61.

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

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J.O. OR W.O NUMBER 0599602	DIVISION AND GROUP G(B)	CALCULATION NUMBER 17, rev 1	OPTIONAL TASK CODE 345W	

1 0815 100 .00 .00 .00 29153. * 1 1635 200 .00 .00 .00 58.
 *

TOTAL RAINFALL = 10.20, TOTAL LOSS = .48, TOTAL EXCESS = 9.72

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW		
		6-HR	24-HR	72-HR	16.58-HR
+ (CFS)	(HR)				
+ 102302.	5.25	(CFS)	60994.	24251.	24251.
		(INCHES)	8.861	9.737	9.737
		(AC-FT)	30245.	33237.	33237.

CUMULATIVE AREA = 64.00 SQ MI

1

RUNOFF SUMMARY
 FLOW IN CUBIC FEET PER SECOND
 TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
+ HYDROGRAPH AT	010	102302.	5.25	60994.	24251.	24251.	64.00		

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

STONE & WEBSTER ENGINEERING CORPORATION
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ATTACHMENT 2 - Access Road - HEC-RAS Outputs Including Input Data and Results

HEC-RAS Version 2.0 April 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```

X   X   XXXXXX   XXXX   XXXX   XX   XXXX
X   X   X       X   X   X   X   X   X
X   X   X       X   X   X   X   X   X
XXXXXXXX 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   XXXXXX   XXXX   X   X   X   X   XXXXX

```

PROJECT DATA

Project Title: PFSF, Access Rd w/embankment & culverts
Project File : access1.prj
Run Date and Time: 5/13/99 9:43:24 AM

Project in English units

Project Description:

Calc 17_1, Access road embankment with 8-11(span)x4(rise) box culverts

FLOW DATA

Flow Title: PMF (CN=96, Ct=11 hr)
Flow File : c:\pfsf\c17_1\road\ras\access1.f01

Flow Data (cfs)

River	Reach	RS	PMF_CN=96
East	PFSF	10060	85000

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
East	PFSF	PMF_CN=96		Normal S = 0.0045

GEOMETRY DATA

Geometry Title: Post construction
Geometry File : c:\pfsf\c17_1\road\ras\access1.g01

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

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CROSS SECTION RIVER: East
 REACH: PFSF RS: 10060

INPUT

Description: Section D4

Station Elevation Data		num= 13							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4507.5	28	4496	523	4498	594	4496	735	4496
792	4498	877	4498	1103	4498	1159	4500	2376	4500
2545	4498	2743	4500	4600	4510				

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	523	.035	2376	.035

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	523	2376		280	280	.1	.3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4506.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4506.65	Reach Len. (ft)	280.00	280.00	280.00
Crit W.S. (ft)		Flow Area (sq ft)	4811.56	13580.93	6599.54
E.G. Slope (ft/ft)	0.000499	Area (sq ft)	4811.56	13580.93	6599.54
Q Total (cfs)	85000.00	Flow (cfs)	20052.39	48607.76	16339.85
Top Width (ft)	3938.52	Top Width (ft)	520.45	1853.00	1565.07
Vel Total (ft/s)	3.40	Avg. Vel. (ft/s)	4.17	3.58	2.48
Max Chl Dpth (ft)	10.45	Hydr. Depth (ft)	9.25	7.33	4.22
Conv. Total (cfs)	3804145.0	Conv. (cfs)	897437.6	2175423.0	731284.2
Length Wtd. (ft)	280.00	Wetted Per. (ft)	522.51	1853.10	1565.11
Min Ch El (ft)	4496.00	Shear (lb/sq ft)	0.29	0.23	0.13
Alpha	1.09	Stream Power (lb/ft s)	1.20	0.82	0.33
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	380.23	2112.46	395.18
C & E Loss (ft)	0.03	Cum SA (acres)	135.45	552.42	147.83

CROSS SECTION RIVER: East
 REACH: PFSF RS: 9780

INPUT

Description: Section D3

Station Elevation Data		num= 19							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4507.5	28	4496	150	4494.4	365	4495.1	645	4494
764	4496	792	4498	834	4498	1030	4495.4	1046	4496
1103	4496	1131	4498	1595	4496.1	2015	4495.7	2687	4498
2865	4495.6	2885	4496	3083	4500	4620	4510		

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28	.035	2885	.035

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	28	2885		80	80	.1	.3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4506.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4506.54	Reach Len. (ft)	80.00	80.00	80.00
Crit W.S. (ft)	4499.15	Flow Area (sq ft)	132.66	29288.11	4857.14
E.G. Slope (ft/ft)	0.000176	Area (sq ft)	132.66	29288.11	4857.14

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CALCULATION SHEET

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Q Total (cfs)	85000.00	Flow (cfs)	213.32	77794.95	6991.73
Top Width (ft)	4070.09	Top Width (ft)	25.42	2857.00	1187.67
Vel Total (ft/s)	2.48	Avg. Vel. (ft/s)	1.61	2.66	1.44
Max Chl Dpth (ft)	12.44	Hydr. Depth (ft)	5.22	10.25	4.09
Conv. Total (cfs)	6410868.0	Conv. (cfs)	16088.8	5867449.0	527329.9
Length Wtd. (ft)	80.00	Wetted Per. (ft)	27.48	2857.23	1187.73
Min Ch El (ft)	4494.00	Shear (lb/sq ft)	0.05	0.11	0.04
Alpha	1.08	Stream Power (lb/ft s)	0.09	0.30	0.06
Frctn Loss (ft)		Cum Volume (acre-ft)	364.34	1974.68	358.36
C & E Loss (ft)		Cum SA (acres)	133.70	537.28	138.98

CULVERT RIVER: East
 REACH: PFSF RS: 9740

INPUT

Description:

Distance from Upstream XS = 27
 Deck/Roadway Width = 26
 Weir Coefficient = 2.6
 Bridge Deck/Roadway Skew =

Upstream Deck/Roadway Coordinates

num=	3										
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi
0	4507.5		0	250	4502		0	3920	4503		0

Upstream Bridge Cross Section Data

Station Elevation Data				num=	19						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4507.5	28	4496	150	4494.4	365	4495.1	645	4494		
764	4496	792	4498	834	4498	1030	4495.4	1046	4496		
1103	4496	1131	4498	1595	4496.1	2015	4495.7	2687	4498		
2865	4495.6	2885	4496	3083	4500	4620	4510				

Manning's n Values

num=				3							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28	.035	2885	.035						

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	28	2885	.1	.3	

Downstream Deck/Roadway Coordinates

num=	3										
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi
0	4507.5		0	250	4502		0	3920	4503		0

Downstream Bridge Cross Section Data

Station Elevation Data				num=	25						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4507.5	28	4495	150	4494.4	365	4495.1	509	4496		
566	4496	636	4494	645	4494	707	4494	792	4498		
820	4498	877	4496	1030	4495.4	1103	4496	1131	4498		
1165	4498	1570	4496	1595	4496.1	2015	4495.7	2376	4496		
2687	4498	2828	4498	2865	4495.6	3111	4500	4565	4510		

Manning's n Values

num=				3							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28	.035	2865	.035						

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	28	2865	.1	.3	

Upstream Embankment side slope = 3 horiz. to 1.0 vertical
 Downstream Embankment side slope = 3 horiz. to 1.0 vertical

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Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 8

Culvert Name Shape Rise Span
Culvert #1 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4494.4
 Centerline Station = 150
Downstream Elevation = 4494
 Centerline Station = 150

Culvert Name Shape Rise Span
Culvert #2 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4495.1
 Centerline Station = 365
Downstream Elevation = 4495
 Centerline Station = 365

Culvert Name Shape Rise Span
Culvert #3 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4494
 Centerline Station = 645
Downstream Elevation = 4493.5
 Centerline Station = 645

Culvert Name Shape Rise Span
Culvert #4 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4495.4
 Centerline Station = 1030
Downstream Elevation = 4495
 Centerline Station = 1030

Culvert Name Shape Rise Span
Culvert #5 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4496.1

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Centerline Station = 1595
Downstream Elevation = 4496
Centerline Station = 1595

Culvert Name Shape Rise Span
Culvert #6 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4495.7
 Centerline Station = 2015
Downstream Elevation = 4495.4
 Centerline Station = 2015

Culvert Name Shape Rise Span
Culvert #7 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4495.6
 Centerline Station = 2854
Downstream Elevation = 4495
 Centerline Station = 2854

Culvert Name Shape Rise Span
Culvert #8 Box 4 11
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist Length n Value Entrance Loss Coef Exit Loss Coef
 20 40 .03 .5 1
Upstream Elevation = 4495.6
 Centerline Station = 2876
Downstream Elevation = 4495
 Centerline Station = 2876

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #1

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4494.40
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4494.00
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57
Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4503.37	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55
Culv WS In (ft)	4498.40	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4498.00	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #2

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
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# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4495.10
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4495.00
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57
Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4504.09	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55
Culv WS In (ft)	4499.10	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4499.00	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #3

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4494.00
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4493.50
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57
Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4502.97	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55
Culv WS In (ft)	4498.00	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4497.50	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #4

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4495.40
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4495.00
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57
Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4504.37	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55
Culv WS In (ft)	4499.40	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4499.00	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #5

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4496.10
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4496.00
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57

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Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4505.09	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55
Culv WS In (ft)	4500.10	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4500.00	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #6

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4495.70
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4495.40
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57
Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4504.68	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55
Culv WS In (ft)	4499.70	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4499.40	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #7

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4495.60
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4495.00
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57
Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4504.56	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55
Culv WS In (ft)	4499.60	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4499.00	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CULVERT OUTPUT Profile #PMF_CN=96
Culvert ID : Culvert #8

Culv Q (cfs)	556.48	Culv Vel In (ft/s)	12.65
# Barrels	1	Culv Vel Out (ft/s)	12.65
Q Barrel (cfs)	556.48	Culv Inv El Up (ft)	4495.60
