



**AFRICAN DEVELOPMENT BANK**



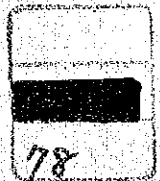
**THE DEMOCRATIC REPUBLIC OF THE SUDAN  
MINISTRY OF TRANSPORT  
ROADS AND BRIDGES PUBLIC CORPORATION**

**FEASIBILITY AND PRELIMINARY ENGINEERING  
STUDY OF ROAD PROJECT EL OBEID-UM RUABA**

**FINAL REPORT  
DRAWINGS**

**MARCH 1978**

**JAPAN INTERNATIONAL COOPERATION AGENCY**







**AFRICAN DEVELOPMENT BANK**



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MINISTRY OF TRANSPORT  
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DRAWINGS**

JICA LIBRARY



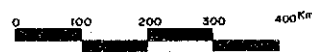
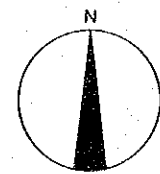
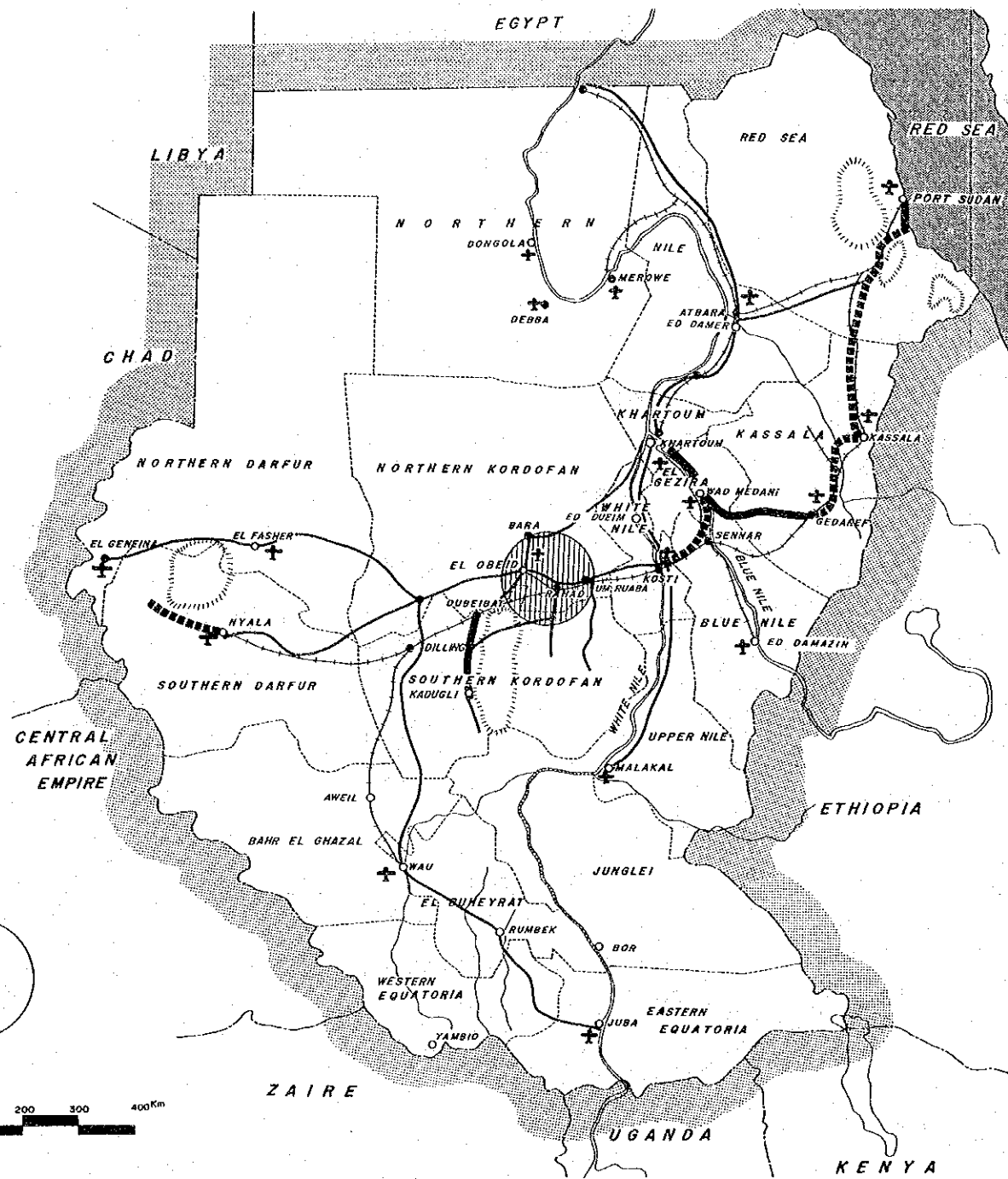
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**MARCH 1978**

国際協力事業団	
受入 月日 '84. 9. 25	415
登録No. 9025	6134
	SDS

**JAPAN INTERNATIONAL COOPERATION AGENCY**

# MAP OF THE SUDAN



### LEGEND

- PAVED ROADS
- UNDER CONSTRUCTION ROADS
- EARTH ROADS
- RAILWAYS
- AIRPORTS
- INTERNATIONAL BOUNDARY
- PROVINCE BOUNDARY
- MOUNTAINS
- PROJECT AREA

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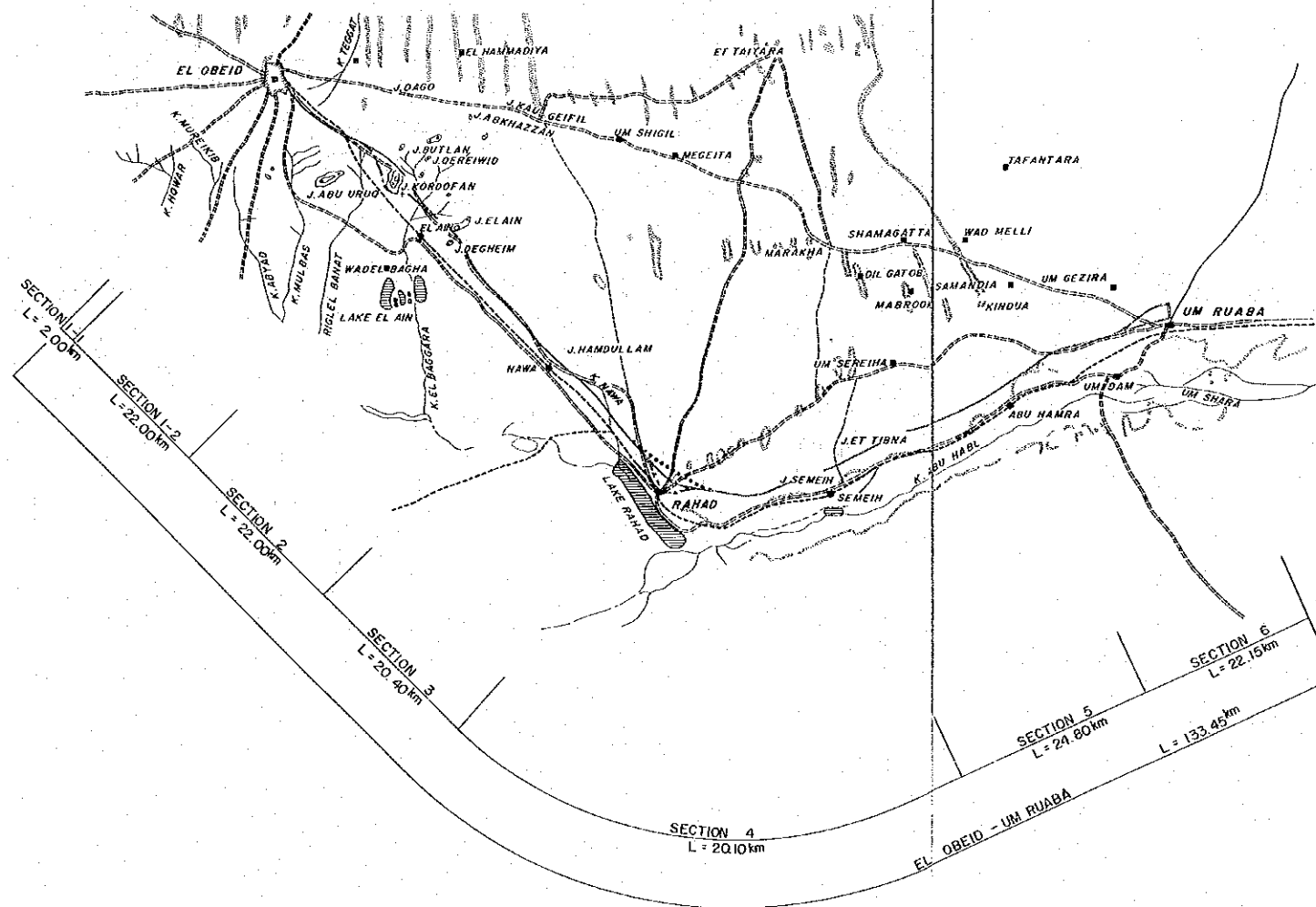
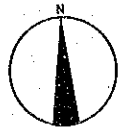
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**REDUCED PLAN**  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

# I OPTIMUM ROUTE

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# LOCATION MAP

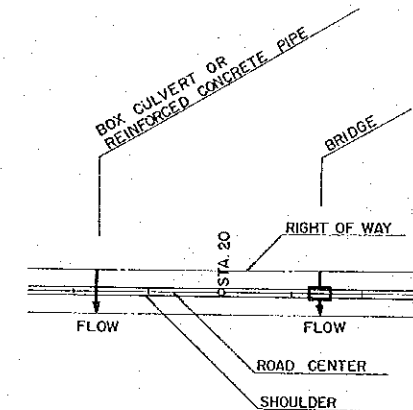


### ABBREVIATION

A	PARAMETER OF CLOTHOID
AC	ASPHALT CONCRETE
BC	BEGINNING OF CURVE
DBST	DOUBLE BITUMINOUS SURFACE TREATMENT
EC	END OF CURVE
I	GRADIENT
IA	INTERSECTION ANGLE
IP	INTERSECTION POINT
KA	BEGINNING OF CLOTHOID
KE	END OF CLOTHOID
L	LENGTH
R	RADIUS OF CURVE
	R = 2 500      RADIUS OF 2 500 <sup>m</sup>
	R = ∞      STRAIGHT LINE
STA	STATION
t	THICKNESS
φ	DIAMETER

### LEGEND

	EXISTING ROADS		PROPOSED ROUTE
	RAILWAYS		MAIN ROAD      L = 133.45 <sup>km</sup>
	RIVERS (KHORS)		ACCESS ROAD (RAHAD)      L = 1.53
	QOZ		ACCESS ROAD (UM RUABA)      L = 1.04
	HILLS	<b>MINOR ALTERNATIVE ROUTES</b>	
			J KORDOFAN BYPASS "B"      L = 14.80
			RAHAD BYPASS "C"      L = 13.70
			ACCESS ROAD (RAHAD)      L = 2.66
			RAHAD ROUTE "E"      L = 16.30
			UM RUABA ROUTE "G"      L = 6.56



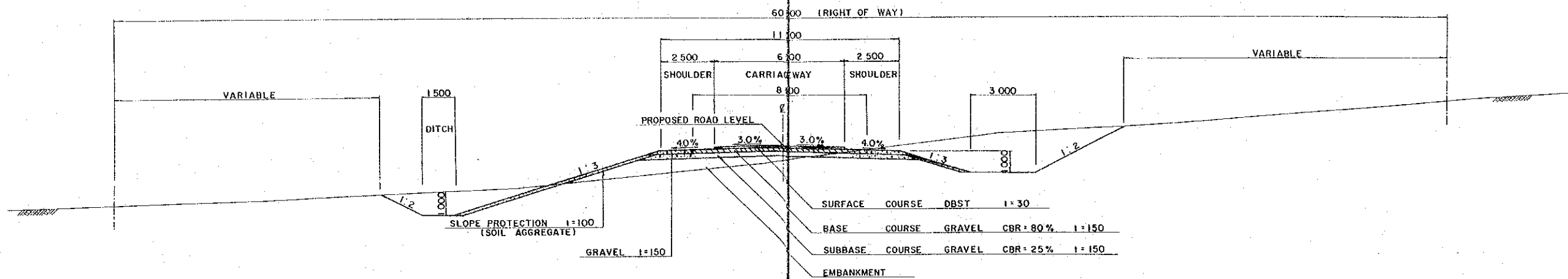
**REDUCED PLAN**  
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# TYPICAL CROSS SECTION OF MAIN ROAD

## FIRST STAGE

BANKING

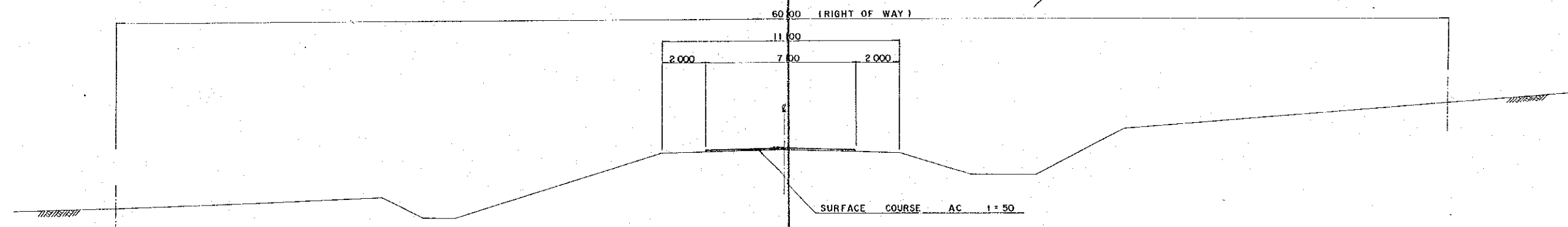
CUTTING



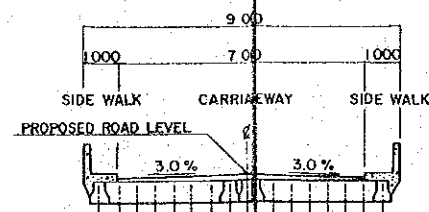
## SECOND STAGE

BANKING

CUTTING



## BRIDGE SECTION



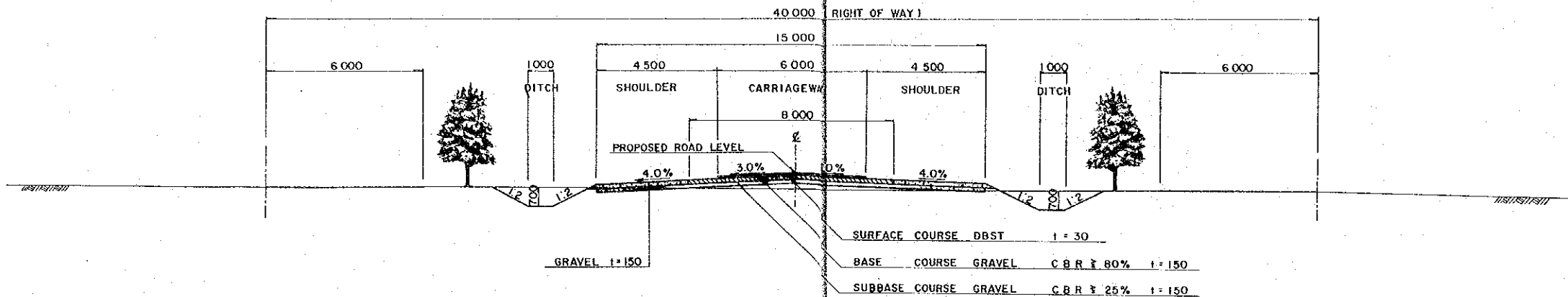
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THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	TYPICAL CROSS SECTION (I)	APPROVED BY	AMENDMENTS	SCALE 1:100	DATE 1978
						SHEET NO. 3 OF 87

