

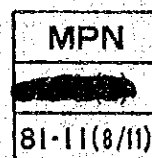
REPUBLIC OF THE PHILIPPINES
NATIONAL POWER CORPORATION

**FEASIBILITY REPORT
ON
AGOS RIVER HYDROPOWER PROJECT**

**DATA BOOK I
TOPOGRAPHIC SURVEY**

MARCH 1981

JAPAN INTERNATIONAL COOPERATION AGENCY



REPUBLIC OF THE PHILIPPINES
NATIONAL POWER CORPORATION

**FEASIBILITY REPORT
ON
AGOS RIVER HYDROPOWER PROJECT**

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DATA BOOK I
TOPOGRAPHIC SURVEY

MARCH, 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

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受入 月日 584. 89. 24	17810
登録No. 09851	6432
	MPN

AGOS RIVER HYDROPOWER PROJECT

FEASIBILITY REPORT

Main Report

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Appendix	B	Geology and Construction Materials
Appendix	C	Power Study
Appendix	D	Optimization Study for the Development on the Agos River System
Appendix	E	Project Works
Appendix	F	Computer Outputs
Data Book	I	Topographic Survey
Data Book	II	Meteorology and Hydrology
Data Book	III	Geological Exploration
Data Book	IV	Construction Materials

DATA BOOK I TOPOGRAPHIC SURVEY

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CHAPTER I

INTRODUCTION

The available maps for planning of the Agos Project were the national maps of scale 1 to 50,000 with 20 meter contours, which cover whole the project area. For the detailed study the following survey works were required to be conducted.

- a) Preparation of aero-photo maps covering the proposed reservoir area (1 to 5,000 scale with 5 meter contours),
- b) Ground control survey by staking points for horizontal and vertical control
- c) Setting bench marks from the estuary of the Agos river to the Agos damsite
- d) River profile and cross-section survey from the estuary of the Agos river to the Agos damsite
- e) Preparation of detailed topographical maps of 1 to 1,000 scale with 1 meter contours covering the following areas
 - i) Agos damsite (1.92 km²)
 - ii) Afterbay weir site (0.32 km²)
 - iii) Kanan No.1 damsite (0.83 km²)

Out of the survey works listed above, the aerial-photo maps for the reservoir area along the Kanan river were prepared by PICOREM the copy of which was given to us in October 1979. The aerial-photo maps for the remaining reservoir area mainly along the Kaliwa river were prepared by NAPOCOR and were given to us in July 1980. All other topographic surveys were carried out by JICA experts and NAPOCOR surveyors.

Besides the above, the survey works required for the geological and construction material investigations including the line survey of seismic exploration were conducted. Longitudinal cross section survey for Kanan No.5 damsite (previously selected by Lahmeyer Consult Co.) was also made for reference. All the survey works were almost completed by the end of August 1980. The survey works conducted during the whole study period for the Project are summarized in Dwg.1.

DETAILED SCOPE OF GROUND SURVEY TO BE DONE BY NPC

Item	Scope of Works	Main Equipment	Measuring Method & allowable Errors
Leveling	<p>1) Primary leveling and Bench Mark setting along the road from Infanta to the Agos No.1 damsite and along Agos River down to the estuary,</p> <p>Distance: about 30 km (single distance) Bench Mark: Approx. 2 km interval, concrete post 20 pcs. Intermediate: approx 1 km interval, painting or timber peg. 20 nos.</p>	<p>2nd Class auto level - 2 sets Folding hinged staff - 4 pcs.</p>	<p>1) Closing error of leveling 10 mm x D for bench mark setting survey (D; Distance in km)</p>
	<p>2) Branch leveling: for river sectional survey: Approx. 40 open branches, 30 km in total single distance.</p>	<p>Telescopic staff - 4 pcs.</p>	<p>2) Closing error of leveling 40 mm x D for Branch leveling</p>
Ground Control survey	<p>Ground control points shall be set up at an average interval of 3 km along</p> <p>i) Agos River up to the confluence of Kanan and Kaliwa Rivers (20 km),</p> <p>ii) Kanan River from the confluence up to the proposed Kanan No.1 damsite (15 km), and</p> <p>iii) Kaliwa River from the confluence up to the existing control points already set up by PICOREM (17 km).</p>	<p>Light wave range finder (Wild 1) distmat D1-35 or Zeiss ELDI-2 Class) - 2 sets Theodolite (Wild T-2 class) - 2 sets Steel tape (50 m) - 2 pcs. Polyester tape (50 m) - 2 pcs. Long distance transceiver (Camp to Base camp) - 2 sets</p>	<p>1) Angle Measurement Angle observation: 3 series Observation error 10" Double angle difference 20" Max. closing error of azimuth 5"/sta. or 10" + 15" N 2) Distance Measurement by Range finder Twich readings x 2 series (4 readings) at the control point.</p>

