A000085

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April 10, 1989

Mr. Frederick M. Chatry
Chief - Engineering Division
New Orleans District
Corps of Engineers
Post Office Box 60267
New Orleans, LA 70160

RE: 17TH STREET CANAL PARALLEL FLOOD PROTECTION
PHASE 1B - HAMMOND HIGHWAY TO SOUTHERN RAILWAY
OLB PROJECT NO. 2043-0207

Dear Mr. Chatry:

In your letter of October 21, 1988, you listed comments on our preliminary plans for the above referenced project. In our review of those comments, we discovered that the slope stability calculations for the first six reaches of this project do not properly reflect the actual factors of safety.

In order to achieve the required factors of safety using the cross-sections proposed by Eustis Engineers in our earlier submission to your office, a great deal of earth work would be required on the land side of the levee. Because of the proximity of fences, garages, swimming pools, and out buildings, we felt it in the best interest of the project to develop new levee cross-sections that required no work on the landside slope of the levee. This has been done and a description of the revisions given below.

Reach 1 - Realign the sheet pile wall and increase the horizontal step width to 12.0'.

Reach 2 - Realign the sheet pile wall and decrease the horizontal step width to 9.0'.

Reach 3 - Realign the sheet pile wall, lower the crown elevation to 5.5, lower the horizontal step elevation to 2.0 and decrease the horizontal step width to 9.0'.

Reach 4 - Realign the sheet pile wall and decrease the horizontal step width to 9.0'.

Reach 5 - Realign the sheet pile wall, raise the horizontal step elevation to 5.5 and decrease the horizontal step width to 8.5'.

Reach 6 - Realign the sheet pile wall.

We are submitting revised slope stability and sheet pile analyses for Reaches 1 through 6 which supersede the previously submitted calculations and consequently make obsolete comments "a" and "b" of your letter of October 21, 1988.

Regarding comments "c" and "d" of your letter, we concur that the cross-sections at the stations cited do not provide an adequate factor of safety. Subsequent analysis on our part has revealed that it will be necessary to lower the proposed crown elevation in order to meet the required factor of safety while maintaining our objective of staying off the landslide slope. The revisions made in Reaches 7 and 8 are as follows:

Reach 7 - Lower the crown elevation to 12.0 (increasing the total crown width accordingly).

Reach 8 - Lower the crown elevation to 12.0 (holding 8.0' crown width behind sheet pile wall and 2.0' crown width in front of sheet pile wall, thereby increasing the horizontal step width at elevation 2.0).

We are submitting revised canalside failure slope stability analyses only for the stations in question. It is obvious that the remaining stations, which were satisfactory before, will have even higher factors of safety as a result of the changes described above.

We would like to point out that the revised cross-sections in Reaches 3 and 5 do result in an increase in the amount of sheet piling required for the project. It is estimated that this additional cost will be approximately $160,000. As we have already pointed out, the landslide slope of the levee falls within privately owned property. If the additional cost is divided over the number of residences along the reaches involved, it works out to less than $3,000 per residence. It is our opinion that this cost pales in comparison with the potential costs associated with performing construction on privately owned property occupied by so many facilities.

Should you have any questions regarding these revised analyses, please do not hesitate to call.

Revised preliminary plans will be submitted for your review once we receive your apporval of these new sections.

Very truly yours,

MODJESKI AND MASTERS
Engineers

Barney T. Martin, Jr.

BTM:jrb
cc: Mr. John Holtgreve - D.E.I.
Mr. Ed Bailey - Orleans Levee District

GDM + M+M87 sheetpile alignment

REACH 1
STA. 553+70 TO STA. 568+00

STA.	OFFSET TO EL. 5.5 ON EXISTING BACKSLOPE (FT)		OFFSET TO SHEET PILE (FT)	CROWN WIDTH (FT)	EXISTING BACKSLOPE (H : V)	EXISTING LANDSIDE TOE EL.	DIST. FROM TOE TO GROUND PT. (FT)	EXISTING LANDSIDE GROUND EL.
554+00	219.5	208.5	211.0	8.5	3.1 : 1	-1.77	10.0	-2.17
556+00	219.6	207.9	210.4	9.2	2.9 : 1	-2.37	10.0	-3.27
558+00	219.8	207.3	209.8	10.0	3.1 : 1	-3.04	10.0	-3.24
560+00	218.2	206.6	209.2	9.0	3.0 : 1	-3.64	10.0	-4.04
562+00	216.9	206.0	208.5	8.4	4.4 : 1	-2.43	10.0	-3.59
564+00	221.4	205.9	208.3	13.1	3.6 : 1	-2.03	7.3	-2.03
566+00	219.3	206.2	208.3	11.0	3.8 : 1	-0.43	10.0	-1.44
568+00	218.4	207.3	208.2	10.2	3.5 : 1	-3.32	10.0	-3.62

Revisions to Cross-Section : Realign Sheet Pile
Increase Step Width to 12.0' (Hold Elevation at 2.0)

Slope Stability Analysis :

The following cross-sections were checked to determine the minimum factor of safety :

Canalside Failure - 562+00, 564+00 and 566+00. The section at Sta. 564+00 governs.
*** Minimum Factor of Safety = 1.30 ***

Landside Failure - 554+00, 556+00, 560+00 and 562+00. The section at Sta. 560+00 governs.
*** Minimum Factor of Safety = 1.33 ***

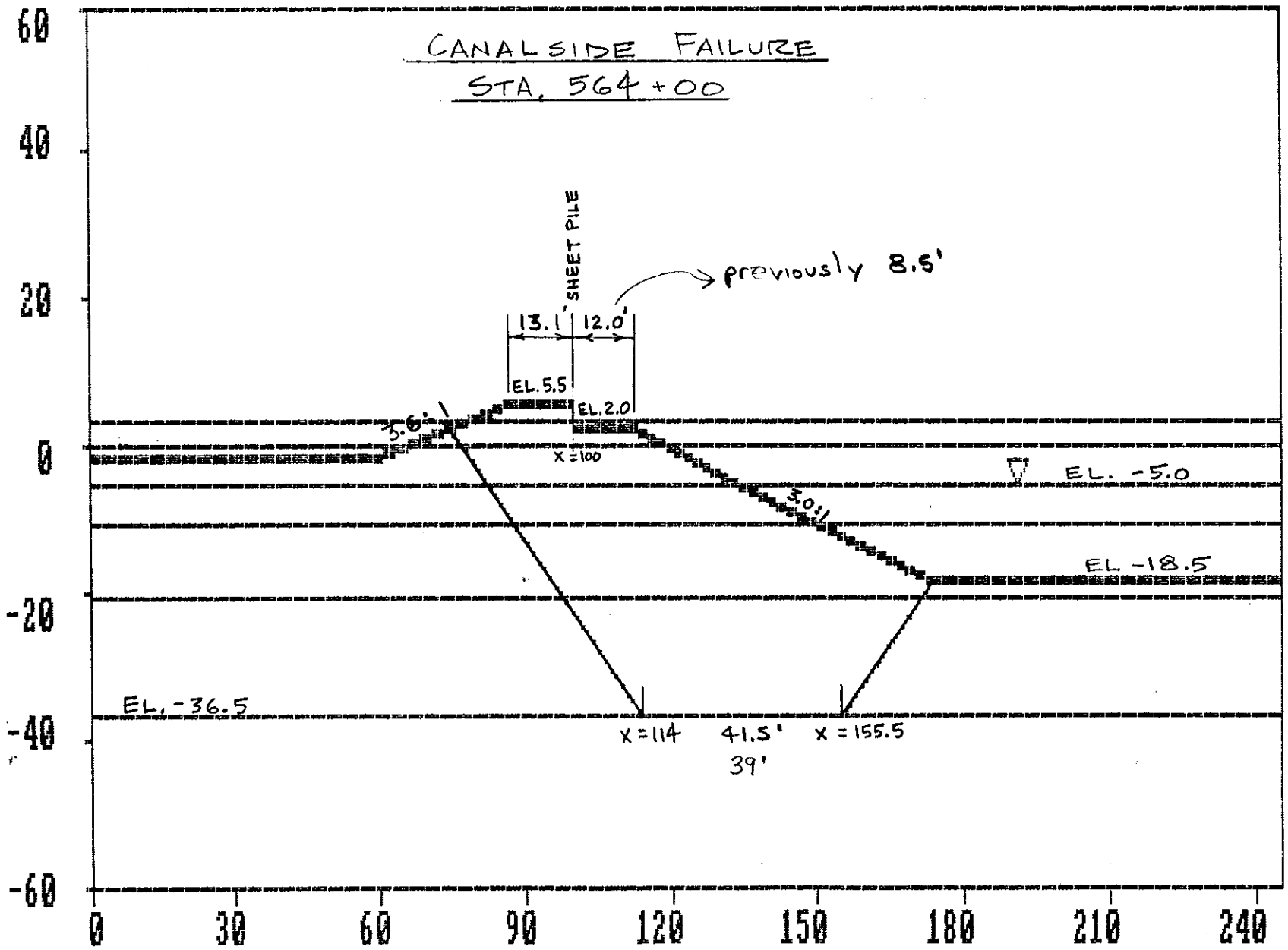
Sheet Pile Analysis :

The following cross-sections were checked to determine the required penetration, design bending moment and maximum deflection :

Canalside Failure - 562+00, 564+00 and 566+00.
Landside Failure - 554+00, 556+00, 560+00 and 562+00.

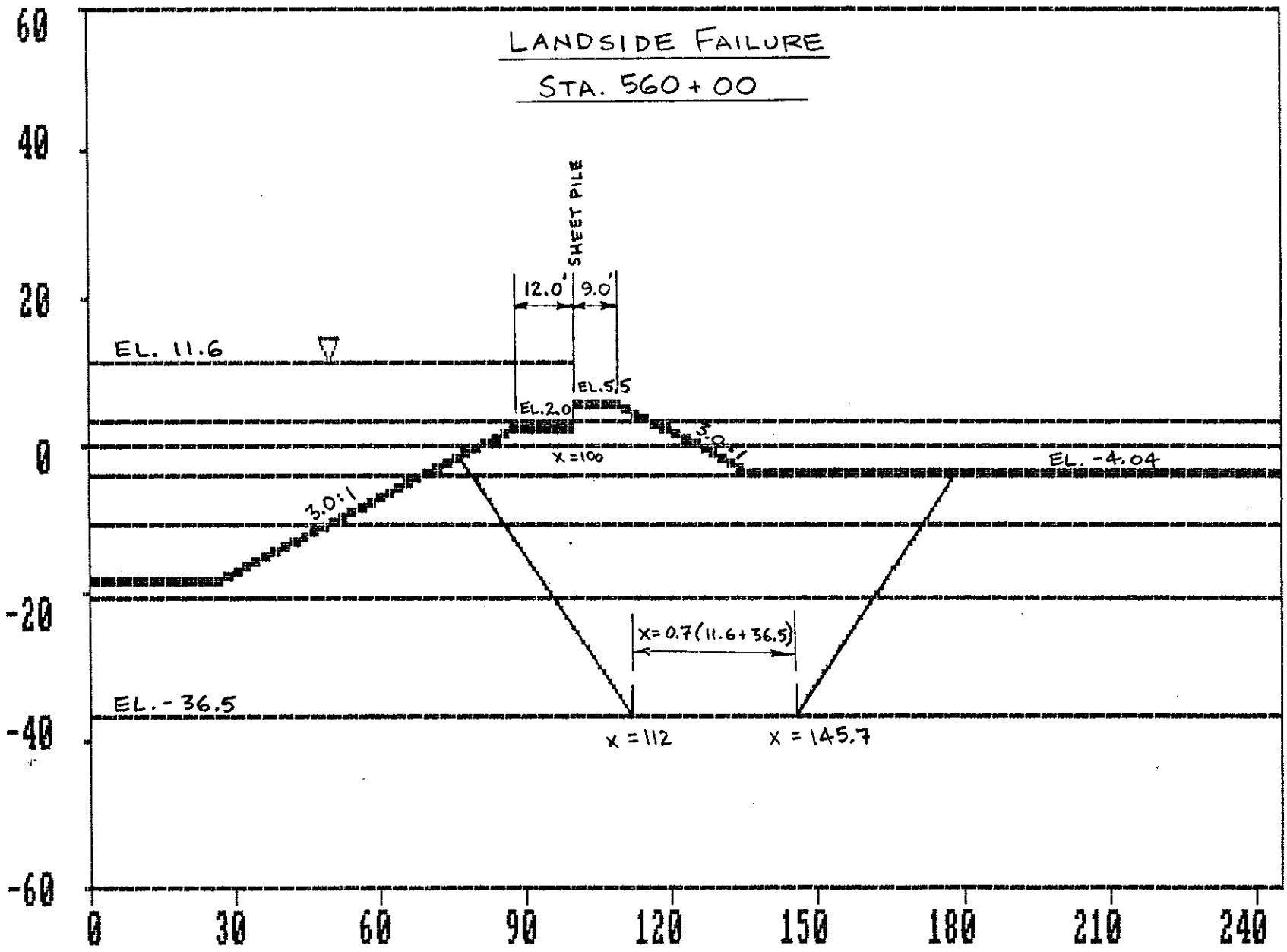
Required Penetration : -12.8 (Landside Failure 3:1 Ratio; S-Case F.S. = 1.25)
Design Bending Moment : 11.5 Ft-K/Ft @ El. -2.8 (Landside Failure 3:1 Ratio; S-Case F.S. = 1.25)
Maximum Deflection : In.