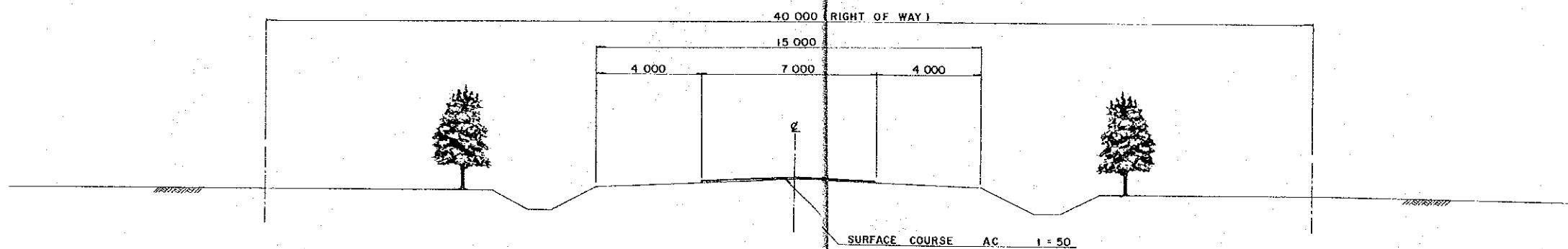


# TYPICAL CROSS SECTION OF ACCESS ROAD

## FIRST STAGE

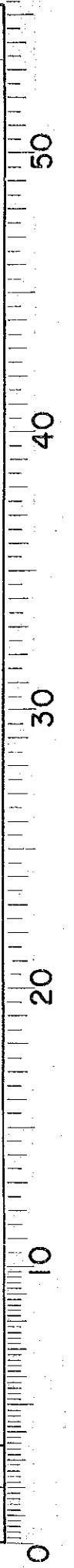


## SECOND STAGE

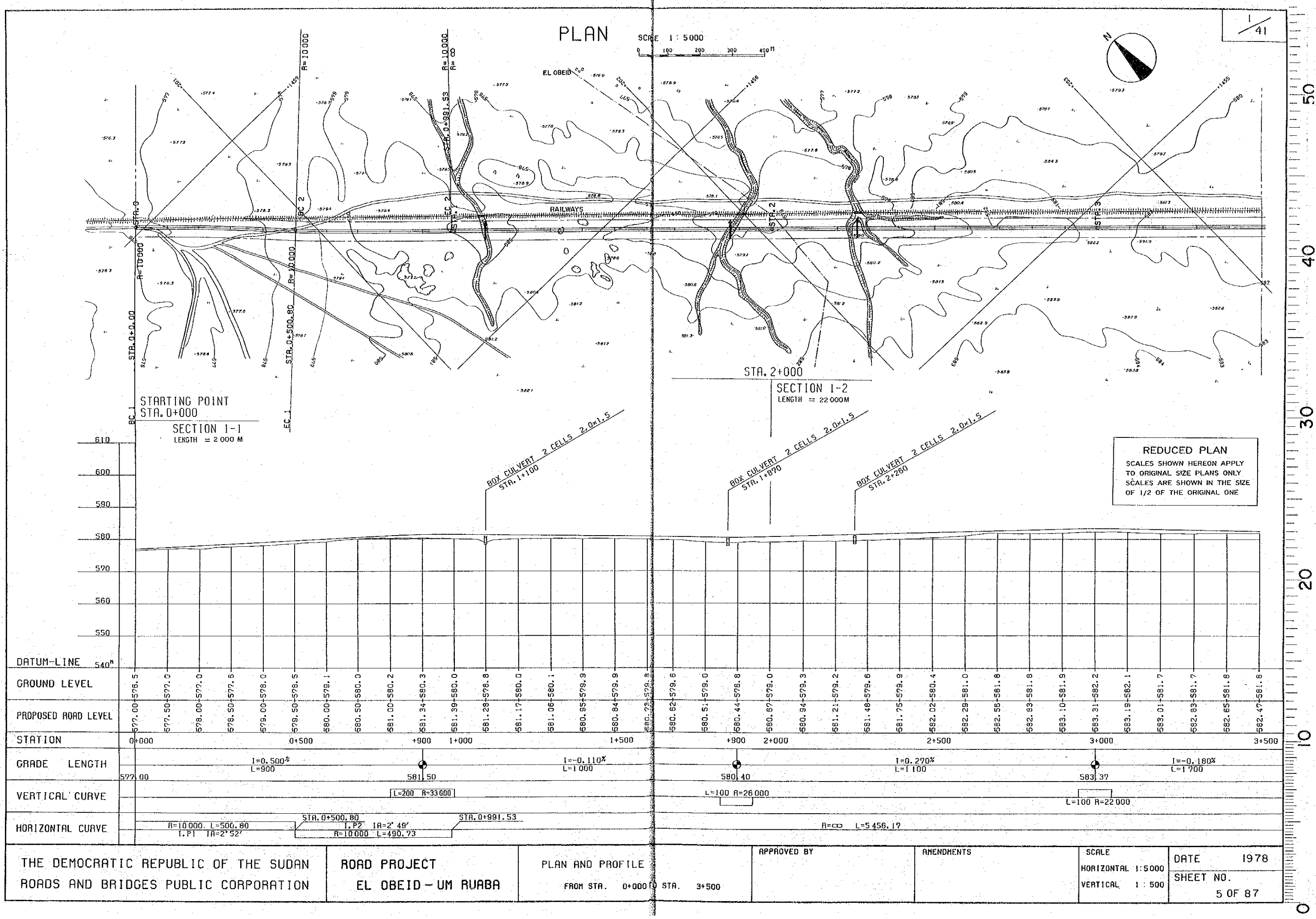


**REDUCED PLAN**  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
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THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	TYPICAL CROSSSECTION (2)	APPROVED BY	AMENDMENTS	SCALE 1:100	DATE 1978 SHEET NO. 4 OF 87
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THE DEMOCRATIC REPUBLIC OF THE SUDAN  
ROADS AND BRIDGES PUBLIC CORPORATION

ROAD PROJECT  
EL OBEID - UM RUABA

PLAN AND PROFILE  
FROM STA. 0+000 TO STA. 3+500

APPROVED BY

AMENDMENTS

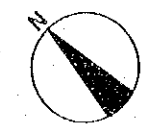
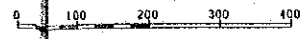
SCALE  
HORIZONTAL 1:5000  
VERTICAL 1:500

DATE 1978  
SHEET NO.  
5 OF 87

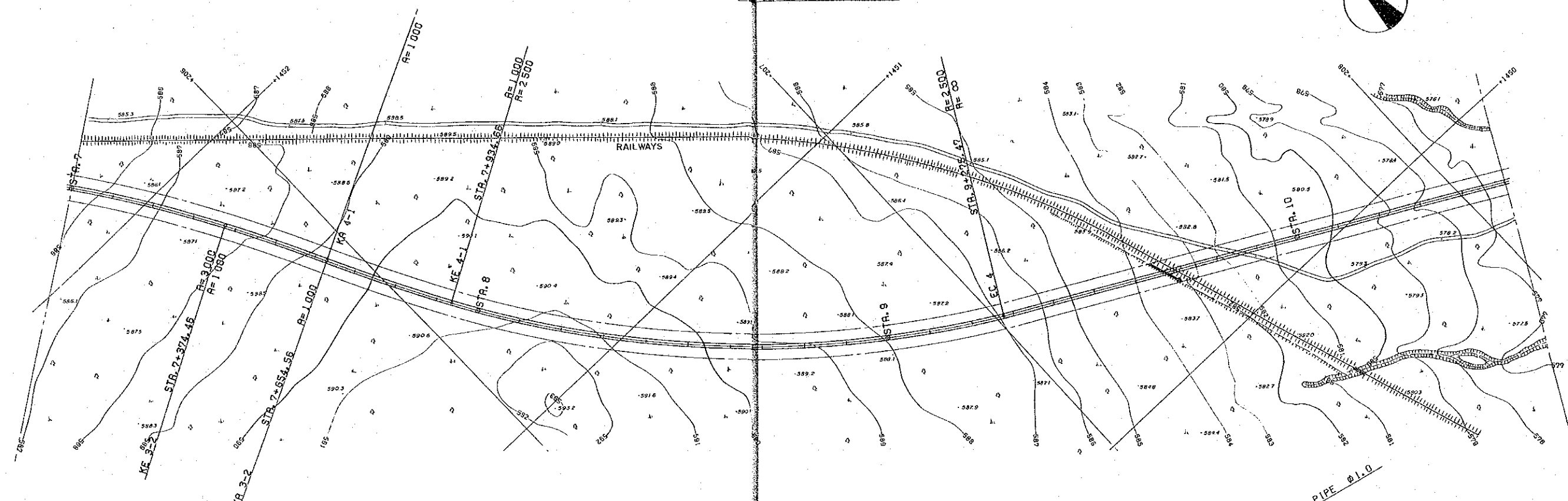


# PLAN

SCALE 1 : 5000

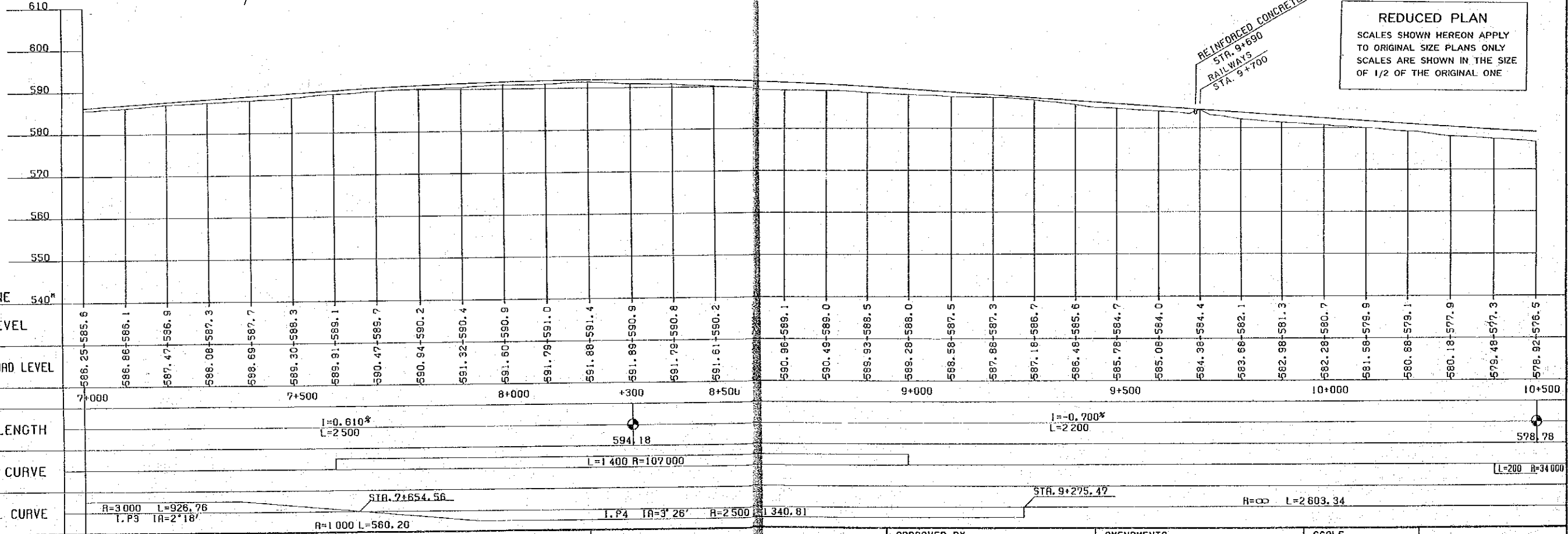


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50  
40  
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10  
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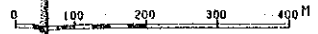
**REDUCED PLAN**  
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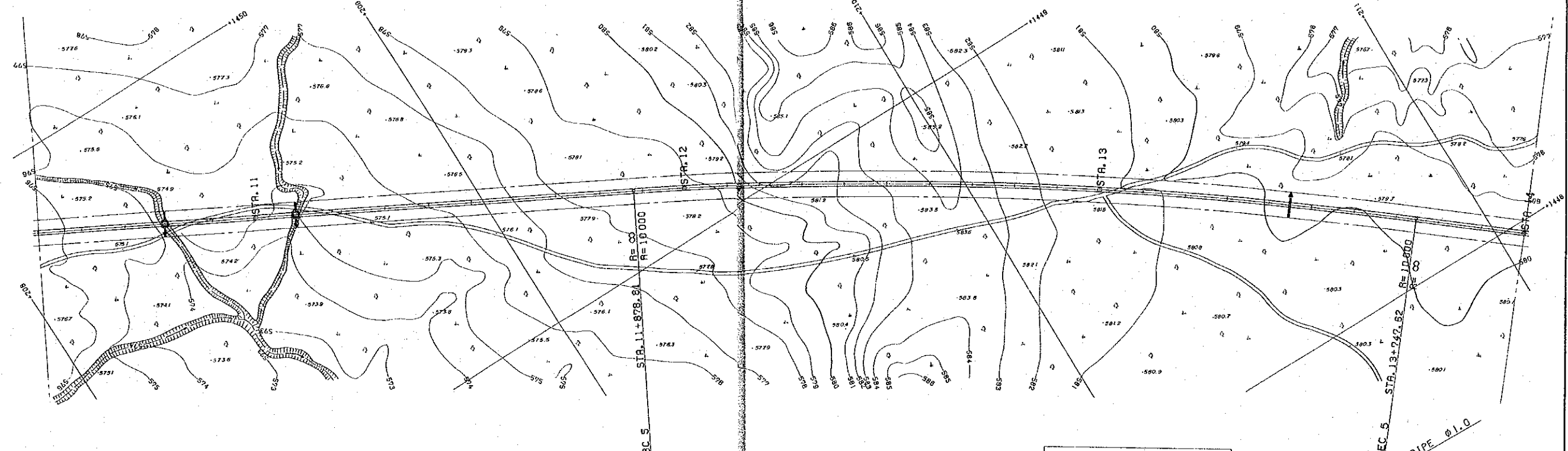
THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 7+000 TO STA. 10+500	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
						SHEET NO. 7 OF 87

PLAN

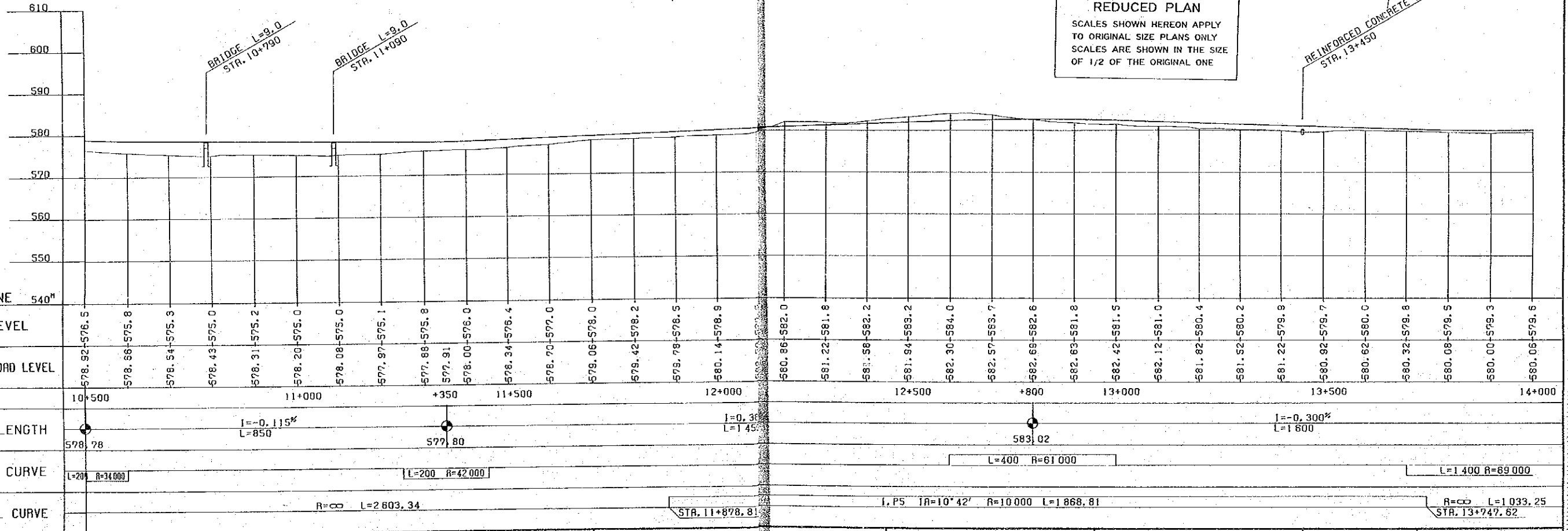
SCALE 1 : 5000



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41



**REDUCED PLAN**  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE



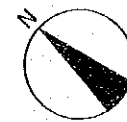
THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 10+500 STA. 14+000	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978 SHEET NO. 8 OF 87
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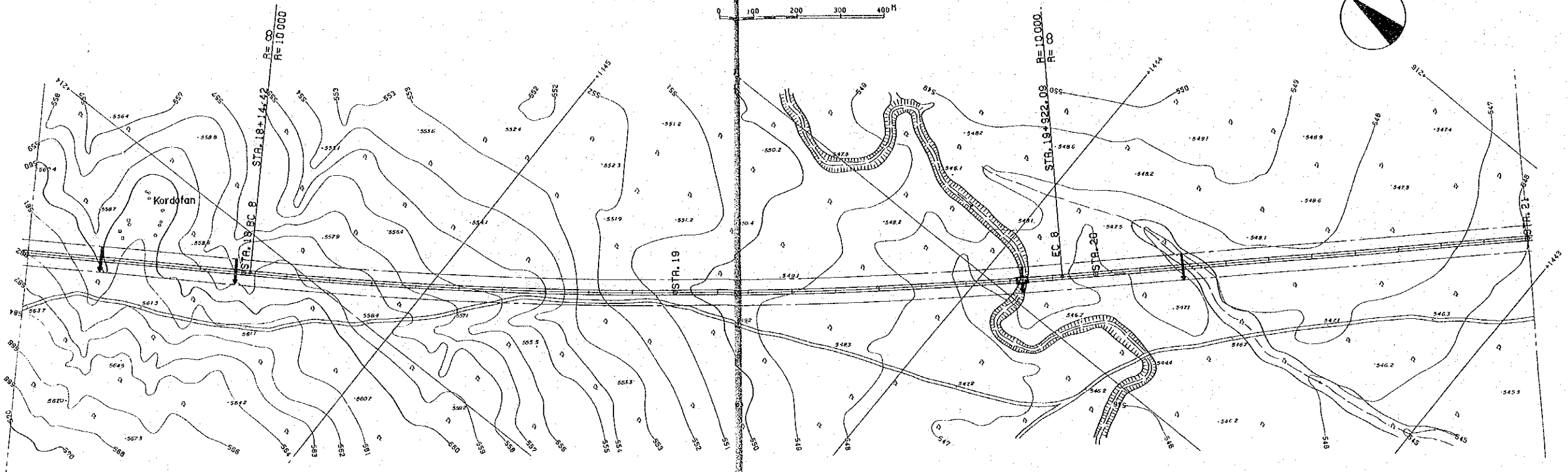