W.S. US. (ft)	4506.44	Culv Inv El Dn (ft)	4495.00
E.G. US. (ft)	4506.54	Culv Frctn Ls (ft)	1.57
Delta WS (ft)	5.19	Culv Ext Lss (ft)	2.01
Delta EG (ft)	4.81	Culv Ent Lss (ft)	1.24
E.G. IC (ft)	4504.56	Q Weir (cfs)	80555.98
E.G. OC (ft)	4506.54	Weir Sta Lft (ft)	43.55

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Culv WS In (ft)	4499.60	Weir Sta Rgt (ft)	4786.83
Culv WS Out (ft)	4499.00	Weir Submerg	0.00
Culv Nml Depth (ft)		Weir Max Depth (ft)	4.54
Culv Crt Depth (ft)	4.00	Weir Avg Depth (ft)	3.41
Culv Ful Lngh (ft)	40.00	Min Top Rd (ft)	4502.00

CROSS SECTION RIVER: East
REACH: PFSF RS: 9700

INPUT

Description: Section D2

Station Elevation Data		num=	25						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4507.5	28	4495	150	4494.4	365	4495.1	509	4496
566	4496	636	4494	645	4494	707	4494	792	4498
820	4498	877	4496	1030	4495.4	1103	4496	1131	4498
1165	4498	1570	4496	1595	4496.1	2015	4495.7	2376	4496
2687	4498	2828	4498	2865	4495.6	3111	4500	4565	4510

Manning's n Values		num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28	.035	2865	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
28	2865	900	900	900	.1	.3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4501.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4501.73	Reach Len. (ft)	900.00	900.00	900.00
Crit W.S. (ft)		Flow Area (sq ft)	43.77	14528.57	962.91
E.G. Slope (ft/ft)	0.001988	Area (sq ft)	43.77	14528.57	962.91
Q Total (cfs)	85000.00	Flow (cfs)	166.72	81703.71	3129.57
Top Width (ft)	3278.97	Top Width (ft)	14.00	2837.00	427.96
Vel Total (ft/s)	5.47	Avg. Vel. (ft/s)	3.81	5.62	3.25
Max Chl Dpth (ft)	7.25	Hydr. Depth (ft)	3.13	5.12	2.25
Conv. Total (cfs)	1906349.0	Conv. (cfs)	3739.1	1832421.0	70188.9
Length Wtd. (ft)	900.00	Wetted Per. (ft)	15.34	2837.33	428.01
Min Ch El (ft)	4494.00	Shear (lb/sq ft)	0.35	0.64	0.28
Alpha	1.03	Stream Power (lb/ft s)	1.35	3.57	0.91
Frctn Loss (ft)	3.63	Cum Volume (acre-ft)	364.17	1934.45	353.02
C & E Loss (ft)	0.12	Cum SA (acres)	133.66	532.05	137.50

CROSS SECTION RIVER: East
REACH: PFSF RS: 8800

INPUT

Description: Section D11

Station Elevation Data		num=	4				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4497.5	50	4496	1505	4490	3200	4500

Manning's n Values		num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	50	.035	1505	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
50	1505	1600	1600	1600	.1	.3

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CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4496.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.65	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4497.98	Reach Len. (ft)	1600.00	1600.00	1600.00
Crit W.S. (ft)	4496.33	Flow Area (sq ft)	1.83	4846.68	3396.97
E.G. Slope (ft/ft)	0.012190	Area (sq ft)	1.83	4846.68	3396.97
Q Total (cfs)	85000.00	Flow (cfs)	2.58	50670.14	34327.28
Top Width (ft)	2539.15	Top Width (ft)	11.04	1455.00	1073.11
Vel Total (ft/s)	10.31	Avg. Vel. (ft/s)	1.41	10.45	10.11
Max Chl Dpth (ft)	6.33	Hydr. Depth (ft)	0.17	3.33	3.17
Conv. Total (cfs)	769881.9	Conv. (cfs)	23.4	458941.4	310917.1
Length Wtd. (ft)	1600.00	Wetted Per. (ft)	11.04	1455.01	1073.13
Min Ch El (ft)	4490.00	Shear (lb/sq ft)	0.13	2.53	2.41
Alpha	1.00	Stream Power (lb/ft s)	0.18	26.50	24.34
Frctn Loss (ft)	9.76	Cum Volume (acre-ft)	363.70	1734.29	307.98
C & E Loss (ft)	0.34	Cum SA (acres)	133.40	487.72	121.99

CROSS SECTION RIVER: East
REACH: PFSF RS: 7200

INPUT

Description: Section D1

Station Elevation Data		num= 6							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4488	30	4485	3600	4480	4200	4482	5100	4490
5500	4500								

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	30	.035	4200	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30	4200	1300	1300	1300	.1	.3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4485.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4486.19	Reach Len. (ft)	1300.00	1300.00	1300.00
Crit W.S. (ft)		Flow Area (sq ft)	2.31	14159.30	761.63
E.G. Slope (ft/ft)	0.003652	Area (sq ft)	2.31	14159.30	761.63
Q Total (cfs)	85000.00	Flow (cfs)	2.88	82063.37	2933.76
Top Width (ft)	4590.76	Top Width (ft)	6.80	4170.00	413.96
Vel Total (ft/s)	5.70	Avg. Vel. (ft/s)	1.25	5.80	3.85
Max Chl Dpth (ft)	5.68	Hydr. Depth (ft)	0.34	3.40	1.84
Conv. Total (cfs)	1406614.0	Conv. (cfs)	47.6	1358018.0	48549.0
Length Wtd. (ft)	1300.00	Wetted Per. (ft)	6.83	4170.01	413.98
Min Ch El (ft)	4480.00	Shear (lb/sq ft)	0.08	0.77	0.42
Alpha	1.02	Stream Power (lb/ft s)	0.10	4.49	1.62
Frctn Loss (ft)	7.15	Cum Volume (acre-ft)	363.63	1385.24	231.60
C & E Loss (ft)	0.10	Cum SA (acres)	133.07	384.41	94.68

CROSS SECTION RIVER: East
REACH: PFSF RS: 5900

INPUT

Description: Section C

Station Elevation Data		num= 7							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

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0599602	G(B)		17, rev 1		345WA	

0 4480 1100 4477 2900 4472 3400 4472 4100 4480
4800 4490 5300 4490

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .035 2900 .035 3400 .035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
2900 3400 1400 1400 1400 .1 .3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4477.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.55	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4478.94	Reach Len. (ft)	1400.00	1400.00	1400.00
Crit W.S. (ft)	4477.36	Flow Area (sq ft)	5228.25	2694.58	1270.63
E.G. Slope (ft/ft)	0.009213	Area (sq ft)	5228.25	2694.58	1270.63
Q Total (cfs)	85000.00	Flow (cfs)	41221.52	33752.45	10026.03
Top Width (ft)	2914.24	Top Width (ft)	1942.69	500.00	471.55
Vel Total (ft/s)	9.25	Avg. Vel. (ft/s)	7.88	12.53	7.89
Max Chl Dpth (ft)	5.39	Hydr. Depth (ft)	2.69	5.39	2.69
Conv. Total (cfs)	885549.0	Conv. (cfs)	429455.1	351640.5	104453.4
Length Wtd. (ft)	1400.00	Wetted Per. (ft)	1942.70	500.00	471.58
Min Ch El (ft)	4472.00	Shear (lb/sq ft)	1.55	3.10	1.55
Alpha	1.17	Stream Power (lb/ft s)	12.20	38.83	12.23
Frctn Loss (ft)	11.43	Cum Volume (acre-ft)	285.58	1133.74	201.28
C & E Loss (ft)	0.18	Cum SA (acres)	103.98	314.72	81.47

CROSS SECTION RIVER: East
REACH: PFSF RS: 4500

INPUT

Description: Section A3

Station Elevation Data num= 6
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
0 4474 30 4468 1600 4464 3000 4460 4800 4470
5600 4480

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .035 30 .035 3000 .035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
30 3000 1700 1700 1700 .1 .3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4466.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.94	Wt. n-Val.		0.035	0.035
E.G. Elev (ft)	4467.33	Reach Len. (ft)	1700.00	1700.00	1700.00
Crit W.S. (ft)		Flow Area (sq ft)		7268.46	3675.61
E.G. Slope (ft/ft)	0.007286	Area (sq ft)		7268.46	3675.61
Q Total (cfs)	85000.00	Flow (cfs)		56103.00	28897.00
Top Width (ft)	3488.63	Top Width (ft)		2338.32	1150.31
Vel Total (ft/s)	7.77	Avg. Vel. (ft/s)		7.72	7.86
Max Chl Dpth (ft)	6.39	Hydr. Depth (ft)		3.11	3.20
Conv. Total (cfs)	995772.8	Conv. (cfs)		657245.3	338527.6
Length Wtd. (ft)	1700.00	Wetted Per. (ft)		2338.33	1150.33
Min Ch El (ft)	4460.00	Shear (lb/sq ft)		1.41	1.45
Alpha	1.00	Stream Power (lb/ft s)		10.91	11.43
Frctn Loss (ft)	9.73	Cum Volume (acre-ft)	201.56	973.64	121.79
C & E Loss (ft)	0.03	Cum SA (acres)	72.76	269.11	55.40

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CROSS SECTION RIVER: East
 REACH: PFSF RS: 2800

INPUT

Description: Section A2

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4460	1600	4450	3500	4455	4100	4460	5400	4470

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	1600	.035	3500	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 1600 3500 1500 1500 1500 .1 .3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4456.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4457.56	Reach Len. (ft)	1500.00	1500.00	1500.00
Crit W.S. (ft)		Flow Area (sq ft)	3633.93	8055.52	181.60
E.G. Slope (ft/ft)	0.004626	Area (sq ft)	3633.93	8055.52	181.60
Q Total (cfs)	85000.00	Flow (cfs)	23586.60	60935.54	477.86
Top Width (ft)	3187.13	Top Width (ft)	1078.36	1900.00	208.77
Vel Total (ft/s)	7.16	Avg. Vel. (ft/s)	6.49	7.56	2.63
Max Chl Dpth (ft)	6.74	Hydr. Depth (ft)	3.37	4.24	0.87
Conv. Total (cfs)	1249667.0	Conv. (cfs)	346769.4	895872.3	7025.5
Length Wtd. (ft)	1500.00	Wetted Per. (ft)	1078.38	1900.01	208.78
Min Ch El (ft)	4450.00	Shear (lb/sq ft)	0.97	1.22	0.25
Alpha	1.03	Stream Power (lb/ft s)	6.32	9.26	0.66
Frctn Loss (ft)	6.77	Cum Volume (acre-ft)	130.65	674.62	46.52
C & E Loss (ft)	0.07	Cum SA (acres)	51.72	186.41	28.88

CROSS SECTION RIVER: East
 REACH: PFSF RS: 1300

INPUT

Description: Section A1

Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4460	2400	4450	4500	4445	6300	4447	6900	4450
7700	4460								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	2400	.035	6300	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 2400 6300 1300 1300 1300 .1 .3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4450.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4450.72	Reach Len. (ft)	1300.00	1300.00	1300.00
Crit W.S. (ft)		Flow Area (sq ft)	1.93	12945.12	976.82
E.G. Slope (ft/ft)	0.004412	Area (sq ft)	1.93	12945.12	976.82
Q Total (cfs)	85000.00	Flow (cfs)	0.87	81229.45	3769.68

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Top Width (ft)	4540.63	Top Width (ft)	30.47	3900.00	610.16
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)	0.45	6.27	3.86
Max Chl Dpth (ft)	5.13	Hydr. Depth (ft)	0.06	3.32	1.60
Conv. Total (cfs)	1279673.0	Conv. (cfs)	13.1	1222907.0	56752.4
Length Wtd. (ft)	1300.00	Wetted Per. (ft)	30.47	3900.01	610.16
Min Ch El (ft)	4445.00	Shear (lb/sq ft)	0.02	0.91	0.44
Alpha	1.03	Stream Power (lb/ft s)	0.01	5.74	1.70
Frctn Loss (ft)	5.77	Cum Volume (acre-ft)	68.05	313.04	26.58
C & E Loss (ft)	0.01	Cum SA (acres)	32.63	86.55	14.78

CROSS SECTION RIVER: East
REACH: PFSF RS: 0

INPUT

Description: Section A

Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4450	5100	4440	7000	4440	7900	4450	8700	4470

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	5100	.035	7000	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
5100	7000	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #PMF_CN=96

W.S. Elev (ft)	4444.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4444.94	Reach Len. (ft)			
Crit W.S. (ft)	4443.38	Flow Area (sq ft)	4558.44	8033.25	804.43
E.G. Slope (ft/ft)	0.004502	Area (sq ft)	4558.44	8033.25	804.43
Q Total (cfs)	85000.00	Flow (cfs)	21389.48	59836.06	3774.46
Top Width (ft)	4436.82	Top Width (ft)	2156.29	1900.00	380.52
Vel Total (ft/s)	6.35	Avg. Vel. (ft/s)	4.69	7.45	4.69
Max Chl Dpth (ft)	4.23	Hydr. Depth (ft)	2.11	4.23	2.11
Conv. Total (cfs)	1266775.0	Conv. (cfs)	318772.5	891751.2	56251.7
Length Wtd. (ft)		Wetted Per. (ft)	2156.30	1900.00	380.55
Min Ch El (ft)	4440.00	Shear (lb/sq ft)	0.59	1.19	0.59
Alpha	1.13	Stream Power (lb/ft s)	2.79	8.85	2.79
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River: East

Reach	River Sta.	n1	n2	n3
PFSF	10060	.035	.035	.035
PFSF	9780	.035	.035	.035
PFSF	9740	Culvert		
PFSF	9700	.035	.035	.035
PFSF	8800	.035	.035	.035
PFSF	7200	.035	.035	.035
PFSF	5900	.035	.035	.035
PFSF	4500	.035	.035	.035
PFSF	2800	.035	.035	.035

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PFSF	1300	.035	.035	.035
PFSF	0	.035	.035	.035

SUMMARY OF REACH LENGTHS

River: East

Reach	River Sta.	Left	Channel	Right
PFSF	10060	280	280	280
PFSF	9780	80	80	80
PFSF	9740	Culvert		
PFSF	9700	900	900	900
PFSF	8800	1600	1600	1600
PFSF	7200	1300	1300	1300
PFSF	5900	1400	1400	1400
PFSF	4500	1700	1700	1700
PFSF	2800	1500	1500	1500
PFSF	1300	1300	1300	1300
PFSF	0	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: East

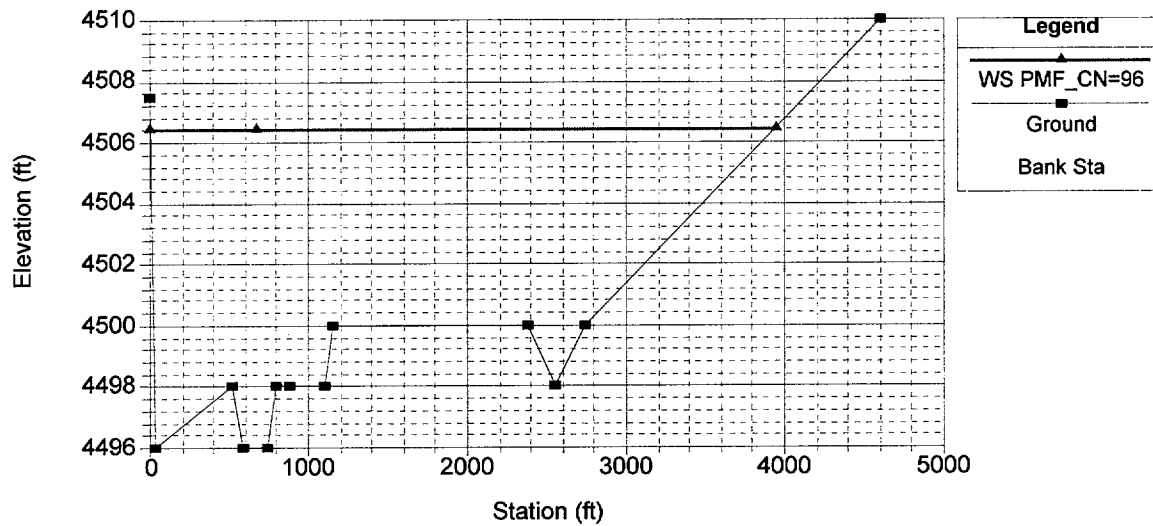
Reach	River Sta.	Contr.	Expan.
