

JUL 10 1989

A000092

17TH STREET CANAL - PHASE 1B

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HAMMOND HIGHWAY TO SOUTHERN RAILWAY  
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The following revised slope stability and sheet pile design calculations address all comments made in the Corps' letter of April 25, 1989. A brief description of the revisions made to the cross-sections since the last submittal of April 10, 1989, is given for each of the eight reaches. Also given for each of the reaches is a listing of new submittals, stating which of the Corps' comments were addressed.

In a previous submittal of September 21, 1988, pressure diagrams for the Q-case, factor of safety = 1.0 were given in the report prepared by Eustis Engineering dated 31 August 1988. The maximum deflection calculated for the reaches using PZ 22 sheet pile was 0.56", and for the reaches using PMA 22 sheet pile was 0.75". Although there has been a 0.5' drop in the step elevation for the cross-sections which generated the maximum PZ 22 deflection of 0.56", it is obvious the this change will not increase the deflection to more than the allowable 1 1/2". The maximum deflection for the PMA 22 of 0.75" is still valid.

REACH 1

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Revisions :

1. Entire sheet pile wall moved 0.5' closer to the canal thus increasing the crown width 0.5' along the entire reach.
2. Step elevation lowered from El. 2.0 to El. 1.5.

Submittals :

1. New canalside stability analyses taking into account the above revisions and the correction to the soil shear strength from El. 0.0 to El. -2.0.
2. New landside stability analyses taking into account the above revisions and including calculations at El. -20.5.
2. New sheet pile analyses taking into account the above revisions and the submerged canalside soil weight.

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	218.5	9.0	3.1 : 1	-1.77 (31.5)	10.0 41.5	-2.17
556+00	219.6	209.9	9.7	2.9 : 1	-2.37 (32.5)	10.0	-3.27 42.5
558+00	219.8	209.3	10.5	3.1 : 1	-3.04	10.0	-3.24
560+00	218.2	208.7	9.5	3.0 : 1	-3.64 36.9	10.0	-4.04 → 46.9 *
562+00	216.9	208.0	8.9	4.4 : 1	-2.43 (43.8)	10.0	-3.59 → 53.8
564+00	221.4	207.8	13.6	3.6 : 1	-2.03 (40.7)	7.3	-2.03 48
566+00 (X Pt.)	219.3	207.8	11.5	3.8 : 1	-0.43 (34.0)	10.0	-1.44 44
568+00	218.4	207.7	10.7	3.5 : 1	-3.32 (41.6)	10.0	-3.62 51.5

Cross-Section Geometry :      Crown El. 5.5      Crown Width Varies  
   Step El. 1.5      Step Width = 12.0'

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 = 1.32 at El. -36.5 \*\*\*

Landside Failure - 554+00, 556+00, 560+00 and 562+00. The section at Sta. 560+00 governs.  
\*\*\* Minimum Factor of Safety = 1.30 at El. -20.5 \*\*\*

Sheet Pile Analysis :

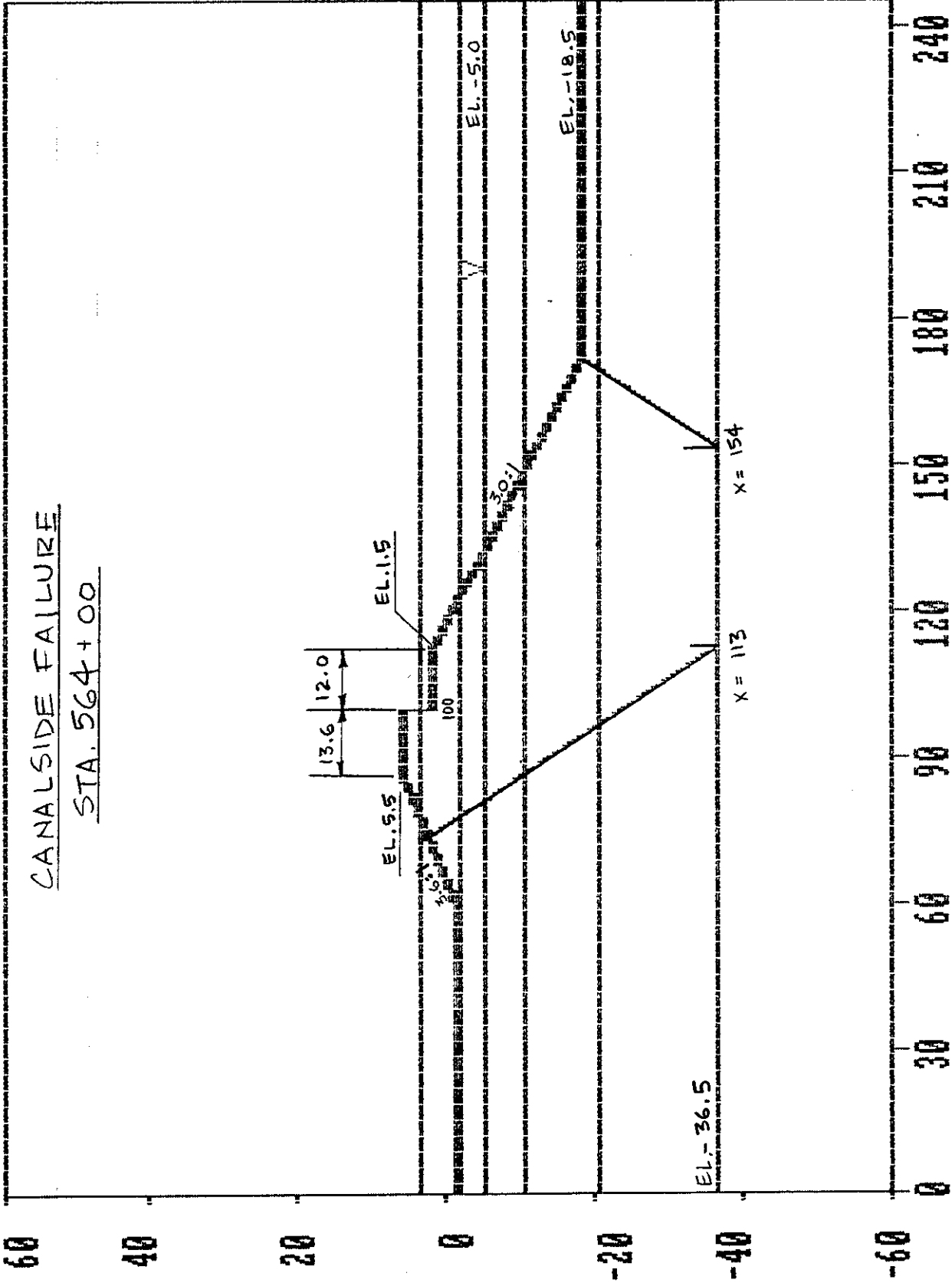
The following cross-sections were checked to determine the required penetration, design bending moment and maximum deflection :

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. = 1.37)  
Design Bending Moment : 11.9 Ft-K/Ft @ El. -2.9      (Landside Failure 3:1 Ratio; S-Case F.S. = 1.37)