# PLAN

SCALE 1:5000  
0 100 200 300 400M

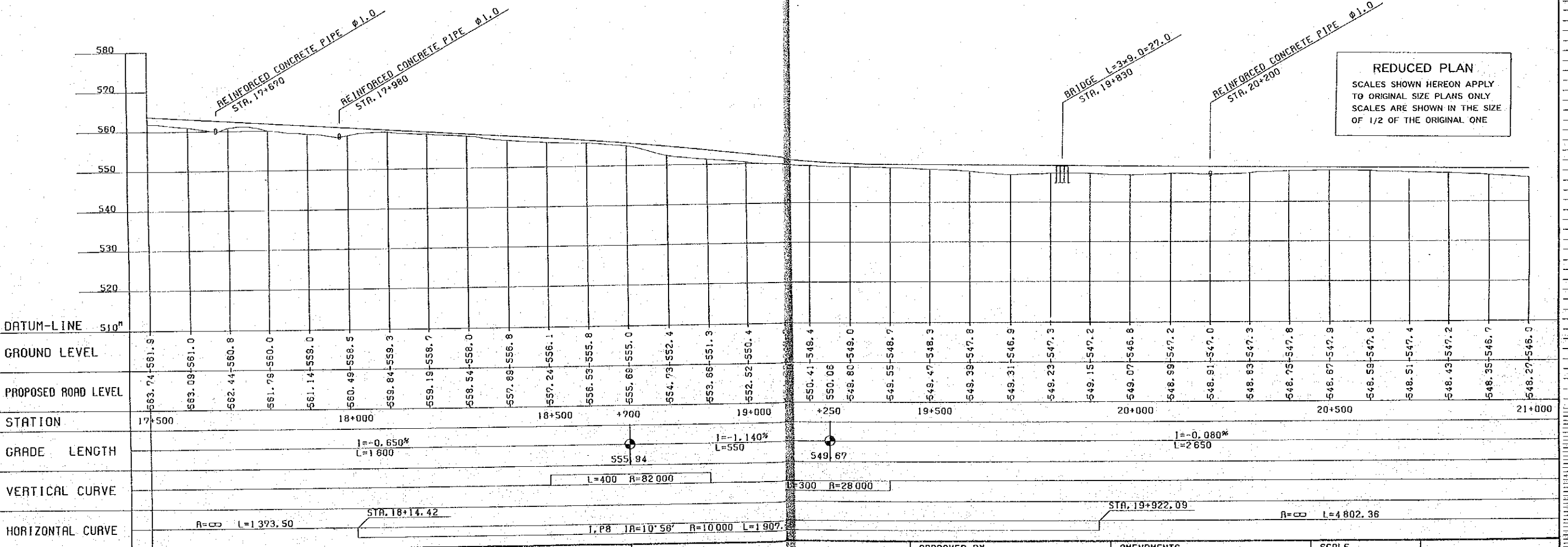


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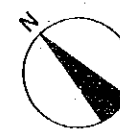
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**REDUCED PLAN**  
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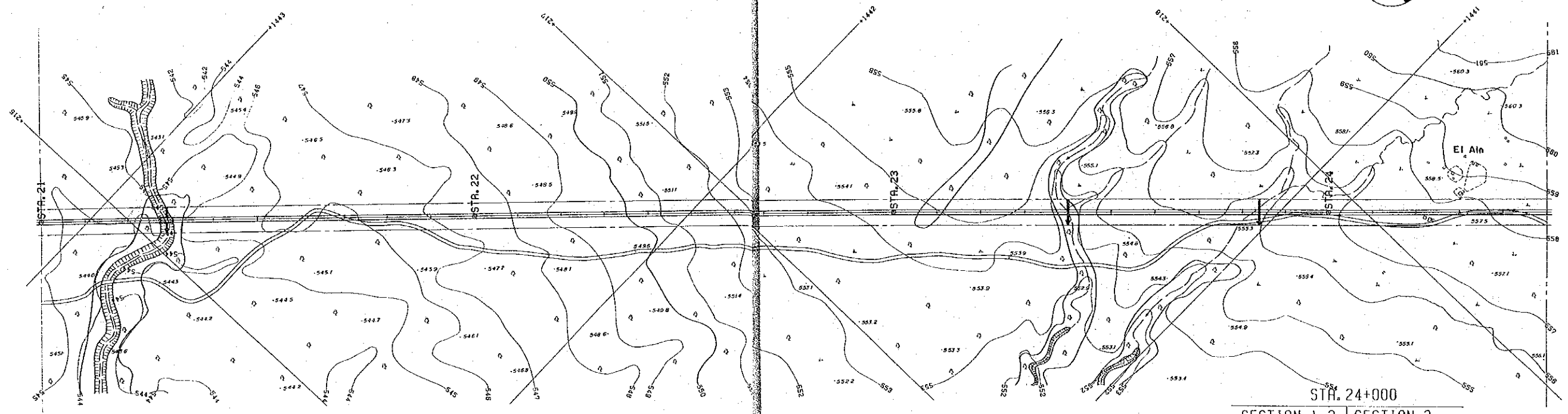


# PLAN

SCALE 1 : 5000  
0 100 200 300 400 M



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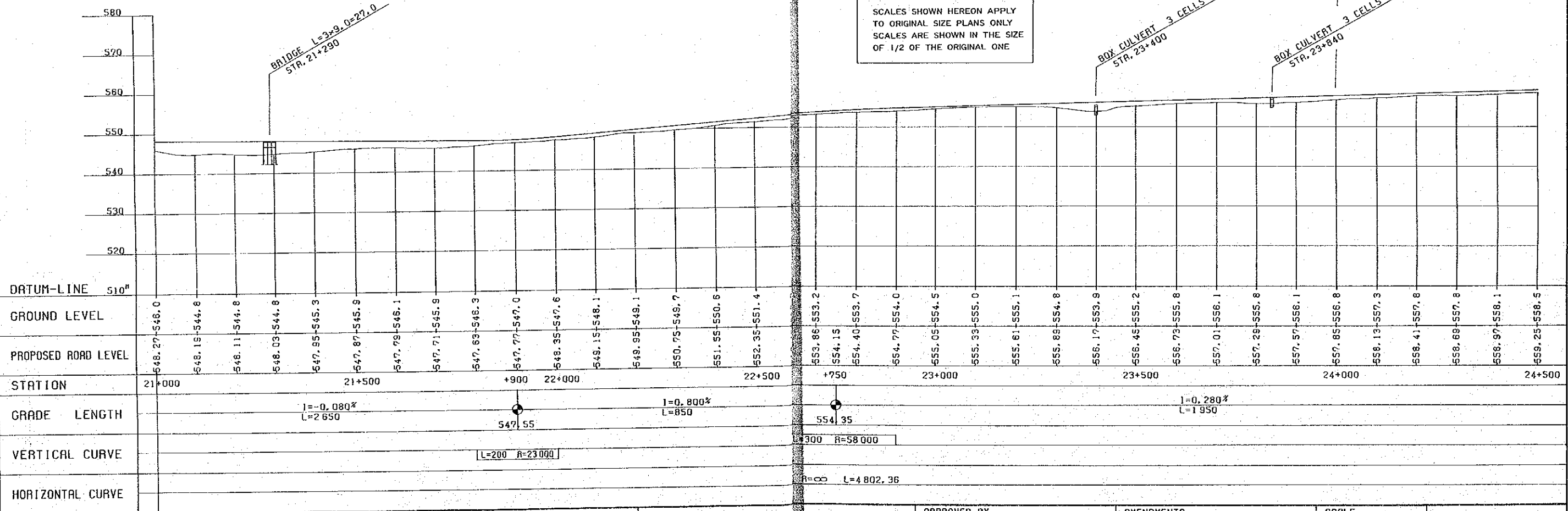
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STA. 24+000  
SECTION 1-2 LENGTH = 22 000M  
SECTION 2 LENGTH = 22 000M

BOX CULVERT 3 CELLS 2.0x1.5  
STA. 23+400

BOX CULVERT 3 CELLS 2.0x1.5  
STA. 23+840

BRIDGE L=3x9, 0=27.0  
STA. 21+790

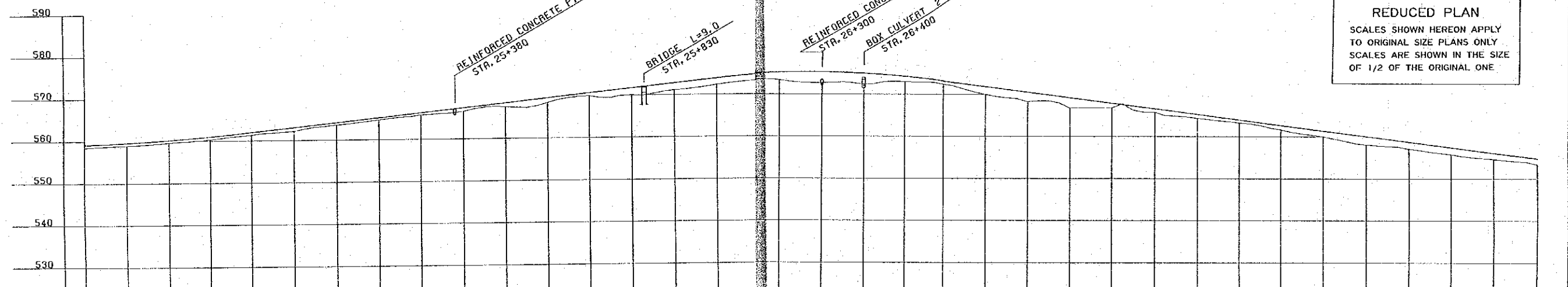
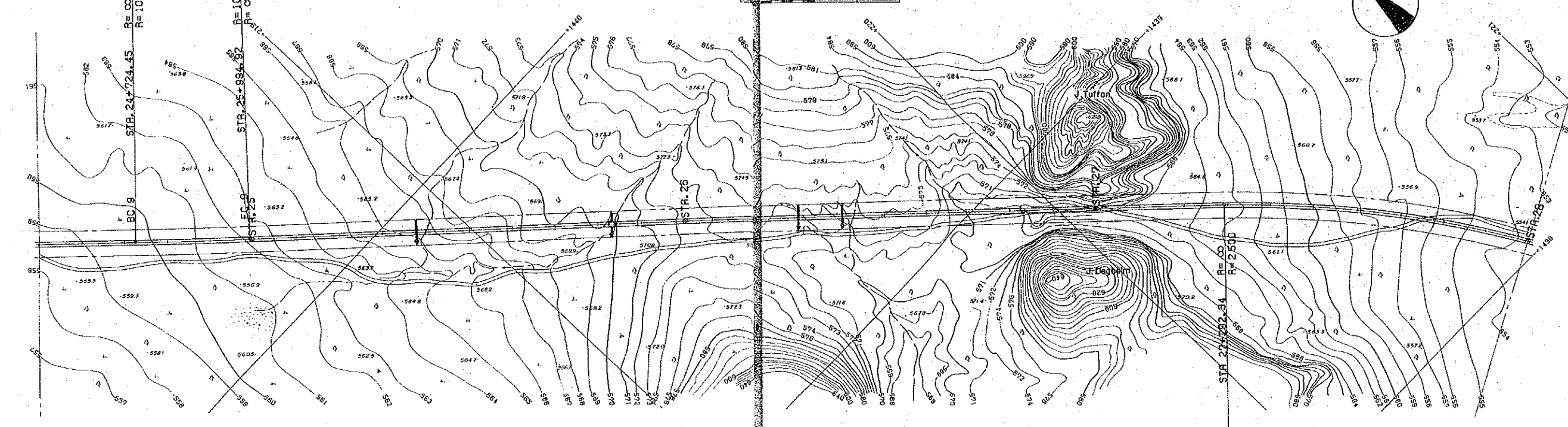


# PLAN

SCALE 1 : 5000  
0 100 200 300 400 M



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STATION	24+500	24+700	25+000	25+500	26+000	26+500	27+000	27+500	28+000																						
DATUM-LINE	520 <sup>m</sup>																														
GROUND LEVEL	559.25	559.0	559.6	560.3	561.3	562.2	563.6	564.7	565.8	566.5	567.5	568.4	569.9	570.0	571.1	572.3	573.4	574.7	575.4	576.8	577.8	579.0	580.0	581.7	582.8	584.4	585.8	587.0	588.1	589.1	590.0
PROPOSED ROAD LEVEL	559.62	559.0	560.20	560.3	561.97	562.05	564.13	565.21	566.29	567.37	568.45	569.53	570.61	571.69	572.77	573.85	574.93	576.01	577.09	578.17	579.25	580.33	581.41	582.49	583.57	584.65	585.73	586.81	587.89	588.97	590.05
GRADE LENGTH	J=0.280% L=1950		J=1.080% L=1600				J=1.080% L=1600		J=1.080% L=1600		J=1.080% L=1600		J=-1.310% L=2000				J=-1.310% L=2000														
VERTICAL CURVE	L=400 R=50000		L=600 R=25000				L=600 R=25000				L=600 R=25000				L=600 R=25000																
HORIZONTAL CURVE	R=∞ L=4802.36		STA. 24+724.45 I.P. TA=33° R=10000 L=270.47		STA. 24+994.92		R=∞ L=2297.42		R=∞ L=2297.42		R=∞ L=2297.42		I.P10 TA=3°26' R=2500 L=865.13				I.P10 TA=3°26' R=2500 L=865.13														

**REDUCED PLAN**  
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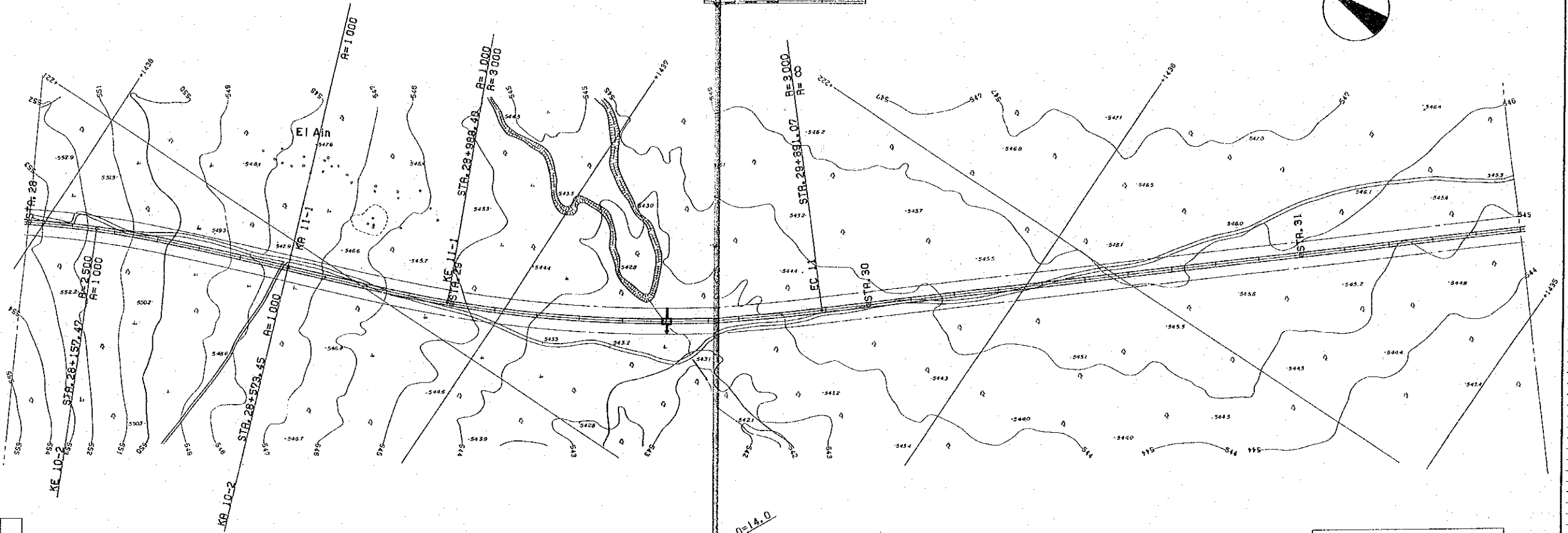
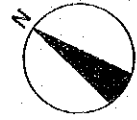
50  
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PLAN

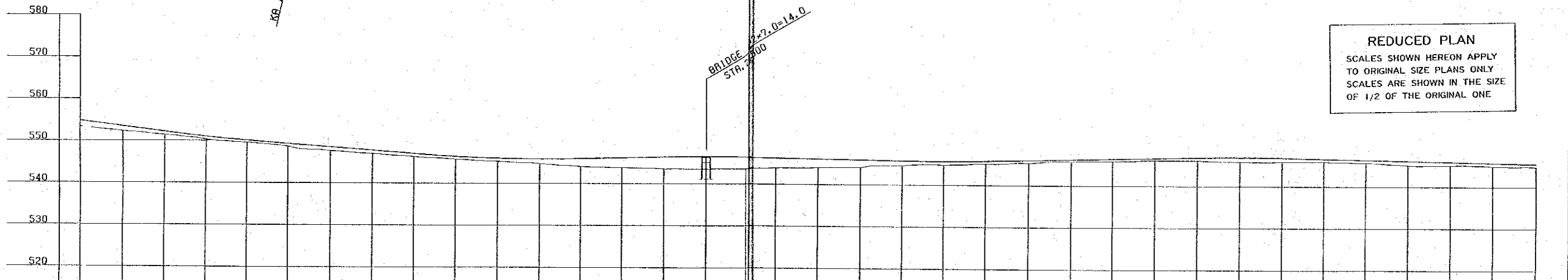
SCALE 1:5000  
0 100 200 300 400 M

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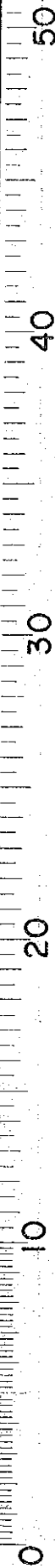
BRIDGE 2x7.0=14.0  
STA. 29+700

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SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
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STATION	28+000 +300 28+500			29+000 +500 29+500			30+000 +100 30+500			31+000 +800 31+500																																																																																											
DATUM-LINE	510 <sup>n</sup>																																																																																																				
GROUND LEVEL	554.82	553.4		553.51	552.3		552.20	551.4		551.02	550.3		549.35	548.7		547.81	547.0		547.04	546.3		546.39	545.7		545.99	545.2		545.84	544.7		545.94	544.0		546.16	543.8		546.38	543.5		546.50	543.5		546.43	543.6		546.26	543.9		546.09	544.0		545.92	544.1		545.75	544.6		545.67	544.8		545.79	545.1		546.00	545.3		546.21	545.7		546.42	545.8		546.63	546.1		546.84	546.1		546.94	545.9		546.89	545.9		546.61	545.9		546.39	545.7		546.17	545.1		545.95	545.1		545.73	544.9		545.51	544.8
PROPOSED ROAD LEVEL	Same values as Ground Level																																																																																																				
GRADE LENGTH	$I = -1.310\%$ $L = 2000$ PVI 550.89 $I = -0.770\%$ $L = 700$ PVI 545.50 $I = 0.220\%$ $L = 500$ PVI 546.60 $I = -0.170\%$ $L = 600$ PVI 545.59 $I = 0.210\%$ $L = 700$ PVI 547.05 $I = -0.220\%$ $L = 2800$																																																																																																				
VERTICAL CURVE	[L=200 R=37000]      [L=400 R=40000]      [L=200 R=51000]      [L=200 R=53000]      [L=200 R=47000]																																																																																																				
HORIZONTAL CURVE	R=2500 L=865.13 PIV 1A=3°26' STA. 28+523.45      I, P.I. 1A=5°9' R=3000 L=901.67      STA. 29+891.07      R=infinity L=4790.27																																																																																																				