PFSF	10060	.1	.3
PFSF	9780	.1	.3
PFSF	9740	Culvert	
PFSF	9700	.1	.3
PFSF	8800	.1	.3
PFSF	7200	.1	.3
PFSF	5900	.1	.3
PFSF	4500	.1	.3
PFSF	2800	.1	.3
PFSF	1300	.1	.3
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STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

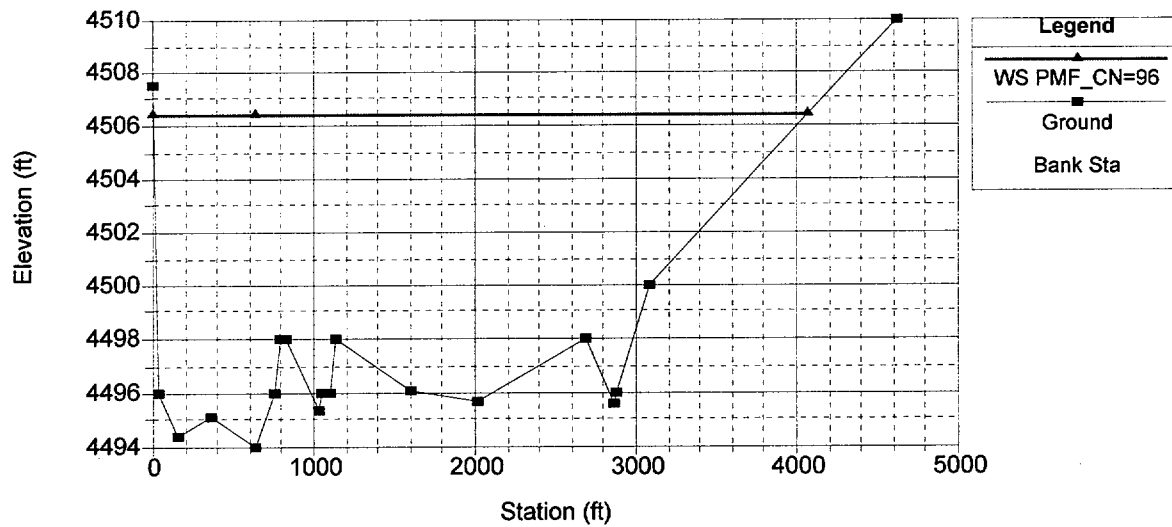
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ATTACHMENT 3 - Access Road - Floodway Cross-section plots

Section D4 RS = 10060



Section D3 RS = 9780



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J.O. OR W.O NUMBER
0599602

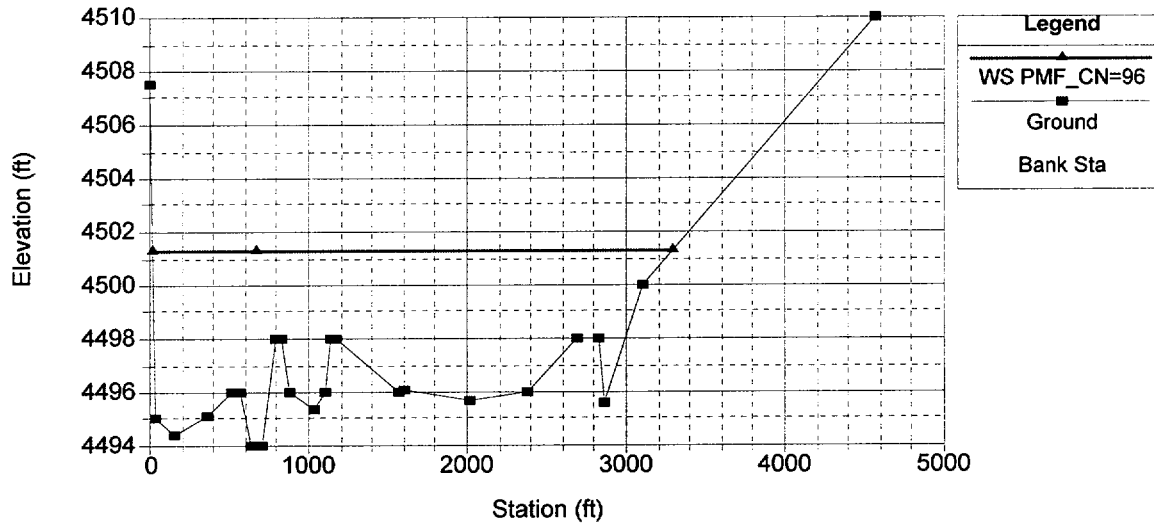
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G(B)

CALCULATION NUMBER
17, rev 1

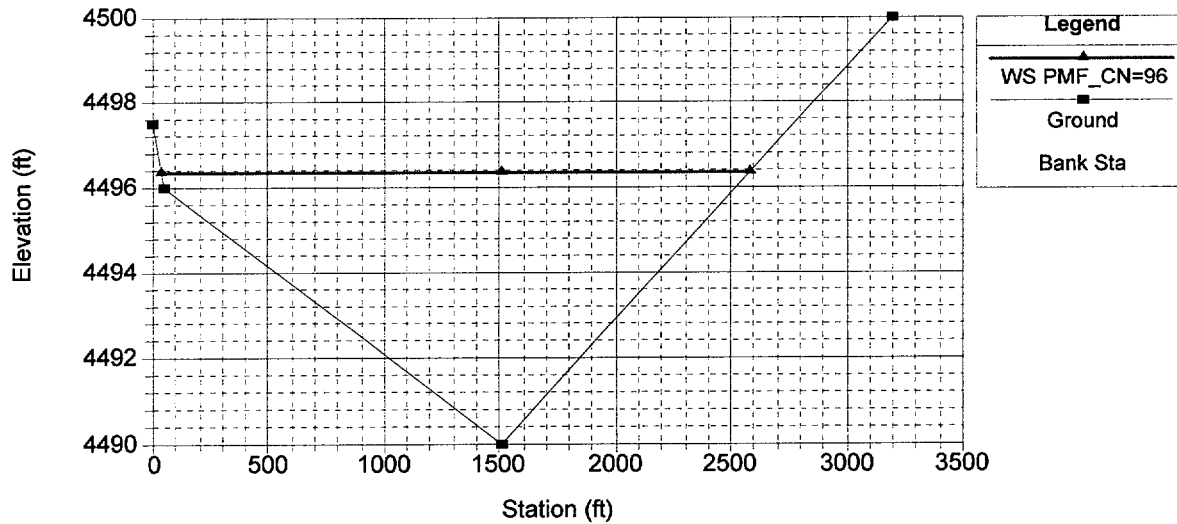
OPTIONAL TASK CODE
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Section D2 RS = 9700



Section D11 RS = 8800



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0599602

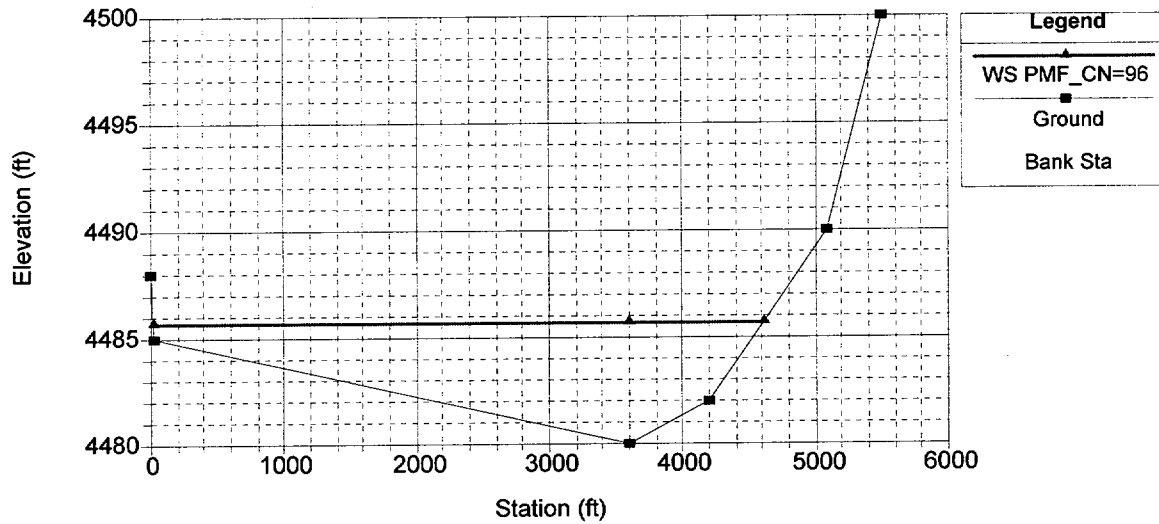
DIVISION AND GROUP
G(B)

CALCULATION NUMBER
17, rev 1

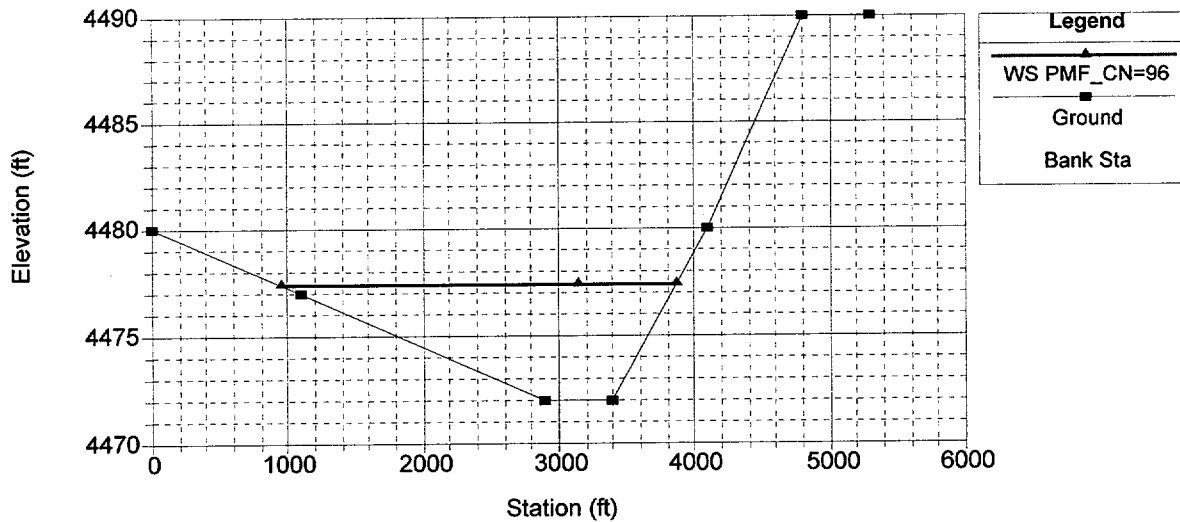
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Section D1 RS = 7200