Item	Scope of Works	Main Equipment	Measuring Method & allowable Errors
	<p>Wooden pegs (12 cm x 12 cm x 80 cm, creosoted) shall be used for the above staking points.</p> <p>Number of pegs required may be around 20 to 25 including 4 or 5 astronomical azimuth survey points.</p>		<p>Twice readings x 2 series (4 readings) at the different point set up 3 to 5 meters away from the control point in the same direction.</p> <p>Errors 5 cm + 1/50,000 x D (D: distance)</p>
Topographic survey	<p>Topographic survey shall be carried out at prospective damsites (e.g. Agos No.1, Agos No.2, Kanan No.1, Kanan No.5 damsites), quarry site and borrow area.</p> <p>Survey area: approx 7 km² in total</p> <p>Mapping: Scale of 1/1,000 with 1 m contour lines as far as possible. (2 or 5 m contours in case of steep slope)</p> <p>Those mapping method should be used by detail traversing, cross-leveling and plane table surveying.</p> <p>Detail traversing length: approx. 15 km</p> <p>Cross-leveling; approx 45 km</p> <p>(Agos No.1, No.2; interval 100 m, 20 lines Kanan No.5; 1 line</p> <p>Other Areas; interval 200 m, 60 lines)</p> <p>Plane table surveying; approx. 7 km²</p> <p>Concrete post (10cm x 10cm x 80cm) have to be used for Base-line of each area (total approx. 20 nos.)</p>	<p>Light wave rangefinder (Wild 1) Angle Measurement of distmat Di-3S or Zeiss ELDI-2 Traversing: 2 series class; (common use with Ground Control survey) - 2 sets Observation error 40" Double angel error 50"</p> <p>Theodolite (20" division)</p> <p>- 2 sets Distance Measurement by Steel tape (100 m) - 2 pcs. Rangefinder or steel tape; 1 set (2 readings)</p> <p>Polyester tape (100 m) - 4 pcs.</p> <p>Tranciever - 4 sets</p> <p>Plane-table - 4 sets</p> <p>Telescopic staff - 6 pcs.</p>	<p>According to ordinary method Some special cases, Consultants will instruct surveyors in the field according to necessity.</p>

Item	Scope of Works	Main Equipment	Measuring Method & Allowable errors
River cross sectional survey	River cross sectional survey shall be carried out along the Agos River from Agos No.1 dam site down to the estuary.	2nd class auto level - 2 sets (in addition to the page 1)	Sounding interval have to be less than 10 m.
	Number of cross section Agos No.1 to Agos No.2; 20 lines (to relative height 15 m above the water surface) Agos No.2 to estuary; 10 lines (to the shoulders of higher terraces of both banks) Those lines have to be connected to ground control points or 2nd class traverse points and branched Bench marks.	Telescopic staff - 4 pcs. Polyester Tape (100 m)-2 pcs.	Closing error of leveling 50 cm + 10 cm D (D: distance in km)
	River water depths shall be surveyed during shallow water season by rope with a weight or measuring rod.		

CHAPTER 2

GROUND CONTROL SURVEY

The ground control survey was started from Bureau of Land's reference points Infanta BLLM #1 and BLLM #2 whose coordinates were provided by NPC. For the purpose of river cross section survey on Agos river, the route of survey was so arranged to pass the Agos river. On the way to the confluence of Kanan and Kaliwa rivers, the route is connected to BLLM #11 and #12, and finally connected to PICOREM's reference points of S-26 and S-16A established by F.F. Cruz Co., Ltd. (Survey contractor of PICOREM). The difference of bearings to North between NPC's survey results based on Bureau of Land's reference points and PICOREM's results is only 5 seconds, but the difference in coordinates between NPC derived from BLLM's reference points and PICOREM is 17.883 m in X direction and 108.497 m in Y direction. It has been finally concluded that the PICOREM's coordinates of S-26 and S-16A shall be used as the original points for ground control.