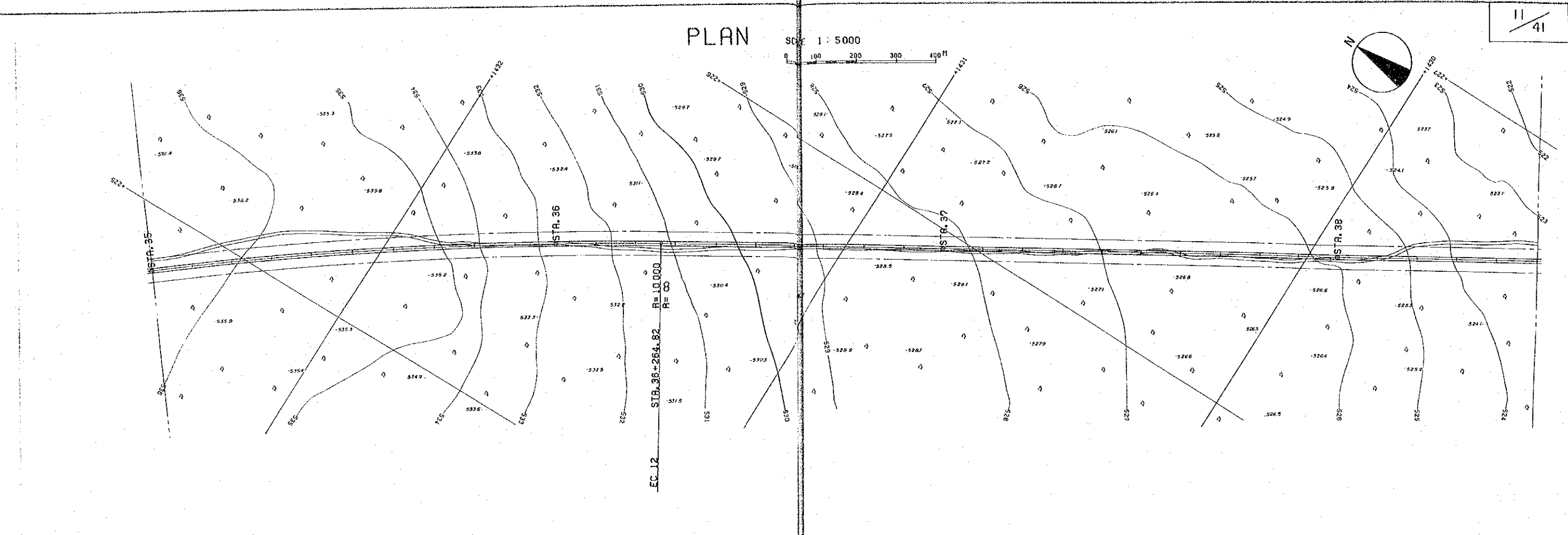
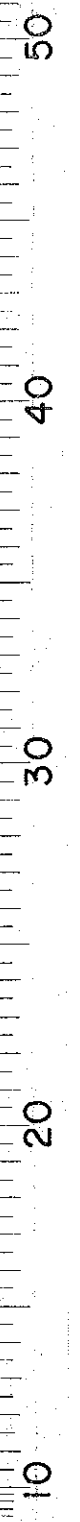
THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 28+000 TO STA. 31+500	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978 SHEET NO. 13 OF 87





PLAN

SCALE 1 : 5000



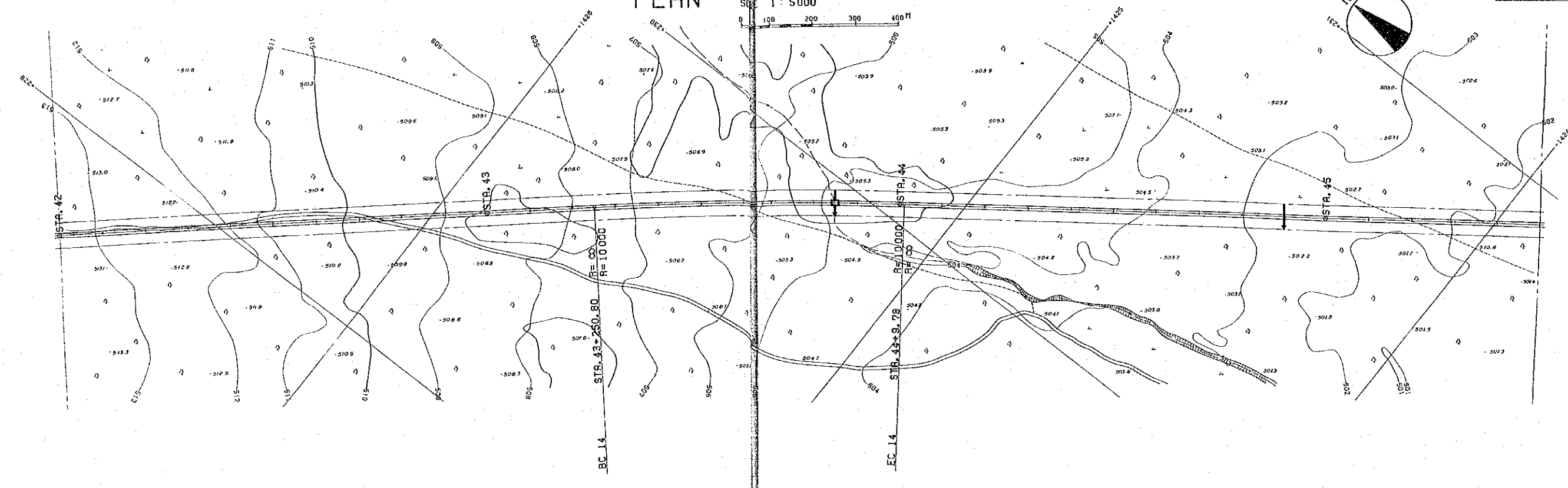
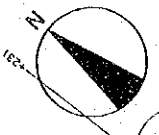
DATUM-LINE	490 <sup>m</sup>																																																																					
	GROUND LEVEL	537.53	538.4	537.29	536.3	537.05	536.1	536.81	535.8	536.57	535.7	536.33	535.4	536.03	535.3	535.73	535.1	536.13	534.1	533.4	533.69	532.8	532.97	532.3	532.25	531.6	531.53	530.9	530.88	530.3	530.62	530.39	529.8	528.60	528.9	528.54	528.7	528.28	528.4	528.02	528.2	528.76	527.9	528.50	527.7	528.24	527.3	527.98	527.0	527.72	526.9	527.46	526.7	527.20	526.4	526.94	526.3	526.68	526.1	526.36	525.8	525.92	525.4	525.42	524.8	524.92	523.9	524.42	523.6	523.92
PROPOSED ROAD LEVEL																																																																						
STATION	35+000	35+500				+700	36+000				+450	36+500	37+000				37+500	38+000				38+500																																																
GRADE LENGTH	$I = -0.240\%$ $L = 2100$										$535.85$	$I = -0.720\%$ $L = 950$										$530.45$	$I = -0.260\%$ $L = 1550$										$526.42$	$I = -0.500\%$ $L = 700$																																				
VERTICAL CURVE	$L = 200$ $R = 42000$														$L = 300$ $R = 65000$														$L = 200$ $R = 83000$																																									
HORIZONTAL CURVE	$L.P12$ $IA = 9'4"$ $R = 10000$ $L = 1583.48$														$STA. 36+264.82$ $R = \infty$ $L = 3336.00$																																																							

**REDUCED PLAN**  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE



PLAN

1 : 5000



50

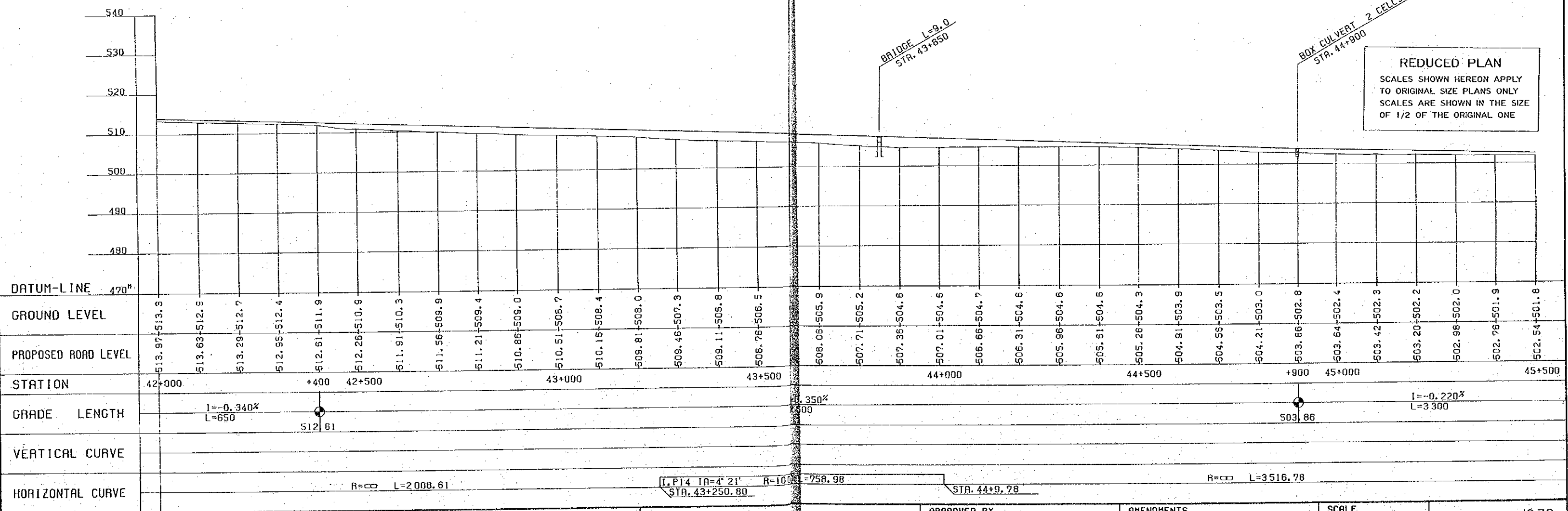
40

30

20

10

0



BRIDGE L=9.0  
STA. 43+500

BOX CULVERT 2 CELLS 2.0x1.5  
STA. 44+900

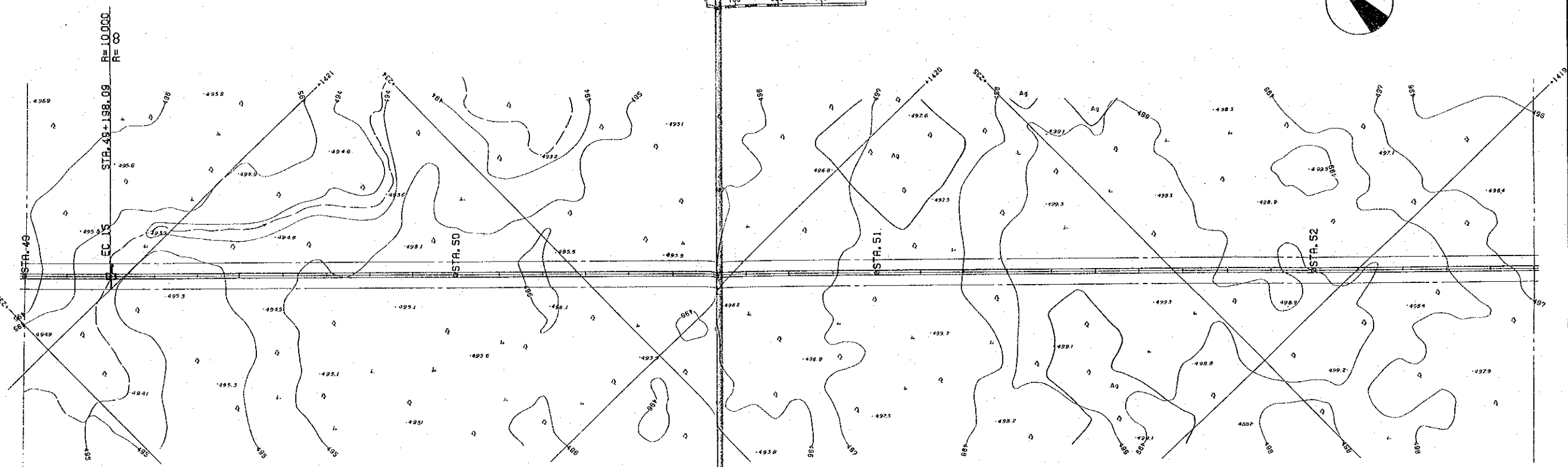
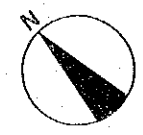
REDUCED PLAN  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 42+00 TO STA. 45+500	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1 : 5000 VERTICAL 1 : 500	DATE 1978
						SHEET NO. 17 OF 87



PLAN

SCALE 1 : 5000  
0 100 200 300 400M



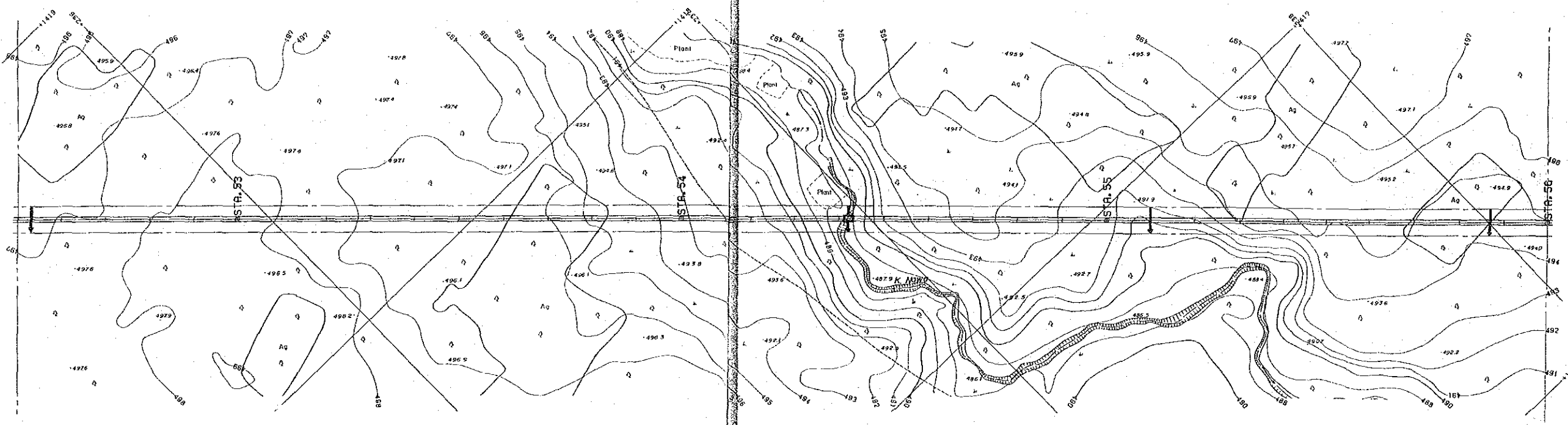
REDUCED PLAN  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

BRIDGE L=227.0 R=14.0  
STA. 49+200

DATUM-LINE	460 <sup>m</sup>																																																																					
GROUND LEVEL	497.40	496.1	497.50	495.2	497.46	494.8	497.27	495.2	498.94	495.2	496.61	494.8	496.26	494.8	495.95	495.0	495.74	495.1	495.78	495.1	495.94	495.2	496.10	495.7	496.26	496.0	496.42	495.3	496.58	495.2	496.74	495.7	497.06	496.3	497.29	496.6	497.68	496.9	498.14	497.3	498.60	497.6	499.05	498.0	499.52	499.0	499.88	499.4	500.30	499.5	500.34	499.5	500.24	499.3	500.14	498.9	500.04	498.9	499.94	499.0	499.84	498.9	499.74	498.6	499.64	498.0	499.54	497.3	499.44	496.9
PROPOSED ROAD LEVEL	497.40	496.1	497.50	495.2	497.46	494.8	497.27	495.2	498.94	495.2	496.61	494.8	496.26	494.8	495.95	495.0	495.74	495.1	495.78	495.1	495.94	495.2	496.10	495.7	496.26	496.0	496.42	495.3	496.58	495.2	496.74	495.7	497.06	496.3	497.29	496.6	497.68	496.9	498.14	497.3	498.60	497.6	499.05	498.0	499.52	499.0	499.88	499.4	500.30	499.5	500.34	499.5	500.24	499.3	500.14	498.9	500.04	498.9	499.94	499.0	499.84	498.9	499.74	498.6	499.64	498.0	499.54	497.3	499.44	496.9
STATION	49+000	+200	49+500	+800	50+000	50+500	+800	51+000	51+500	52+000	52+500																																																											
GRADE LENGTH	I=0.100% L=1000		I=-0.330% L=600		I=0.160% L=1000		I=0.460% L=700		I=-0.100% L=1950																																																													
VERTICAL CURVE	[L=200 R=47000]		[L=200 R=41000]		[L=200 R=67000]		[L=200 R=36000]																																																															
HORIZONTAL CURVE	L.P15 1A=9°35' R=10000 L=1671.53		STA. 49+198.09		R=∞ L=7014.97																																																																	

# PLAN

Scale 1:5000  
0 100 200 300 400m



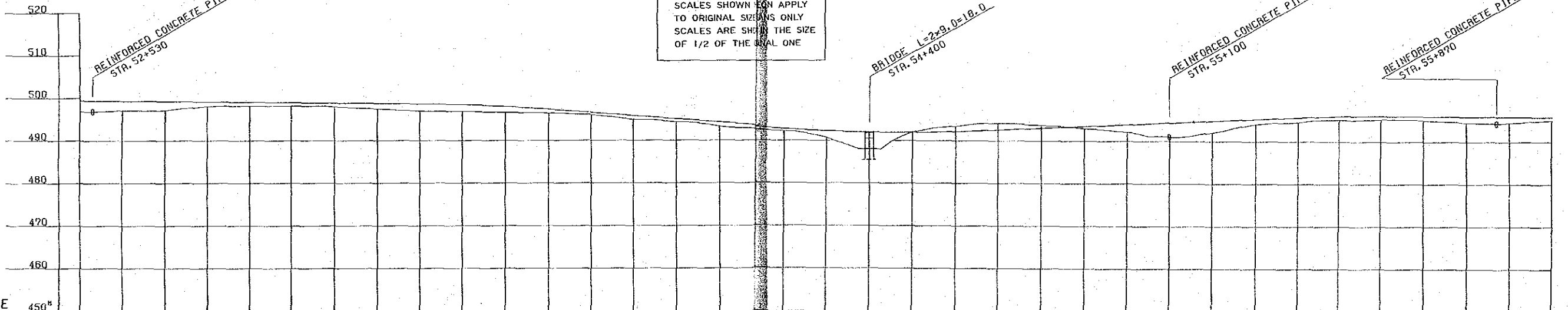
**REDUCED PLAN**  
 SCALES SHOWN BELOW APPLY TO ORIGINAL SIZES ONLY  
 SCALES ARE SHOWN THE SIZE OF 1/2 OF THE ORIGINAL ONE