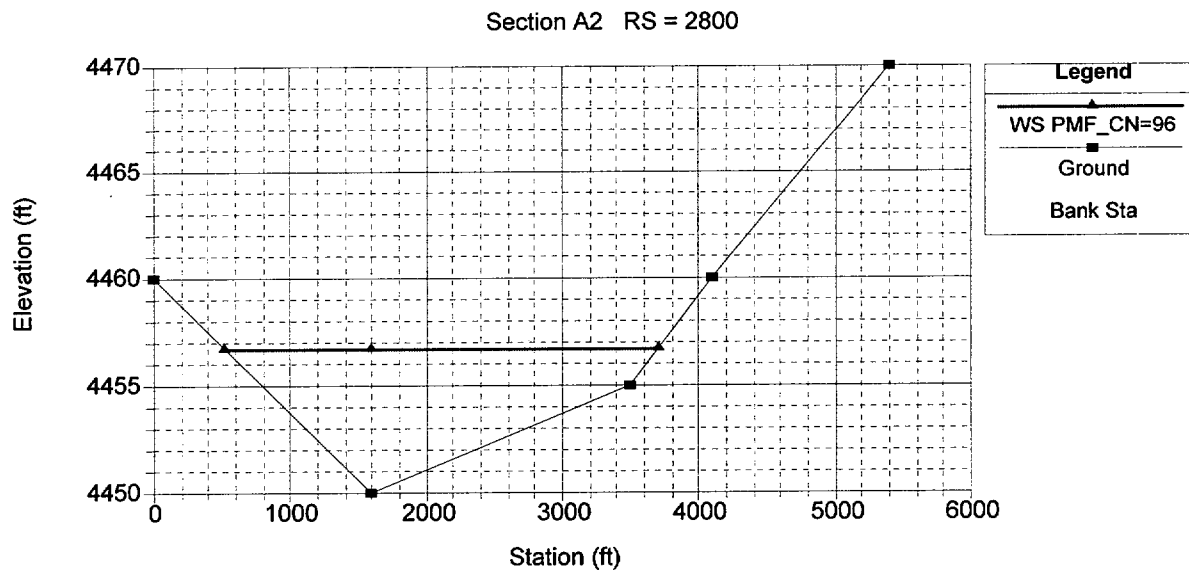
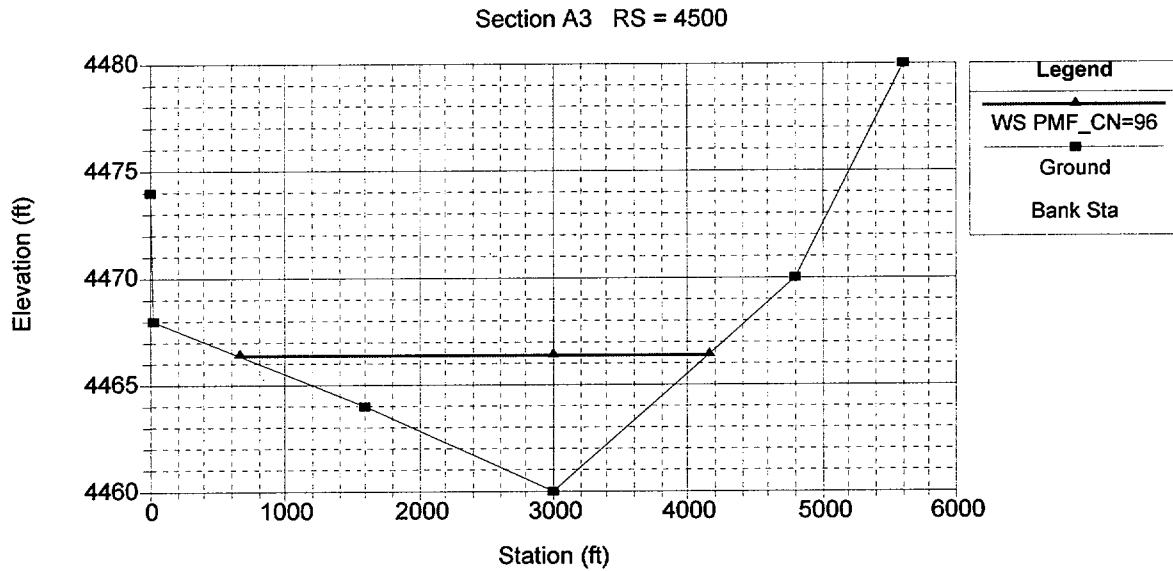


Section C RS = 5900



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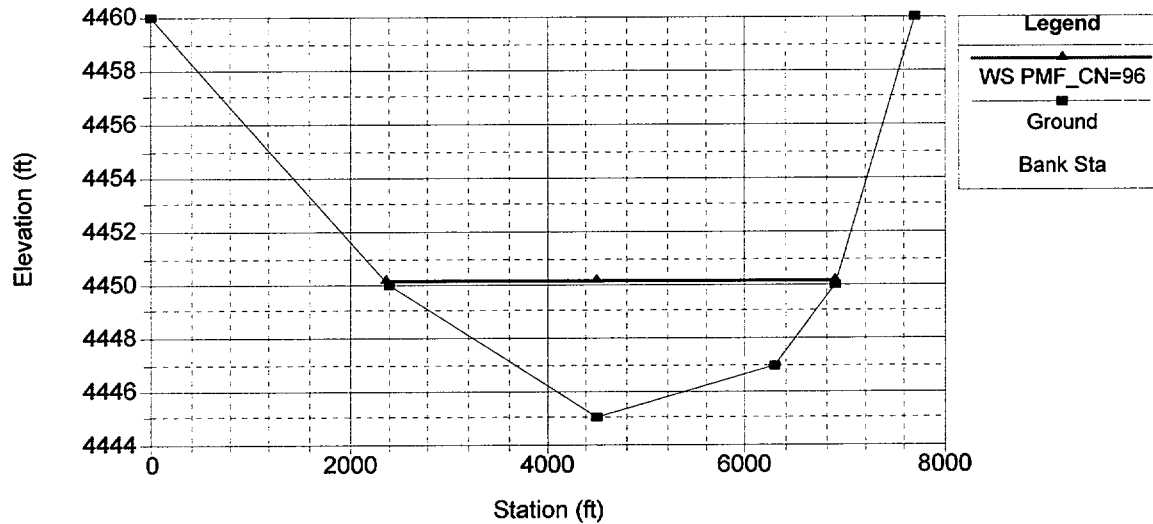


STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

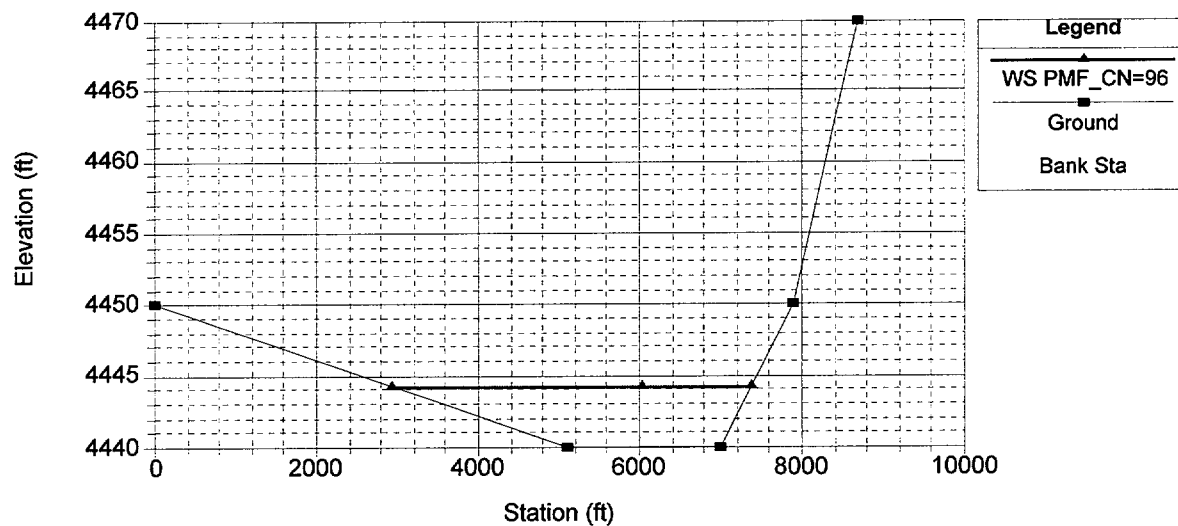
CALCULATION IDENTIFICATION NUMBER

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Section A1 RS = 1300



Section A RS = 0



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ATTACHMENT 4 - Rail Road - HEC-RAS Outputs Including Input Data and Results

HEC-RAS Version 2.0 April 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```

X   X XXXXXX   XXXX   XXXX   XX   XXXX
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X   X XXXXXX   XXXX   X   X   X   X   XXXXX

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PROJECT DATA

Project Title: Railroad, PMF only, CN=96
Project File : rail4.prj
Run Date and Time: 5/17/99 4:49:32 PM

Project in English units

Project Description:

Flood level with rail embankment, no culvert is assumed (a small culvert to avoid program error).