Ground Control

成果表

GA-1

点 名	X	Y	H	
	m	m	m	
7 1	+1630 677.210	+569 991.557	.	
2	838.627	495.354	.	
3	369.163	212.315	.	
4	433.439	568 952.216	.	
5	533.052	520.343	.	
6	679.357	567 926.013	.	
7	802.787	406.215	.	
8	853.043	194.834	.	
10	961.527	566 736.960	.	
11	1631 036.921	438.311	.	
12	109.646	340.606	.	
13	202.932	297.790	.	
14	315.491	303.421	.	
15	521.588	367.307	.	
16	560.692	363.115	.	
17	569.718	236.245	.	=R 5
18	736.434	327.874	.	=L 5
19	443.018	365.530	.	
20	341.912	707.104	.	
21	198.137	961.409	.	
22	250.209	567 019.358	.	=R 4
23	196.387	249.014	.	
T 24	213.938	568 160.790	.	=R 3

点検者

国務航業株式会社

Ground control

2

成果表

GA-I

点 名	X	Y	H	
	m	m	m	
T 25	+1632 032.823	+568 274.905	.	
26	342.150	108.030	.	
27	718.101	569 016.520	.	= L-2
28	675.112	522.761	.	
29	750.357	836.731	.	
30	690.772	845.914	.	
31	507.447	815.308	.	
32	372.522	835.080	.	
33	233.725	839.851	.	
34	177.123	800.425	.	
35	107.961	816.218	.	
36	1631 868.704	740.943	.	
37	614.369	652.277	.	
38	503.675	705.971	.	
39	352.449	764.670	.	
40	251.622	807.585	.	
41	129.092	768.998	.	
42	083.906	892.697	.	
43	1630 914.127	831.722	.	
44	870.996	967.080	.	
T 45	844.336	570 255.822	.	
	.	.	.	
	.	.	.	

国際航業株式会社

点検者

PICOREM

成果表

GA-I

山

点 名	X	Y	H	
	m	m	m	
CM 3	+1635 312.70	+567 957.88	3.857	MPL -0.4785
CM 4	1634 441.65	569 873.33	3.118	
P 4	1631 032.21	468.30	—	
5	1626 319.71	563 903.43	449.031	
6	1624 978.30	562 560.27	253.307	
7	1627 895.62	940.75	331.971	
8	1633 376.17	566 446.10	127.321	
9	1631 334.17	558 020.79	672.449	
10	1627 893.66	559 801.66	892.591	
11	1630 580.14	555 604.65	64.346	
12	1632 977.95	554 730.16	483.605	
13	1637 057.52	556 484.57	723.706	
14	1633 934.40	557 622.35	743.172	
15	1636 951.46	554 150.46	581.217	
15A	1640 425.60	284.76	711.575	
16	849.91	497.62	721.756	
16A	1623 944.43	557 527.14	404.241	
17	1620 682.79	556 451.70	622.323	
18	1615 296.69	552 495.63	517.534	
19	1612 542.89	549 508.64	632.583	
20	1614 962.76	543 336.69	—	
21	1618 096.02	652.05	—	
S 22	1617 518.93	545 521.67	472.310	
点検者				

PICOREM

成果表

GA-1

点 名	X	Y	H	
	m	m	m	
S 23	+1616 214.42	+547 023.15	717.221	MFL -0.4285
24	1620 603.65	552 787.69	640.020	
25	1622 625.34	554 640.68	—	
26	1624 853.37	556 058.60	274.365	=PP-48Y
30	1635 447.77	552 845.85	742.226	
31	1633 772.60	550 103.02	818.208	
32	1632 628.50	548 621.48	658.405	
32A	1635 069.45	245.63	593.828	
33	1636 170.78	014.21	538.923	
34	952.46	549 748.58	756.507	
35	1638 103.54	552 076.31	724.225	
36	1640 162.16	550 134.20	653.026	
S-47	1043 374.63	552 965.95	697.225	
CH 1	1617 108.56	544 858.48	175.037	
	316.93	949.23	175.740	
	.	.	.	
	.	.	.	
	.	.	.	
	.	.	.	
	.	.	.	
	.	.	.	
	.	.	.	
	.	.	.	
	.	.	.	
	.	.	.	