REINFORCED CONCRETE PIPE  $\phi 1.0$   
 STA. 52+530

BRIDGE L=279.0=18.0  
 STA. 54+400

REINFORCED CONCRETE PIPE  $\phi 1.0$   
 STA. 55+100

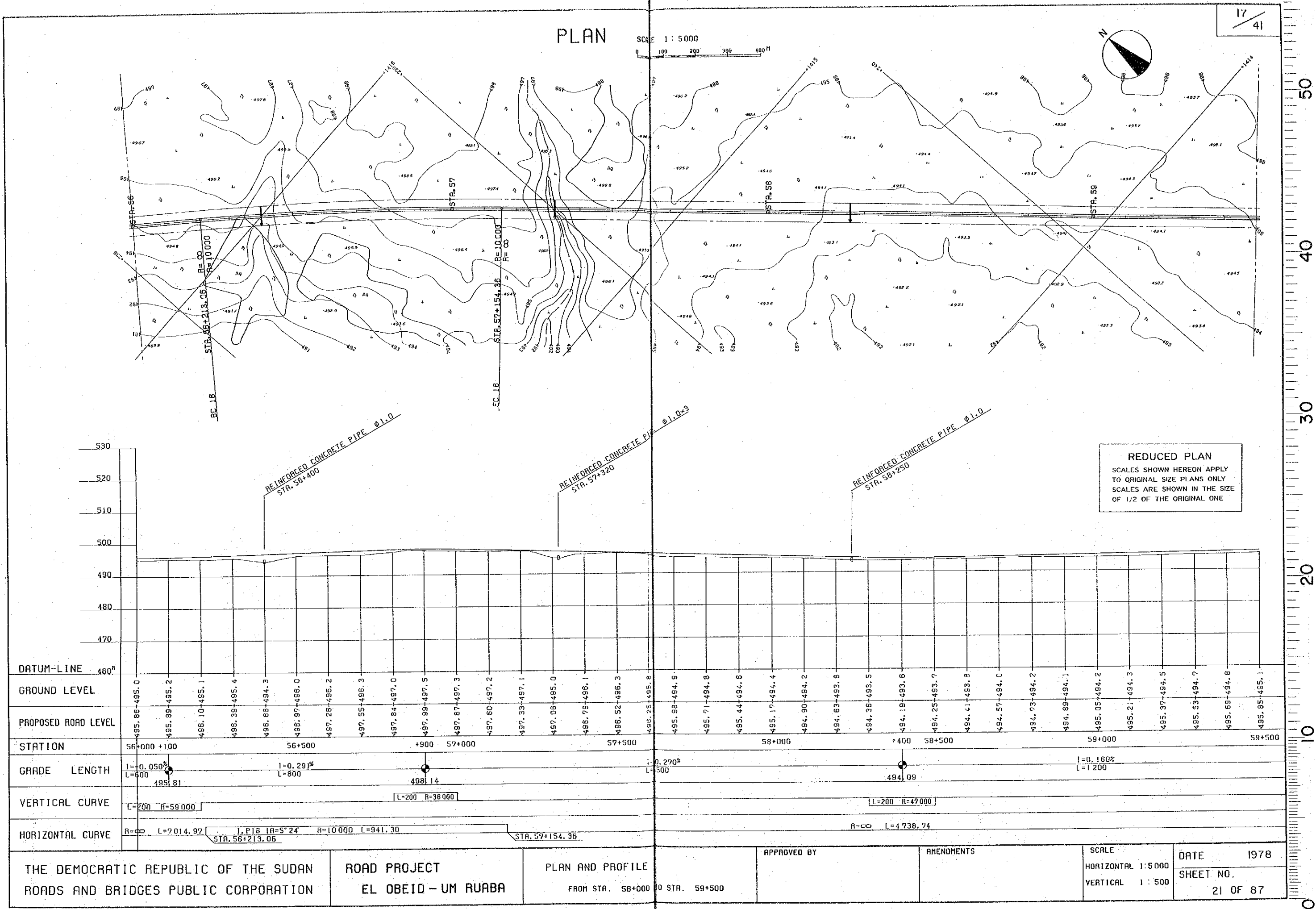
REINFORCED CONCRETE PIPE  $\phi 1.0$   
 STA. 55+870



STATION	GROUND LEVEL	PROPOSED ROAD LEVEL
52+500	499.44	496.9
52+550	499.34	497.1
52+600	499.24	497.1
52+650	499.14	498.0
52+700	499.04	498.1
52+750	498.94	498.1
52+800	498.84	497.9
52+850	498.74	497.4
52+900	498.64	496.9
52+950	498.54	496.5
53+000	498.44	496.3
53+050	498.34	496.3
53+100	498.24	496.0
53+150	498.14	495.7
53+200	498.04	495.4
53+250	497.94	495.1
53+300	497.84	494.8
53+350	497.74	494.5
53+400	497.64	494.2
53+450	497.54	493.9
53+500	497.44	493.6
53+550	497.34	493.3
53+600	497.24	493.0
53+650	497.14	492.7
53+700	497.04	492.4
53+750	496.94	492.1
53+800	496.84	491.8
53+850	496.74	491.5
53+900	496.64	491.2
53+950	496.54	490.9
54+000	496.44	490.6
54+050	496.34	490.3
54+100	496.24	490.0
54+150	496.14	489.7
54+200	496.04	489.4
54+250	495.94	489.1
54+300	495.84	488.8
54+350	495.74	488.5
54+400	495.64	488.2
54+450	495.54	487.9
54+500	495.44	487.6
54+550	495.34	487.3
54+600	495.24	487.0
54+650	495.14	486.7
54+700	495.04	486.4
54+750	494.94	486.1
54+800	494.84	485.8
54+850	494.74	485.5
54+900	494.64	485.2
54+950	494.54	484.9
55+000	494.44	484.6
55+050	494.34	484.3
55+100	494.24	484.0
55+150	494.14	483.7
55+200	494.04	483.4
55+250	493.94	483.1
55+300	493.84	482.8
55+350	493.74	482.5
55+400	493.64	482.2
55+450	493.54	481.9
55+500	493.44	481.6
55+550	493.34	481.3
55+600	493.24	481.0
55+650	493.14	480.7
55+700	493.04	480.4
55+750	492.94	480.1
55+800	492.84	479.8
55+850	492.74	479.5
55+900	492.64	479.2
55+950	492.54	478.9
56+000	492.44	478.6

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 52+500 TO STA. 56+000	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978 SHEET NO. 20 OF 87
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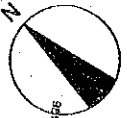




PLAN

SCALE 1 : 5000

17/41



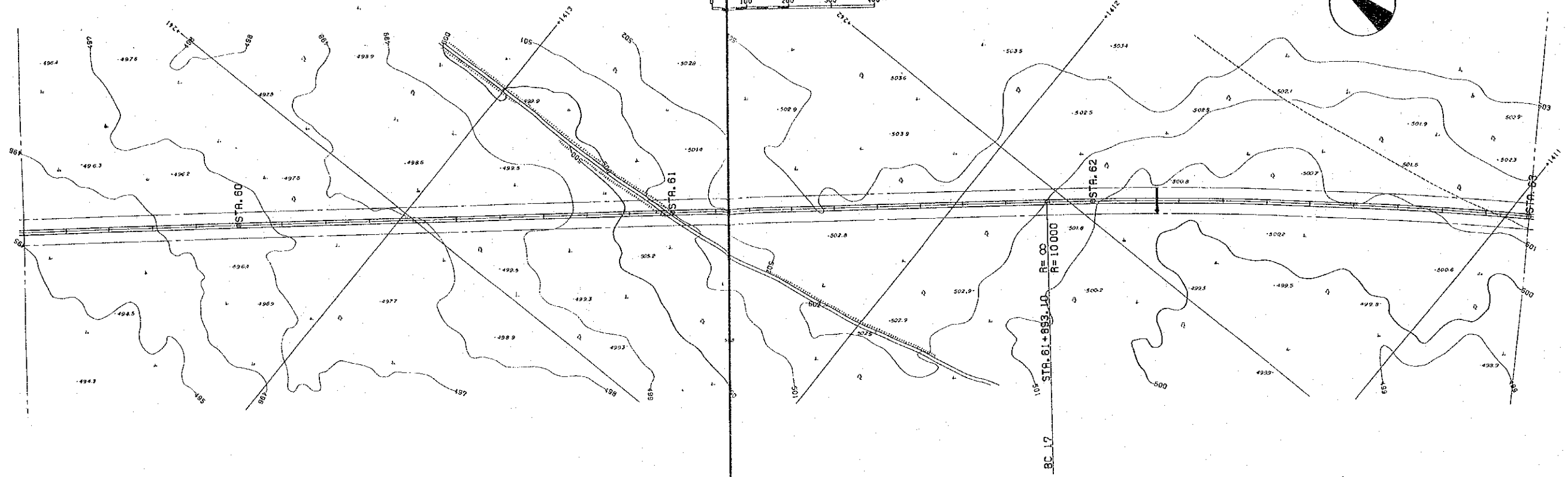
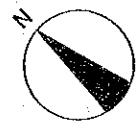
REDUCED PLAN  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

530																																																																								
520																																																																								
510																																																																								
500																																																																								
490																																																																								
480																																																																								
470																																																																								
DATUM-LINE 460 <sup>n</sup>																																																																								
GROUND LEVEL	495.86	495.0	495.89	495.2	496.10	495.1	496.39	495.4	496.68	494.3	496.97	496.0	497.26	496.2	497.55	496.3	497.84	497.0	497.99	497.5	497.87	497.3	497.60	497.2	497.33	497.1	497.06	495.0	496.79	496.1	496.52	496.3	498.26	495.8	495.88	494.9	495.71	494.8	495.44	494.6	495.17	494.4	494.90	494.2	494.63	493.6	494.36	493.5	494.19	493.6	494.25	493.7	494.41	493.8	494.57	494.0	494.73	494.2	494.89	494.1	495.05	494.2	495.21	494.3	495.37	494.5	495.53	494.7	495.69	494.8	495.85	495.1
PROPOSED ROAD LEVEL	495.86	495.0	495.89	495.2	496.10	495.1	496.39	495.4	496.68	494.3	496.97	496.0	497.26	496.2	497.55	496.3	497.84	497.0	497.99	497.5	497.87	497.3	497.60	497.2	497.33	497.1	497.06	495.0	496.79	496.1	496.52	496.3	498.26	495.8	495.88	494.9	495.71	494.8	495.44	494.6	495.17	494.4	494.90	494.2	494.63	493.6	494.36	493.5	494.19	493.6	494.25	493.7	494.41	493.8	494.57	494.0	494.73	494.2	494.89	494.1	495.05	494.2	495.21	494.3	495.37	494.5	495.53	494.7	495.69	494.8	495.85	495.1
STATION	56+000 +100						56+500						+900		57+000						57+500						58+000				+400		58+500						59+000		59+500																															
GRADE LENGTH	=-0.050%  L=500						=-0.29%  L=800						=-0.270%  L=500								=-0.160%  L=1200																																																			
VERTICAL CURVE	L=200 R=59000						L=200 R=38000								L=200 R=47000																																																									
HORIZONTAL CURVE	R=∞ L=2014.97		P.16  A=5°24'  R=10000 L=941.30				STA. 56+213.06				STA. 57+154.36						R=∞ L=4738.74																																																							

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 56+000 TO STA. 59+500	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
						SHEET NO. 21 OF 87

PLAN

SCALE 1 : 5000



50  
40  
30  
20  
10  
0

**REDUCED PLAN**  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

DATUM-LINE	460 <sup>m</sup>				
GROUND LEVEL	495.85, 495.1, 496.03, 495.4, 496.38, 495.7, 496.71, 495.9, 497.06, 496.4, 497.41, 496.7, 497.76, 497.1, 498.11, 497.5, 498.46, 497.8, 498.81, 497.9, 499.16, 498.2, 499.51, 498.6, 499.86, 498.8, 500.30, 499.3, 500.93, 500.1, 501.65, 501.0, 502.37, 501.8, 503.00, 502.4, 503.45, 502.8, 503.73, 502.8, 503.84, 502.9, 503.76, 502.8, 503.51, 502.7, 503.17, 502.4, 502.83, 501.9, 502.49, 501.1, 502.15, 500.7, 501.81, 500.4, 501.53, 500.6, 501.39, 500.5, 501.39, 500.8, 501.53, 501.0, 501.73, 500.9, 501.93, 501.1, 502.13, 501.3, 502.33, 501.4				
PROPOSED ROAD LEVEL					
STATION	59+500 +600, 60+000, 60+500, +800, 61+000, +400, 61+500, 62+000, +400, 62+500, 63+000				
GRADE LENGTH	$I=0.160\%$ $L=200$ 496.01	$I=0.350\%$ $L=1200$ 500.21	$I=0.710\%$ $L=600$ 504.53	$I=-0.340\%$ $L=1000$ 501.13	$I=0.200\%$ $L=1900$
VERTICAL CURVE	$L=100$ $R=53000$	$L=200$ $R=54000$	$L=600$ $R=57000$	$L=400$ $R=74000$	
HORIZONTAL CURVE		$R=\infty$ $L=4738.74$		$I.P17$ $iR=9^{\circ}51'$ $R=10000$ $L=1718.87$ STA. 61+893.10	

THE DEMOCRATIC REPUBLIC OF THE SUDAN  
 ROADS AND BRIDGES PUBLIC CORPORATION

ROAD PROJECT  
 EL OBEID - UM RUABA

PLAN AND PROFILE  
 FROM STA. 59+500 TO STA. 63+000

APPROVED BY

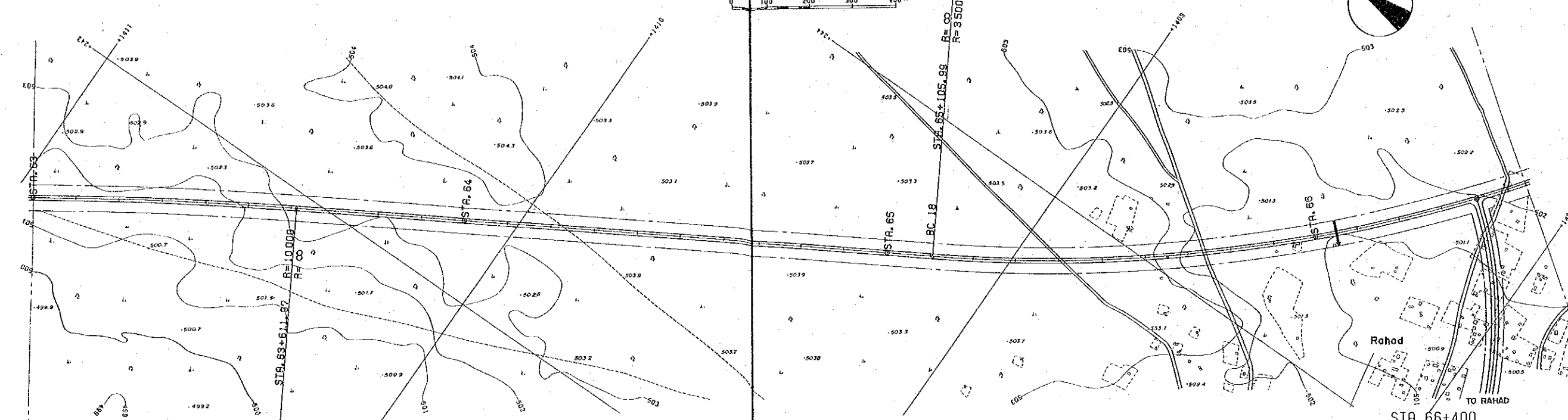
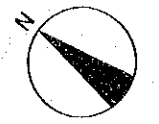
AMENDMENTS

SCALE  
 HORIZONTAL 1:5000  
 VERTICAL 1:500

DATE 1978  
 SHEET NO. 22 OF 87

PLAN

SCALE 1 : 5000

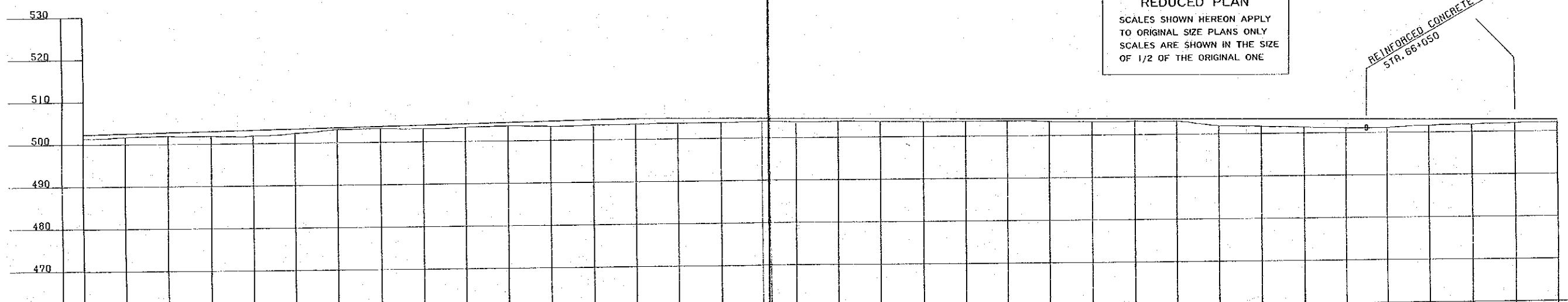


SECTION 3  
LENGTH = 20400M

SECTION 4  
LENGTH = 20100M

REDUCED PLAN  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

REINFORCED CONCRETE PIPE  $\phi$  1.0  
STA. 66+050

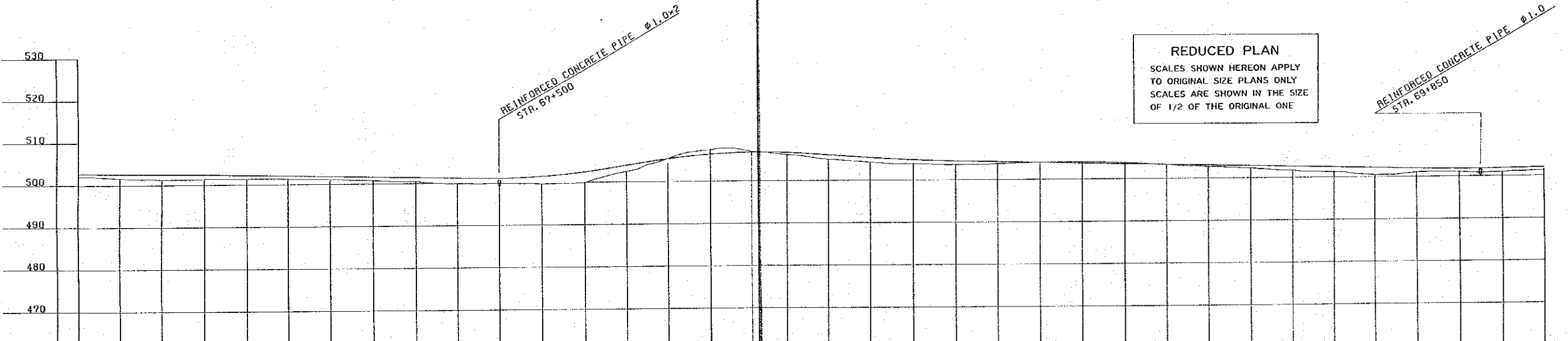
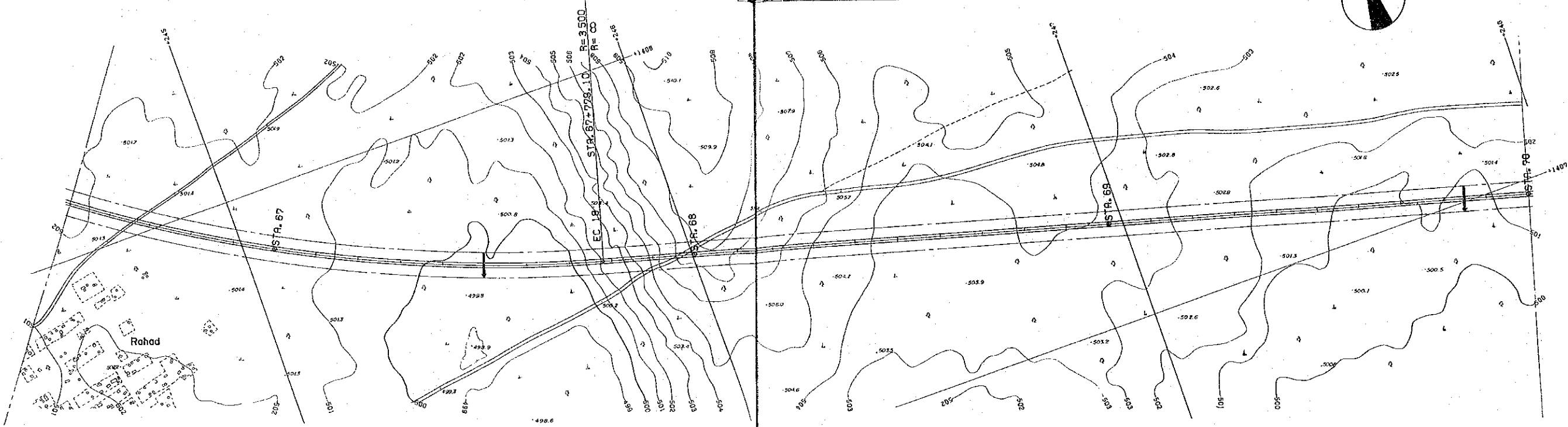