GDM section is a minimum composite with a 9' for I-WALL crown width and a bench @ EL 2.0 with a maximum crown width of 11.5'. Tip EL -12.74 3:1 (F.S.=1.32)



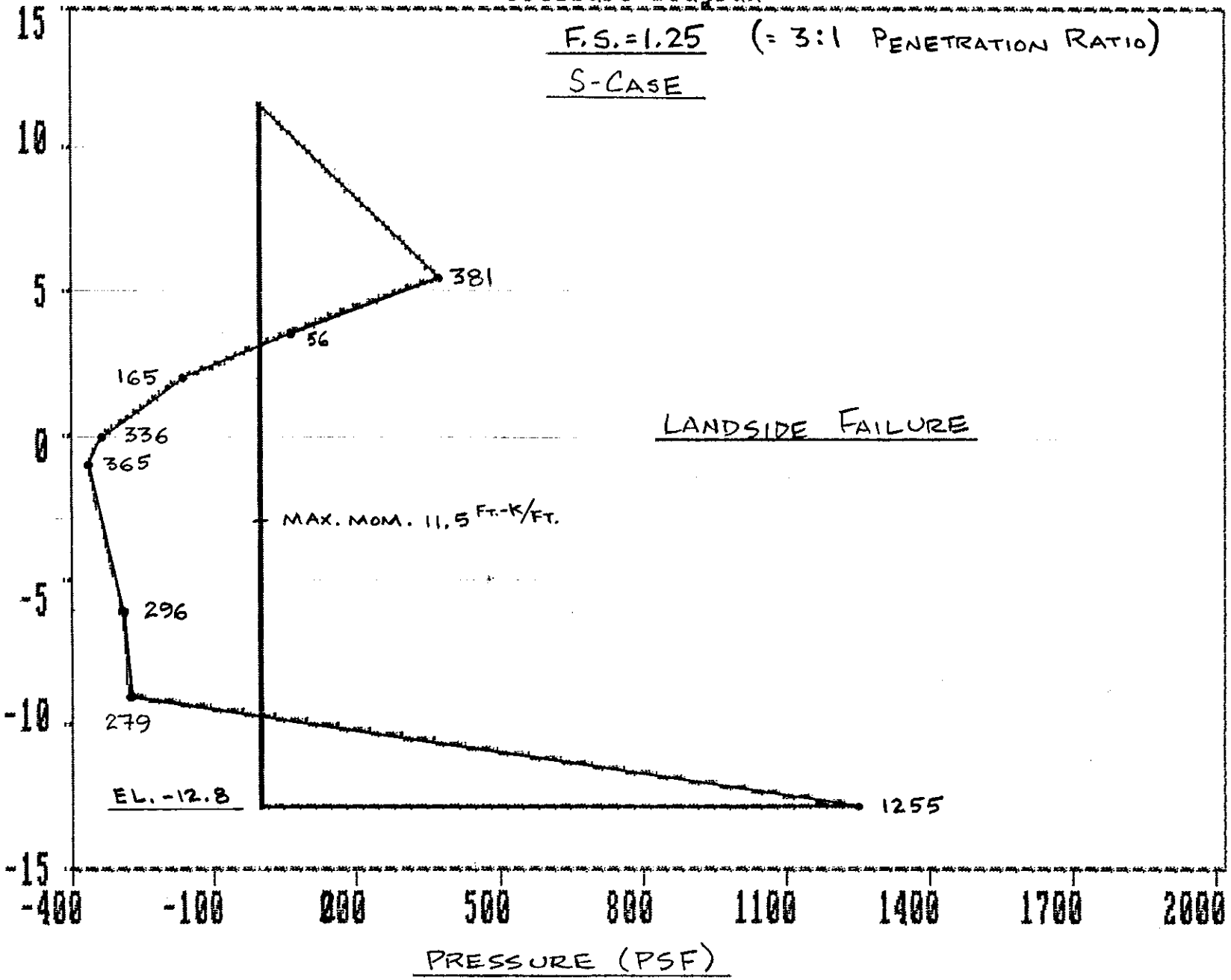
$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{27{,}827 \quad 15{,}770 \quad 13{,}480}{26{,}922 + 15{,}770 + 13{,}834} = \frac{1.30}{51{,}901 - 8{,}381 \quad 43{,}520} = 1.30$$

$$83{,}567 - 39{,}626 = 43{,}941$$



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{23\,452 + 12\,736 + 22\,400}{23{,}751 + 12{,}795 + 22{,}399} = \frac{65{,}291 - 21{,}001 = 44{,}290}{98703 - 54{,}283 = 44{,}420} \quad 1.33 \quad 1.32$$

Pressure Diagram



GDM + M+M sheetpile alignment

REACH 2
STA. 568+00 TO STA. 589+00

STA.	OFFSET TO EL. 5.5 ON EXISTING BACKSLOPE (FT)		OFFSET TO SHEET PILE (FT)	CROWN WIDTH (FT)	EXISTING BACKSLOPE (H : V)	EXISTING LANDSIDE TOE EL.	DIST. FROM TOE TO GROUND PT. (FT)	EXISTING LANDSIDE GROUND EL.
568+00	218.4	205.6	208.2	10.2	3.5 : 1	-3.32	10.0	-3.62
570+00	220.5	208.4	208.1	12.4	4.2 : 1	-1.01	10.0	-1.77
572+00	219.1	208.7	207.9	11.2	3.6 : 1	-1.08	10.0	-1.48
574+00	218.8	209.0	207.8	11.0	3.1 : 1	-2.08	10.0	-2.18
576+00	216.9	206.5	207.7	9.2	3.0 : 1	-3.79	6.0	-3.99
578+00	220.7	210.0	211.7	9.0	3.1 : 1	-2.79	10.0	-2.99
580+00	225.9	215.0	216.6	9.3	3.1 : 1	-2.57	10.0	-2.67
582+00	231.4	220.0	221.4	10.0	2.9 : 1	-1.97	10.0	-2.37
584+00	235.6	225.0	226.3	9.3	2.6 : 1	-2.46	10.0	-2.86
586+00	242.1	230.0	231.2	10.9	2.9 : 1	-1.56	2.0	-1.96
588+00	245.8	234.9	235.9	9.9	2.5 : 1	-2.44	10.3	-2.64

Revisions to Cross-Section : Realign Sheet Pile
Decrease Step Width to 9.0' (Hold Elevation at 2.0)

Slope Stability Analysis :

The following cross-sections were checked to determine the minimum factor of safety :

Canalside Failure - 570+00.
*** Minimum Factor of Safety = 1.31 ***

Landside Failure - 576+00, 578+00, 584+00 and 588+00. The section at Sta. 576+00 governs.
*** Minimum Factor of Safety = 1.33 ***

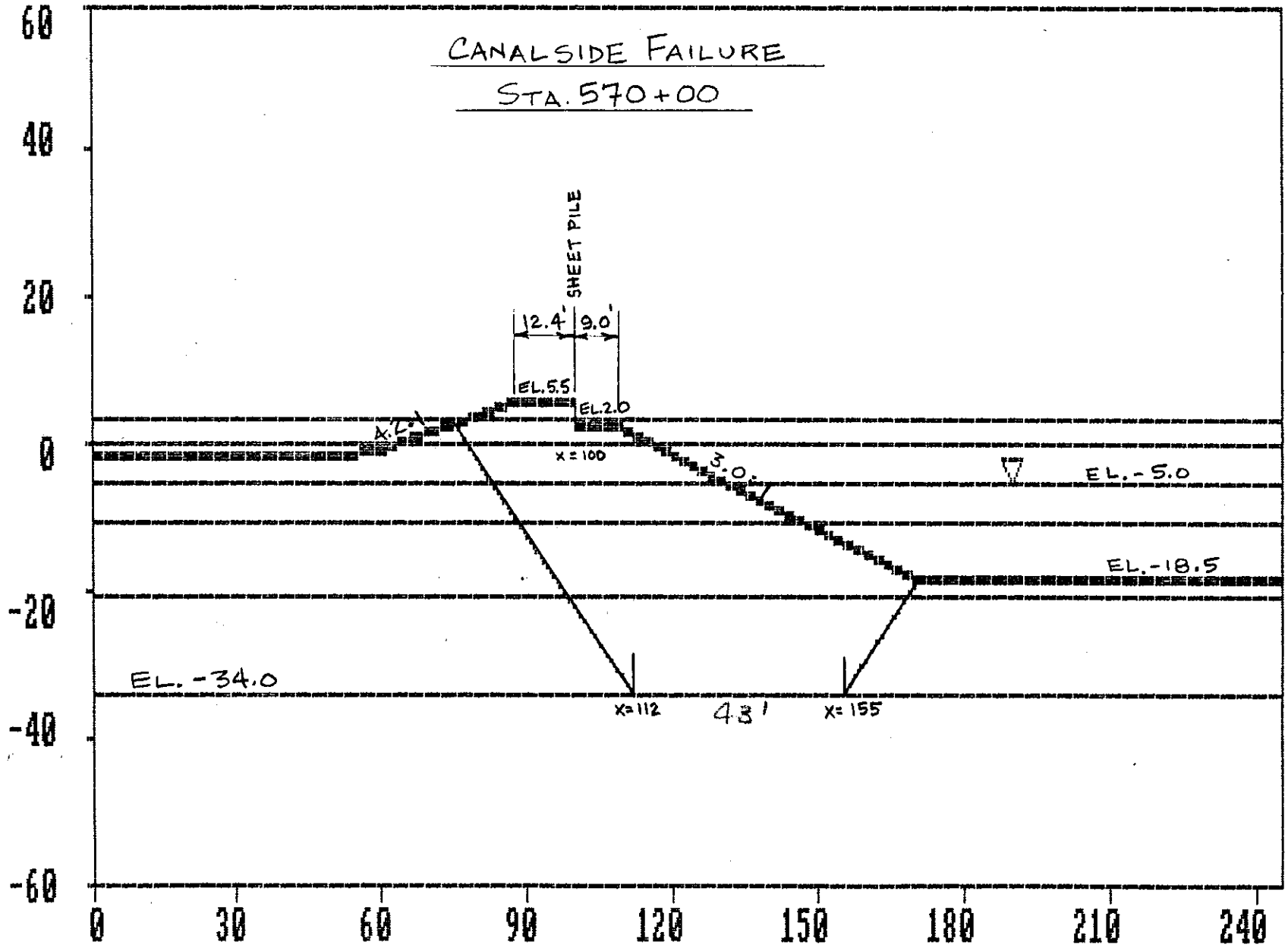
Sheet Pile Analysis :

The following cross-sections were checked to determine the required penetration, design bending moment and maximum deflection :

Canalside Failure - 570+00.
Landside Failure - 576+00, 578+00, 584+00 and 588+00.

Required Penetration : -12.8 (Landside Failure 3:1 Ratio; S-Case F.S. = 1.26)
Design Bending Moment : 11.5 Ft-K/Ft @ El. -2.7 (Landside Failure 3:1 Ratio; S-Case F.S. = 1.26)
Maximum Deflection : In.

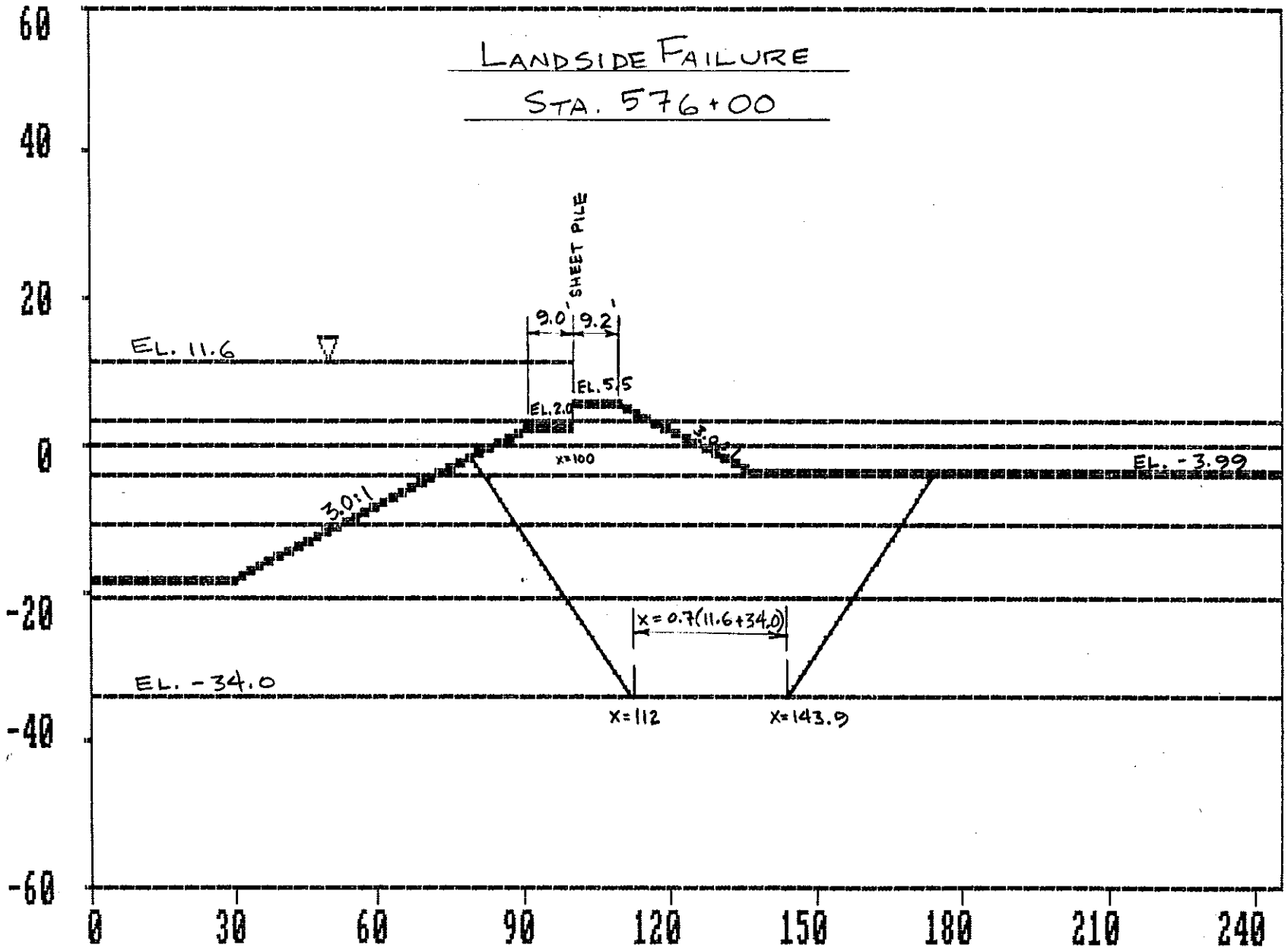
GDM Section – 12.74 (F.S. = 1.32) (3:1) with 9' I-Wall crown
Bench @ +2.5 Max Crown width 13'