CANALSIDE FAILURE

STA. 564+00

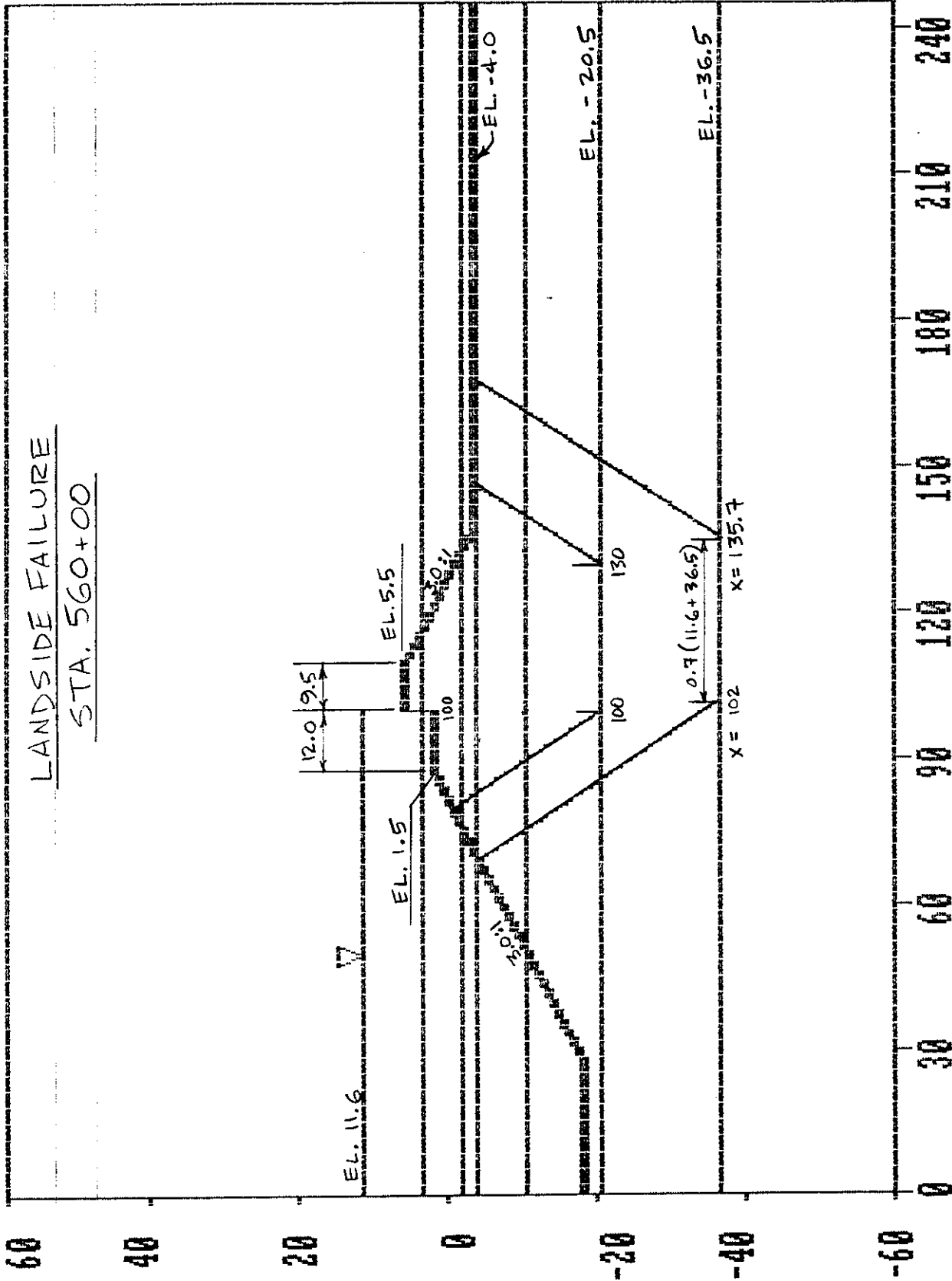


ELEV.	RA	RB	RF	DA	DP	F.S.
-36.5	27,668	15,580	13,640	82,429	39,344	1.32

1.2965  
1.2946

# LANDSIDE FAILURE

STA. 560+00

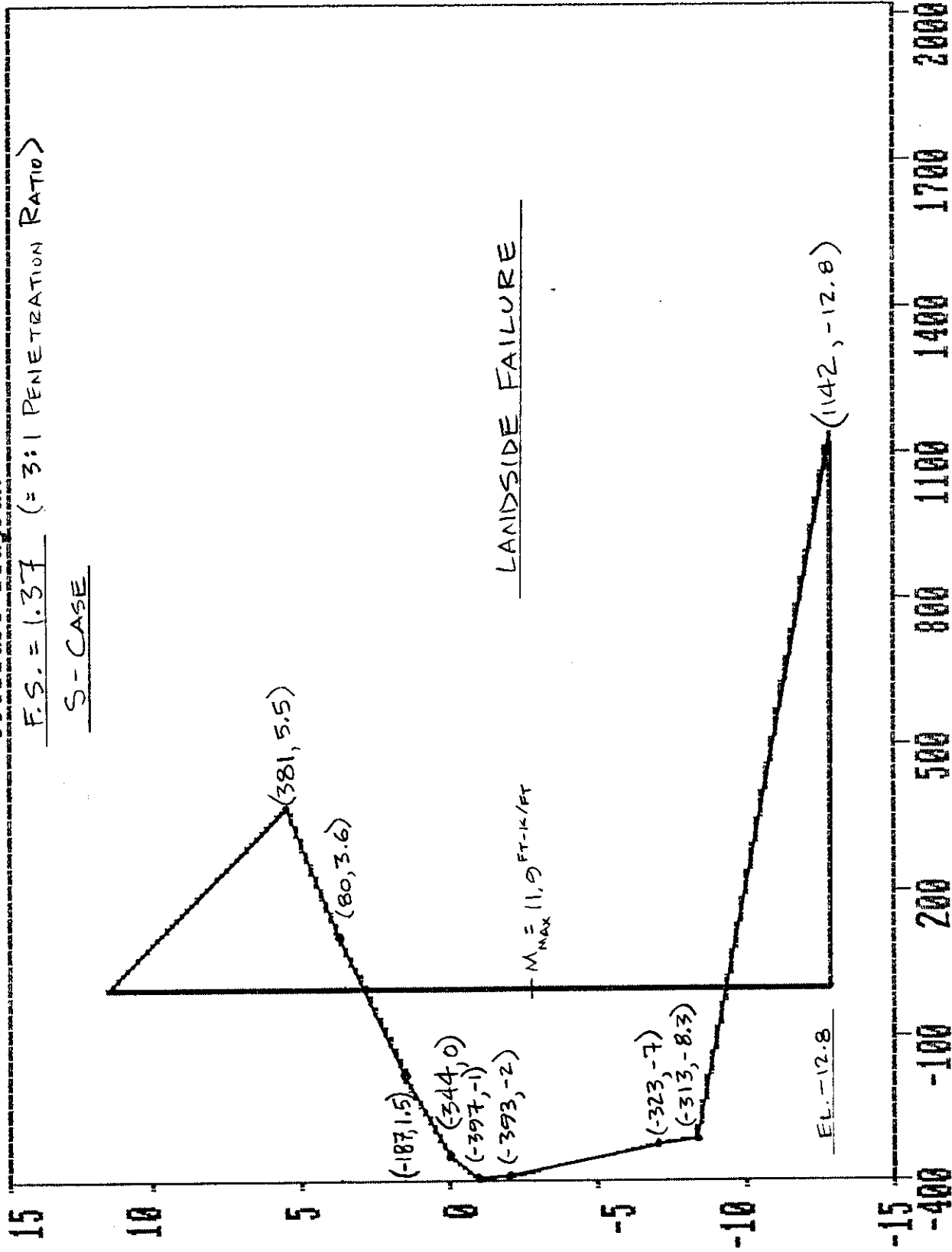


ELEV.	R <sub>A</sub>	R <sub>B</sub>	R <sub>P</sub>	D <sub>A</sub>	D <sub>P</sub>	F.S.
-20.5	12,361	11,400	10,228	41,468	15,263	1.30
-36.5	22,118	12,806	22,379	97,819	54,159	1.31

# Pressure Diagram

F.S. = 1.37 (= 3:1 PENETRATION RATIO)

S-CASE



**REACH 2**

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**Revisions :**

1. Entire sheet pile wall moved 0.5' closer to the canal thus increasing the crown width 0.5' along the entire reach.
2. Step elevation lowered from El. 2.0 to El. 1.5.
3. Step width increased from 9.0' to 12.0'.

**Submittals :**

1. New canalside stability analyses taking into account the above revisions and the correction to the soil shear strength from El. 0.0 to El. -2.0.
2. New landside stability analyses taking into account the above revisions and including calculations at El. -20.5.
2. New sheet pile analyses taking into account the above revisions and the submerged canalside soil weight.

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	207.7	18.7	3.5 : 1	-3.32	18.0	-3.62
570+00	220.5	207.6	12.9	4.2 : 1	-1.01 (38.1)	18.0	-1.77 48.1
572+00	219.1	207.4	11.7	3.6 : 1	-1.06	18.0	-1.48
574+00	218.8	207.3	11.5	3.1 : 1	-2.00	18.0	-2.18
576+00	216.9	207.2	9.7	3.0 : 1	-3.79 (37.6)	6.0	-3.99 43.6
578+00	220.7	211.2	9.5	3.1 : 1	-2.79 (35.2)	18.0	-2.99 45.2
580+00	225.9	216.1	9.8	3.1 : 1	-2.57	18.0	-2.67
582+00	231.4	220.9	10.5	2.9 : 1	-1.97	18.0	-2.37
584+00	235.6	225.8	9.8	2.6 : 1	-2.46 (30.5)	18.0	-2.86 40.5
586+00	242.1	230.7	11.4	2.9 : 1	-1.56	2.0	-1.96
588+00	245.8	235.4	10.4	2.5 : 1	-2.44 (30.25)	18.3	-2.64 40.55

Cross-Section Geometry : Crown El. 5.5      Crown Width Varies  
Step El. 1.5      Step Width = 12.0'

Slope Stability Analysis :

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

Canalside Failure - 570+00.

\*\*\* Minimum Factor of Safety = 1.35 at El. -34.0 \*\*\*

Landside Failure - 576+00, 578+00, 584+00 and 588+00. The section at Sta. 576+00 governs.

\*\*\* Minimum Factor of Safety = 1.30 at El. -34.0 \*\*\*

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.

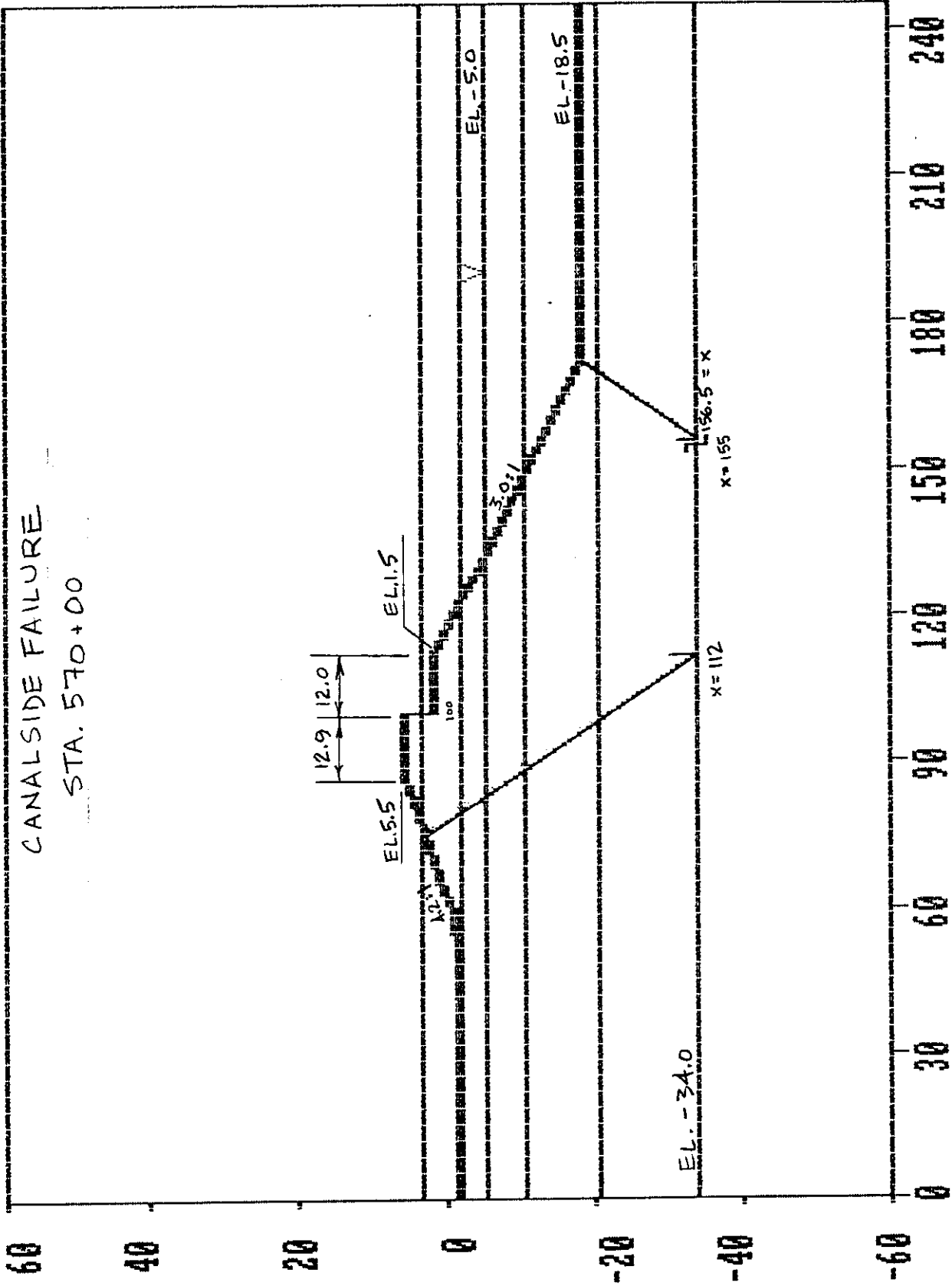
Required Penetration : -12.0 (Landside Failure 3:1 Ratio; S-Case F.S. = 1.39)