DATUM-LINE	460 <sup>n</sup>																																
GROUND LEVEL	502.33	501.7	501.8	501.8	501.8	502.3	503.1	503.2	503.1	503.3	503.5	503.3	503.5	503.6	503.7	503.7	503.8	503.6	503.5	503.5	503.3	503.1	503.2	503.1	501.9	501.7	501.4	501.1	501.1	501.5	501.7	502.0	502.1
PROPOSED ROAD LEVEL	502.33	501.7	501.8	501.8	501.8	502.3	503.1	503.2	503.1	503.3	503.5	503.3	503.5	503.6	503.7	503.7	503.8	503.6	503.5	503.5	503.3	503.1	503.2	503.1	501.9	501.7	501.4	501.1	501.1	501.5	501.7	502.0	502.1
STATION	63+000				63+500					64+000	+300		64+500						65+000				65+500				66+000					66+500	
GRADE LENGTH																		$i=0.200\%$ $L=1900$				$i=-0.100\%$ $L=2500$											
VERTICAL CURVE																		$L=260 \quad R=67000$															
HORIZONTAL CURVE	$R=10000 \quad L=1718.87$ $I.P17 \quad \Delta A=9^{\circ}51'$					STA. 63+611.97					$R=\infty \quad L=1494.02$					STA. 65+105.99					$I.P18 \quad \Delta A=8^{\circ}45' \quad R=3500 \quad L=2673.11$												

# PLAN

SCALE 1 : 5000

20  
41

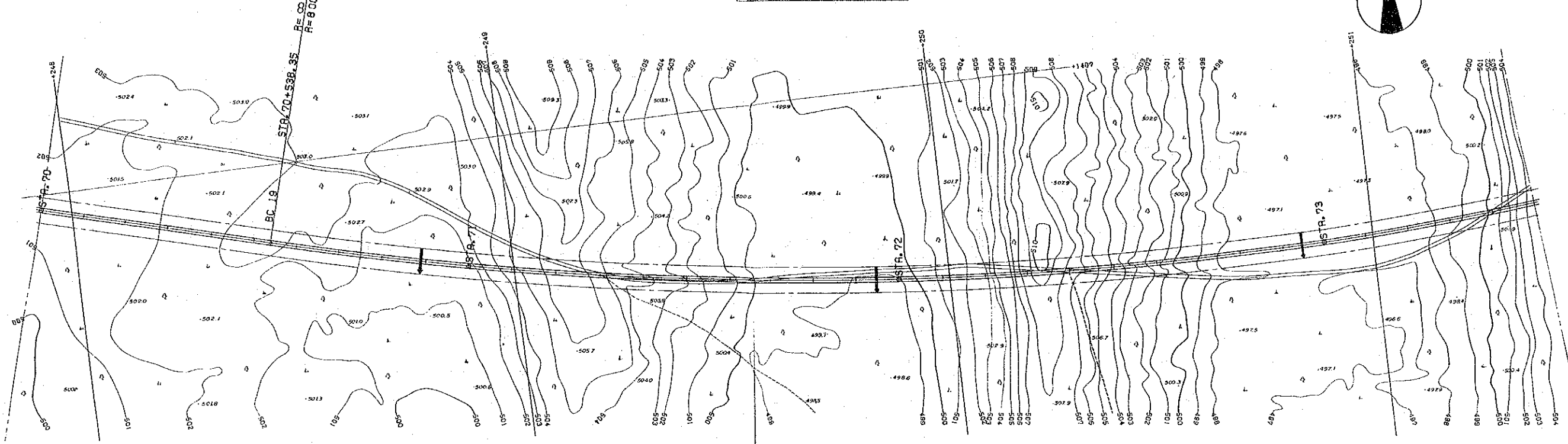
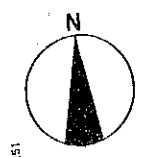
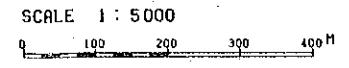


**REDUCED PLAN**  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

DATUM-LINE	460 <sup>p</sup>																			
GROUND LEVEL	[Ground level profile line]																			
PROPOSED ROAD LEVEL	[Proposed road level profile line]																			
STATION	66+500	+800	67+000	67+500	+600	68+000	+050	68+500	69+000	69+500	+800	70+000								
GRADE LENGTH	=-0.100% L=2500		=-0.200% L=800		=-0.200% L=800		=1.540% L=450		=1.540% L=450		=1.540% L=450		=1.540% L=450		=1.540% L=450		=1.540% L=450		=1.540% L=450	
VERTICAL CURVE	502.43		500.83		507.96		504.90		504.90		501.71									
HORIZONTAL CURVE	[Horizontal curve data: I.P18 IR=8°45' R=3500 L=2673.11, STRA. 67+779.10, R=∞ L=2759.25, [L=200 R=56000]]																			

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 66+500 TO STA. 70+000	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
						SHEET NO. 24 OF 87

# PLAN



50

40

30

20

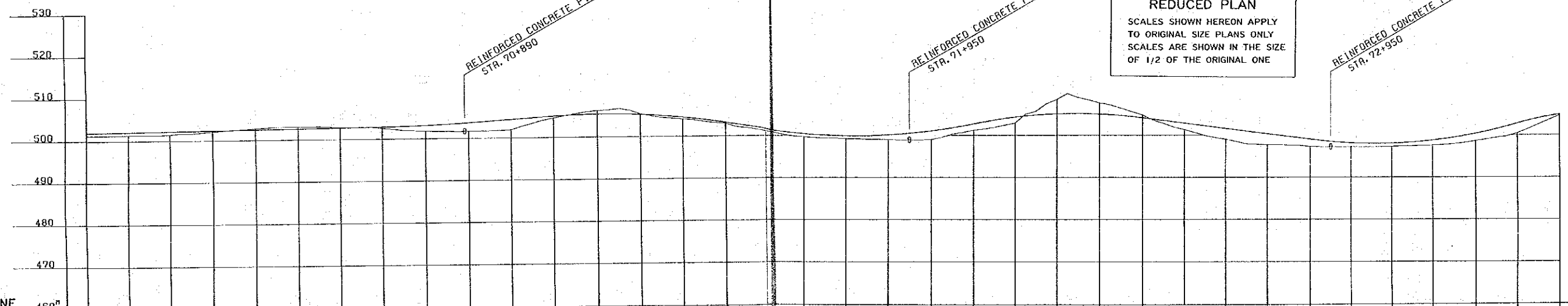
10

**REDUCED PLAN**  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

REINFORCED CONCRETE PIPE Ø1.0  
STA. 70+890

REINFORCED CONCRETE PIPE Ø1.0  
STA. 71+950

REINFORCED CONCRETE PIPE Ø1.0x2  
STA. 72+950

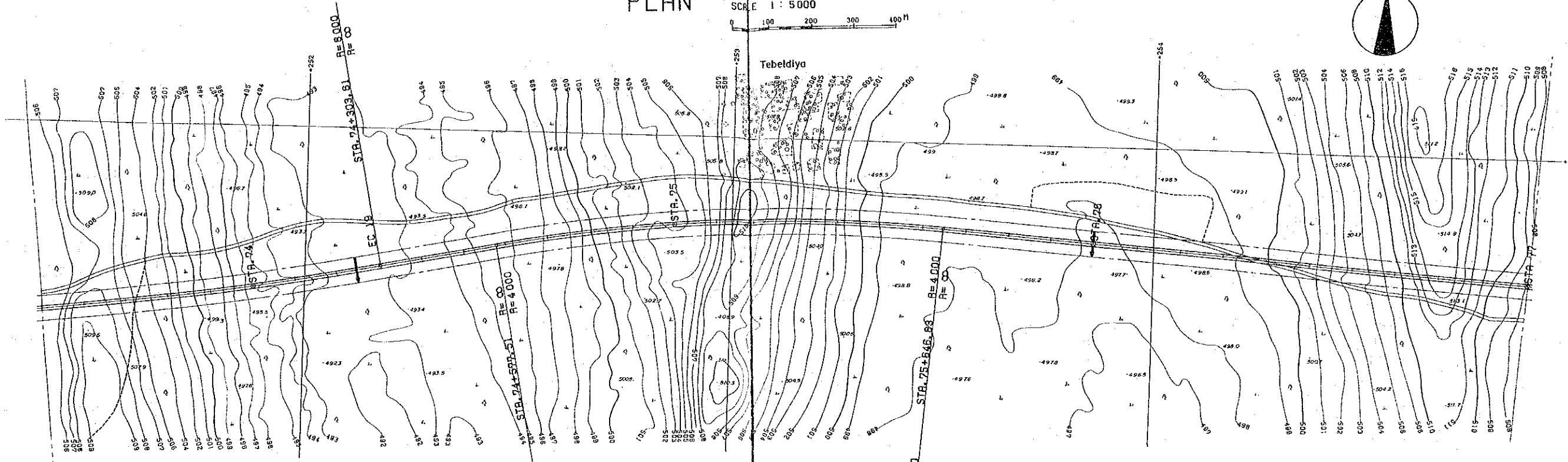
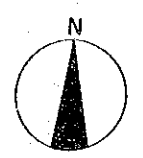


STATION	GROUND LEVEL	PROPOSED ROAD LEVEL	GRADE	LENGTH	VERTICAL CURVE	HORIZONTAL CURVE
70+000		501.3				R=∞ L=2759.25
70+500		502.1	-0.130%	L=1000		
+800		503.1			L=200 R=36000	STA. 70+538.35
71+000		504.9				
+300		505.4			L=400 R=18000	
71+500		506.3	-0.680%	L=500		
		507.2				J.P.19 RA=26°58' R=8000 L=3765.26
+850		508.7			L=500 R=14000	
72+000		509.2				
+300		509.9			L=400 R=12000	
72+500		510.0				
		510.2				
		510.9				
		511.3				
		511.5				
		511.8				
		512.1				
		512.4				
		512.7				
		513.0				
		513.3				
		513.6				
		513.9				
		514.2				
		514.5				
		514.8				
		515.1				
		515.4				
		515.7				
		516.0				
		516.3				
		516.6				
		516.9				
		517.2				
		517.5				
		517.8				
		518.1				
		518.4				
		518.7				
		519.0				
		519.3				
		519.6				
		519.9				
		520.2				
		520.5				
		520.8				
		521.1				
		521.4				
		521.7				
		522.0				
		522.3				
		522.6				
		522.9				
		523.2				
		523.5				
		523.8				
		524.1				
		524.4				
		524.7				
		525.0				
		525.3				
		525.6				
		525.9				
		526.2				
		526.5				
		526.8				
		527.1				
		527.4				
		527.7				
		528.0				
		528.3				
		528.6				
		528.9				
		529.2				
		529.5				
		529.8				
		530.1				
		530.4				
		530.7				
		531.0				
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		532.8				
		533.1				

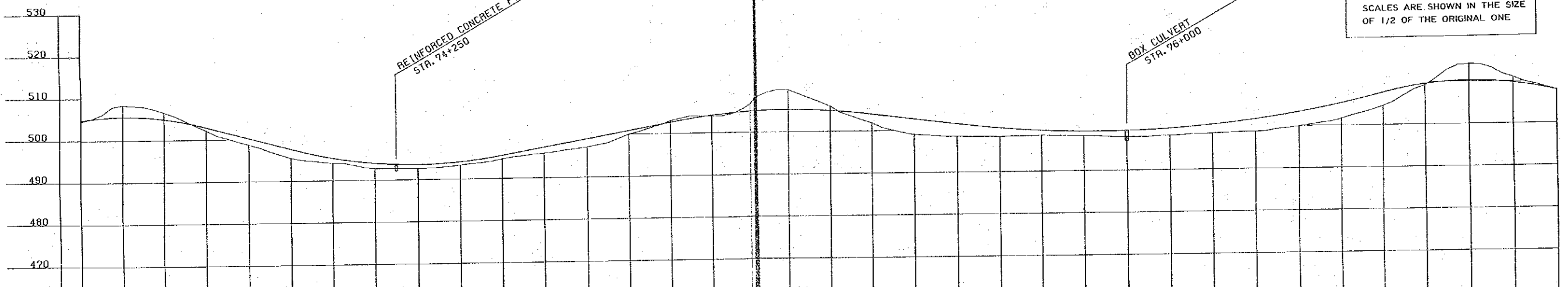
THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 70+000 TO STA. 73+500	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978 SHEET NO. 25 OF 87
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PLAN

SCALE 1 : 5000



REDUCED PLAN  
 SCALES SHOWN HEREON APPLY  
 TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE  
 OF 1/2 OF THE ORIGINAL ONE



DATUM-LINE	460 <sup>n</sup>	
GROUND LEVEL	504.89+504.6	508.64+508.4
PROPOSED ROAD LEVEL	504.99+506.6	502.92+502.2
STATION	500+600	74+000
GRADE LENGTH	$i = -2.760\%$ $L = 450$	$i = -2.666\%$ $L = 650$
VERTICAL CURVE	$L = 400$ $R = 7400$	$L = 500$ $R = 11000$
HORIZONTAL CURVE	$L.P19$ $IA = 26^{\circ}58'$ $R = 8000$ $L = 3765.26$	$STA. 74+303.61$ $R = \infty$ $L = 273.90$

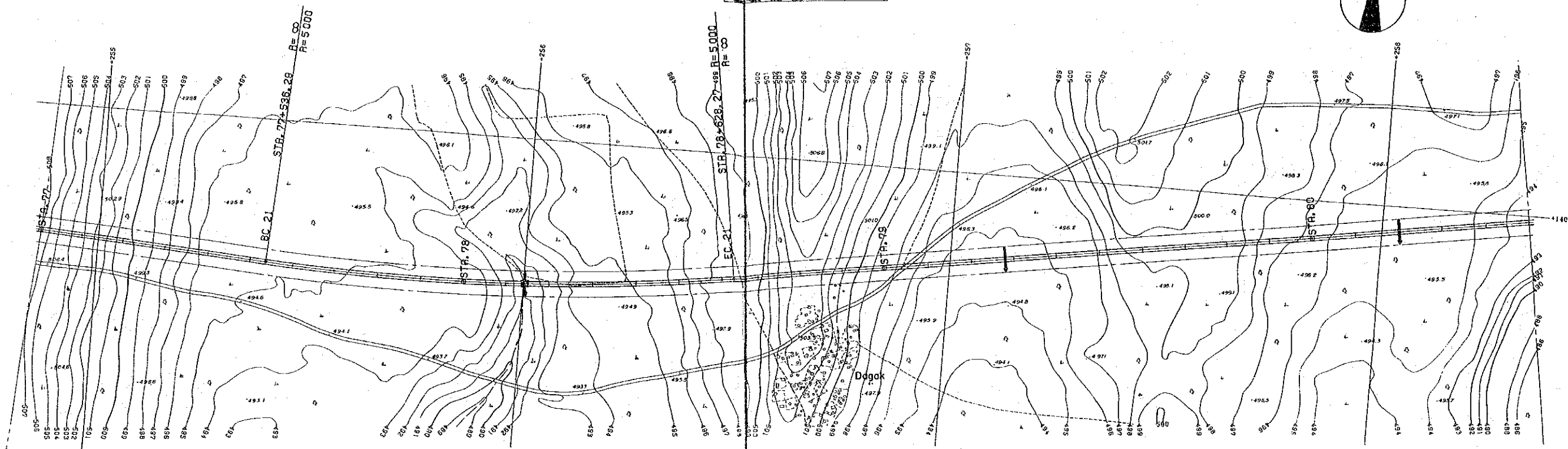
THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 73+500 TO STA. 77+000	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
						SHEET NO. 26 OF 87