FLOW DATA

Flow Title: 100-year flow and PMF
Flow File : c:\pfsf\c17_1\rail\ras\rail4.f01

Flow Data (cfs)

River	Reach	RS	PMF CN=96
Floodway	3-mile rail	5500	102000

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Floodway	3-mile rail	PMF CN=96		Normal S = 0.0067

GEOMETRY DATA

Geometry Title: Post construction
Geometry File : c:\pfsf\c17_1\rail\ras\rail4.g01

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J.O. OR W.O NUMBER 0599602	DIVISION AND GROUP G(B)			CALCULATION NUMBER 17, rev 1			OPTIONAL TASK CODE 345WA																																																																																																																			
<div style="display: flex; justify-content: space-between;"> <div> <p>CROSS SECTION REACH: 3-mile rail</p> </div> <div> <p>RIVER: Floodway RS: 5500</p> </div> </div>																																																																																																																										
<p>INPUT</p> <p>Description: Section A</p> <p>Station Elevation Data num= 10</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Sta</th><th>Elev</th><th>Sta</th><th>Elev</th><th>Sta</th><th>Elev</th><th>Sta</th><th>Elev</th><th>Sta</th><th>Elev</th></tr> </thead> <tbody> <tr> <td>0</td><td>4550</td><td>900</td><td>4540</td><td>1500</td><td>4530</td><td>3000</td><td>4520</td><td>4800</td><td>4510</td></tr> <tr> <td>5600</td><td>4500</td><td>9500</td><td>4500</td><td>12200</td><td>4490</td><td>18000</td><td>4490</td><td>23000</td><td>4500</td></tr> </tbody> </table>											Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	0	4550	900	4540	1500	4530	3000	4520	4800	4510	5600	4500	9500	4500	12200	4490	18000	4490	23000	4500																																																																																		
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CALCULATION SHEET

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Vel Total (ft/s)	7.65	Avg. Vel. (ft/s)	7.65		
Max Chl Dpth (ft)	2.86	Hydr. Depth (ft)	1.76		
Conv. Total (cfs)	825519.1	Conv. (cfs)	825519.1		
Length Wtd. (ft)	750.00	Wetted Per. (ft)	7563.03		
Min Ch El (ft)	4475.00	Shear (lb/sq ft)	1.68		
Alpha	1.00	Stream Power (lb/ft s)	12.85		
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	499.86	1131.74	528.66
C & E Loss (ft)	0.27	Cum SA (acres)	102.98	360.83	119.96

CROSS SECTION RIVER: Floodway
REACH: 3-mile rail RS: 2750

INPUT

Description: Section C

Station Elevation Data

num=

6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1300	4481	4500	4474	8500	4467	10500	4470	14900	4470
15000	4480								

Manning's n Values

num=

3

Sta	n Val	Sta	n Val	Sta	n Val
1300	.035	8500	.035	10500	.035

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	8500	10500		350	350	.1	.3

CROSS SECTION OUTPUT Profile #PMF CN=96

W.S. Elev (ft)	4478.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.035	0.035	0.035
E.G. Elev (ft)	4478.24	Reach Len. (ft)	350.00	350.00	350.00
Crit W.S. (ft)	4471.14	Flow Area (sq ft)	35354.30	19447.27	35966.08
E.G. Slope (ft/ft)	0.000047	Area (sq ft)	35354.30	19447.27	35966.08
Q Total (cfs)	102000.00	Flow (cfs)	33332.49	25921.21	42746.30
Top Width (ft)	12503.82	Top Width (ft)	6111.82	2000.00	4392.01
Vel Total (ft/s)	1.12	Avg. Vel. (ft/s)	0.94	1.33	1.19
Max Chl Dpth (ft)	11.22	Hydr. Depth (ft)	5.78	9.72	8.19
Conv. Total (cfs)	14800710.0	Conv. (cfs)	4836712.0	3761298.0	6202702.0
Length Wtd. (ft)	350.00	Wetted Per. (ft)	6111.83	2000.00	4392.91
Min Ch El (ft)	4467.00	Shear (lb/sq ft)	0.02	0.03	0.02
Alpha	1.06	Stream Power (lb/ft s)	0.02	0.04	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)	195.50	849.59	219.04
C & E Loss (ft)		Cum SA (acres)	50.37	278.50	82.15

CULVERT RIVER: Floodway
REACH: 3-mile rail RS: 2575

INPUT

Description:

Distance from Upstream XS = 162

Deck/Roadway Width = 26

Weir Coefficient = 2.6

Bridge Deck/Roadway Skew =

Upstream Deck/Roadway Coordinates

num=

Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0		4485			1300		4483		0	6580		4478		
8580		4475		0	14100		4475		0	14900		4480		0
15700		4475		0										

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CALCULATION IDENTIFICATION NUMBER										PAGE 47 of 53
J.O. OR W.O NUMBER 0599602	DIVISION AND GROUP G(B)	CALCULATION NUMBER 17, rev 1	OPTIONAL TASK CODE 345WA							
Upstream Bridge Cross Section Data										
Station Elevation Data num= 6										
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
1300	4481	4500	4474	8500	4467	10500	4470	14900	4470	
15000	4480									
Manning's n Values num= 3										
Sta	n Val	Sta	n Val	Sta	n Val					
1300	.035	8500	.035	10500	.035					
Bank Sta: Left Right Coeff Contr. Expan.										
	8500	10500		.1	.3					
Downstream Deck/Roadway Coordinates										
num= 7										
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	
0	4485				1300	4481			0	
8580	4475		0		14100	4475		0	14900	4480
15700	4475		0							
Downstream Bridge Cross Section Data										
Station Elevation Data num= 6										
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
1300	4481	4500	4474	8500	4467	10500	4470	14900	4470	
15000	4480									
Manning's n Values num= 3										
Sta	n Val	Sta	n Val	Sta	n Val					
1300	.035	8500	.035	10500	.035					
Bank Sta: Left Right Coeff Contr. Expan.										
	8500	10500		.1	.3					
Upstream Embankment side slope = 3 horiz. to 1.0 vertical										
Downstream Embankment side slope = 3 horiz. to 1.0 vertical										
Maximum allowable submergence for weir flow = .95										
Elevation at which weir flow begins =										
Energy head used in spillway design =										
Spillway height used in design =										
Weir crest shape = Broad Crested										
Number of Culverts = 1										
Culvert Name Shape Rise Span										
Culvert #1 Box 4 11										
FHWA Chart # 8 - flared wingwalls										
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.										
Solution Criteria = Highest U.S. EG										
Culvert Upstrm Dist	Length	n Value	Entrance Loss Coef	Exit Loss Coef						
140	70	.035	.5	1						
Upstream Elevation = 4467										
Centerline Station = 8500										
Downstream Elevation = 4467										
Centerline Station = 8500										
CULVERT OUTPUT Profile #PMF CN=96										
Culvert ID : Culvert #1										
Culv Q (cfs)	543.18	Culv Vel In (ft/s)	12.35							
# Barrels	1	Culv Vel Out (ft/s)	12.35							
Q Barrel (cfs)	543.18	Culv Inv El Up (ft)	4467.00							
W.S. US. (ft)	4478.22	Culv Inv El Dn (ft)	4467.00							
E.G. US. (ft)	4478.24	Culv Frctn Ls (ft)	3.55							
Delta WS (ft)	7.08	Culv Ext Lss (ft)	1.57							

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CALCULATION IDENTIFICATION NUMBER										PAGE 48 of 53																																																																																										
J.O. OR W.O NUMBER 0599602	DIVISION AND GROUP G(B)		CALCULATION NUMBER 17, rev 1		OPTIONAL TASK CODE 345WA																																																																																															
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Culv Ful Lngh (ft)	70.00	Min Top Rd (ft)	4475.00																																																																																																	
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1300	4481	4500	4474	8500	4467	10500	4470	14900	4470																																																																																											
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<p>CROSS SECTION RIVER: Floodway REACH: 3-mile rail RS: 1800</p>																																																																																																				
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<p>Manning's n Values num= 3</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;">Sta</td> <td style="width: 10%;">n Val</td> <td style="width: 10%;">Sta</td> <td style="width: 10%;">n Val</td> <td style="width: 10%;">Sta</td> <td style="width: 10%;">n Val</td> </tr> <tr> <td>6200</td> <td>.035</td> <td>9400</td> <td>.035</td> <td>15900</td> <td>.035</td> </tr> </table>											Sta	n Val	Sta	n Val	Sta	n Val	6200	.035	9400	.035	15900	.035																																																																														
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6200	.035	9400	.035	15900	.035																																																																																															
<p>Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan. 9400 15900 1800 1800 1800 .1 .3</p>																																																																																																				

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER

J.O. OR W.O NUMBER	DIVISION AND GROUP	CALCULATION NUMBER	OPTIONAL TASK CODE	PAGE 49
0599602	G(B)	17, rev 1	345WA	of 53

CROSS SECTION OUTPUT Profile #PMF CN=96

W.S. Elev (ft)	4464.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.		0.035	0.035
E.G. Elev (ft)	4465.59	Reach Len. (ft)	1800.00	1800.00	1800.00
Crit W.S. (ft)		Flow Area (sq ft)		14051.13	617.03
E.G. Slope (ft/ft)	0.005699	Area (sq ft)		14051.13	617.03
Q Total (cfs)	102000.00	Flow (cfs)		98951.50	3048.50
Top Width (ft)	4636.43	Top Width (ft)		4314.06	322.37
Vel Total (ft/s)	6.95	Avg. Vel. (ft/s)		7.04	4.94
Max Chl Dpth (ft)	4.83	Hydr. Depth (ft)		3.26	1.91
Conv. Total (cfs)	1351137.0	Conv. (cfs)		1310755.0	40381.8
Length Wtd. (ft)	1800.00	Wetted Per. (ft)		4314.07	322.39
Min Ch El (ft)	4460.00	Shear (lb/sq ft)		1.16	0.68
Alpha	1.01	Stream Power (lb/ft s)		8.16	3.36
Frctn Loss (ft)	11.11	Cum Volume (acre-ft)		617.06	16.00
C & E Loss (ft)	0.04	Cum SA (acres)		218.95	14.74

CROSS SECTION RIVER: Floodway
REACH: 3-mile rail RS: 0

INPUT

Description: Section F

Station Elevation Data		num= 11							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4540	3000	4500	3800	4490	4700	4480	5900	4470
7500	4460	8000	4460	14000	4450	15500	4450	18000	4453
21400	4460								

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	8000	.035	18000	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
8000	18000	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PMF CN=96

W.S. Elev (ft)	4453.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.		0.035	0.035
E.G. Elev (ft)	4454.45	Reach Len. (ft)			
Crit W.S. (ft)	4453.24	Flow Area (sq ft)		15814.51	157.45
E.G. Slope (ft/ft)	0.006702	Area (sq ft)		15814.51	157.45
Q Total (cfs)	102000.00	Flow (cfs)		101701.70	298.35
Top Width (ft)	6674.19	Top Width (ft)		6283.11	391.09
Vel Total (ft/s)	6.39	Avg. Vel. (ft/s)		6.43	1.89
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)		2.52	0.40
Conv. Total (cfs)	1245975.0	Conv. (cfs)		1242330.0	3644.5
Length Wtd. (ft)		Wetted Per. (ft)		6283.11	391.09
Min Ch El (ft)	4450.00	Shear (lb/sq ft)		1.05	0.17
Alpha	1.01	Stream Power (lb/ft s)		6.77	0.32
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River: Floodway

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 50 of 53
J.O. OR W.O NUMBER	DIVISION AND GROUP	CALCULATION NUMBER	OPTIONAL TASK CODE	
0599602	G(B)	17, rev 1	345WA	

Reach	River Sta.	n1	n2	n3
3-mile rail	5500	.035	.035	.035
3-mile rail	3500	.035	.035	.035
3-mile rail	2750	.035	.035	.035
3-mile rail	2575	Culvert		
3-mile rail	2400		.035	.035
3-mile rail	1800	.035	.035	.035
3-mile rail	0	.035	.035	.035

SUMMARY OF REACH LENGTHS

River: Floodway

Reach	River Sta.	Left	Channel	Right
3-mile rail	5500	2000	2000	2000
3-mile rail	3500	750	750	750
3-mile rail	2750	350	350	350
3-mile rail	2575	Culvert		
3-mile rail	2400		600	600
3-mile rail	1800	1800	1800	1800
3-mile rail	0	100	100	100

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Floodway

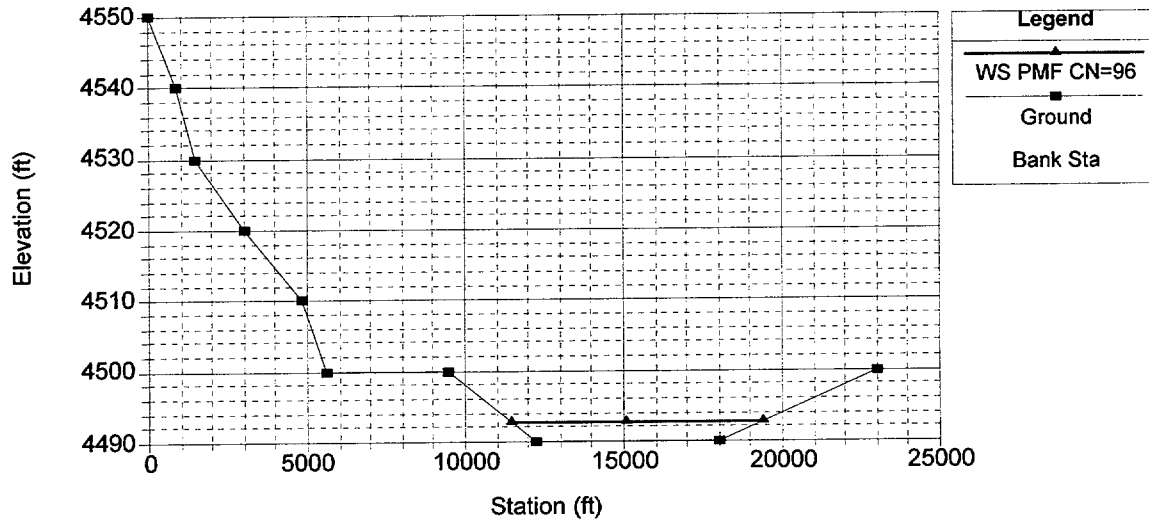
Reach	River Sta.	Contr.	Expan.