Design Bending Moment : 12.0 Ft-K/Ft @ El. -2.0 (Landside Failure 3:1 Ratio; S-Case F.S. = 1.39)



CANALSIDE FAILURE

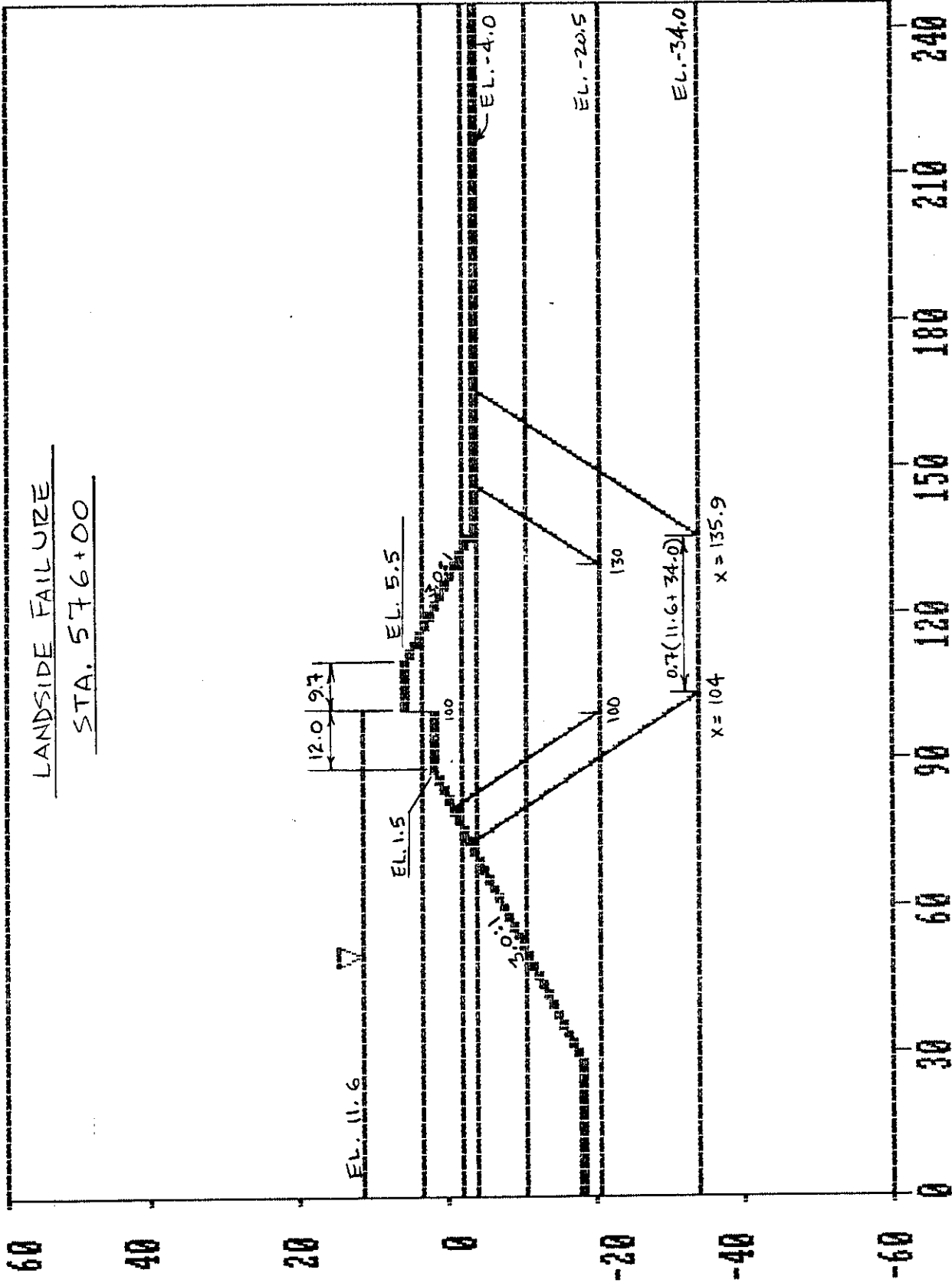
STA. 570+00



ELEV	RA	RB	RF	DA	DF	F.S.
-34.0	26,316	16,899	11,740	73,032	32,469	1.35

LANDSIDE FAILURE

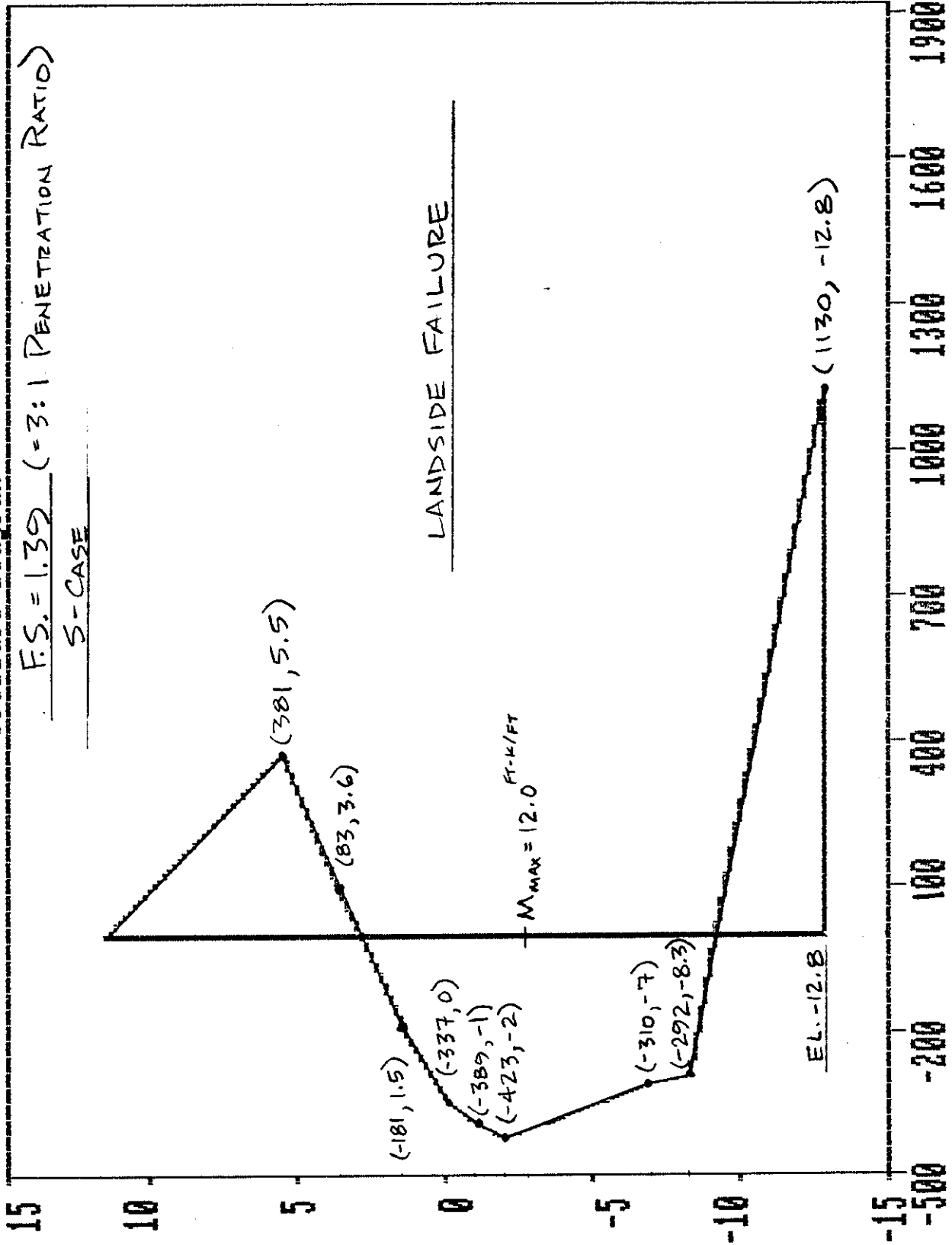
STA. 576+00



ELEV.	RA	RB	RP	DA	DP	F.S.
-20.5	12,361	11,400	10,247	41,468	15,243	1.30
-34.0	20,854	12,122	20,506	87,514	46,254	1.30

# Pressure Diagram

F.S. = 1.39 ( = 3:1 PENETRATION RATIO )  
5-CASE



### REACH 3

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#### Revisions :

1. Entire sheet pile wall moved 0.5' closer to the canal thus increasing the crown width 0.5' along the entire reach.
2. Step elevation lowered from El. 2.0 to El. 1.5.
3. Step width increased from 9.0' to 12.0'.
4. Add 6" of fill from the levee toe to a distance 30' from the levee toe in the vacant lot referenced.

#### Submittals :

1. New canalside stability analyses taking into account the above revisions and the correction to the soil shear strength from El. 0.0 to El. -2.0.
2. New landside stability analyses taking into account the above revisions and including calculations at El. -10.5 and El. -20.5.
2. New sheet pile analyses taking into account the above revisions and the submerged canalside soil weight.