PLAN

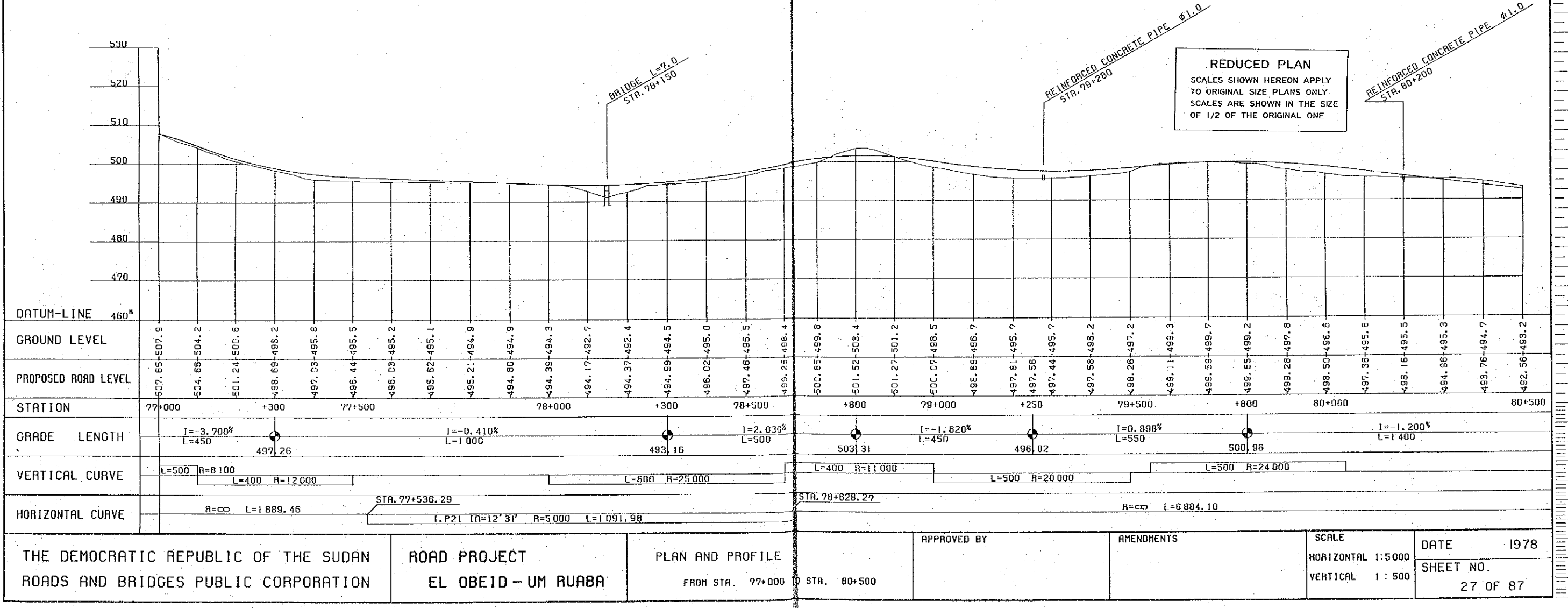
SCALE 1 : 5000



23 / 41



50  
40  
30  
20  
10  
0



**REDUCED PLAN**  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

THE DEMOCRATIC REPUBLIC OF THE SUDAN  
 ROADS AND BRIDGES PUBLIC CORPORATION

ROAD PROJECT  
 EL OBEID - UM RUABA

PLAN AND PROFILE  
 FROM STA. 77+000 TO STA. 80+500

APPROVED BY

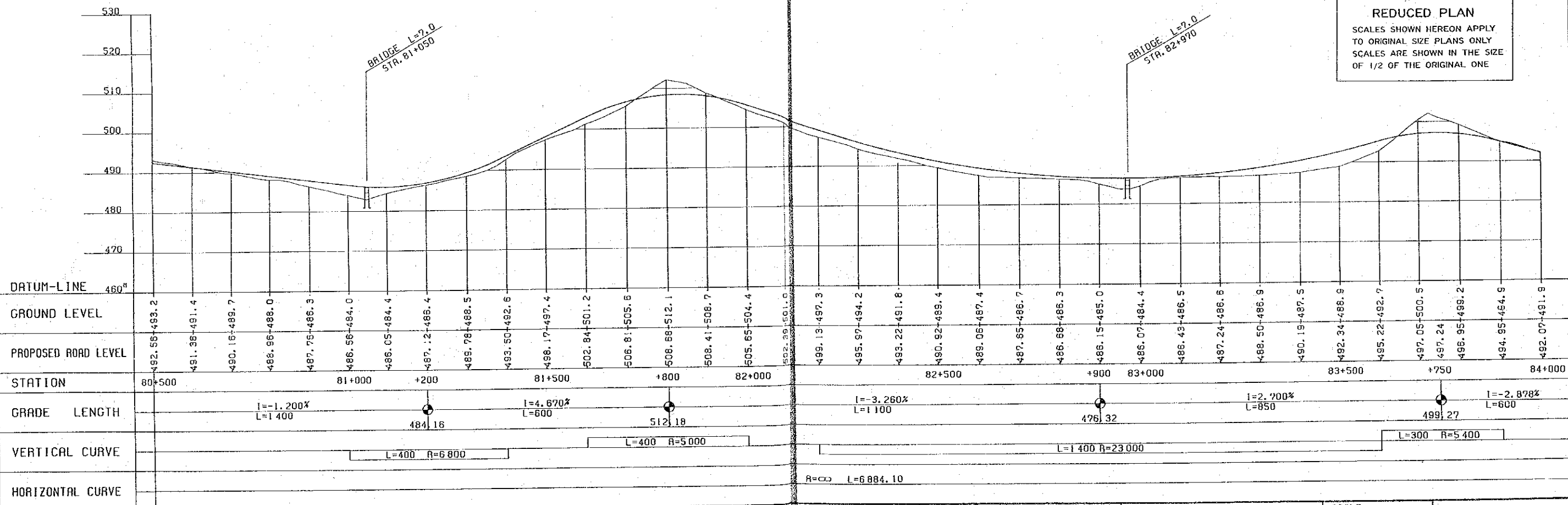
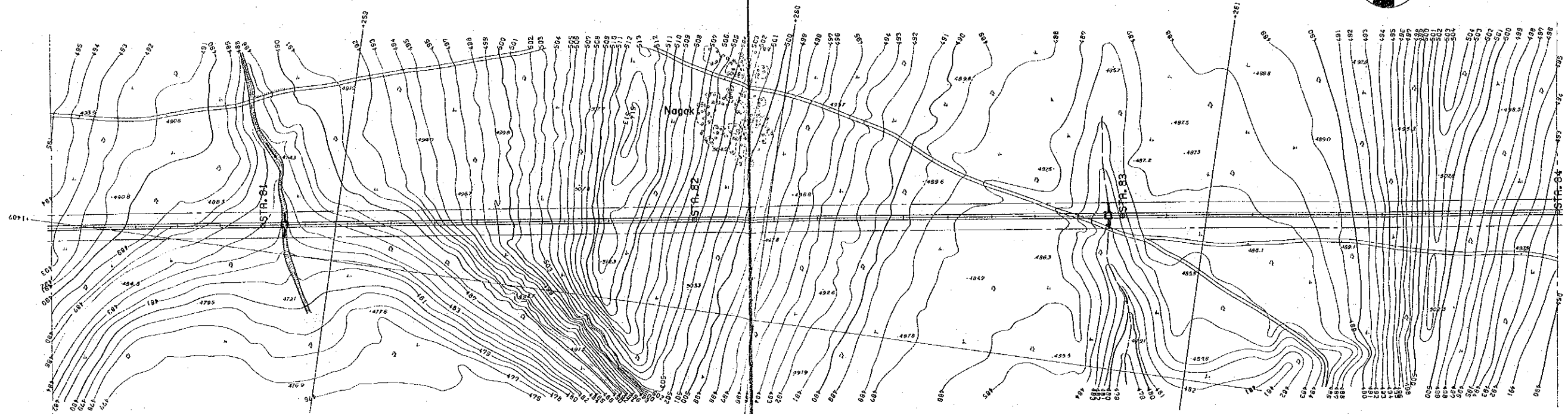
AMENDMENTS

SCALE  
 HORIZONTAL 1:5000  
 VERTICAL 1:500

DATE 1978  
 SHEET NO. 27 OF 87

PLAN

SCALE 1 : 5000  
 0 100 200 300 400 M

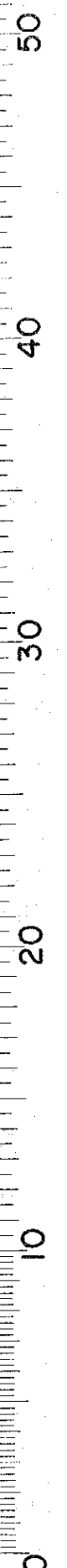
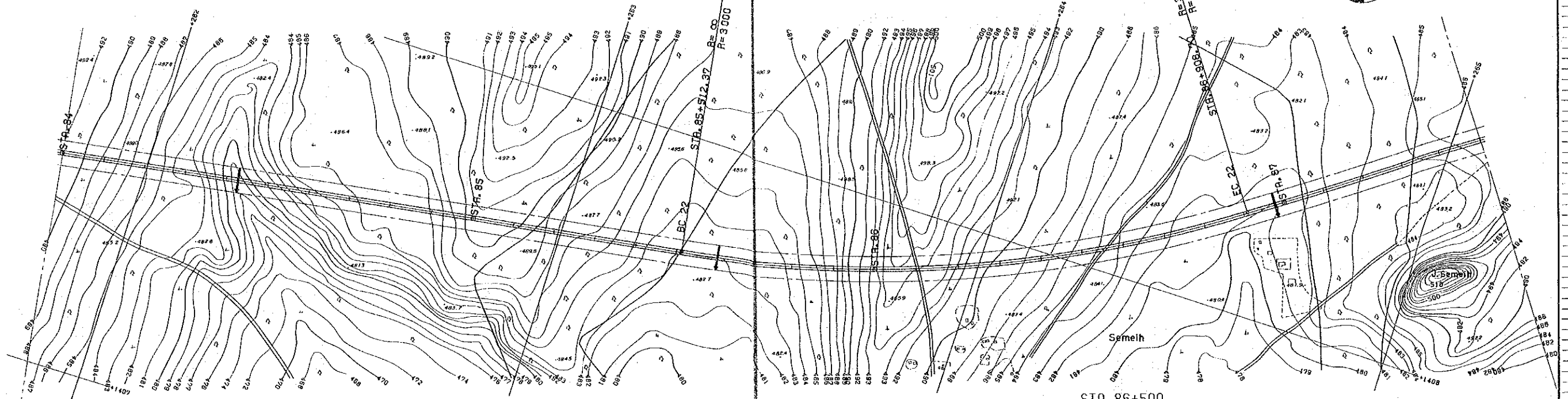
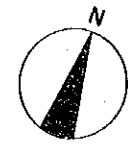
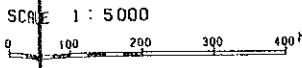


REDUCED PLAN  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 80+500 TO STA. 84+000	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
					SHEET NO. 28 OF 87	

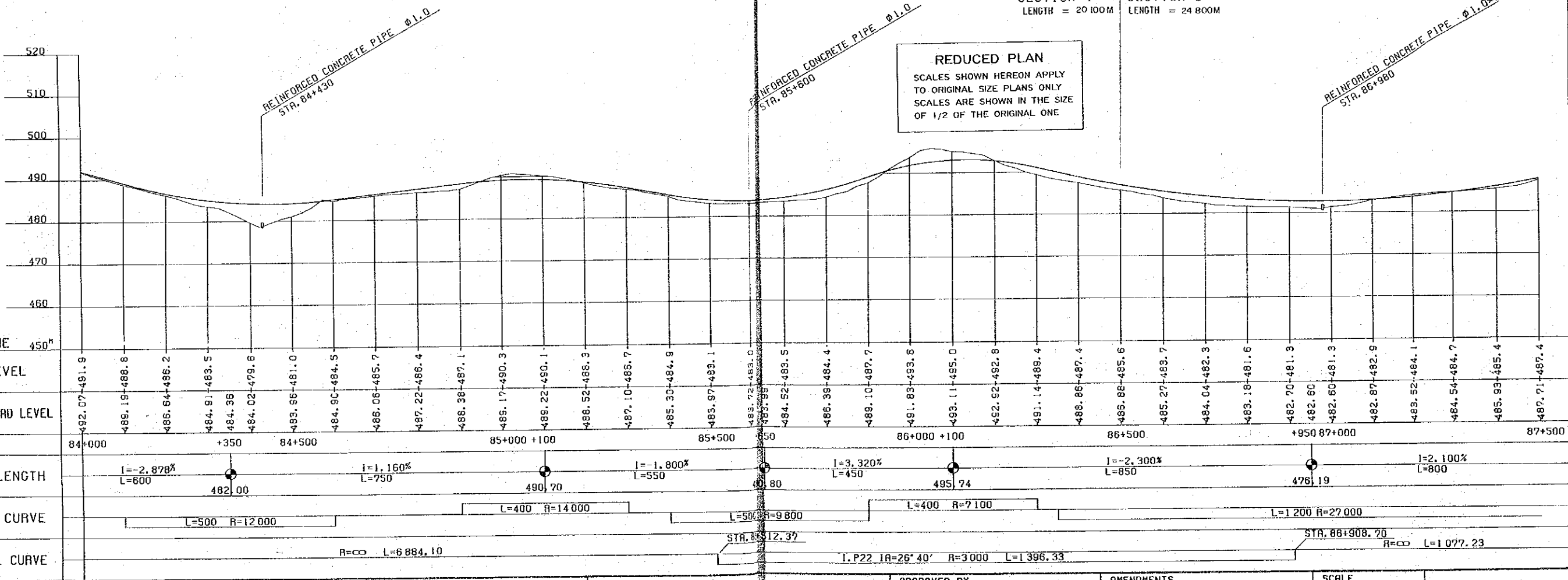


PLAN



SECTION 4 LENGTH = 20 100M  
SECTION 5 LENGTH = 24 800M

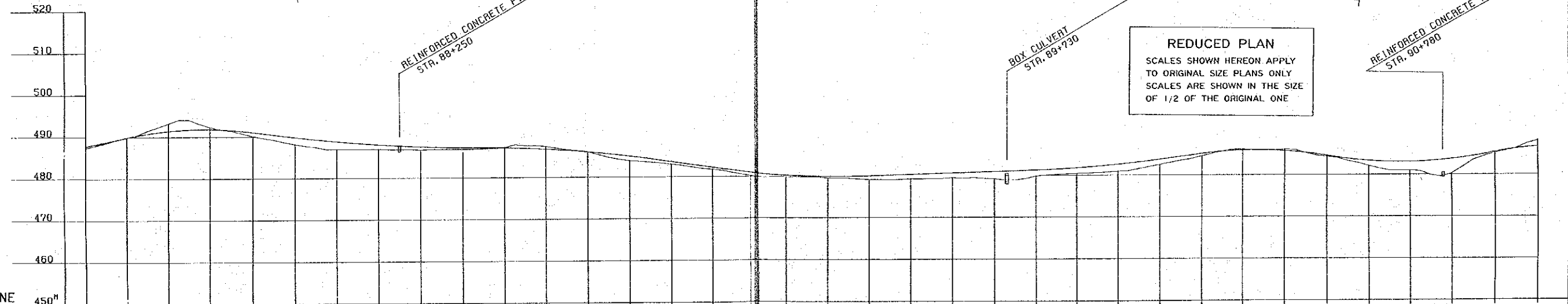
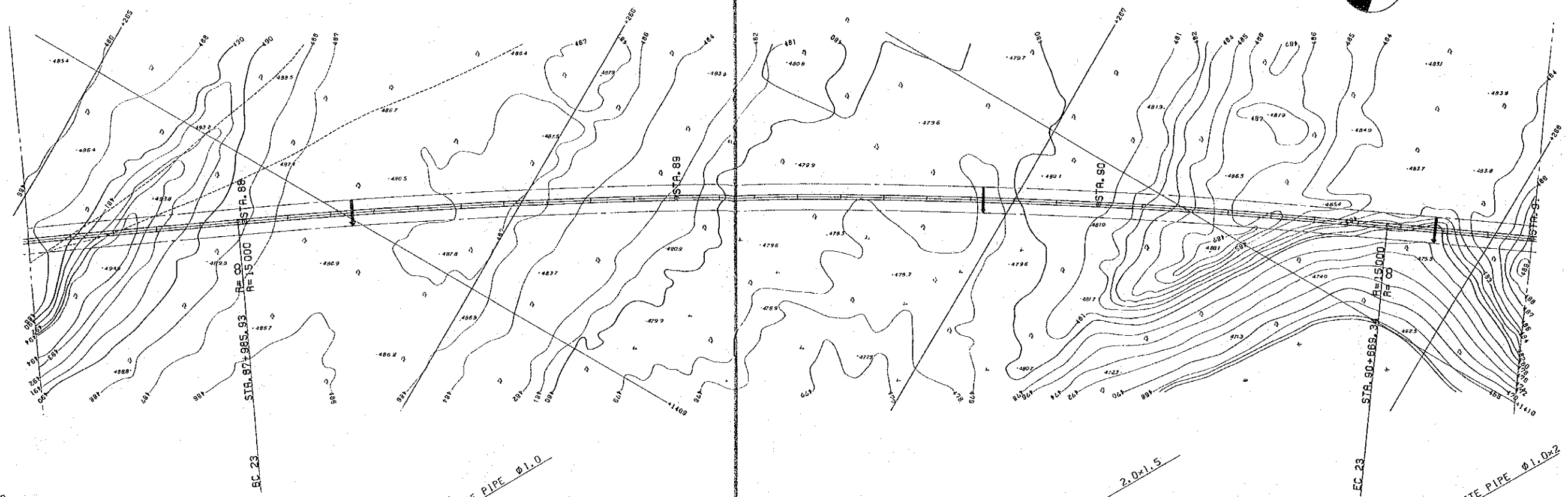
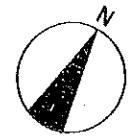
REDUCED PLAN  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE



THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 84+000 TO STA. 87+500	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
						SHEET NO. 29 OF 87