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{26{,}029 \quad 16{,}340 \quad 12{,}075}{25{,}357 + 16{,}340 + 11{,}934} = 1.31$$

$47{,}101 - 6225 = 40{,}876$

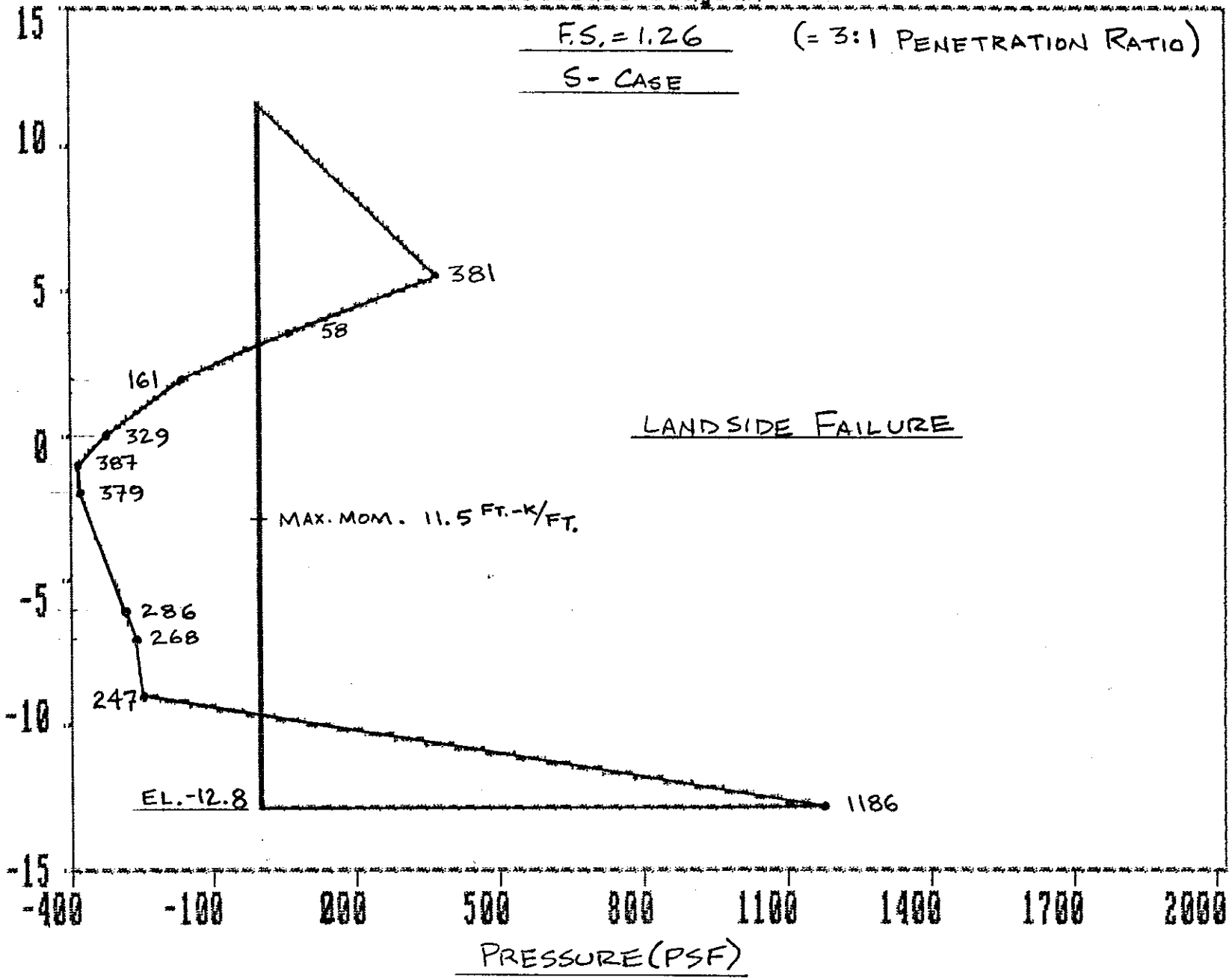
$73{,}589 - 33{,}318 = 40{,}271 = 1.34$



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{21{,}482 \quad 11{,}970 \quad 20{,}500}{21{,}781 + 12{,}130 + 20{,}527} = \frac{1.30}{1.33}$$

$$\frac{59{,}036 - 18{,}005}{87{,}640 - 46{,}282}$$

Pressure Diagram



GDM+M+M sheetpile alinement

REACH 3
STA. 589+00 TO STA. 614+00

STA.	OFFSET TO EL. 5.5 ON EXISTING BACKSLOPE (FT)		OFFSET TO SHEET PILE (FT)	CROWN WIDTH (FT)	EXISTING BACKSLOPE (H : V)	EXISTING LANDSIDE TOE EL.	DIST. FROM TOE TO GROUND PT. (FT)	EXISTING LANDSIDE GROUND EL.
590+00	248.6	234.9	239.5	9.1	2.5 : 1	-2.34	9.8	-2.64
592+00	252.6	238.9	243.0	9.6	2.7 : 1	-2.59	10.0	-2.99
594+00	250.5	237.7	241.5	9.0	1.8 : 1	-1.29	16.5	-1.79
596+00	250.5	236.4	239.8	10.7	2.4 : 1	-2.11	9.9	-1.81
598+00	249.3	235.1	238.1	11.2	3.0 : 1	-3.01	9.9	-3.41
600+00	246.9	233.9	236.4	10.5	3.1 : 1	-2.87	9.5	-3.77
602+00	244.4	232.6	234.7	9.7	3.1 : 1	-1.97	8.2	-2.47
604+00	243.9	231.3	233.0	10.9	2.7 : 1	-3.96	10.0	-4.36
606+00	241.8	230	231.4	10.4	2.7 : 1	-2.86	10.0	-3.56
608+00	243.2	228.7	229.8	13.4	3.2 : 1	-2.10	9.9	-3.20
610+00	242.4	228.3	229.1	13.3	3.1 : 1	-1.40	10.0	-2.20
612+00	244.0	227.9	228.4	15.6	3.6 : 1	-0.89	10.0	-2.09
614+00	242.0	227.5	227.7	14.3	3.6 : 1	-0.79	11.5	-2.49

Revisions to Cross-Section : Realign Sheet Pile
Lower Crown Elevation to El. 5.5 6.5
Lower Step Elevation to El. 2.0 and Decrease Width to 9.0' 19.8'

Slope Stability Analysis :

The following cross-sections were checked to determine the minimum factor of safety :

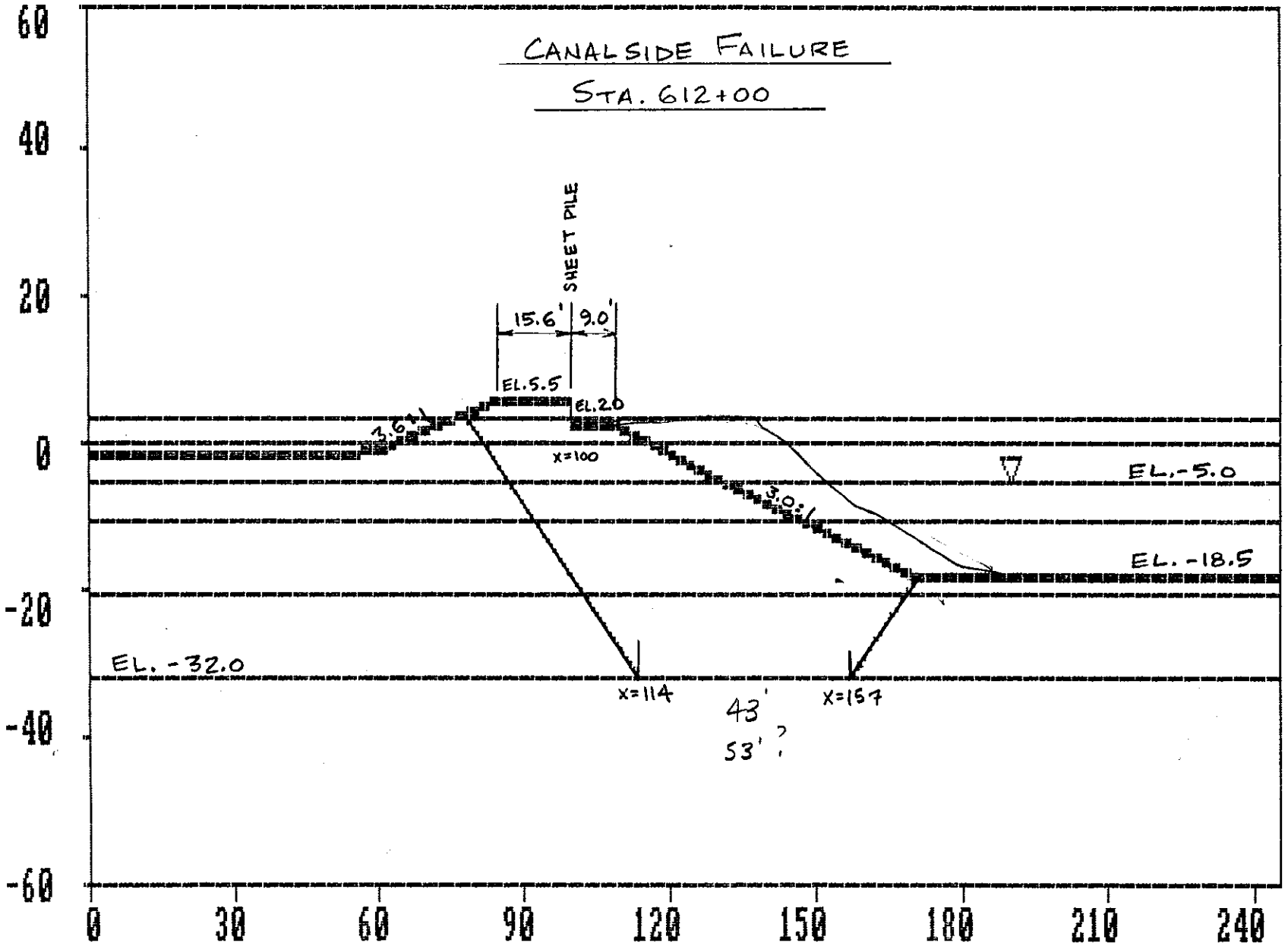
Canalside Failure - 612+00. *** Minimum Factor of Safety = 1.32 ***

Landside Failure - 590+00, 592+00, 594+00, 596+00, 600+00, 604+00 and 606+00.
The section at Sta. 604+00 governs. *** Minimum Factor of Safety = 1.30 ***