#### Note :

Reach 3 landside stability analysis at El. -32.0 with the active wedge at x=110 and the passive wedge at x=140.5 does yield a lower factor of safety than with the wedges at x=111 and 144.5 respectively, as previously submitted. However, it has since been discovered, that placing the active wedge at x=103 and the passive wedge at x=133.5 yields the lowest factor of safety. Therefore these calculations are being submitted in lieu of the requested location.

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	239.0	9.6	2.5 : 1	-2.34	9.8	-2.64
592+00	252.6	242.5	10.1	2.7 : 1	-2.59	10.0	-2.99
594+00	258.5	241.0	9.5	1.8 : 1	-1.29	(21.7) 16.5	-1.79 38.2
596+00	258.5	239.3	11.2	2.4 : 1	-2.11	9.9	-1.81
598+00	249.3	237.6	11.7	3.0 : 1	-3.01	9.9	-3.41
600+00	246.9	235.9	11.0	3.1 : 1	-2.87	9.5	-3.77
602+00	244.4	234.2	10.2	3.1 : 1	-1.97	8.2	-2.47
604+00 (X Pt.)	243.9	232.5	11.4	2.7 : 1	-3.96	10.0	-4.26
606+00	241.8	230.9	10.9	2.7 : 1	-2.86	10.0	-3.56
608+00	243.2	229.3	13.9	3.2 : 1	-2.10	9.9	-3.20
610+00	242.4	228.6	13.8	3.1 : 1	-1.40	10.0	-2.20
612+00	244.0	227.9	16.1	3.6 : 1	-0.89	(39.1) 10.0	-2.09 49.1
614+00	242.0	227.2	14.8	3.6 : 1	-0.79	11.5	-2.49

Cross-Section Geometry : Crown El. 5.5      Crown Width Varies  
Step El. 1.5      Step Width = 12.0'

Slope Stability Analysis :

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

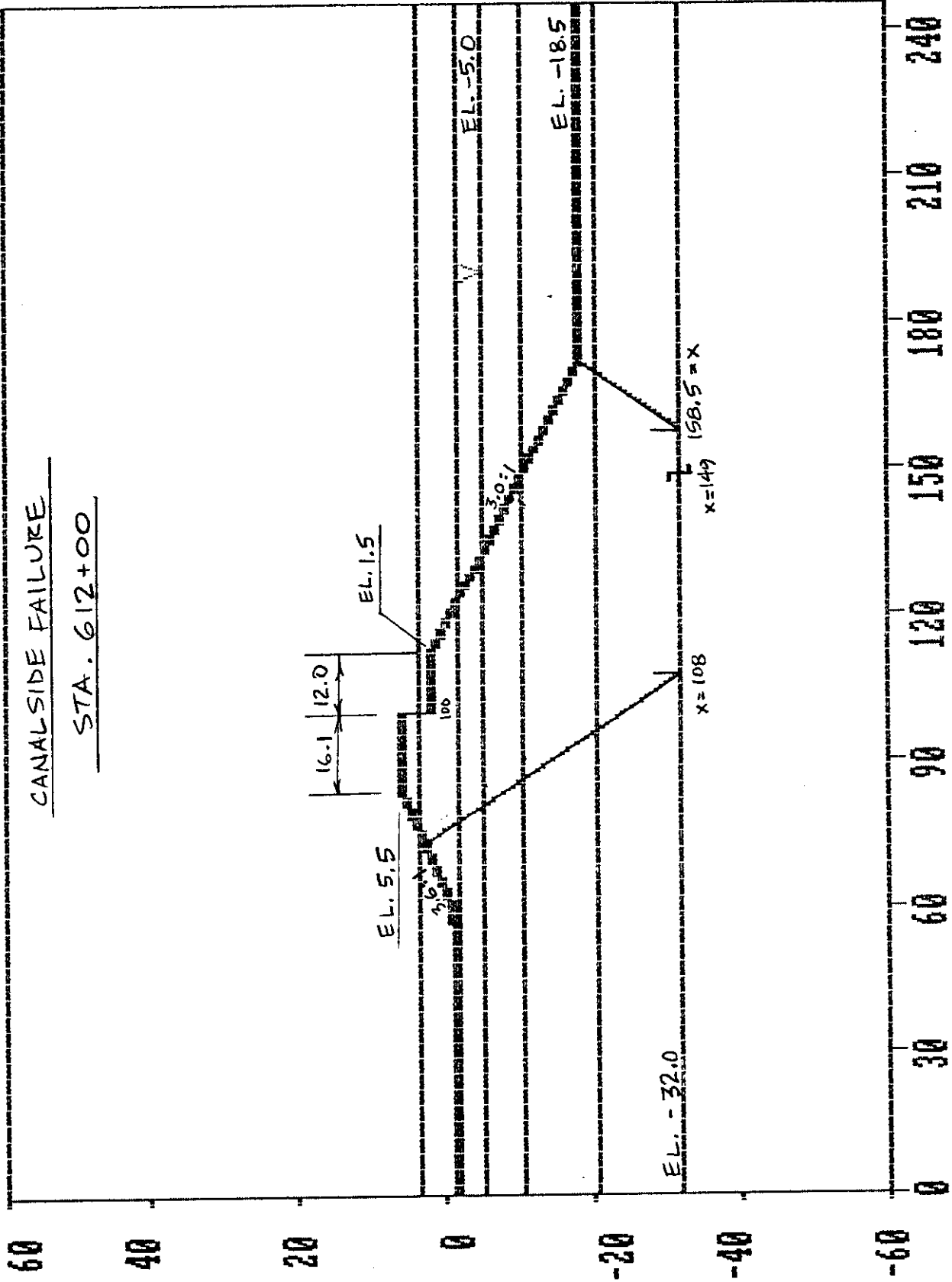
Canalside Failure - 612+00.      \*\*\* Minimum Factor of Safety = 1.36 at El. -32.0 \*\*\*

Landside Failure - 598+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 at El. -20.5 \*\*\*

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.

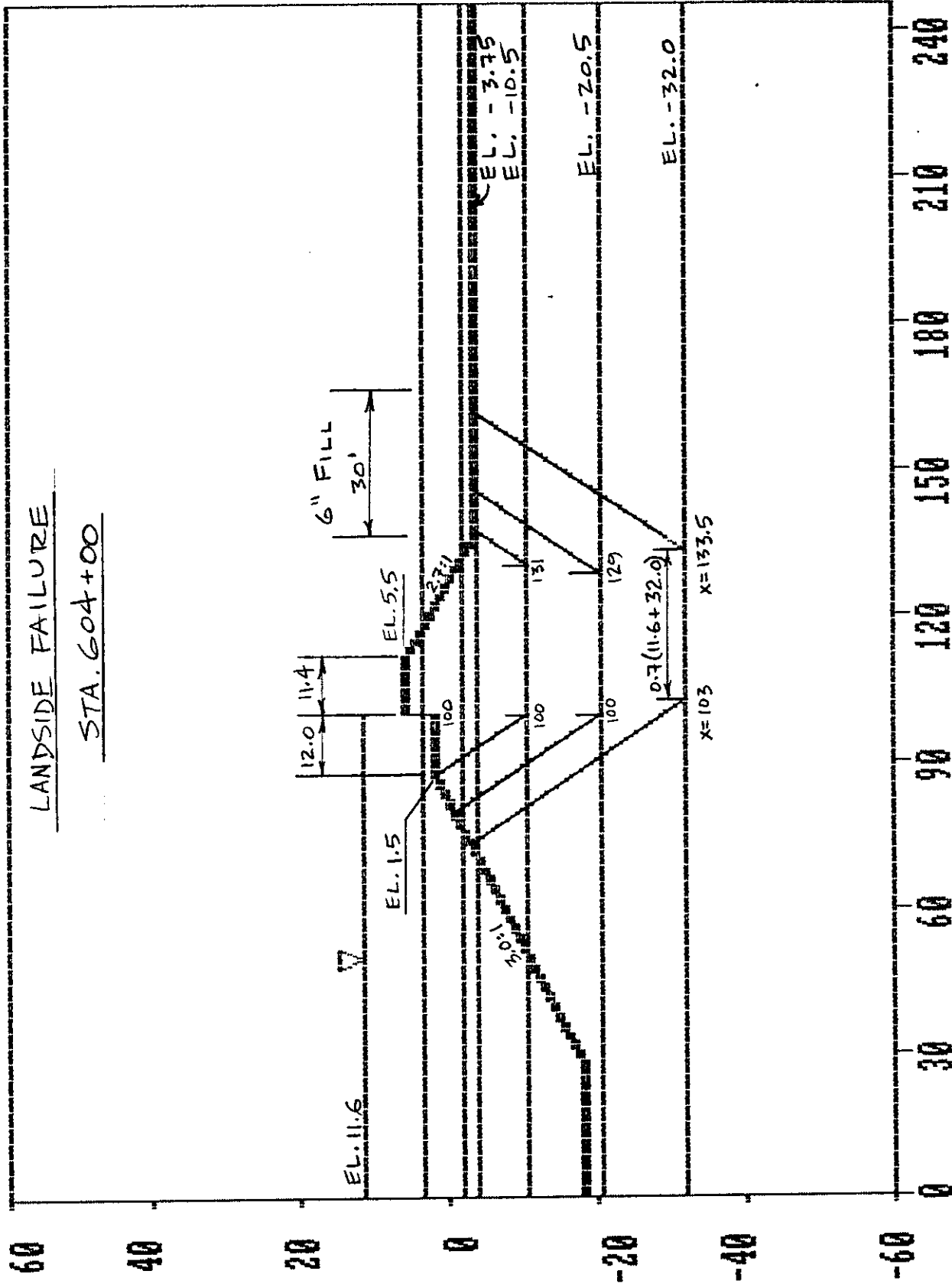
Required Penetration : -12.8      (Landside Failure 3:1 Ratio; S-Case F.S.=1.33)  
Design Bending Moment : 11.6 Ft-K/Ft @ El. -2.5      (Landside Failure 3:1 Ratio; S-Case F.S.=1.33)