PLAN

SCALE 1 : 5000



REDUCED PLAN  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

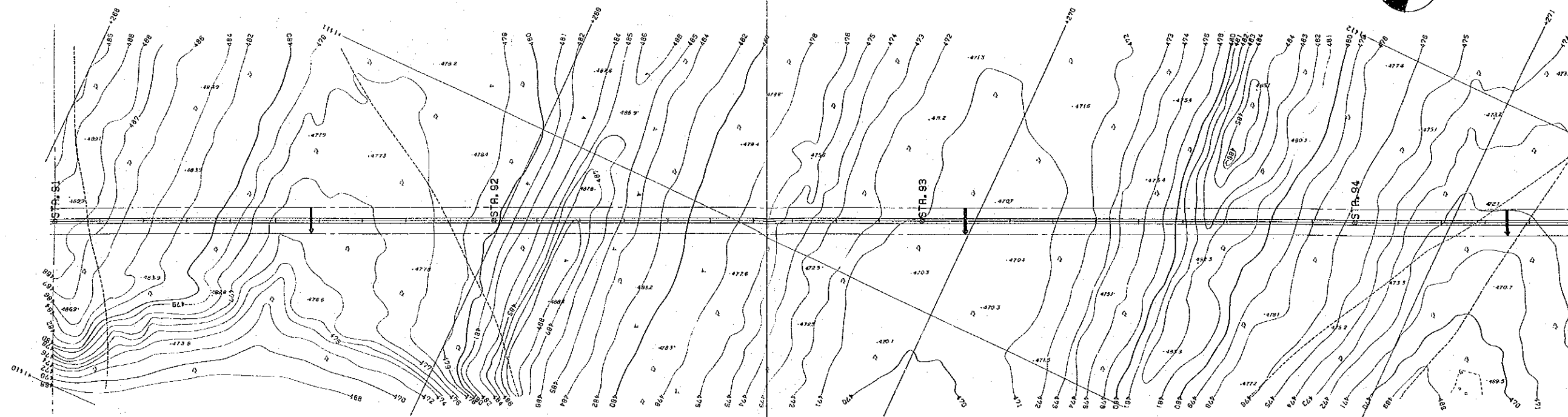
DATUM-LINE	450M																																																																								
GROUND LEVEL	487.71	488.9	493.2	491.75	491.81	492.3	491.04	490.1	489.76	488.1	488.72	486.9	487.93	486.9	487.41	486.7	487.15	486.8	487.09	487.2	486.74	487.4	486.43	486.02	486.0	484.95	483.9	483.59	483.0	482.17	481.7	480.95	480.2	480.18	479.8	479.84	479.5	479.97	479.1	480.29	479.2	480.61	479.5	480.93	479.2	481.25	479.8	481.73	480.4	482.11	482.57	480.9	483.74	482.5	485.06	484.5	485.92	486.2	485.96	485.75	486.1	484.57	484.3	483.33	482.1	483.06	481.0	483.73	480.2	485.33	485.2	486.68	488.1
PROPOSED ROAD LEVEL	487.71	488.9	493.2	491.75	491.81	492.3	491.04	490.1	489.76	488.1	488.72	486.9	487.93	486.9	487.41	486.7	487.15	486.8	487.09	487.2	486.74	487.4	486.43	486.02	486.0	484.95	483.9	483.59	483.0	482.17	481.7	480.95	480.2	480.18	479.8	479.84	479.5	479.97	479.1	480.29	479.2	480.61	479.5	480.93	479.2	481.25	479.8	481.73	480.4	482.11	482.57	480.9	483.74	482.5	485.06	484.5	485.92	486.2	485.96	485.75	486.1	484.57	484.3	483.33	482.1	483.06	481.0	483.73	480.2	485.33	485.2	486.68	488.1
STATION	87+500	87+750	88+000	88+200	88+500	88+750	89+000	89+200	89+500	89+750	90+000	90+200	90+500	90+750	91+000																																																										
GRADE LENGTH	I=2.100% L=800		I=-1.300% L=450		I=0.000% L=450		I=-1.420% L=550		I=0.320% L=750		I=1.340% L=400		I=-1.680% L=350		I=2.060% L=350																																																										
VERTICAL CURVE	L=300 R=8800		L=500 R=38000		L=400 R=28000		L=400 R=23000		L=300 R=29000		L=300 R=9900		L=400 R=11000		L=300 R=6800																																																										
HORIZONTAL CURVE	R=∞ L=1077.23		R=∞ L=1077.23		R=∞ L=1077.23		R=∞ L=1077.23		R=∞ L=1077.23		R=∞ L=1077.23		R=∞ L=1077.23		R=∞ L=1077.23																																																										

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 87+500 TO STA. 91+000	APPROVED BY	REVISIONS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
					SHEET NO.	
					30 OF 87	

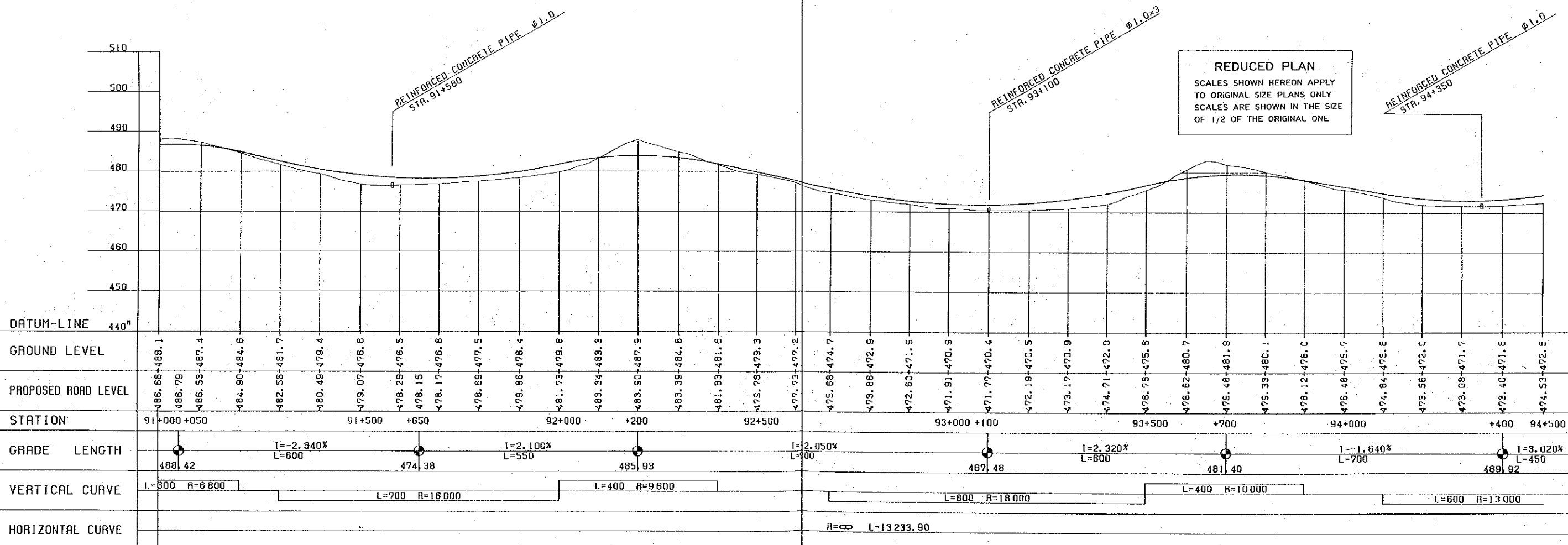
# PLAN

SCALE 1 : 5000  
0 100 200 300 400 M

27 / 41



50  
40  
30  
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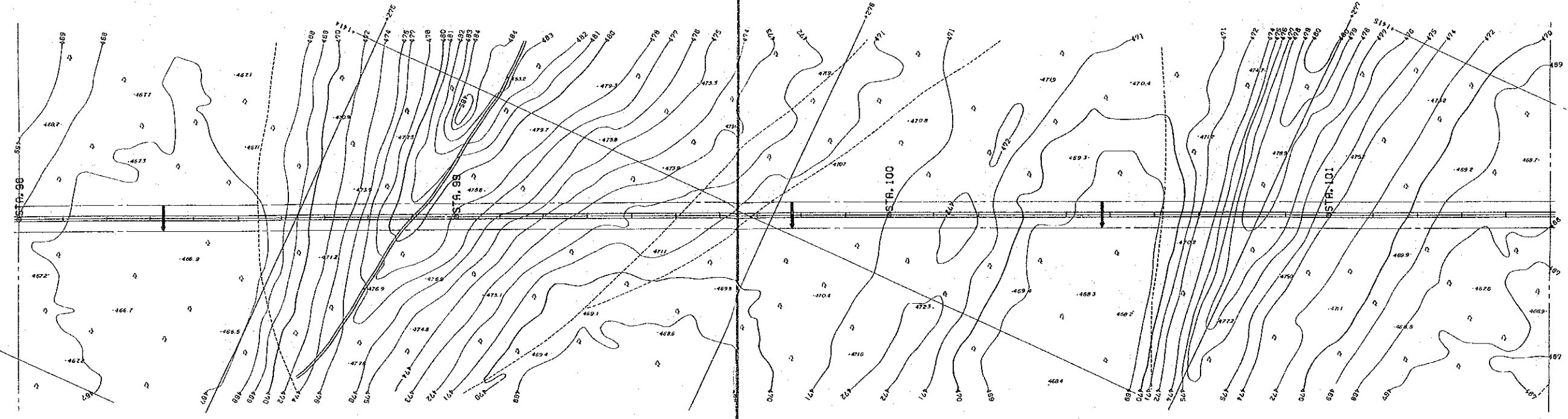
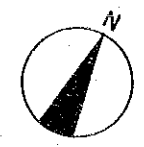
**REDUCED PLAN**  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RARBA	PLAN AND PROFILE FROM STA. 91+000 TO STA. 94+500	APPROVED BY	AMENDMENTS	SCALE HORIZONTAL 1:5000 VERTICAL 1:500	DATE 1978
					SHEET NO. 31 OF 87	

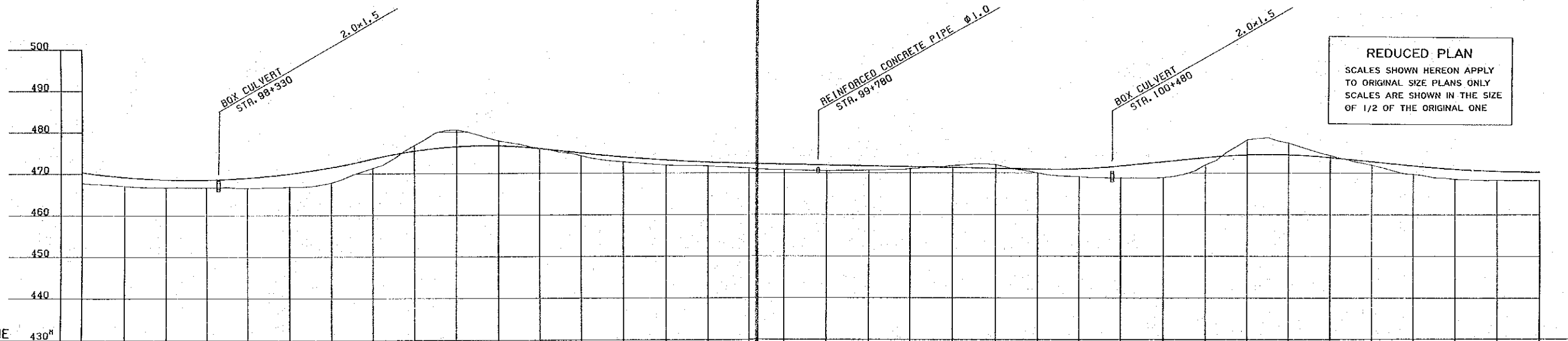


PLAN

SCALE 1 : 5000  
0 100 200 300 400 M



REDUCED PLAN  
SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

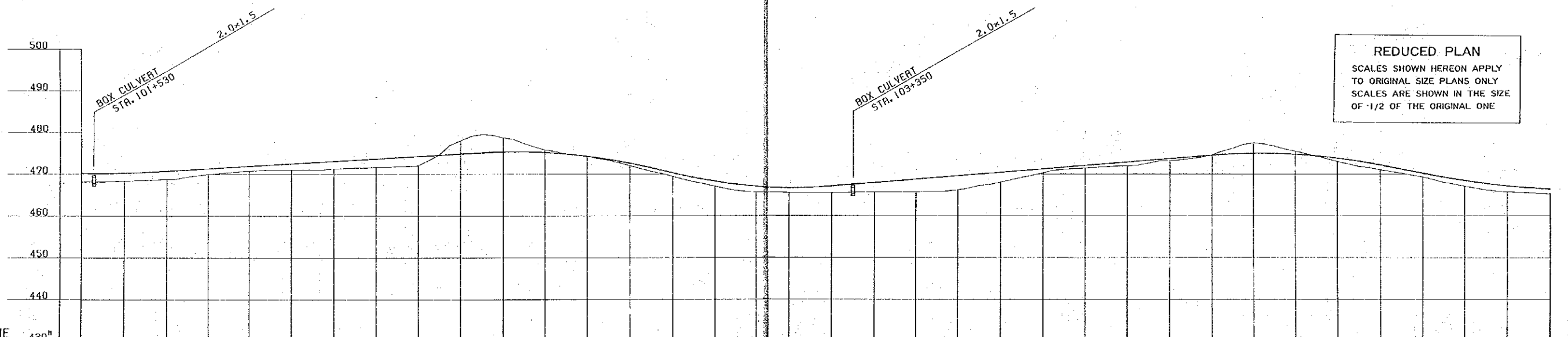
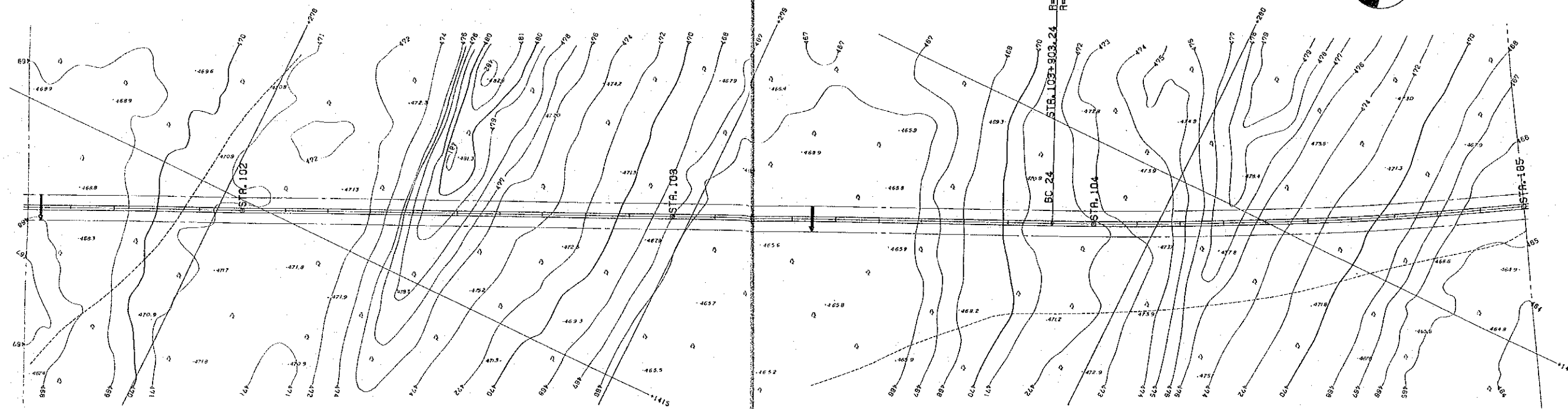
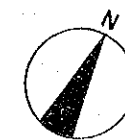


DATUM-LINE	430 <sup>n</sup>																																										
GROUND LEVEL	470.37	469.22	468.61	468.54	468.70	468.00	470.00	471.55	473.53	475.44	476.50	476.68	475.95	474.86	473.87	473.11	472.58	472.28	472.08	471.88	471.68	471.48	471.28	471.08	470.88	470.68	470.48	470.28	470.08	470.08	470.08	471.88	472.68	473.68	474.44	474.56	473.71	472.73	471.95	470.92	470.40	470.26	470.20
PROPOSED ROAD LEVEL	470.37	469.22	468.61	468.54	468.70	468.00	470.00	471.55	473.53	475.44	476.50	476.68	475.95	474.86	473.87	473.11	472.58	472.28	472.08	471.88	471.68	471.48	471.28	471.08	470.88	470.68	470.48	470.28	470.08	470.08	470.08	471.88	472.68	473.68	474.44	474.56	473.71	472.73	471.95	470.92	470.40	470.26	470.20
STATION	98+000	+	350	98+500	+	900	99+000	+	400	99+500	+	100+000	+	400	100+500	+	850	101+000	+	450	101+500																						
GRADE LENGTH	i = -1.400% L = 100		465.48		i = 2.300% L = 550		478.13		i = -1.090% L = 500		472.68		i = -0.200% L = 1000		470.68		i = 1.000% L = 450		475.18		i = -0.980% L = 600		469.30		i = 0.580% L = 1200																		
VERTICAL CURVE	L=700 R=19000				L=400 R=12000				L=400 R=45000				L=200 R=17000				L=300 R=15000				L=500 R=32000																						
HORIZONTAL CURVE	R=∞ L=13233.90																																										

PLAN

SCALE 1 : 5000

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REDUCED PLAN  
 SCALES SHOWN HEREON APPLY TO ORIGINAL SIZE PLANS ONLY  
 SCALES ARE SHOWN IN THE SIZE OF 1/2 OF THE ORIGINAL ONE

DATUM-LINE	430 <sup>m</sup>
GROUND LEVEL	470.20-468.2    470.31-468.4    470.75-466.8    471.33-470.0    471.81-470.8    472.49-471.1    473.07-471.3    473.65-471.7    474.23-472.0    474.81-478.0    475.30-478.7    475.13-475.8    474.76    474.20-474.2    472.51-472.0    470.25-469.4    468.21-467.0    466.99-465.8    466.59-465.5    467.10-465.5    467.92-465.7    468.74-465.7    469.56-466.2    470.38-468.0    471.20-470.3    472.02-471.4    472.84-471.9    473.66-473.2    474.48-474.6    474.95-477.5    474.72-475.5    473.78-473.0    472.18-471.0    470.21-469.3    468.44-467.1    467.15-465.7    466.33-465.2
PROPOSED ROAD LEVEL	
STATION	101+500    102+000    102+500    +650    103+000    +100    103+500    104+000    +400    104+500    105+000
GRADE LENGTH	$i = 0.580\%$ L=1200 $i = -2.400\%$ L=450 $i = 0.820\%$ L=1300 $i = -1.970\%$ L=600
VERTICAL CURVE	L=500 R=32000    L=400 R=13000    L=400 R=2000    L=400 R=14000    L=600 R=21000
HORIZONTAL CURVE	R=∞ L=13233.90    STA. 103+903.24    L.P24 IR=10°34' R=10000 L=1842.96

THE DEMOCRATIC REPUBLIC OF THE SUDAN ROADS AND BRIDGES PUBLIC CORPORATION	ROAD PROJECT EL OBEID - UM RUABA	PLAN AND PROFILE FROM STA. 101+500 TO STA. 105+000	APPROVED BY	AMENDMENTS	SCALE	DATE
					HORIZONTAL 1:5000 VERTICAL 1:500	1978 SHEET NO. 34 OF 87