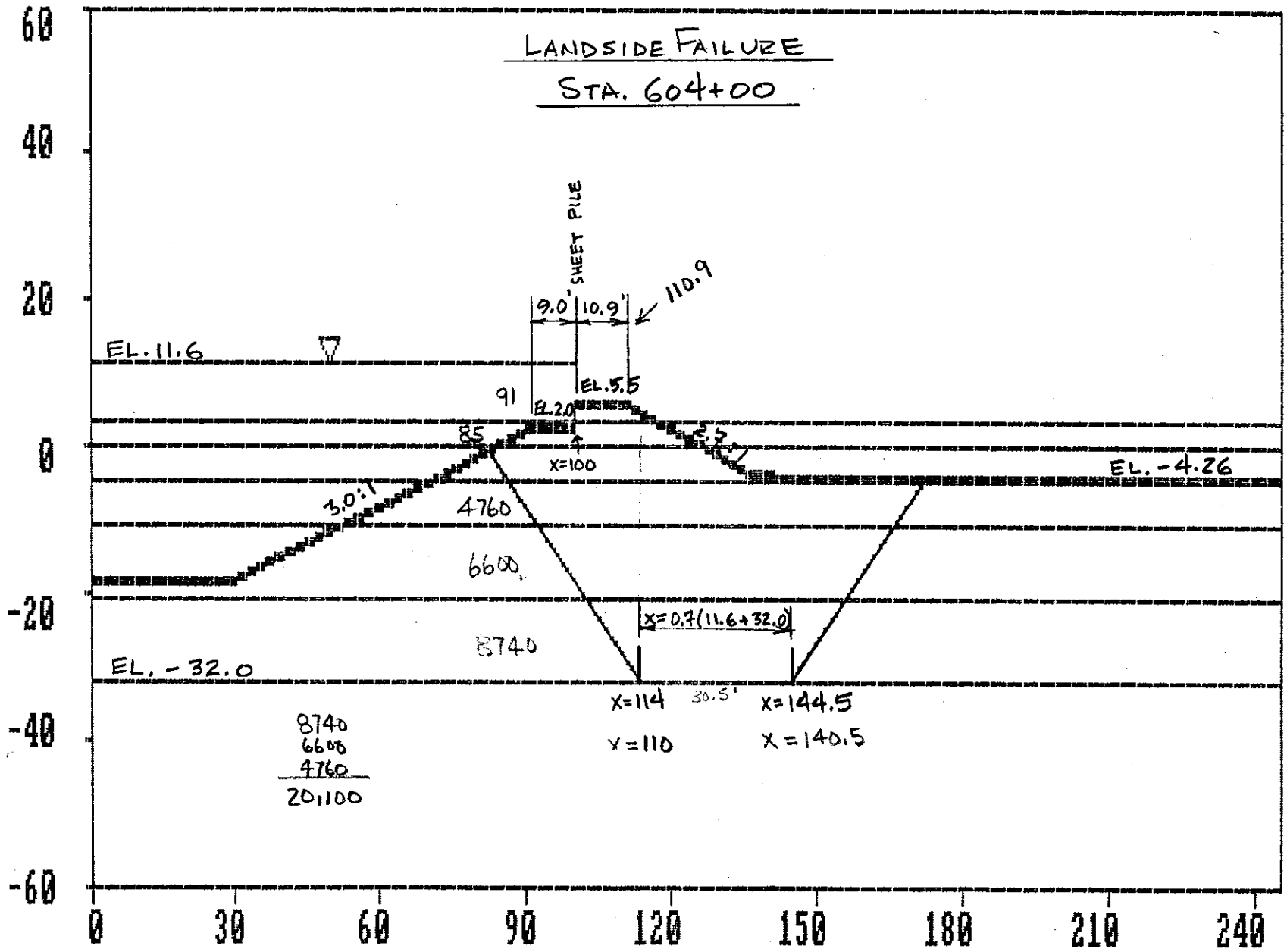
Sheet Pile Analysis :

The following cross-sections were checked to determine the required penetration, design bending moment and maximum deflection : Canalside Failure - 612+00.
Landside Failure - 594+00.

Required Penetration : -12.8 (Landside Failure Sta. 594+00 and 3:1 Ratio; S-Case F.S.=1.2)
Design Mending Moment : 10.9 Ft-K/Ft @ El. -2.3 (Landside Failure Sta. 594+00 and 3:1 Ratio; S-Case F.S.=1.2)
Maximum Deflection : In.



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{25{,}603 + 19{,}799 + 10{,}060}{25{,}024 + 16{,}340 + 10{,}414} = \frac{43{,}917 - 4{,}731 = 39186}{41{,}586} = 1.32$$



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{20{,}352 + 11{,}590 + 18{,}812}{20{,}821 + 11{,}598 + 18{,}855} = 1.27$$

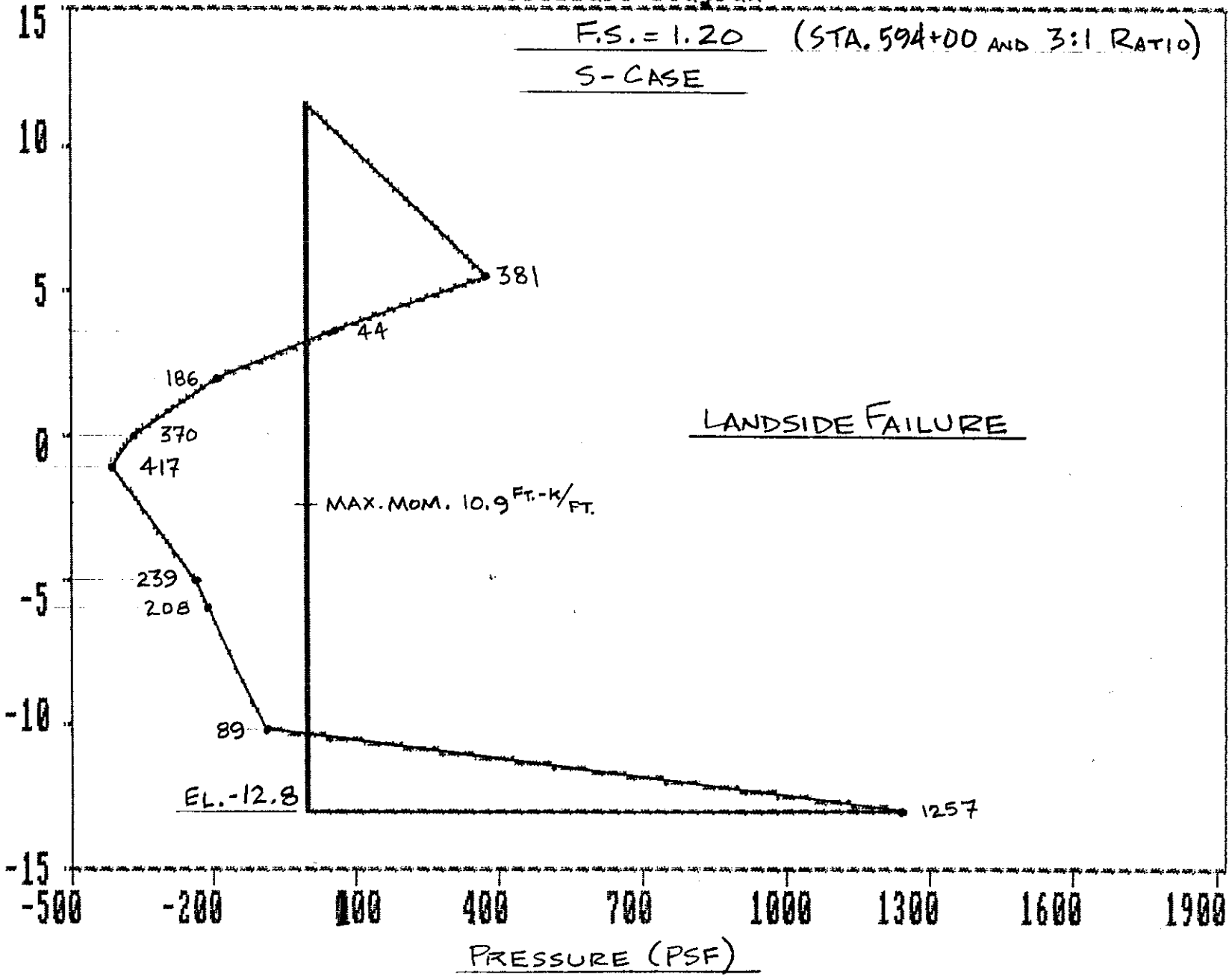
$$54{,}853 - 15{,}425 = 39{,}428 \quad 79{,}437 - 39{,}373 = 40\,064$$

$R_A =$ Active $D_A - D_P$ $= 1.30$ (M+M IF USE $\rightarrow$ Same wedge $= 39{,}602$

Pressure Diagram

F.S. = 1.20 (STA. 594+00 AND 3:1 RATIO)

S-CASE



GDM & M&M Sheetpile alignment

REACH 4
STA. 614+00 TO STA. 625+00

STA.	OFFSET TO EL. 7.0 ON EXISTING BACKSLOPE (FT)		OFFSET TO SHEET PILE (FT)	CROWN WIDTH (FT)	EXISTING BACKSLOPE (H : V)	EXISTING LANDSIDE TOE EL.	DIST. FROM TOE TO GROUND PT. (FT)	EXISTING LANDSIDE GROUND EL.	NEW CANAL TOE	OLD CANAL TOE
614+00	236.6	227.5	227.7	8.9	3.6 : 1	-0.79	11.5	-2.49	152.4	146.1
616+00	233.9	227.1	227.0	6.9	3.9 : 1	-0.55	10.0	-1.65	151.7	145.8
618+00	234.2	226.6	226.3	7.9	3.4 : 1	-1.25	10.0	-3.05	151.0	145.3
620+00	234.3	226.2	225.5	8.8	3.2 : 1	-2.62	10.0	-3.12	150.2	144.9
622+00	233.3	225.7	224.8	8.5	3.1 : 1	-2.62	10.2	-3.02	149.5	144.4
624+27	232.1	225.3	224.0	8.1	3.3 : 1	-1.52	14.5	-2.62		

Revisions to Cross-Section : Realign Sheet Pile
Decrease Step Width to 9.0' (Hold Elevation at 3.6)

Slope Stability Analysis :

The following cross-sections were checked to determine the minimum factor of safety :

Canalside Failure - 614+00 and 616+00. The section at Sta. 614+00 governs.
*** Minimum Factor of Safety = 1.32 ***

Landside Failure - 616+00, 618+00, 620+00, 622+00 and 624+27. The section at Sta. 622+00 governs.
*** Minimum Factor of Safety = 1.30 ***

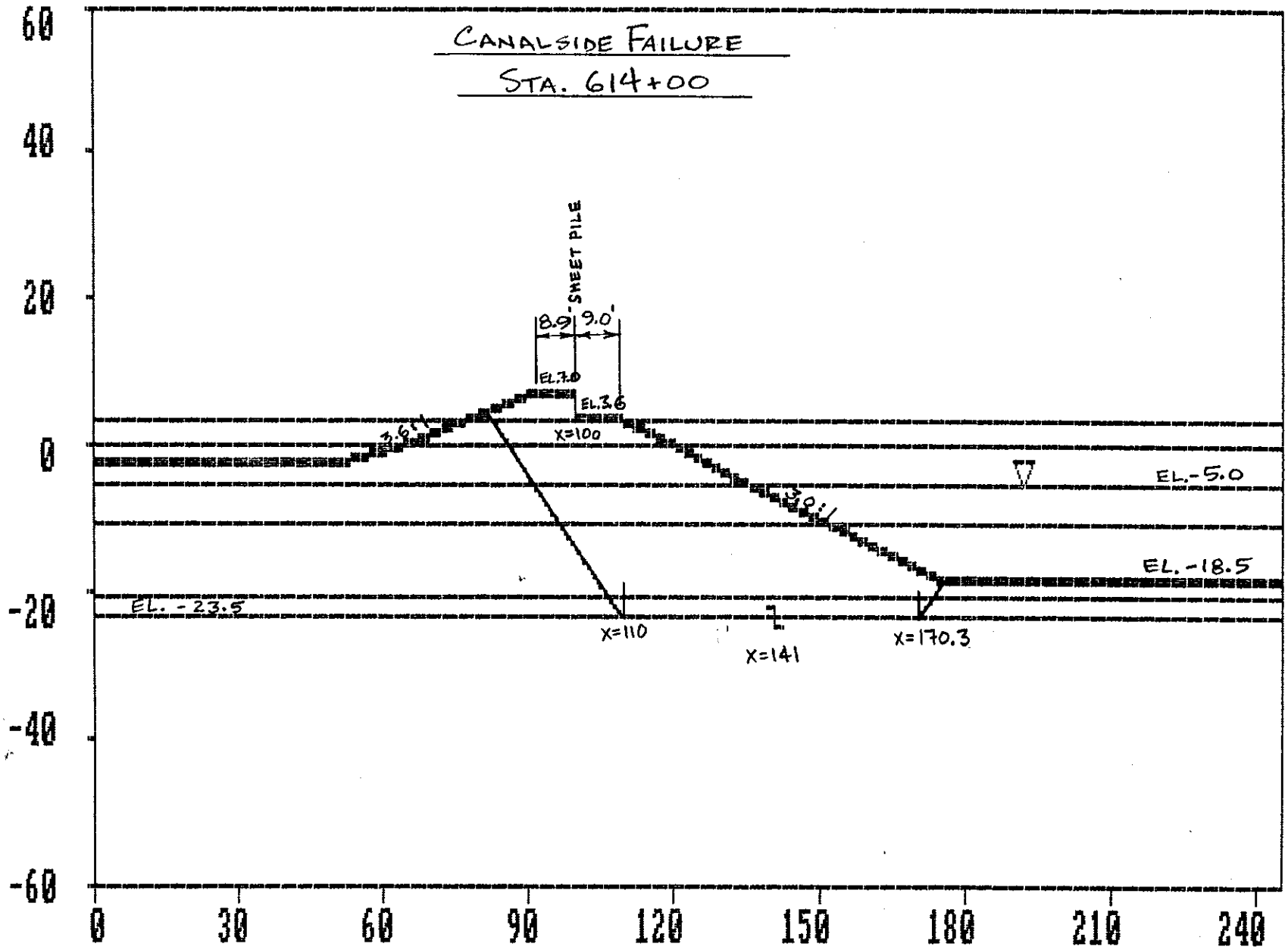
Sheet Pile Analysis :

The following cross-sections were checked to determine the required penetration, design bending moment and maximum deflection :

Canalside Failure - 614+00 and 616+00.
Landside Failure - 616+00, 618+00, 622+00 and 624+27.