点検者

PICOREM (KANAN NO.1)

1

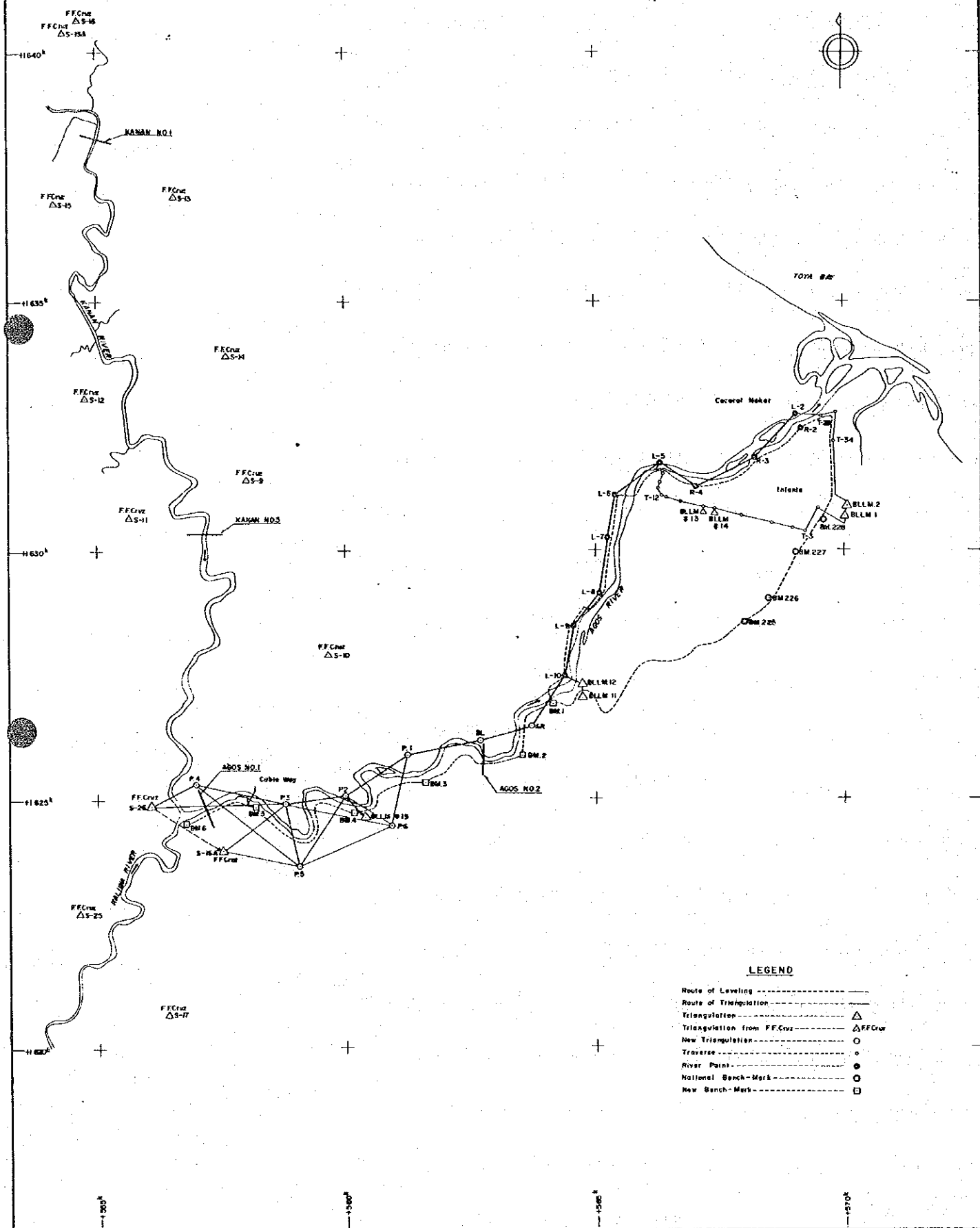
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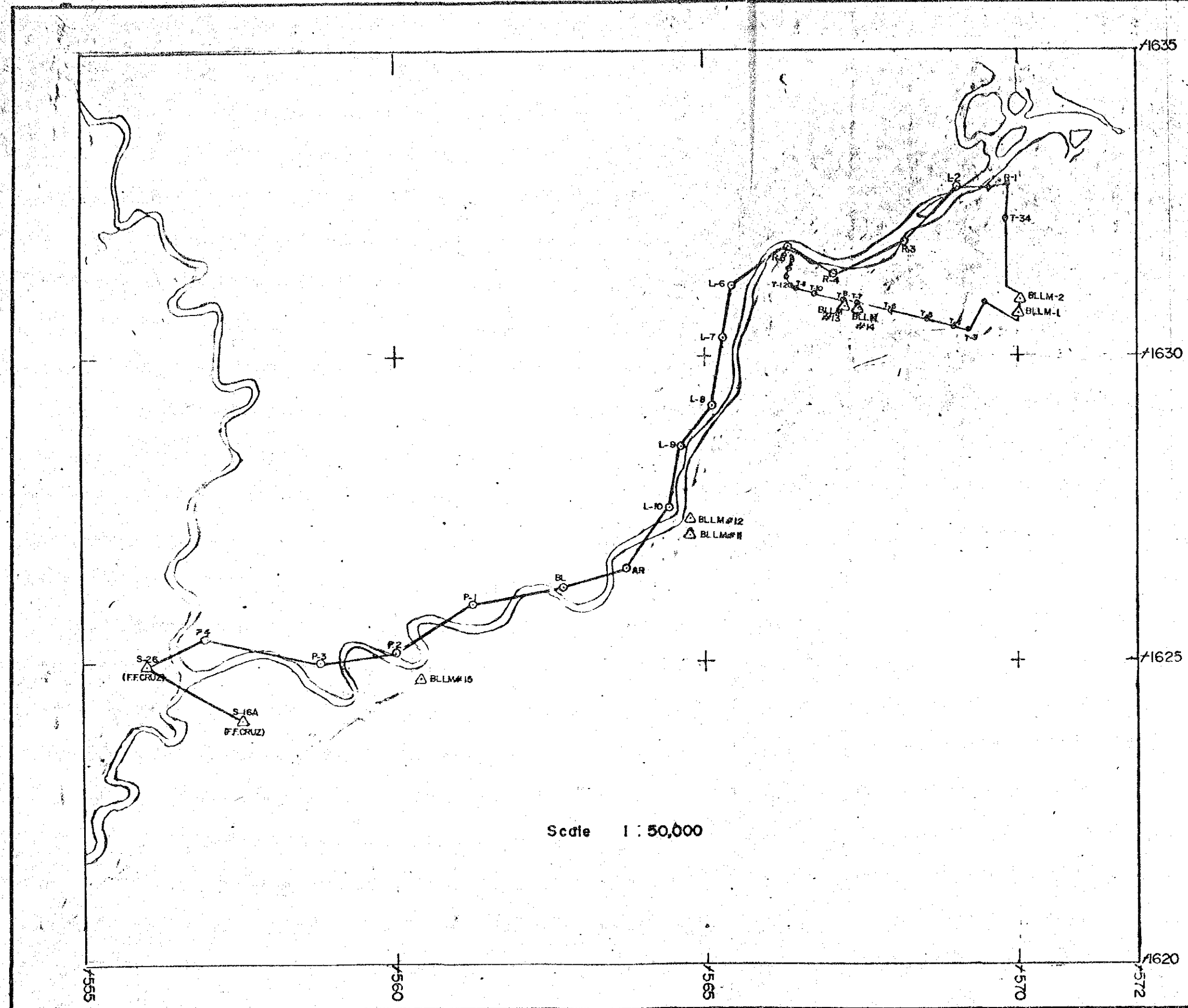
点検者