3-mile rail	5500	.1	.3
3-mile rail	3500	.1	.3
3-mile rail	2750	.1	.3
3-mile rail	2575	Culvert	
3-mile rail	2400		.3
3-mile rail	1800	.1	.3
3-mile rail	0	.1	.3

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

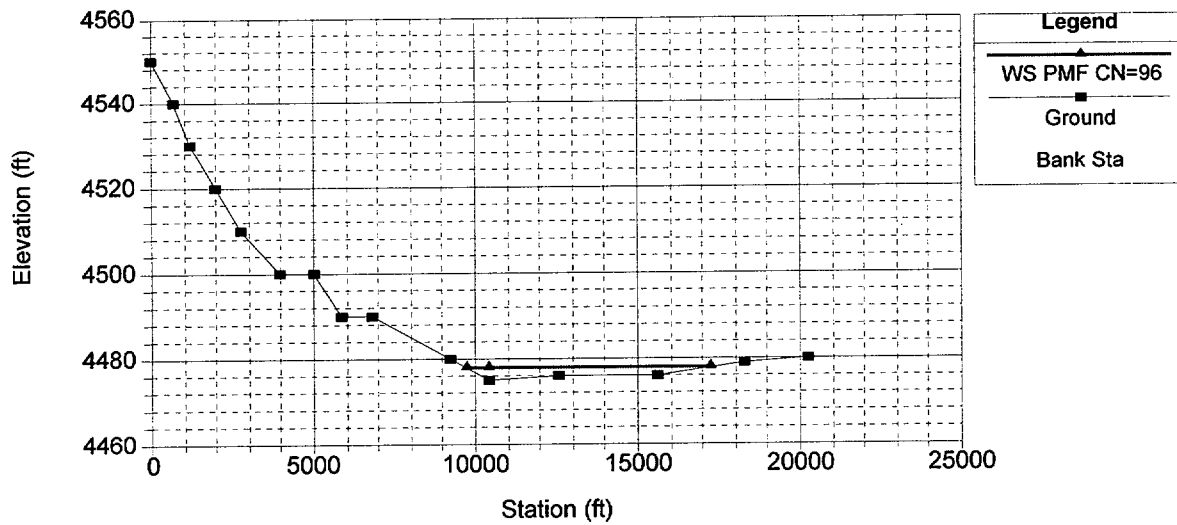
CALCULATION IDENTIFICATION NUMBER				PAGE 51 of 53
J.O. OR W.O NUMBER 0599602	DIVISION AND GROUP G(B)	CALCULATION NUMBER 17, rev 1	OPTIONAL TASK CODE 345WA	

ATTACHMENT 5 - Rail Road - Floodway Cross-section plots

Section A RS = 5500



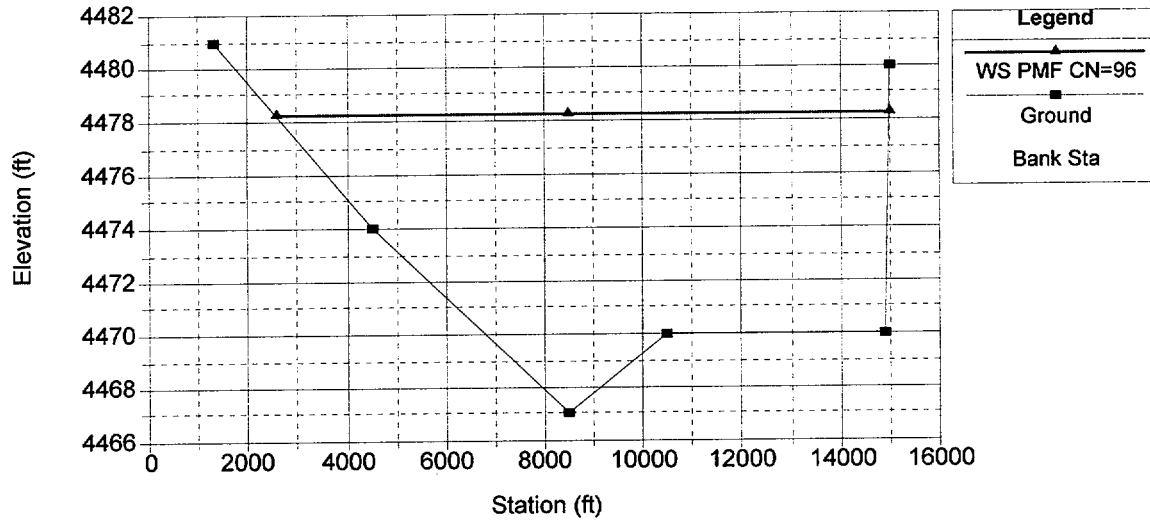
Section B RS = 3500



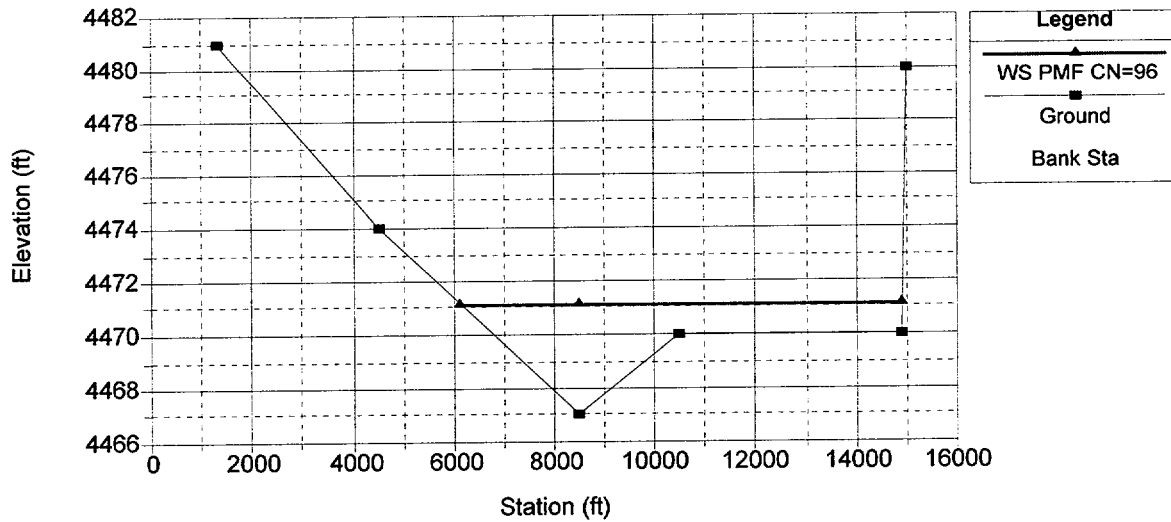
STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER				PAGE 52 of 53
J.O. OR W.O NUMBER 0599602	DIVISION AND GROUP G(B)	CALCULATION NUMBER 17, rev 1	OPTIONAL TASK CODE 345WA	