ELEV.	RA	RB	RP	DA	DP	F.S.
-32.0	24,681	18,864	10,220	66,914	27,479	1.36

LANDSIDE FAILURE

STA. 604+00

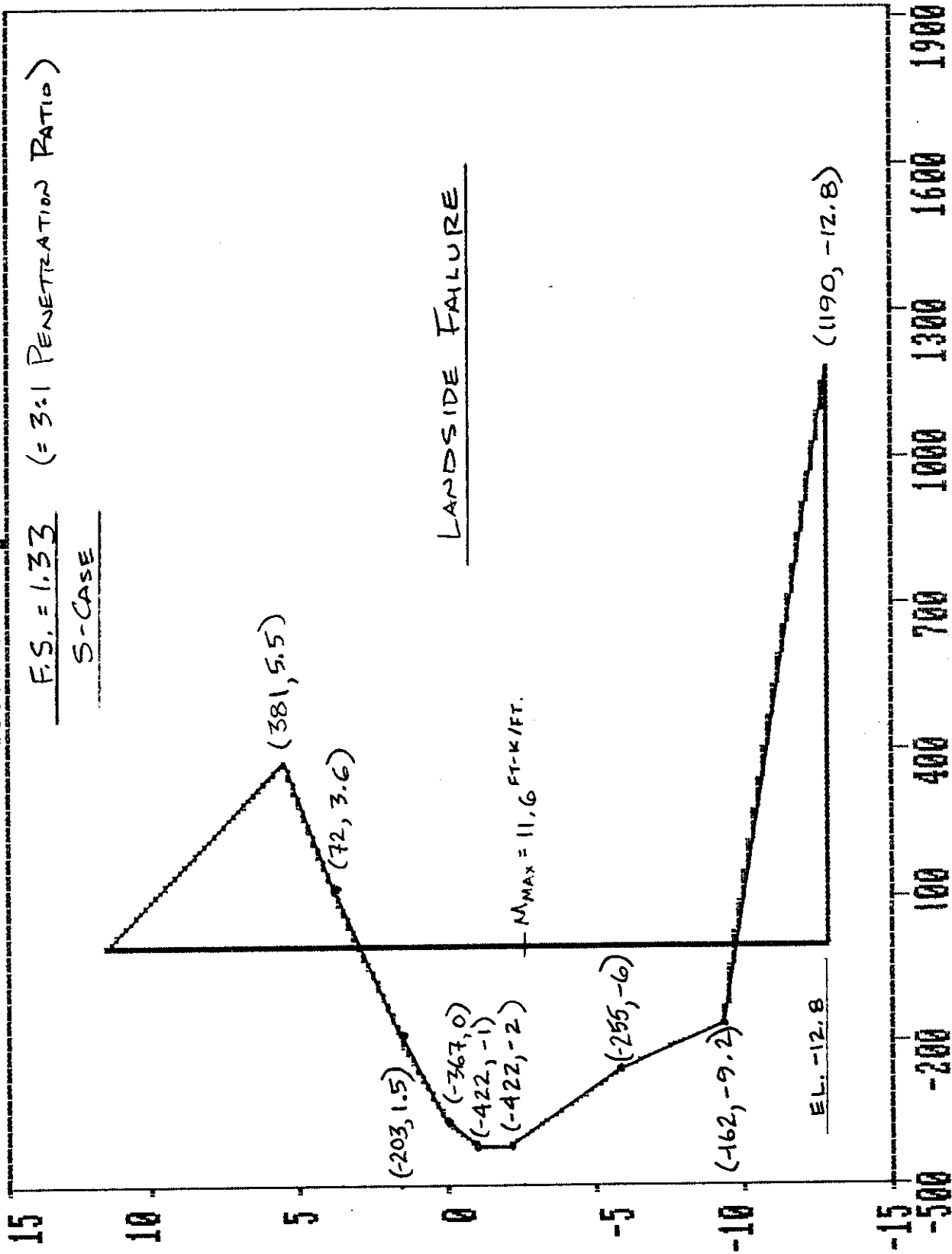


ELEV.	R <sub>A</sub>	R <sub>B</sub>	R <sub>P</sub>	D <sub>A</sub>	D <sub>P</sub>	F.S.
-10.5	8,260	8,680	3,780	18,163	2,906	1.36
-20.5	12,361	11,020	10,381	41,468	15,498	1.30
-32.0	19,471	11,590	19,121	79,600	41,063	1.30

# Pressure Diagram

F.S. = 1.33 (= 3:1 PENETRATION RATIO)

S-CASE





REACH 4 ✓  
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Revisions :

1. Entire sheet pile wall moved 0.5' closer to the canal thus increasing the crown width 0.5' along the entire reach.
2. Crown elevation lowered from El. 7.0 to El. 6.5 thus increasing the crown width an additional amount which depends on the backslope at each station.
3. Step elevation lowered from 3.6 to 3.5.
4. Step width increased from 9.0' to 12.0'.

Submittals :

1. New canalside stability analyses taking into account the above revisions, the correction to the soil shear strength from El. 0.0 to El. -2.0, and the piezometric headline of El. -2.4 in the sand.
2. New landside stability analyses taking into account the above revisions.
3. New sheet pile analyses taking into account the above revisions and the submerged canalside soil weight.

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

STA.	OFFSET TO EL. 6.5 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.
614+00	<del>236.8</del> 238.4	227.2	11.2	3.6 : 1	-0.79 (37.4)	11.5	48.9 -2.49
616+00	<del>232.9</del> 235.5	226.5	9.0	3.9 : 1	-0.55 (36.5)	10.0	46.5 -1.65
618+00	<del>234.2</del> 235.8	225.8	10.0	3.4 : 1	-1.25 (36.4)	10.0	46.4 -3.05
620+00	<del>234.3</del> 235.9	225.0	10.9	3.2 : 1	-2.62	10.0	-3.12
622+00	<del>233.3</del> 234.9	224.3	10.6	3.1 : 1	-2.62 (38.9)	10.2	49.1 -3.02
624+27	<del>232.1</del> 233.7	223.5	10.2	3.3 : 1	-1.52 (36.7)	14.5	51.2 -2.62

Cross-Section Geometry :      Crown El. 6.5      Crown Width Varies  
    Step El. 3.5      Step Width = 12.0'

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 = 1.30 at El. -23.5 \*\*\*

Landside Failure - 616+00, 618+00, 620+00, 622+00 and 624+27. The section at Sta. 622+00 governs.  
    \*\*\* Minimum Factor of Safety = 1.37 at El. -23.5 \*\*\*

Sheet Pile Analysis :

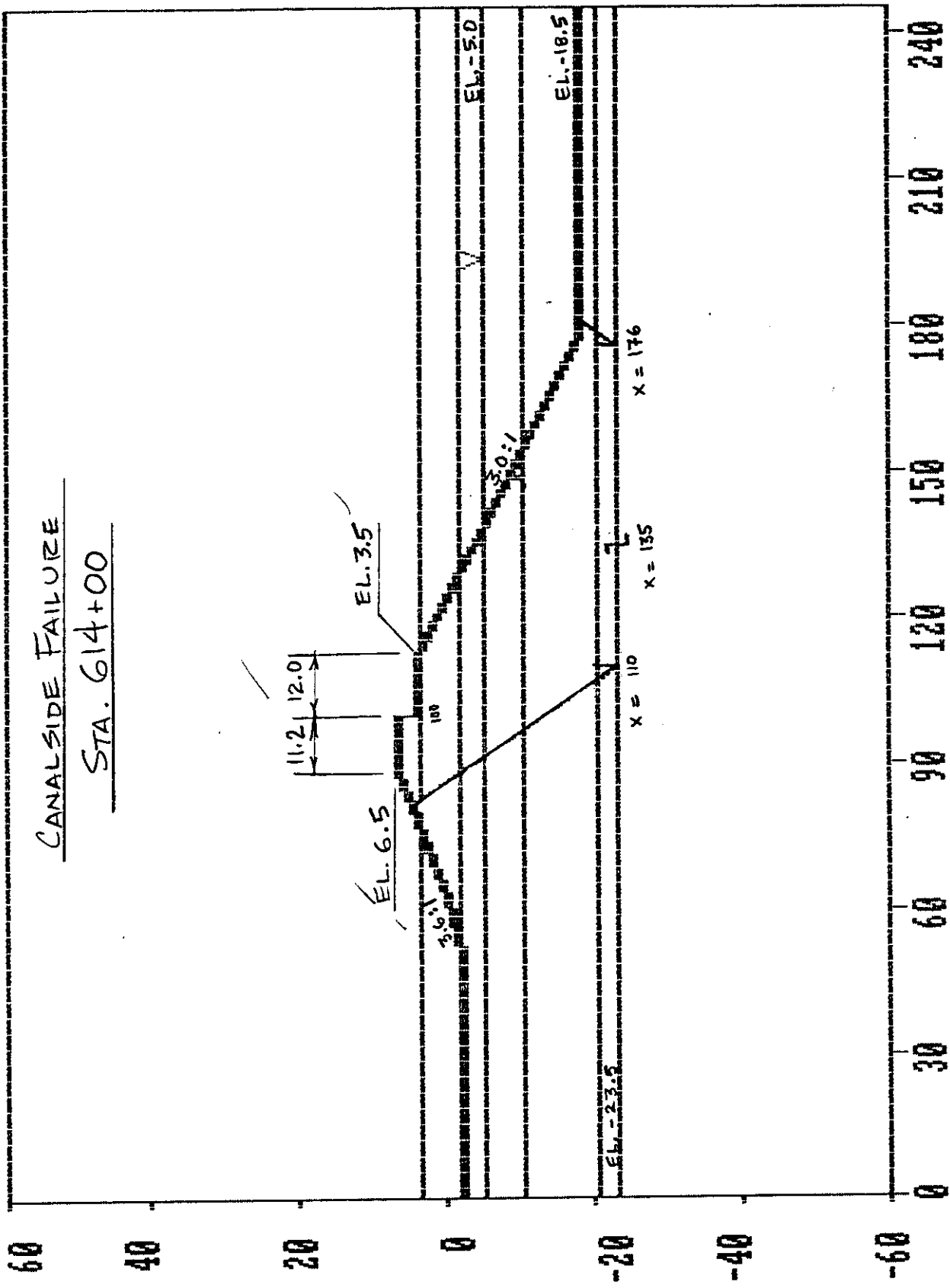
The following cross-sections were checked to determine the required penetration, design bending moment and maximum deflection :

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

Required Penetration : -7.7      (Landside Failure Sta. 616+00; S-Case F.S.=1.5)  
 Design Bending Moment : 7.0 Ft-K/Ft @ El. -0.2      (Landside Failure Sta. 616+00; S-Case F.S.=1.5)