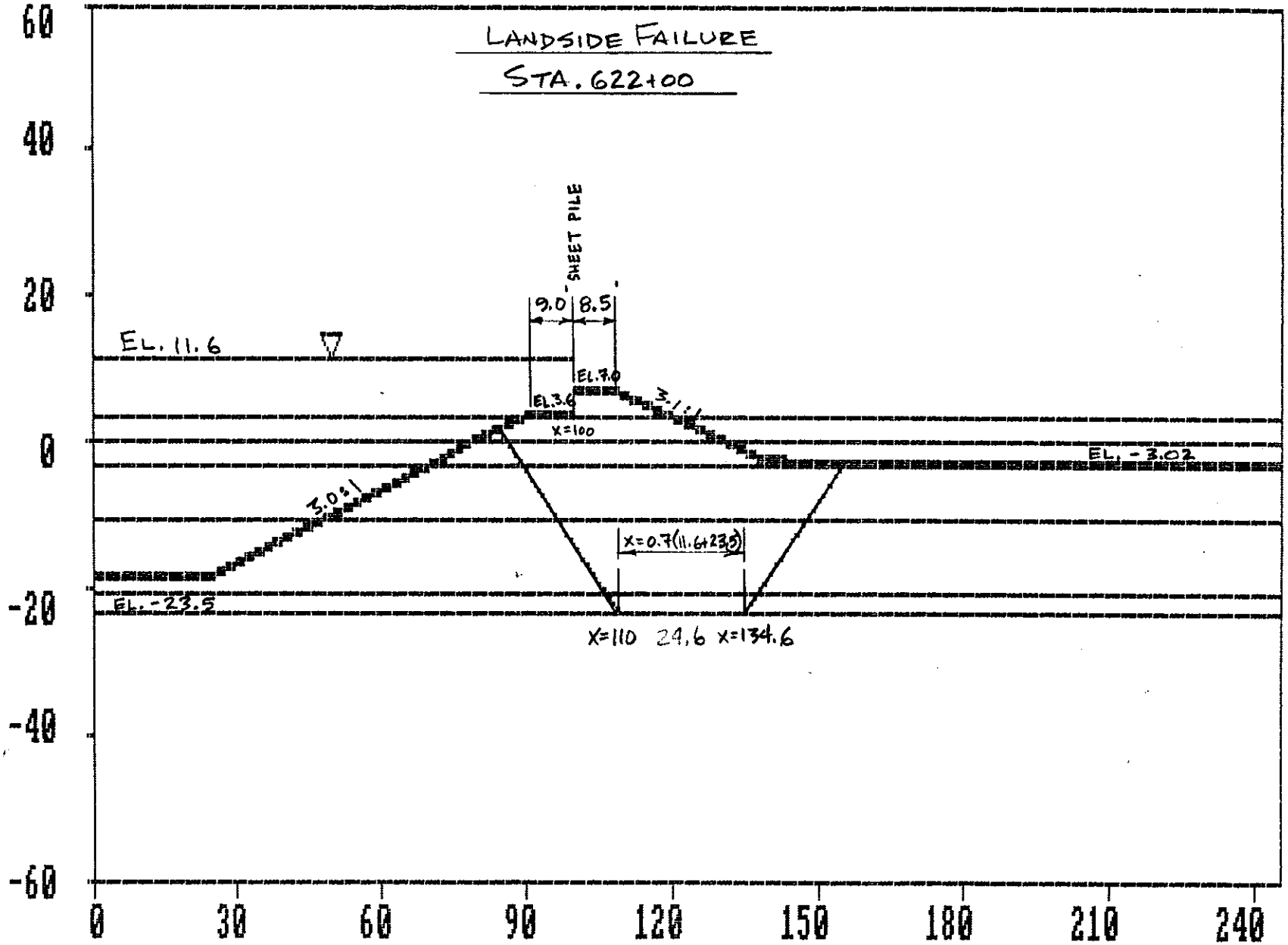
Required Penetration : -6.6 (Canalside Failure 3:1 Ratio; S-Case F.S.=1.48)
Design Bending Moment : 2.8 Ft-K/Ft @ El. -1.7 (Canalside Failure 3:1 Ratio; S-Case F.S.=1.48)
Maximum Deflection : In.

GDM Tip @ -6.8 8' crown width



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{19,685 + 17,251 + 3600}{19,259 + 19,555 + 3,764} \quad 1.24$$

$$\frac{33,030 - 662 = 32,365}{43,979 - 11,230 \quad 32,749} \quad 1.32$$

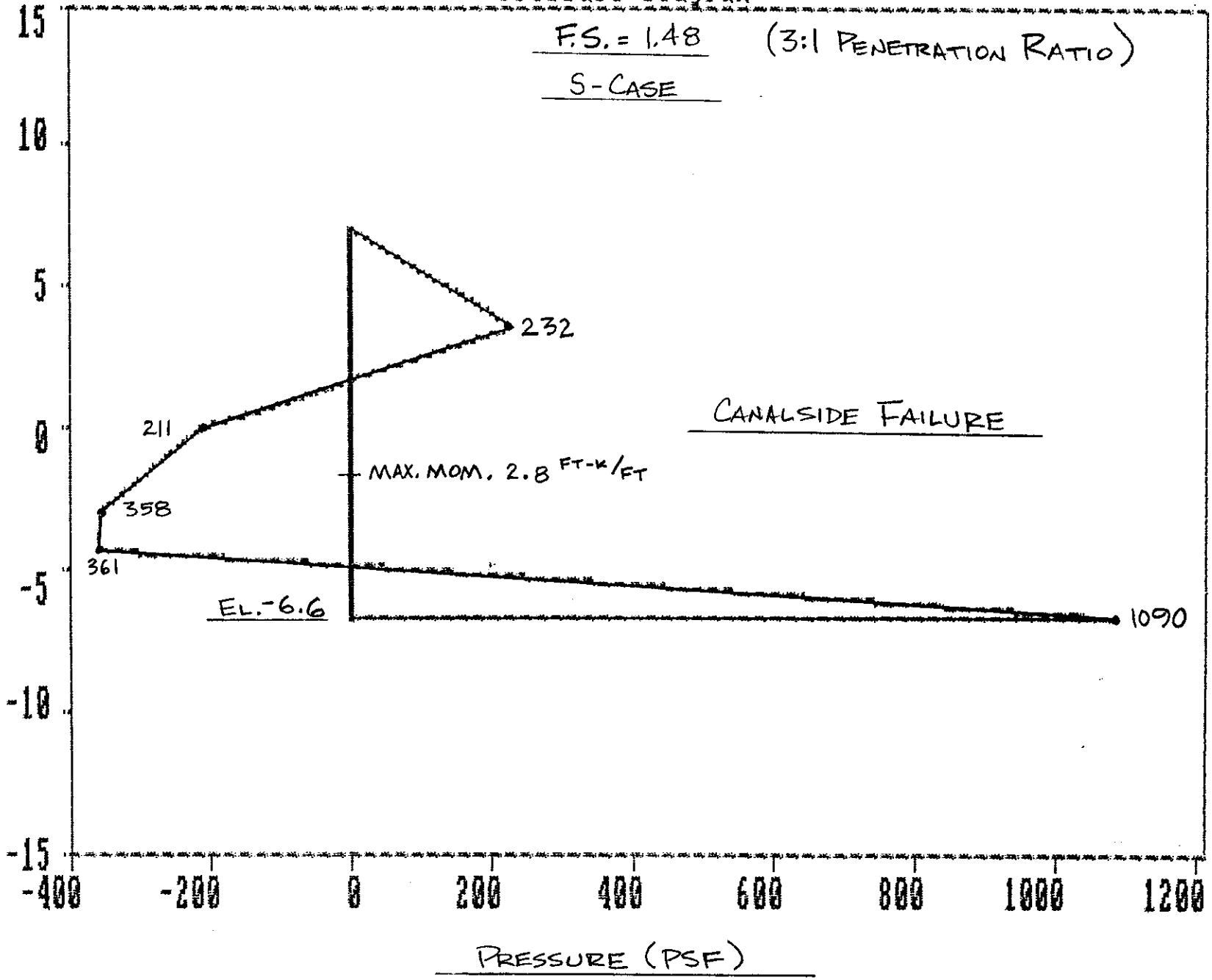


$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{17,217 \quad 13,024}{16,356 + 9337 + 13,090} = 1.30$$

$$38,959 - 9098$$

$$52,099 -$$

Pressure Diagram



GDM+M+M sheetpile alinement

REACH 5
STA. 625+00 TO STA. 635+00

STA.	OFFSET TO EL. 7.5 ON EXISTING BACKSLOPE (FT)		OFFSET TO SHEET PILE (FT)		CROWN WIDTH (FT)	EXISTING BACKSLOPE (H : V)	EXISTING LANDSIDE TOE EL.	DIST. FROM TOE TO GROUND PT. (FT)	EXISTING LANDSIDE GROUND EL.	Toe Canal side
627+28	229.9	223.8	220.7	8'	9.2	3.9 : 1	-0.72	13.6	-1.62	143.2
628+00	227.3	221.1	219.4	8'	7.9	3.5 : 1	-1.92	13.7	-3.02	141.9
630+00	224.4	217.1	215.9	8'	8.5	3.4 : 1	-1.72	14.4	-3.32	138.4
632+00	219.9	213.0	212.4	8'	7.5	3.4 : 1	-2.23	13.5	-3.73	134.9
634+00	215.1	208.9	208.9	8'	6.2	3.7 : 1	-0.53	17.4	-1.23	131.4

→ used 6.5 GDM I-WALL

Revisions to Cross-Section : Realign Sheet Pile
Raise Step Elevation to 5.5 and Decrease Width to 8.5'

crown = 10.9' width
New sheetpile = -2.4' Protected side
8.5' say 1V on 3 gives 5.5 crown width but can slope to point on levee slope to get 6.5 width with 1:3 slope @ 8.5' Elev = 6.57

Slope Stability Analysis :

The following cross-sections were checked to determine the minimum factor of safety :

Canalside Failure - 627+28.
*** Minimum Factor of Safety = 1.30 *** (Rapid Draw-Down Case)

Landside Failure - 632+00 and 634+00. The section at Sta. 632+00 governs.
*** Minimum Factor of Safety = 1.31 ***

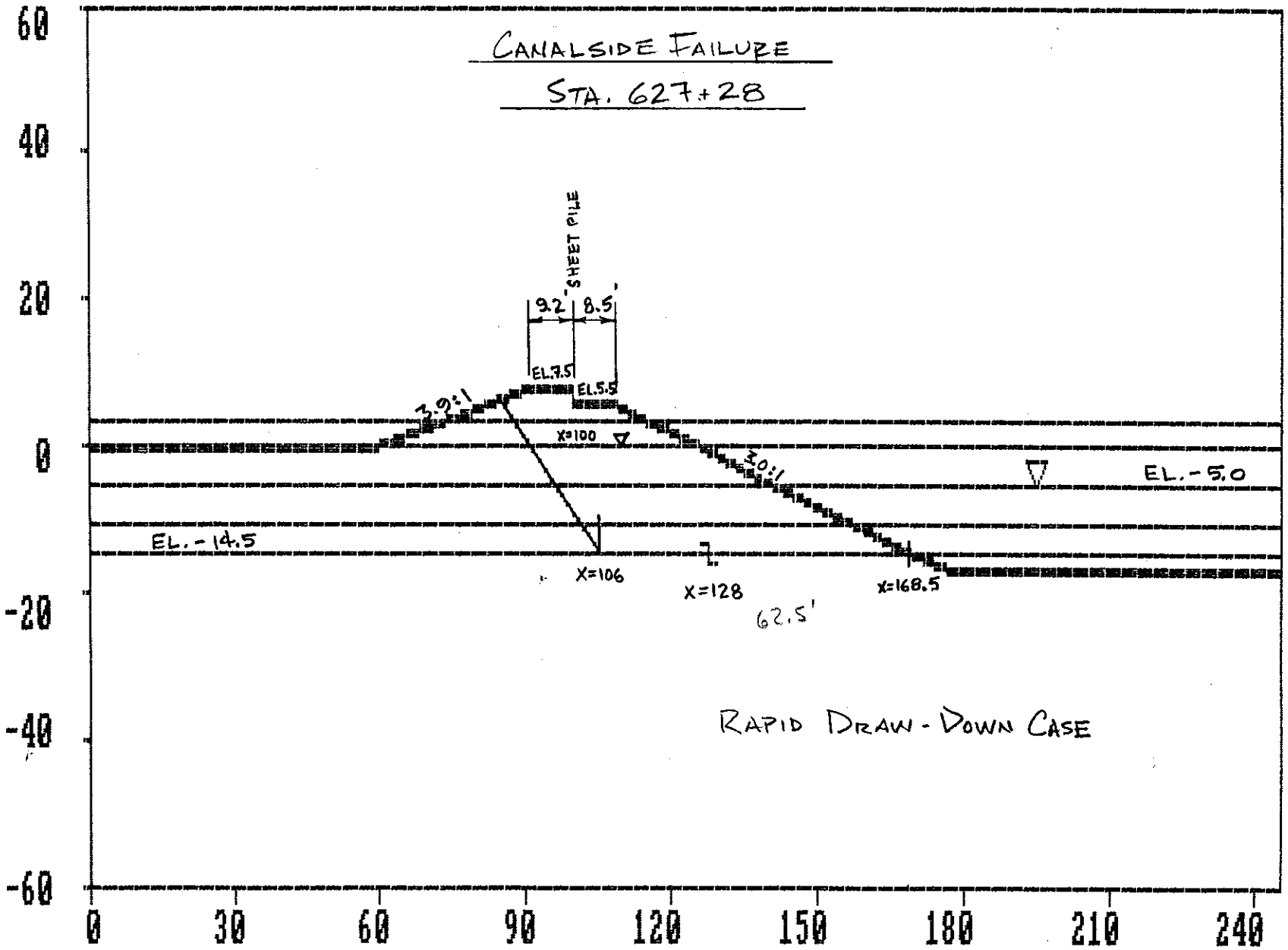
Sheet Pile Analysis :

The following cross-sections were checked to determine the required penetration, design bending moment and maximum deflection :

Canalside Failure - 627+28.
Landside Failure - 632+00 and 634+00.