Section C RS = 2750



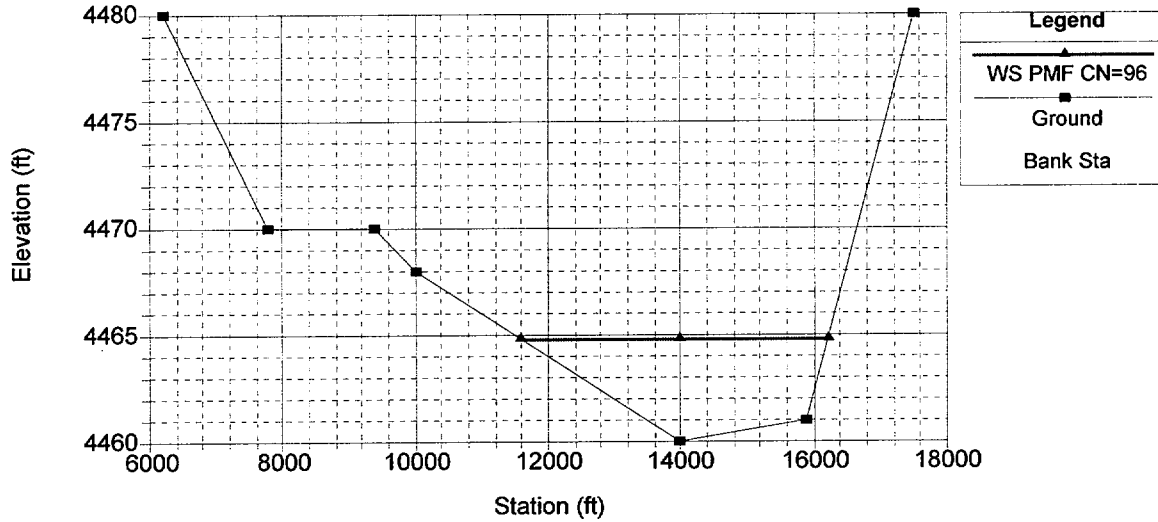
Section D RS = 2400



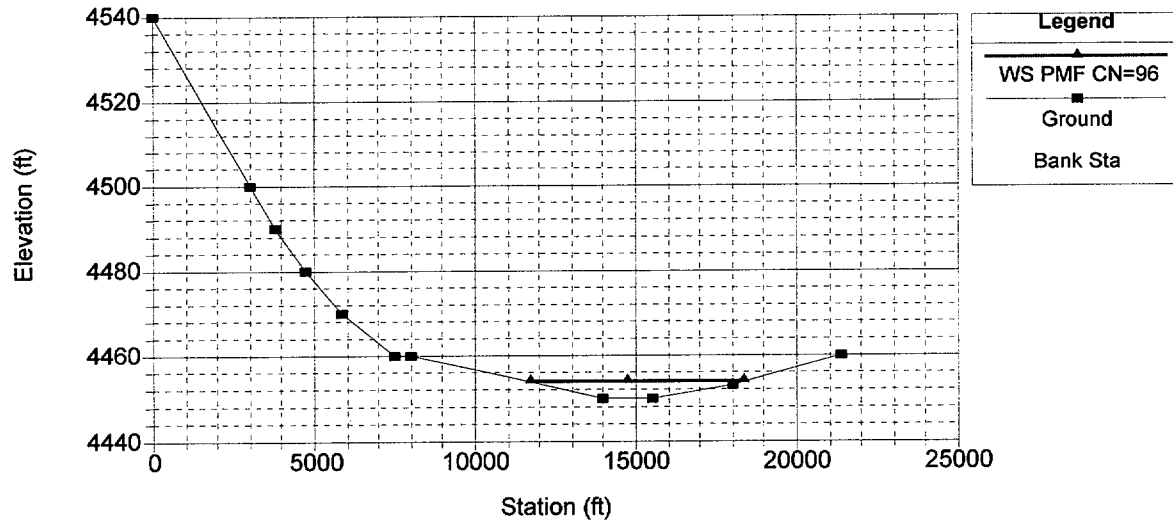
STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET

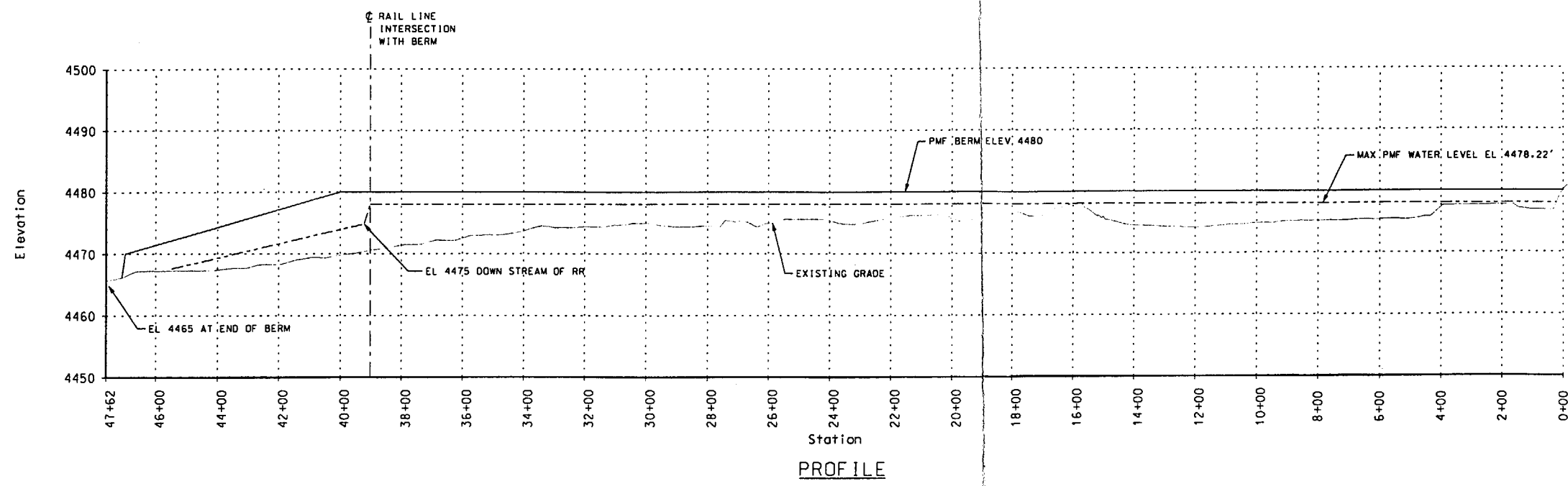
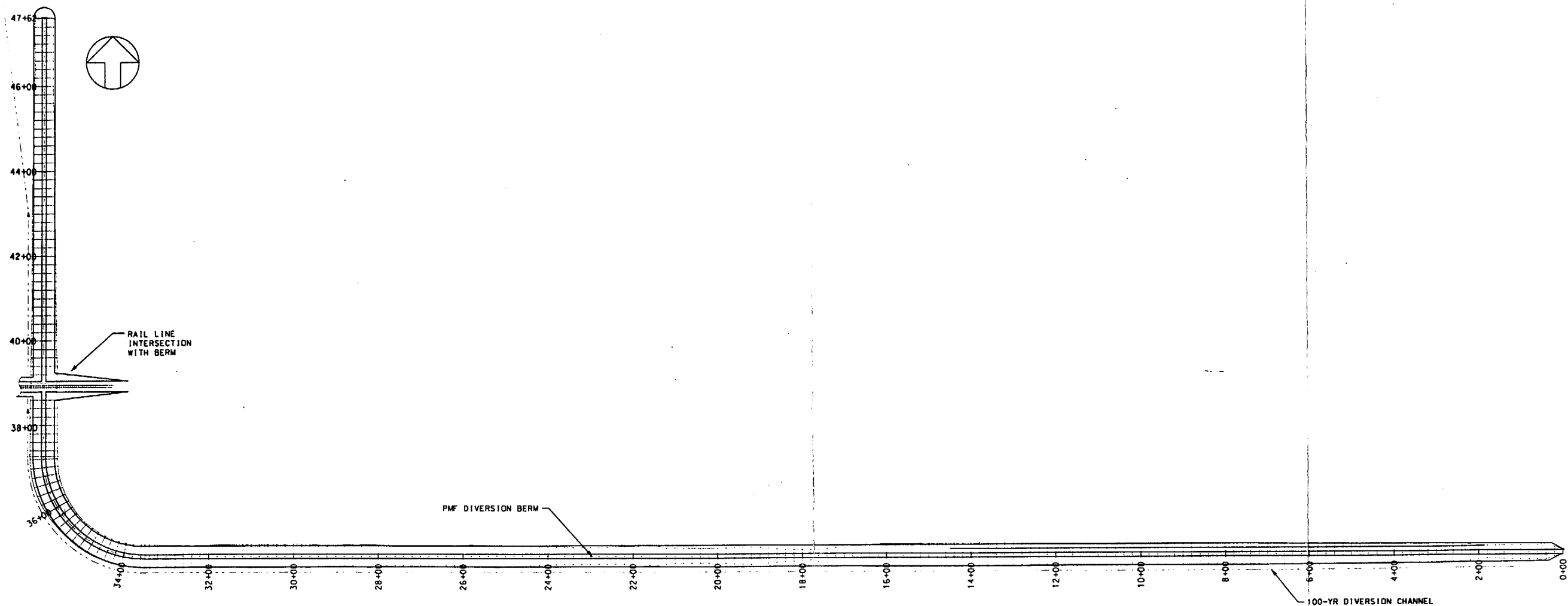
CALCULATION IDENTIFICATION NUMBER				PAGE 53 of 53
J.O. OR W.O NUMBER 0599602	DIVISION AND GROUP G(B)	CALCULATION NUMBER 17, rev 1	OPTIONAL TASK CODE 345WA	

Section E RS = 1800



Section F RS = 0





**APERTURE
CARD**

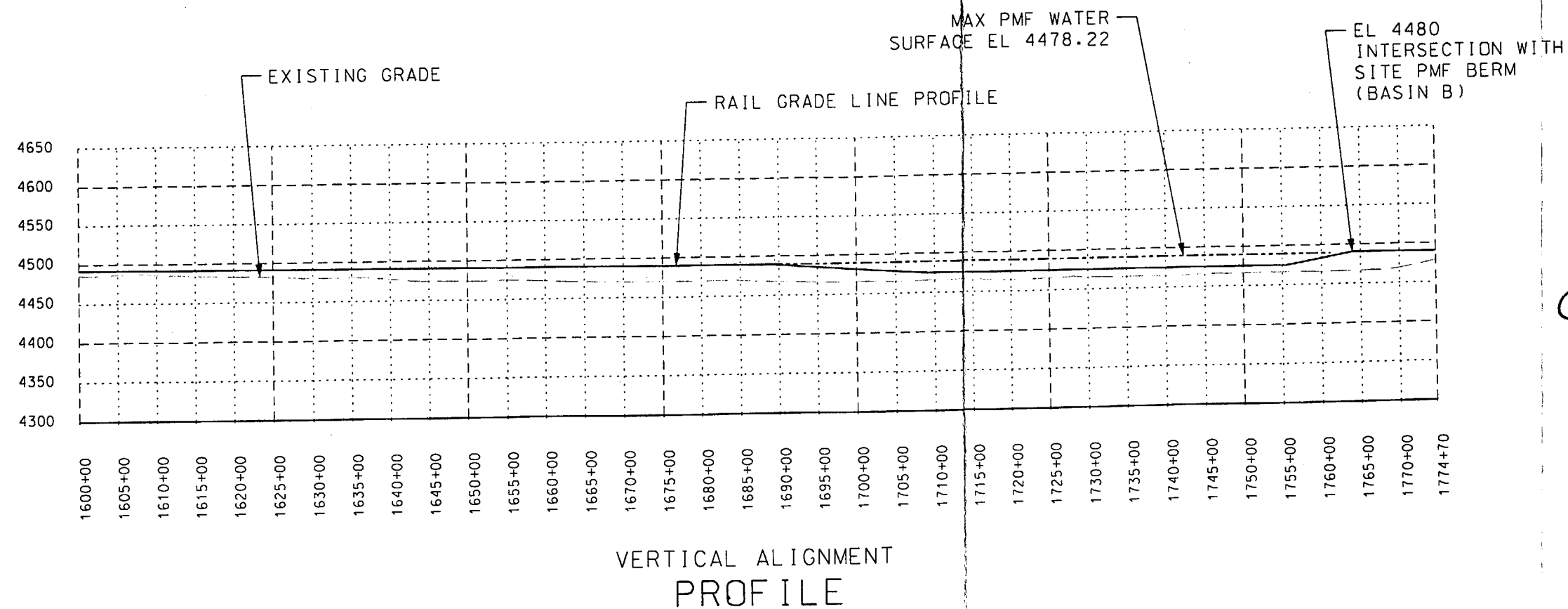
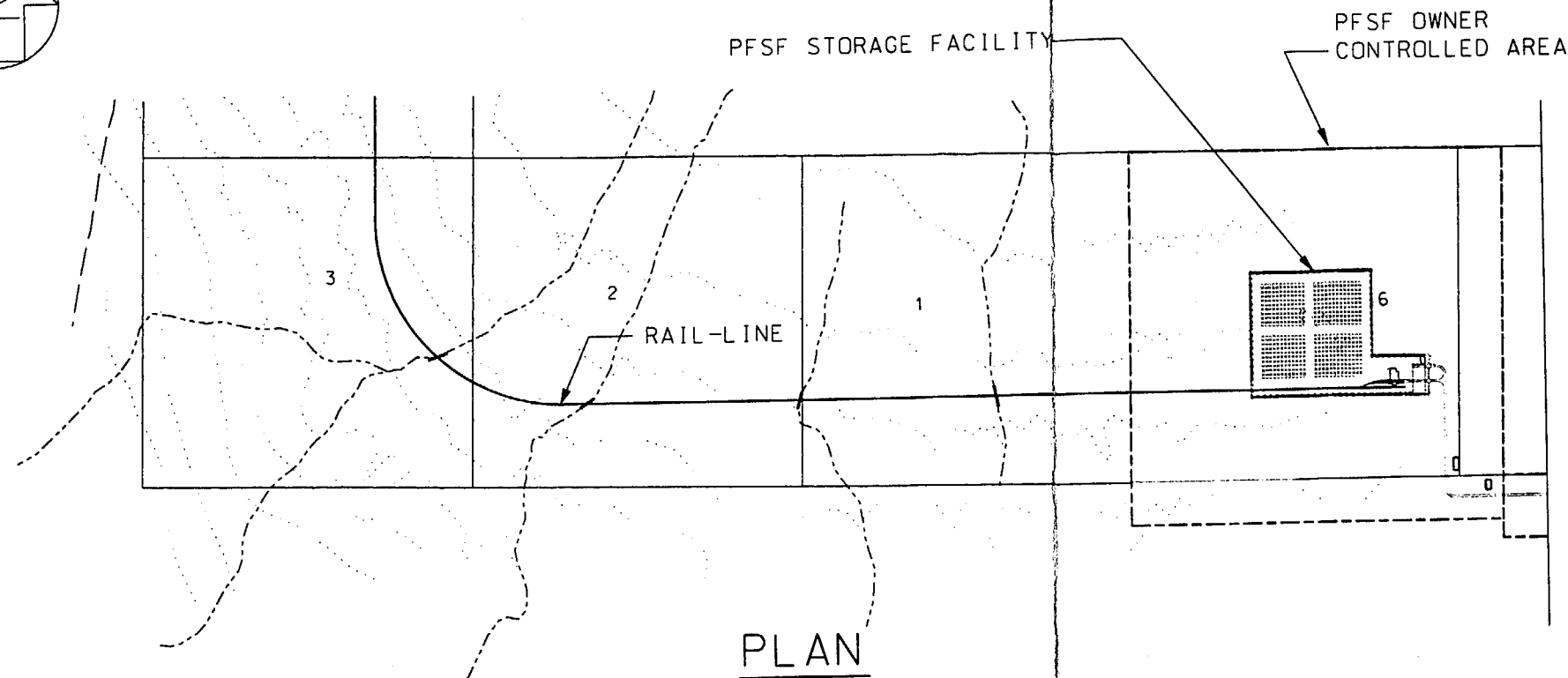
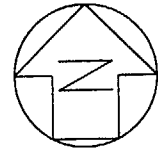
Also Available on
Aperture Card

9905260297-01

NOTE:
SEE FIGURE 2.1-2 FOR OVERALL SITE AND
ACCESS ROAD LOCATION PLAN.