CANALSIDE FAILURE

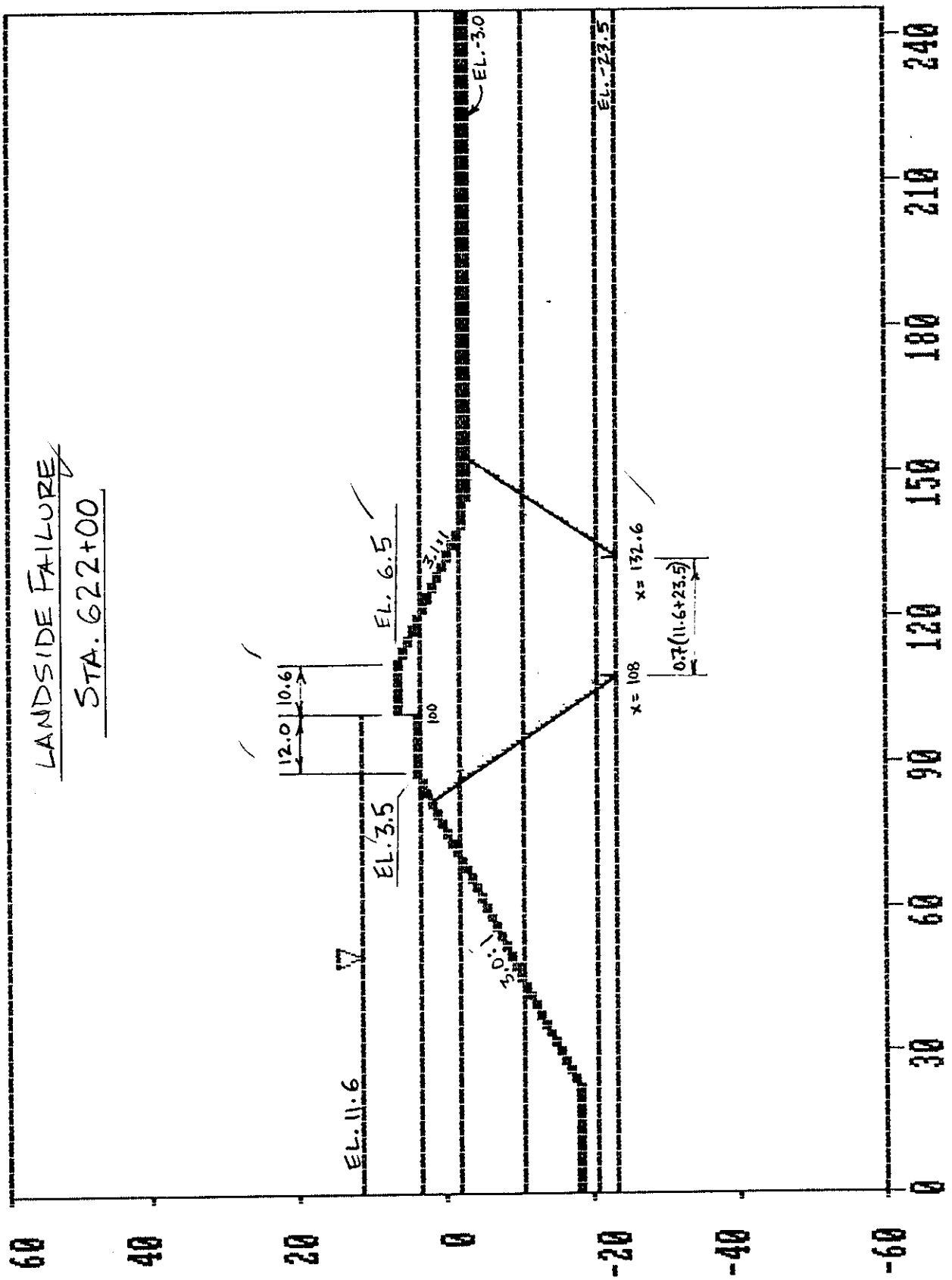
STA. 614+00



ELEV.	RA	RB	Re	DA	DP	FS:
-23.5	20,221	17,497	3,760	43,150	11,199	1.30

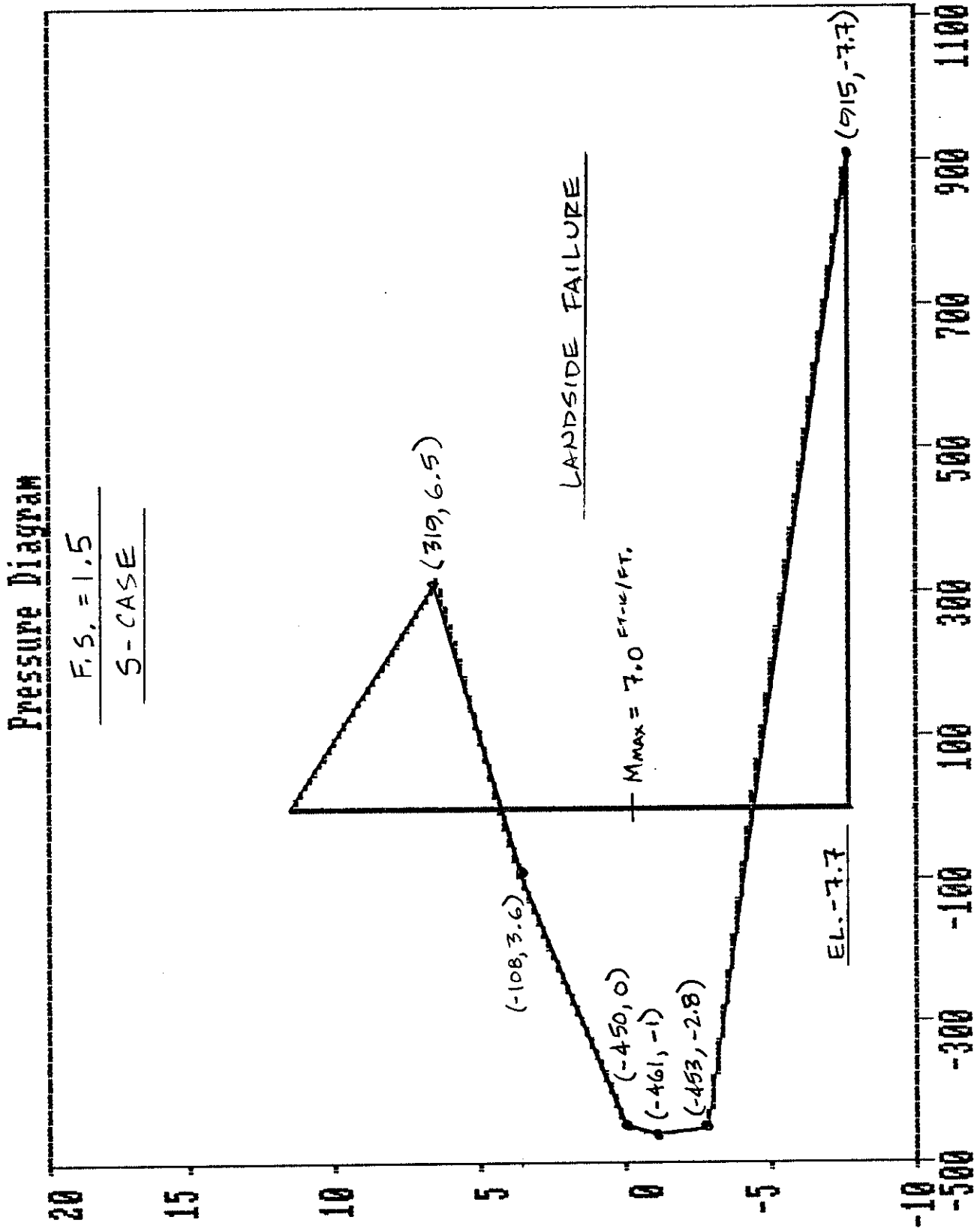
LANDSIDE FAILURE

STA. 622+00



ELEV	RA	RB	RP	DA	DP	F.S.
-23.5	17,391	9,348	13,070	51,799	22,719	1.37

RUN COMPLETED  
Stop - Program terminated



REACH 5 ✓  
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Revisions :

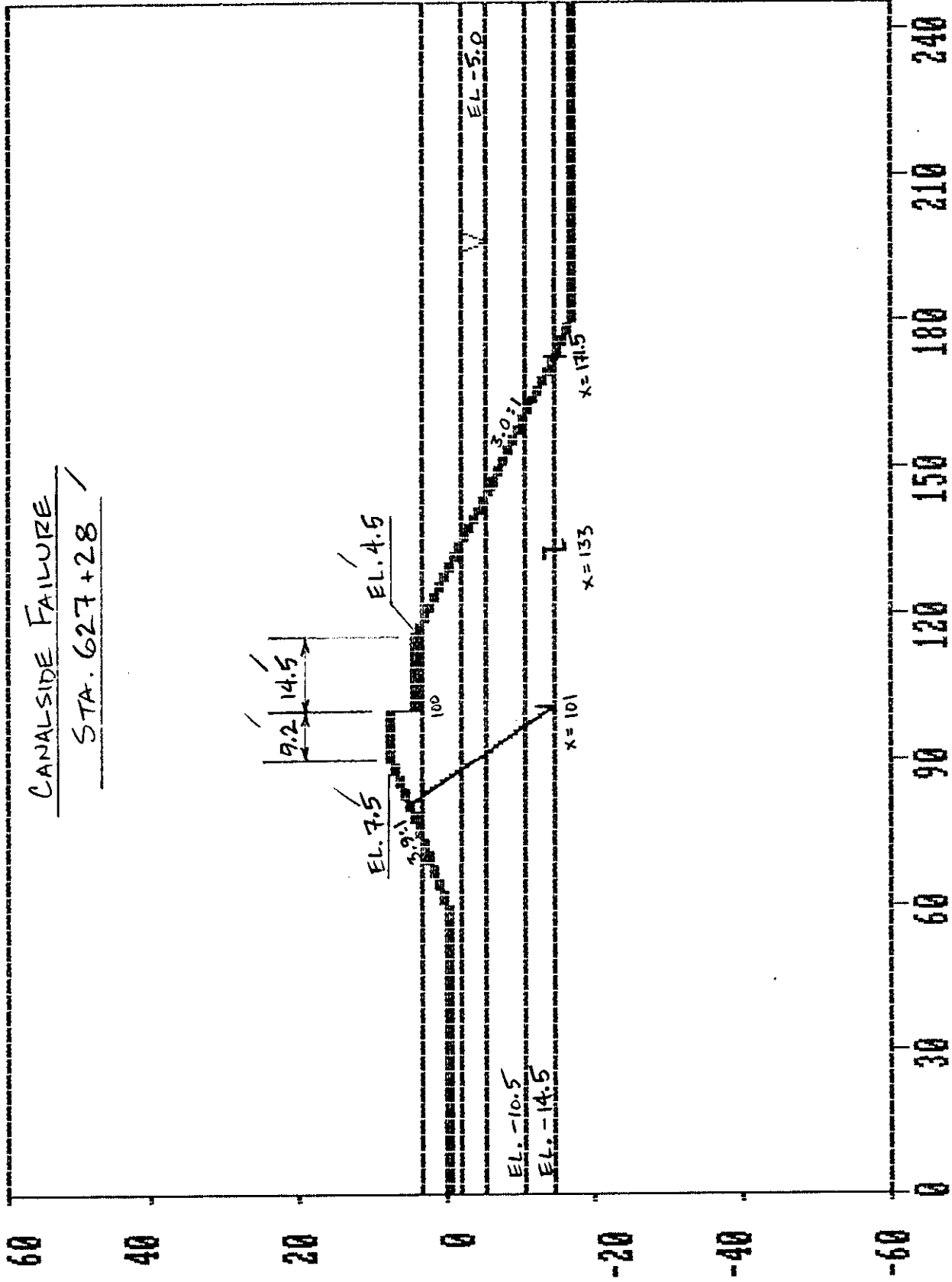
1. Step elevation lowered from 5.5 to 4.5.
2. Step width increased from 8.5' to 14.5'.