Required Penetration : -6.3 (Landside Failure 3:1 Ratio; S-Case F.S.=1.38)
Design Bending Moment : 5.3 Ft-K/Ft @ El. 0.8 (Landside Failure 3:1 Ratio; S-Case F.S.=1.38)
Maximum Deflection : In.

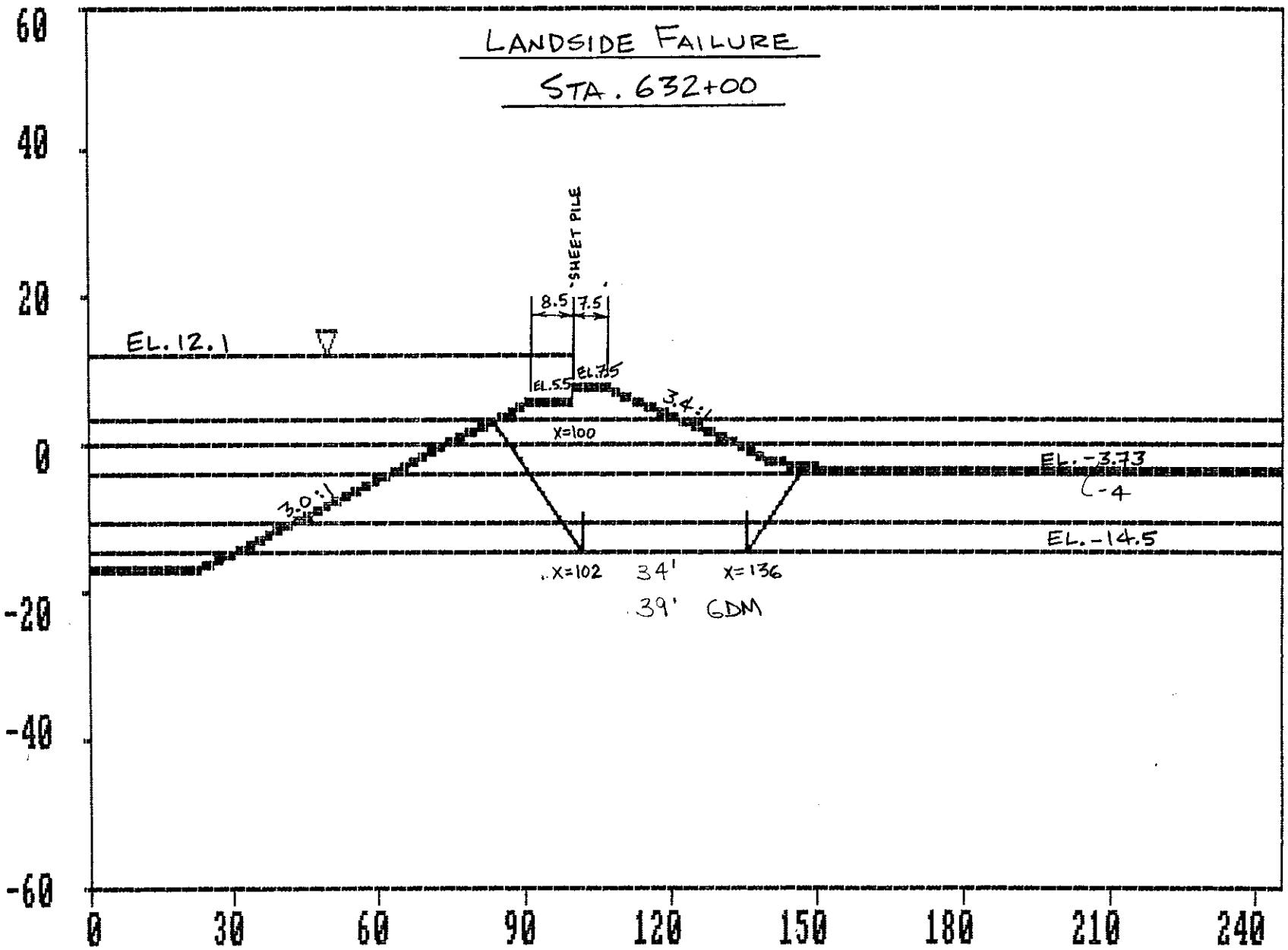
GDM uses EL -4.9 Tip. GDM has I-wall crown width @ 6.5' vs. 6.2' and has flatter back side levee slope.
Using same ground profile as Sta 634 Tip EL -5.45



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{15{,}458 \quad 10{,}633 \quad 0}{14{,}397 + 13{,}448 + 0} = 1.30 \quad 1.24$$

$$21{,}435 - 0$$

$$23{,}875 - 2761 = 21{,}114$$

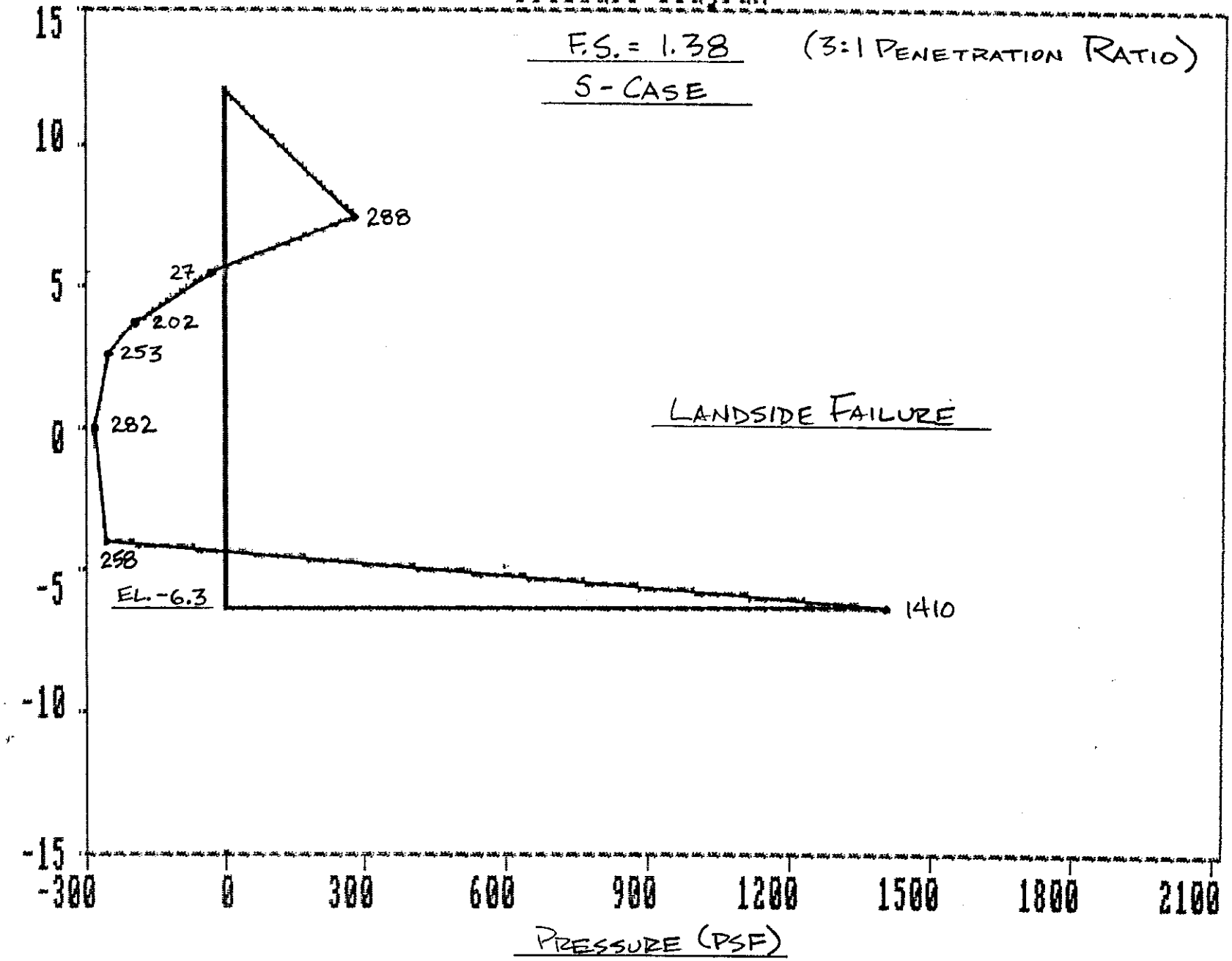


$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{12{,}502 + 12{,}480 + 6349}{11{,}409 + 10{,}880 + 6{,}612} = \frac{}{26{,}207 - 4{,}171 = 22036} = 1.31$$

23,337

Strength Line
Eustis Report
shows 500 psf
to EL -2.0 NOT
EL 0.0

Pressure Diagram



REACH 6
STA. 635+00 TO STA. 643+00

STA.	OFFSET TO EL. 9.5 ON EXISTING BACKSLOPE (FT)	OFFSET TO SHEET PILE (FT)	TOTAL CROWN WIDTH (FT)	EXISTING BACKSLOPE (H : V)	EXISTING LANDSIDE TOE EL.	DIST. FROM TOE TO GROUND EL. (FT)	EXISTING LANDSIDE GROUND EL.
636+00	224.3	213.1	13.2	3.8 : 1	-1.64	10.0	-1.64
638+31	226.6	217.9	10.7	3.9 : 1	-0.64	10.0	-1.54

Revisions to Cross-Section : Realign Sheet Pile

Slope Stability Analysis :

Both cross-sections were checked for failure in each direction to determine the minimum factor of safety.

Canalside Failure - The section at Sta. 638+31 governs.
*** Minimum Factor of Safety = 1.48 *** (Rapid Draw-Down Case)

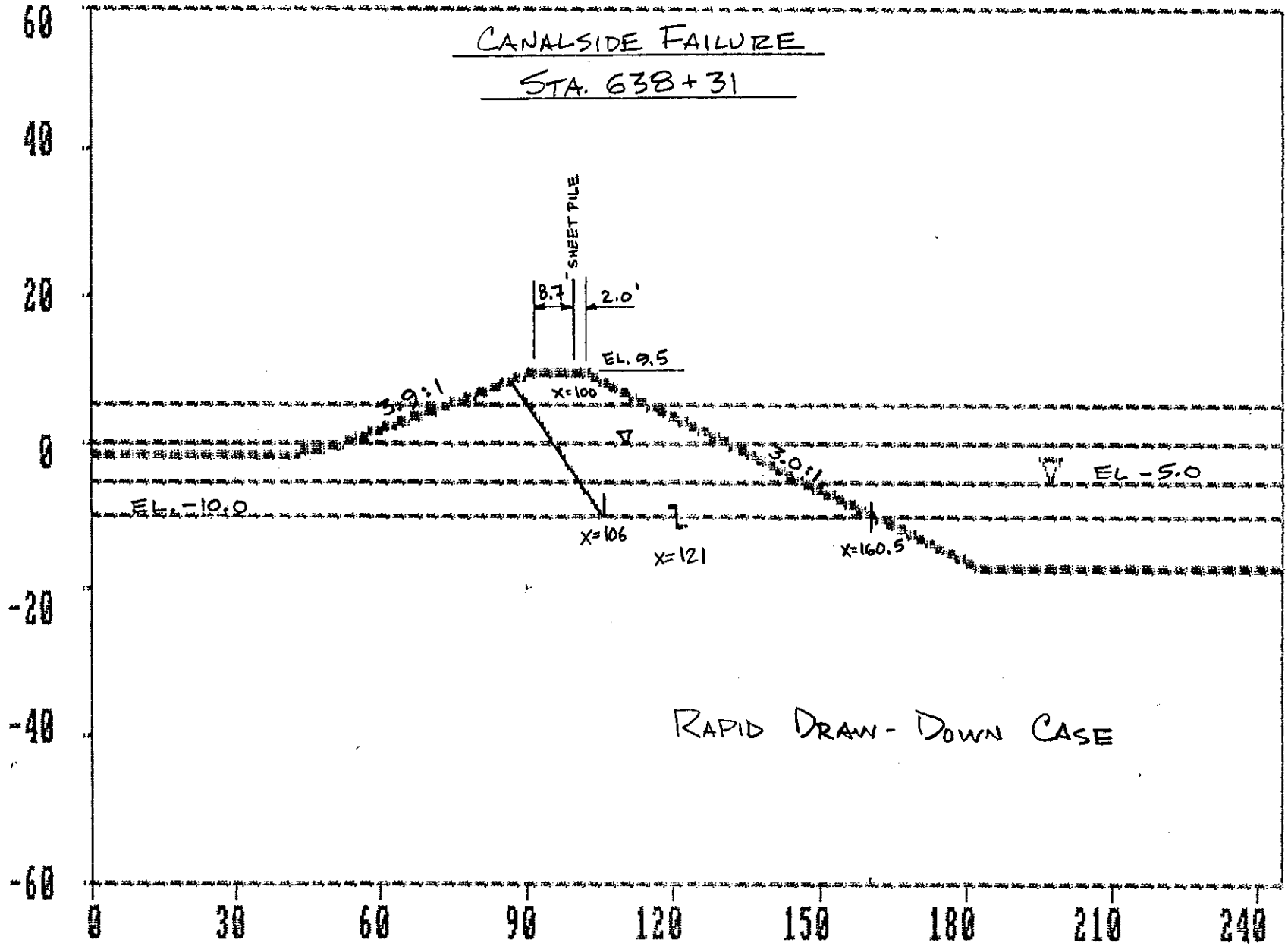
Landside Failure - The section at Sta. 638+31 governs.
*** Minimum Factor of Safety = 2.05 ***