Figure 2.4-2

**PFSF SITE PMF BERM
PLAN & PROFILE**
PRIVATE FUEL STORAGE FACILITY
SAFETY ANALYSIS REPORT



APERTURE
CARD

Also Available on
Aperture Card

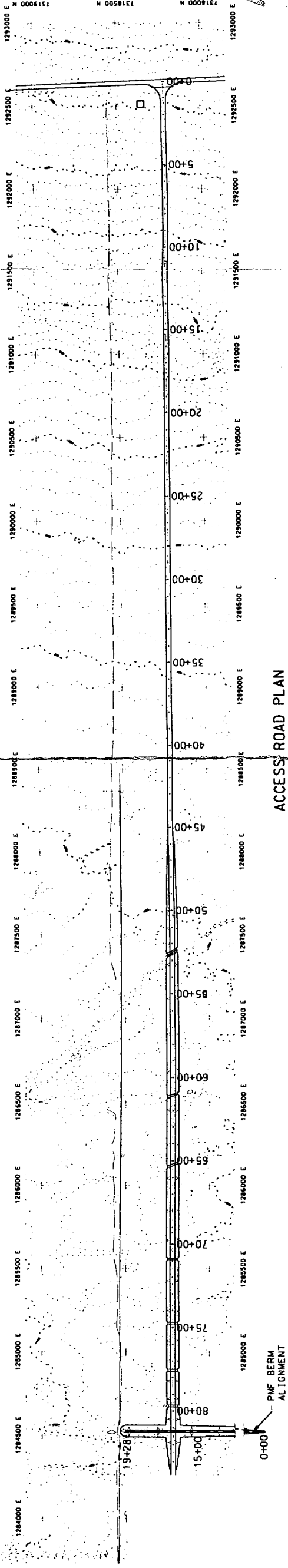
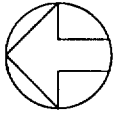
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NOTE:
SEE FIGURE 2.1-2 FOR OVERALL SITE AND
ACCESS ROAD LOCATION PLAN.

Figure 2.4-3

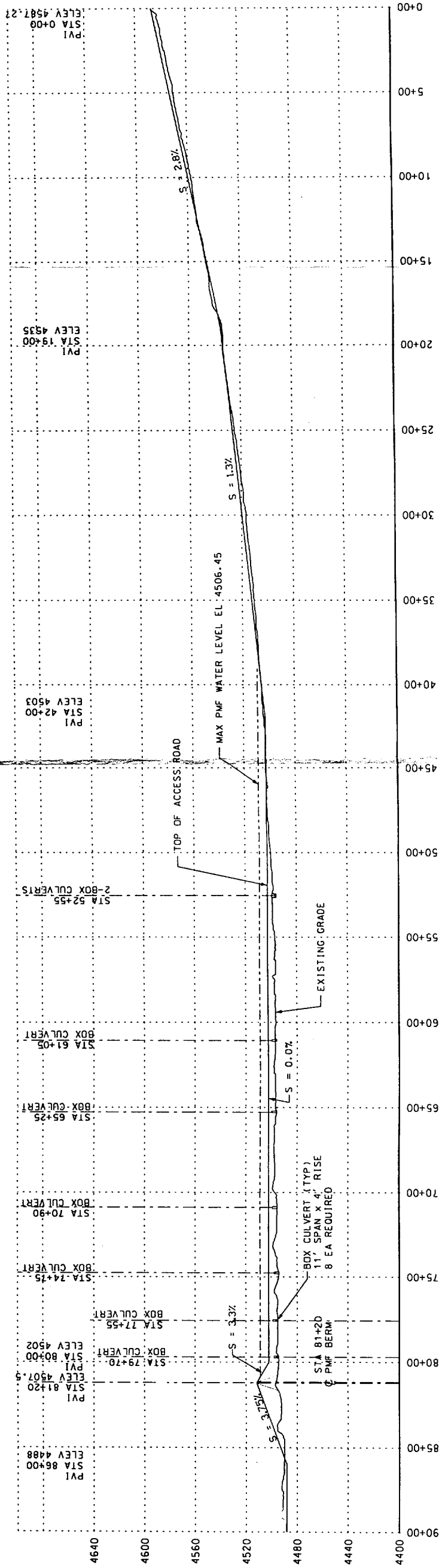
**PFSF RAIL LINE
PLAN & PROFILE**

PRIVATE FUEL STORAGE FACILITY
SAFETY ANALYSIS REPORT



APERTURE CARD

Also Available on Aperture Card



Station (Skull Valley Road to Site)

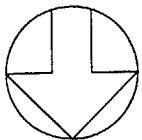
ACCESS ROAD PROFILE

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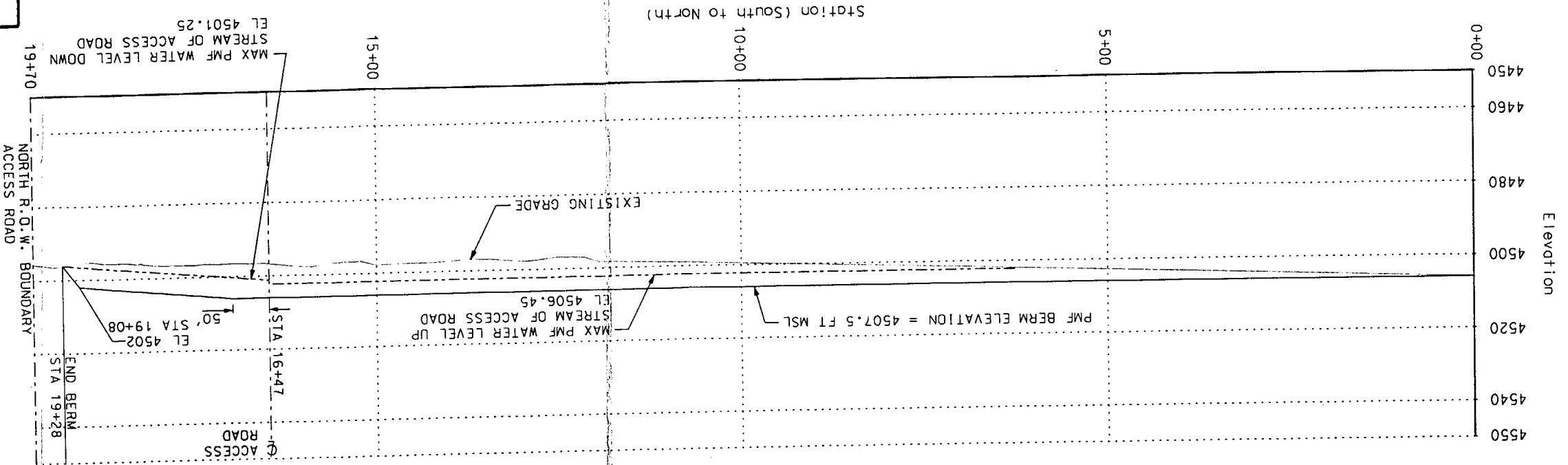
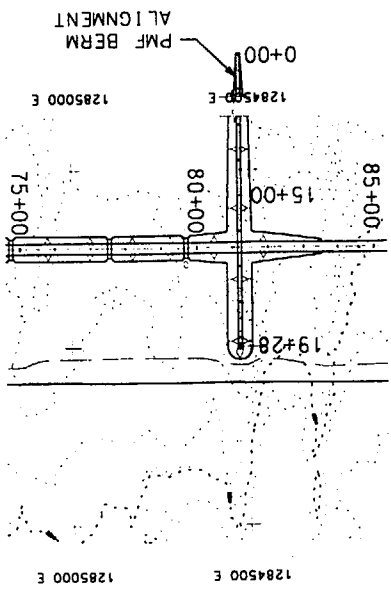
Figure 2.4-4

**PFSF ACCESS ROAD
PLAN & PROFILE**
PRIVATE FUEL STORAGE FACILITY
SAFETY ANALYSIS REPORT

NOTE:
SEE FIGURE 2.1-2 FOR OVERALL SITE AND
ACCESS ROAD LOCATION PLAN.



ACCESS ROAD PLAN



PFSS ACCESS ROAD PMF BERM
PLAN & PROFILE

Figure 2.4-5

PRIVATE FUEL STORAGE FACILITY
SAFETY ANALYSIS REPORT

NOTE:
SEE FIGURE 2.1-2 FOR OVERALL SITE AND
ACCESS ROAD LOCATION PLAN.

APERTURE
CARD
Also Available on
Aperture Card

9905260297-04