Submittals :

1. New canalside stability analyses taking into account the above revisions, the correction to the soil shear strength from El. 0.0 to El. -2.0, and the piezometric headline of El. -2.4 in the sand.
2. New sheet pile analyses taking into account the above revisions and the submerged canalside soil weight.



CANALSIDE FAILURE  
STA. 627+28



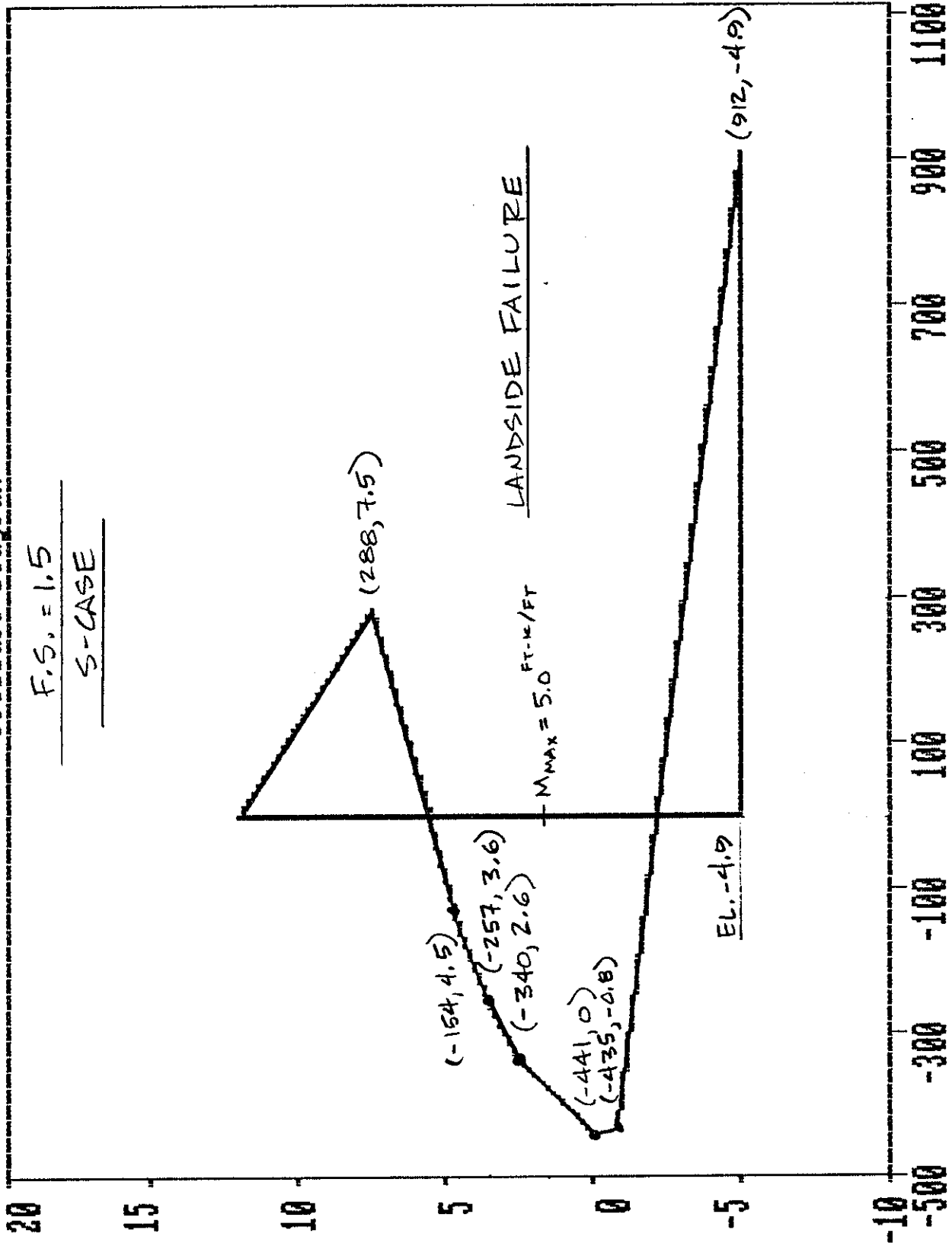
ELEV.	RA	RB	RP	DA	DP	F.S.
-14.5	14,251	13,588	0	24,191	2816	1.30



# Pressure Diagram

F.S. = 1.5

S-CASE



**REACH 6**

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**Revisions :**

**None**

**Submittals :**

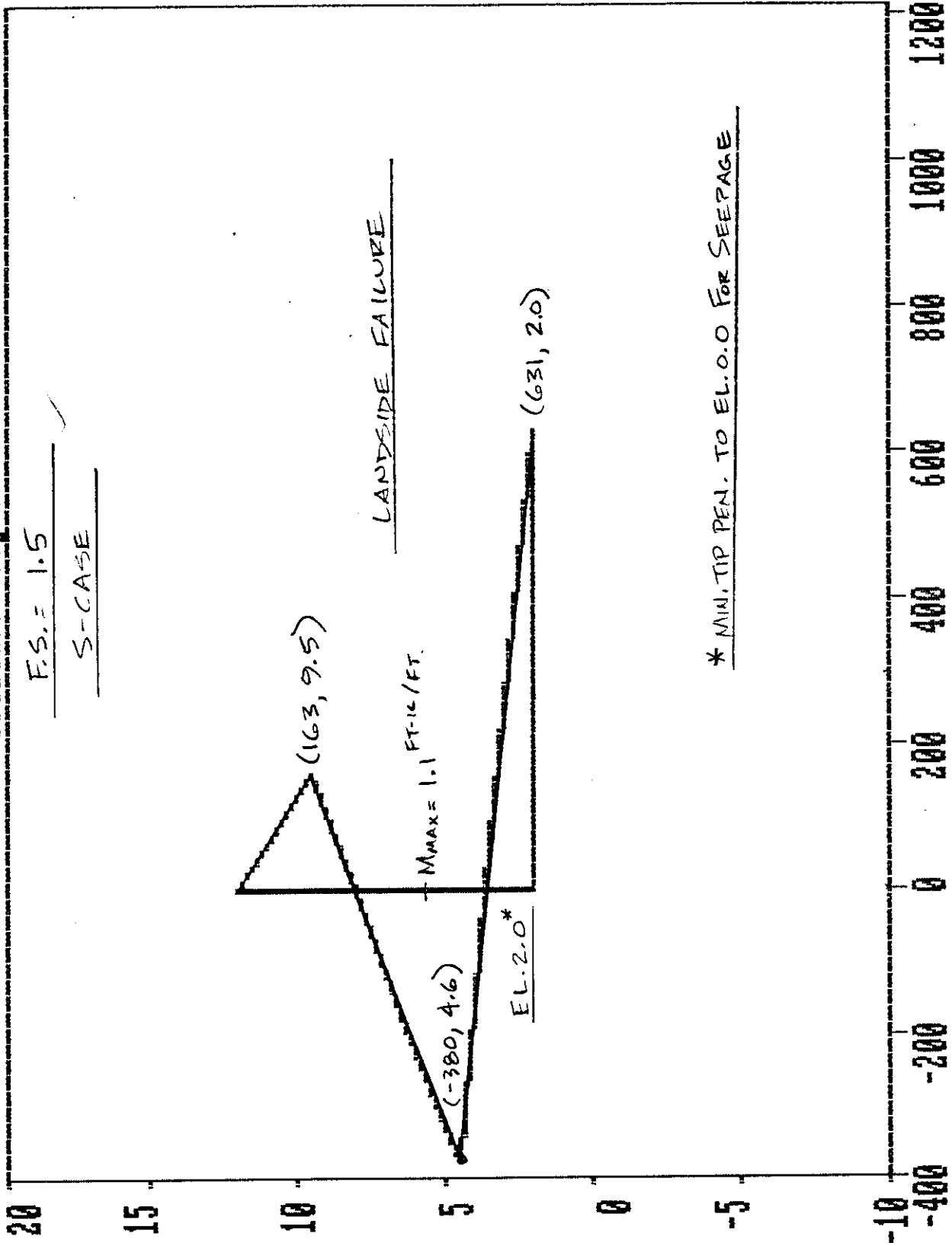
- 1. New sheet pile analyses taking into account the submerged canalside soil weight.**