Sheet Pile Analysis :

Required Penetration : 0.0 (Governed by Seepage)
Design Bending Moment : 1.4 Ft-K/Ft @ El. 5.0 (Landside Failure 3:1 Ratio; S-Case F.S.=1.35)
Maximum Deflection :

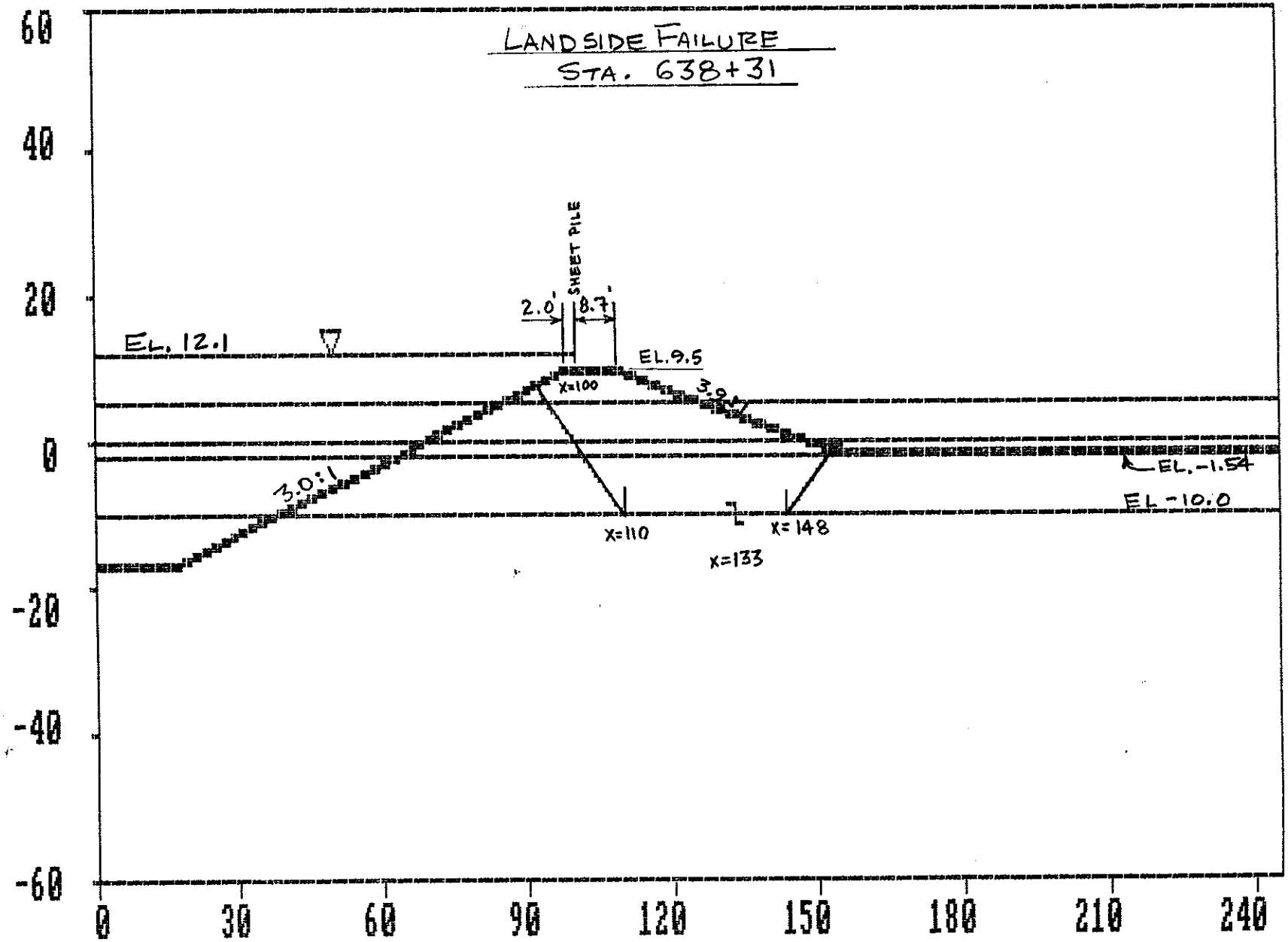
* Total Crown Width Includes 2.0' on Canal Side of Sheet Pile Wall.

OK SAME AS GDM



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{16,064 + 12,119 + 0}{14,969 + 14,078 + 0} = \frac{1.48}{1.48}$$

$$\frac{19,663 - 0}{19,759 - 781 = 18,978}$$

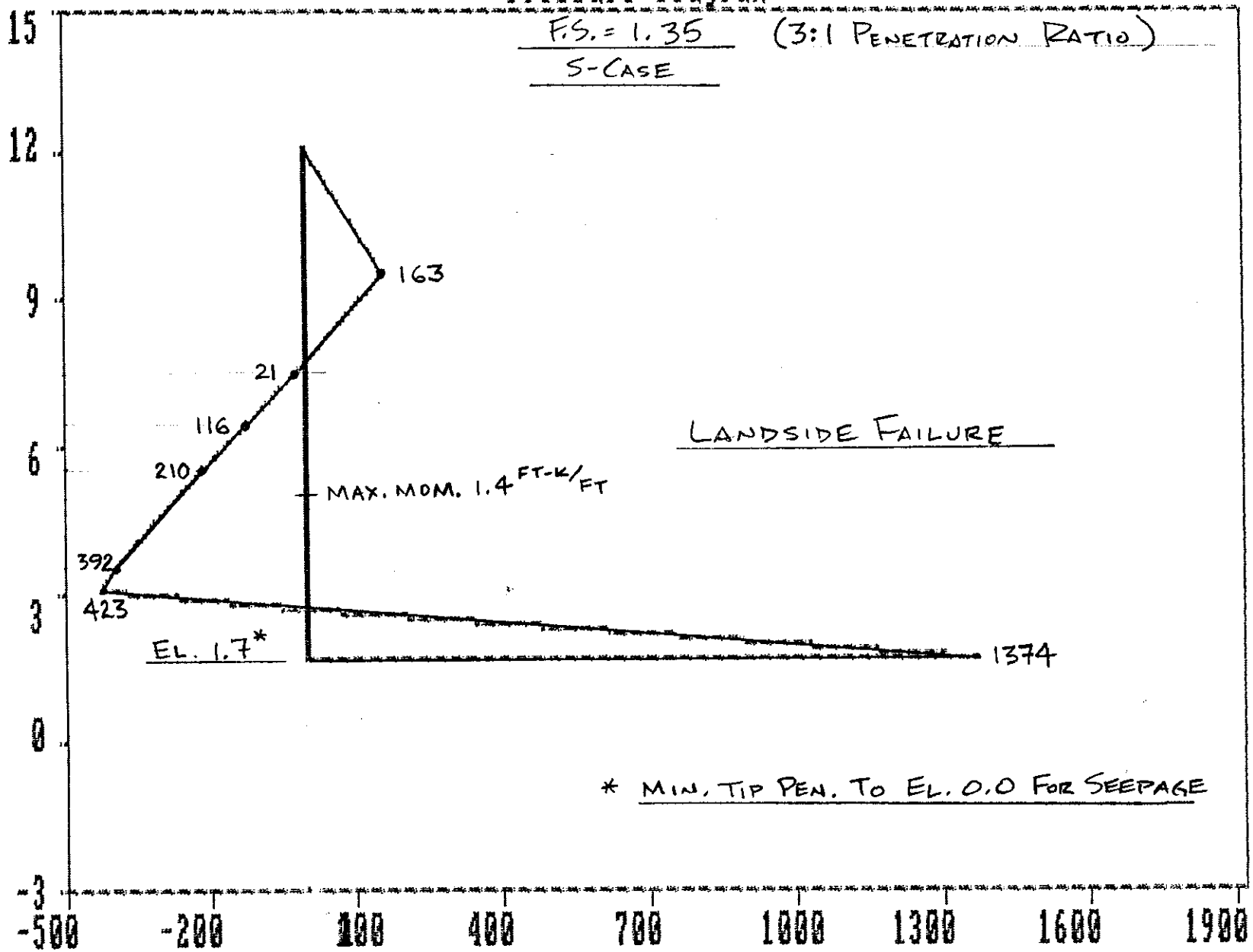


$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{14,230 + 15,699 + 7,110}{20,138 - 2,110} = 2.05$$

Pressure Diagram

F.S. = 1.35 (3:1 Penetration Ratio)

S-Case

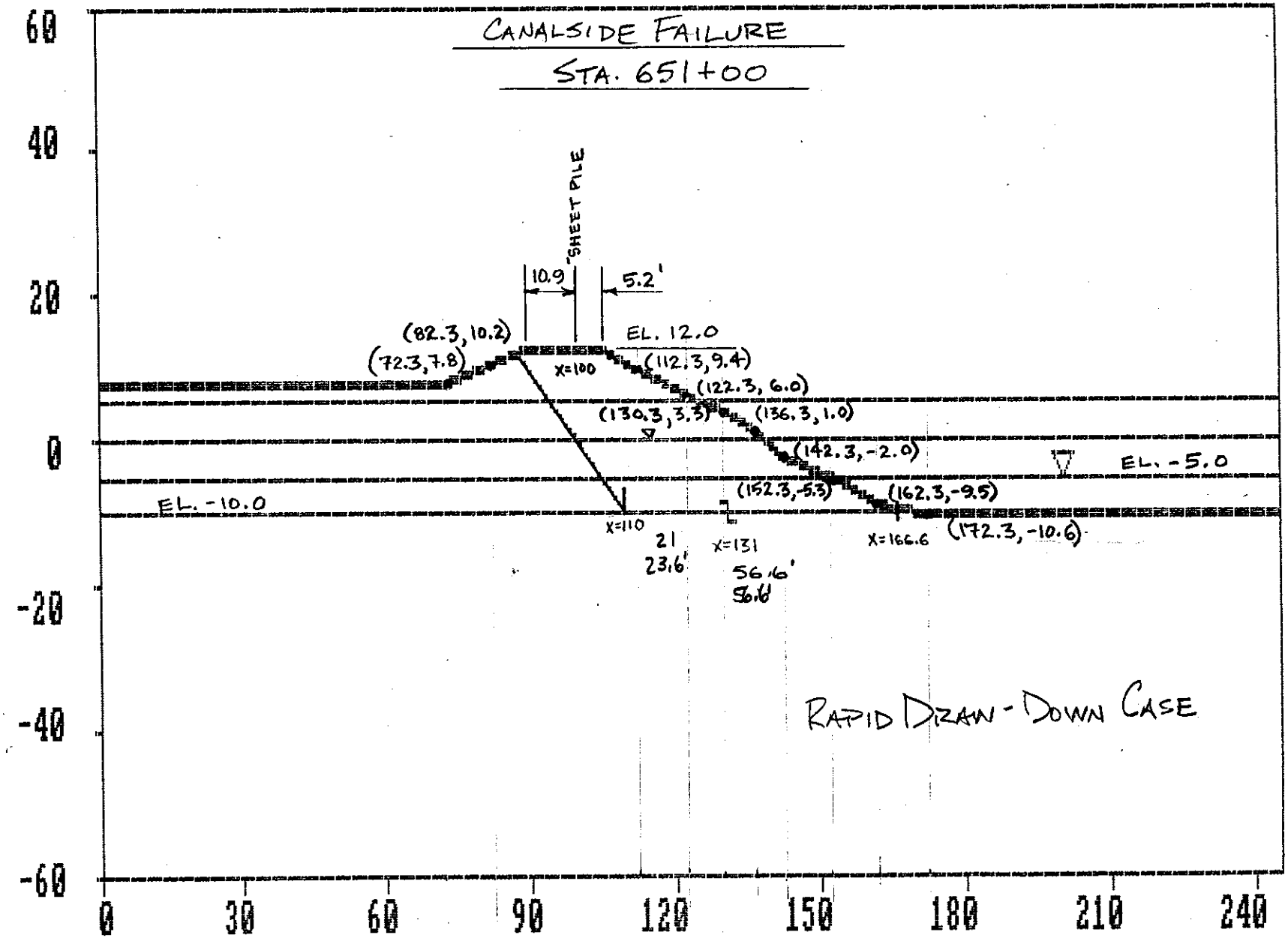


REACH 7 OK SAME AS GDM
STA. 643+00 TO STA. 663+00

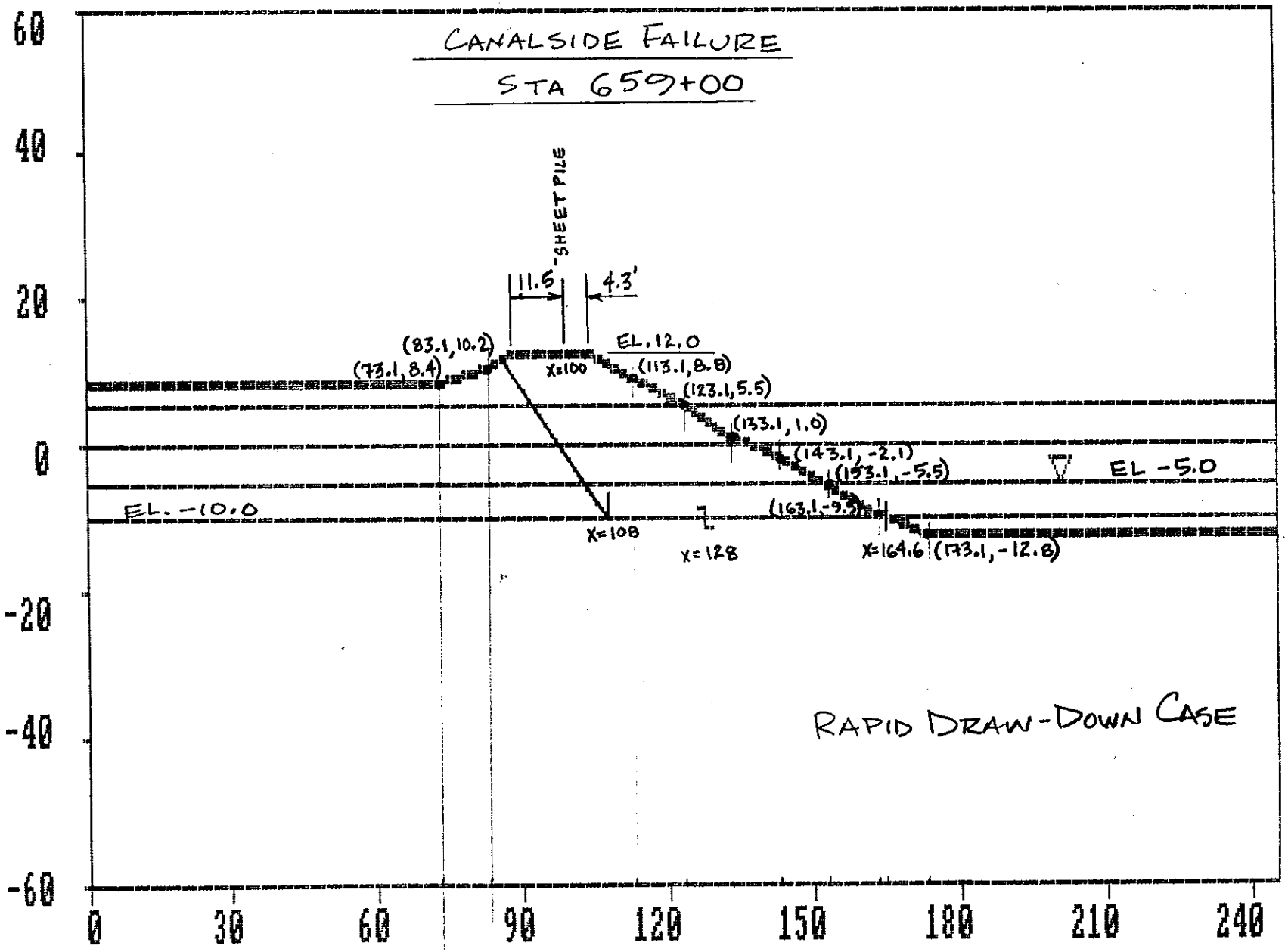
Revisions to Cross-Section : Lower Crown Elevation to El. 12.0
Total Crown Width Increases Accordingly

REACH 8
STA. 663+00 TO STA. 670+00

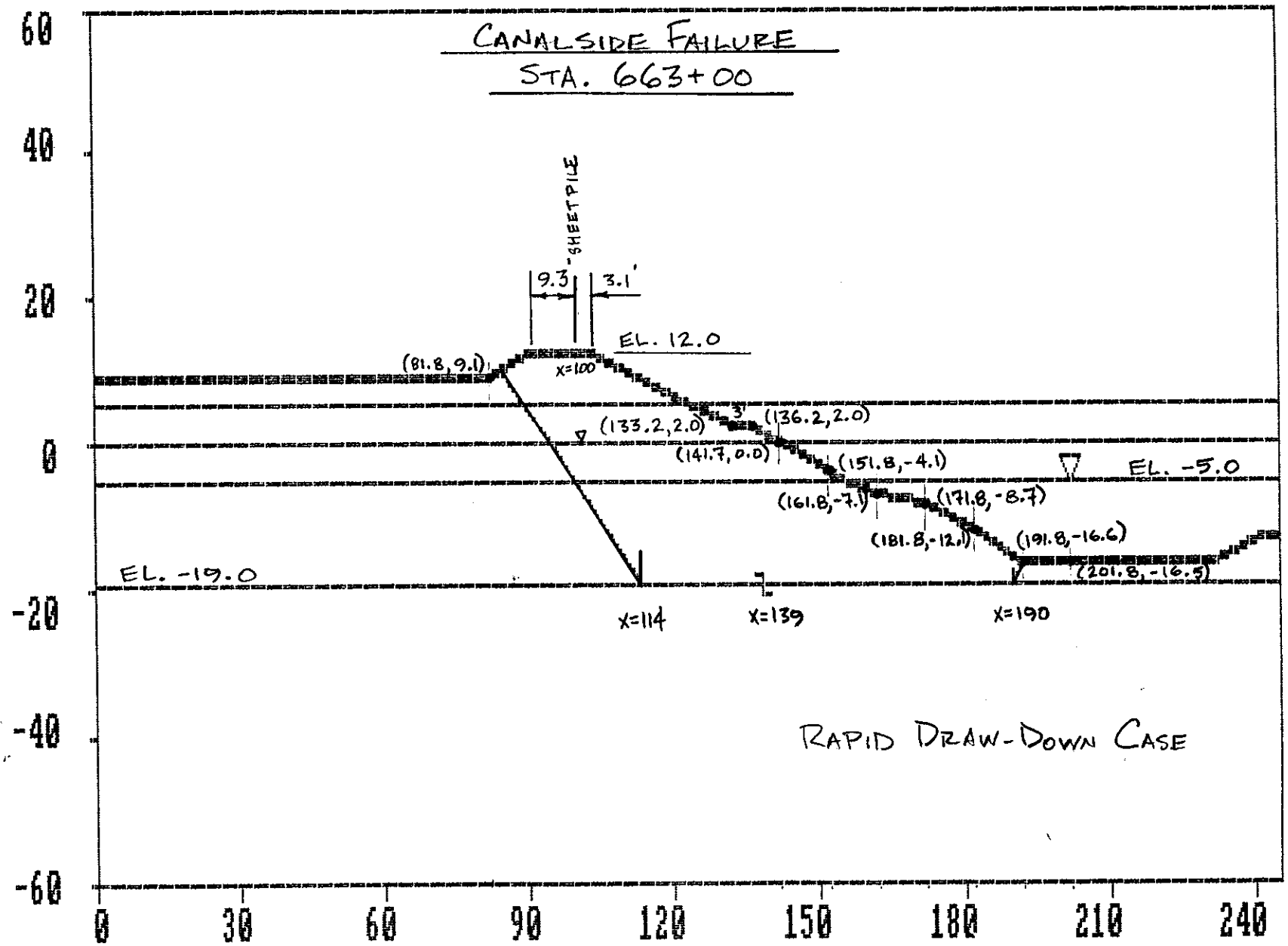
Revisions to Cross-Section : Lower Crown Elevation to El. 12.0
Hold 8.0' Crown Width Behind Sheet Pile Wall
Hold 2.0' Crown Width in Front of Sheet Pile Wall
Step Width Increases Accordingly



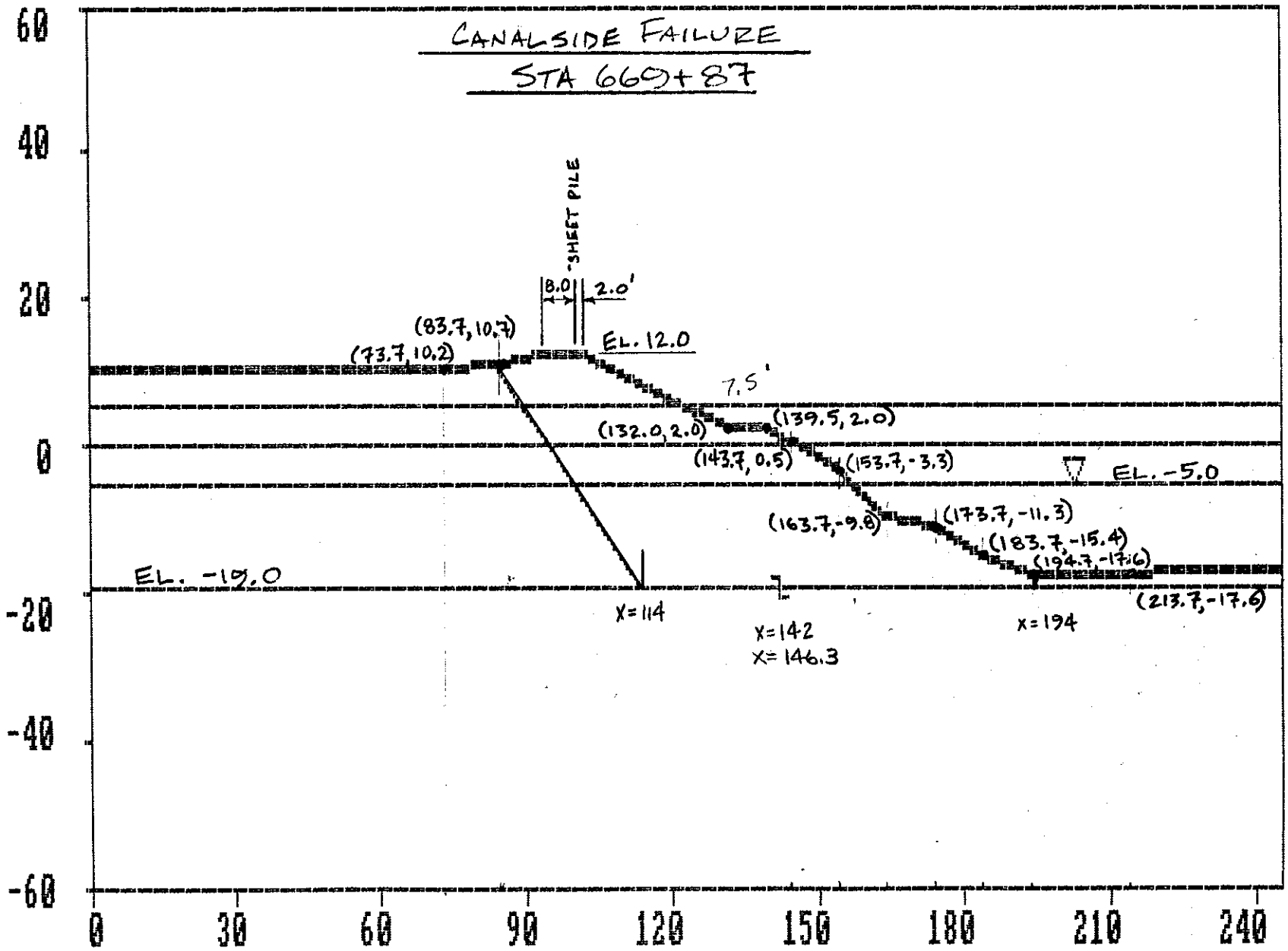
$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\overset{18,084}{19,202} + \overset{15,152}{15,386} + 0}{25,808 - 0} \quad \overset{25,394}{} \quad \overset{1.31}{} = 1.34$$



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{18,723 + 15,821 + 0}{25,928 - 0} = 1.33$$



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{26,282 + 29,018 + 2,263}{44,048 - 158} = 1.31$$



$$F.S. = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{26{,}980 + 29{,}068 + 1{,}818}{43{,}499 - 44} = \frac{26{,}982 + 28{,}224 + 1{,}306}{43{,}455} = 1.30$$

26,980 + 29,068 + 1,818 = 57,866
26,982 + 28,224 + 1,306 = 56,512
43,499 − 44 = 43,455
43,681
43,223