# Pressure Diagram

F.S. = 1.5

S-CASE



\* MIN. TIP PEN. TO EL. 0.0 FOR SEEPAGE

**REACH 7**

**Revisions :**

1. Sheet pile alignment changed. (Maximum change in baseline offset is 1.3')

**Submittals :**

**None**

REACH 7  
STA. 643+00 TO STA. 663+00

STA.	OFFSET TO EL. 12.0 ON EXISTING BACKSLOPE ( FT )	OFFSET TO SHEET PILE ( FT )	OFFSET TO EL. 12.0 ON EXISTING CANALSLOPE ( FT )	TOTAL CROWN WIDTH ( FT )	EXISTING BACKSLOPE ( H : V )
643+00	235.9	224.8	221.3	14.6	3.3 : 1
645+00	233.8	223.4	218.6	15.2	2.1 : 1
647+00	232.8	222.9	219.6	14.2	2.7 : 1
649+00	235.1	222.3	220.1	15.0	4.0 : 1
651+00	233.2	221.7	217.1	16.1	3.0 : 1
653+00	230.8	221.1	214.8	15.2	6.6 : 1
655+00	231.6	220.6	215.4	16.2	3.3 : 1
657+00 (4 Pt.)	231.7	220.0	215.6	16.1	3.5 : 1
659+00	234.6	224.0	218.8	15.8	2.9 : 1
661+00	230.0	227.0	223.2	14.8	2.1 : 1
663+00 ( See Reach 8 )					

Cross-Section Geometry :      Crown El. 12.0      Crown Width on Land Side of Wall Varies  
Crown Width on Canal Side of Wall Varies

Slope Stability Analysis :

No additional stability analysis was done.

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

**REACH 8**

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**Revisions :**

1. Sheet pile alignment changed.
2. Crown elevation lowered from El. 12.0 to El. 11.0.
3. Crown width behind the sheet pile wall changed from a constant 8.0' to a varying width between the sheet pile wall and El. 11.0 on the existing backslope.
4. Step elevation raised from El. 2.0 to El. 7.0.
5. Step width changed based on the above revisions.

**Submittals :**

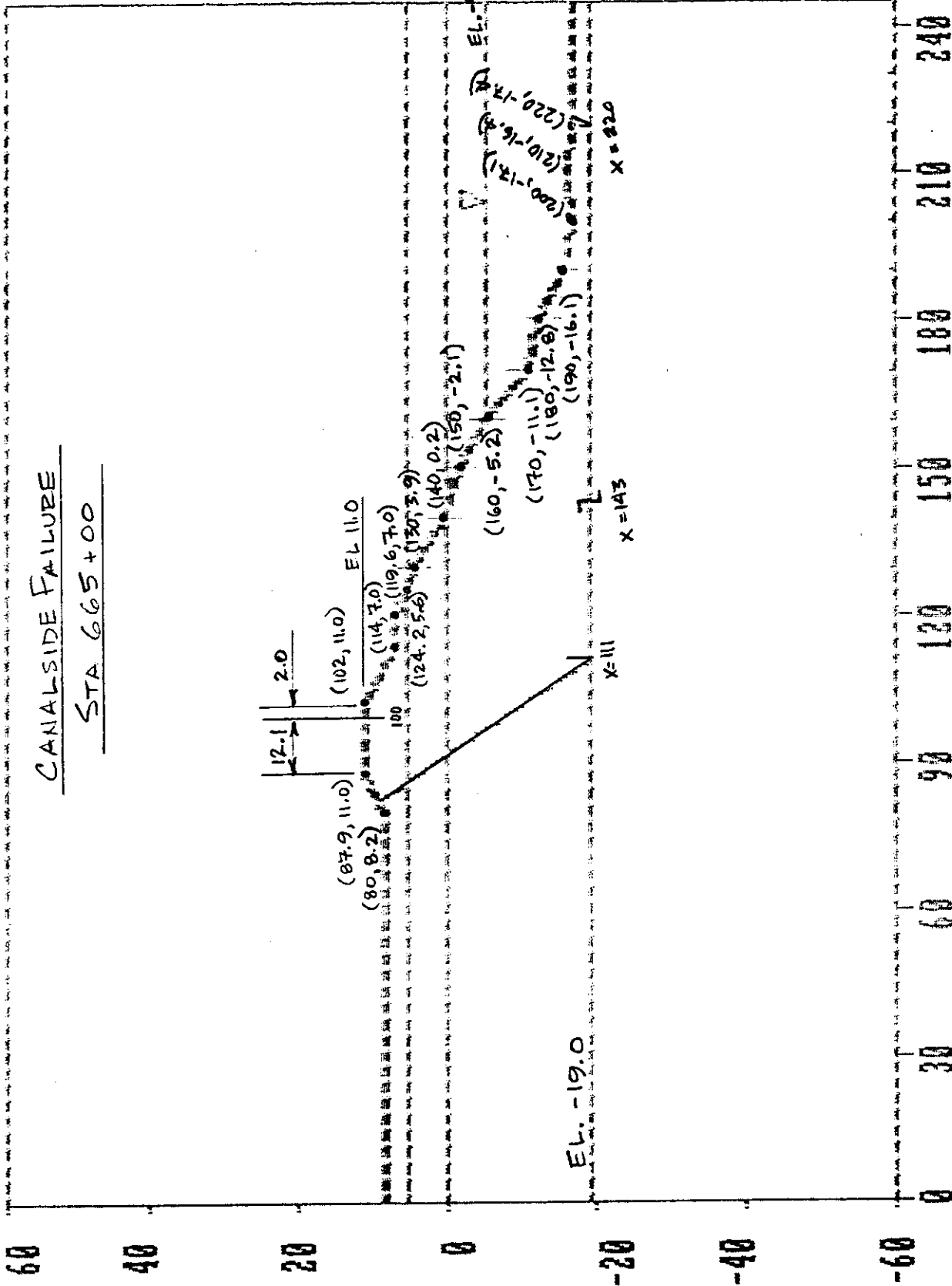
1. New canalside stability analyses taking into account the above revisions and the piezometric headline of El. -2.4 in the sand.





CANALSIDE FAILURE

STA 665+00



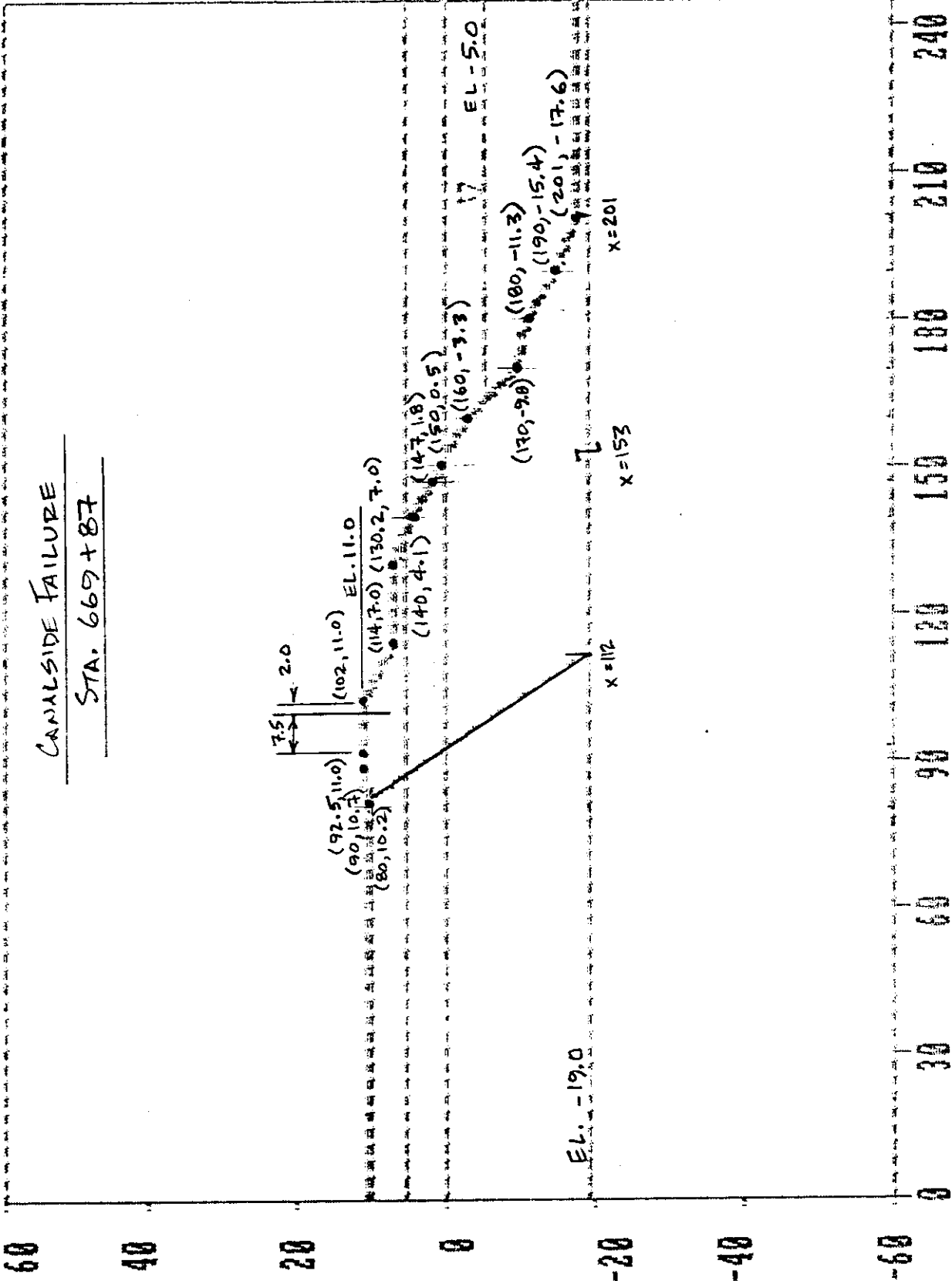
0	30	60	90	120	150	180	210	240
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ELEV.	RA	RB	RP	DA	DP	F.S. ✓
-19.0	25,071	27,446	17,22	47,316	6,172	1.32



CANALSIDE FAILURE

STA. 669+87



ELEV.	PA	PB	PC	PD	PE	F.S.
-19.0	26,438	29,680	1,509	47,194	6,159	1.40