AGOS HYDROELECTRIC PROJECT

CONTROL POINTS NETWORK

SCALE 1:50,000





Scale 1 : 50,000

NATIONAL POWER CORPORATION GEODESY & CARTOGRAPHY DIV.-PROJ. DEVT DEPT.	
LOCATION MAP of GROUND CONTROL POINTS AGOS RIVER H.E. PROJECT Infanta, Quezon	
DRAWN: _____	SUBMITTED: _____
DRAFTED: L.S. SAMONTE JR.	RECOMMENDED: _____
CHECKED: _____	APPROVED: _____
SHEET	OF

CHAPTER 3

LEVELLING

The existing bench mark QZ-226 with EL.6.278 m MSL established by Bureau of Coast and Geodetic Survey was adopted for the base bench mark of the project after a check levelling between the existing marks QZ-225 and QZ-228 along National route No.323 near Infanta. The Levelling network was extended to the confluence and 6 bench marks were established along the existing logging road.

STATION DESIGNATION : BM # 1

PROJECT : Agos HE Project

LOCATION : Brgy. Magsaysay,
Infanta, Quezon

DATE ESTABLISHED : March, 1979

DATUM - HORIZONTAL :
VERTICAL :

COORDINATES -
NORTHING :
EASTING :
LATITUDE :
LONGITUDE :

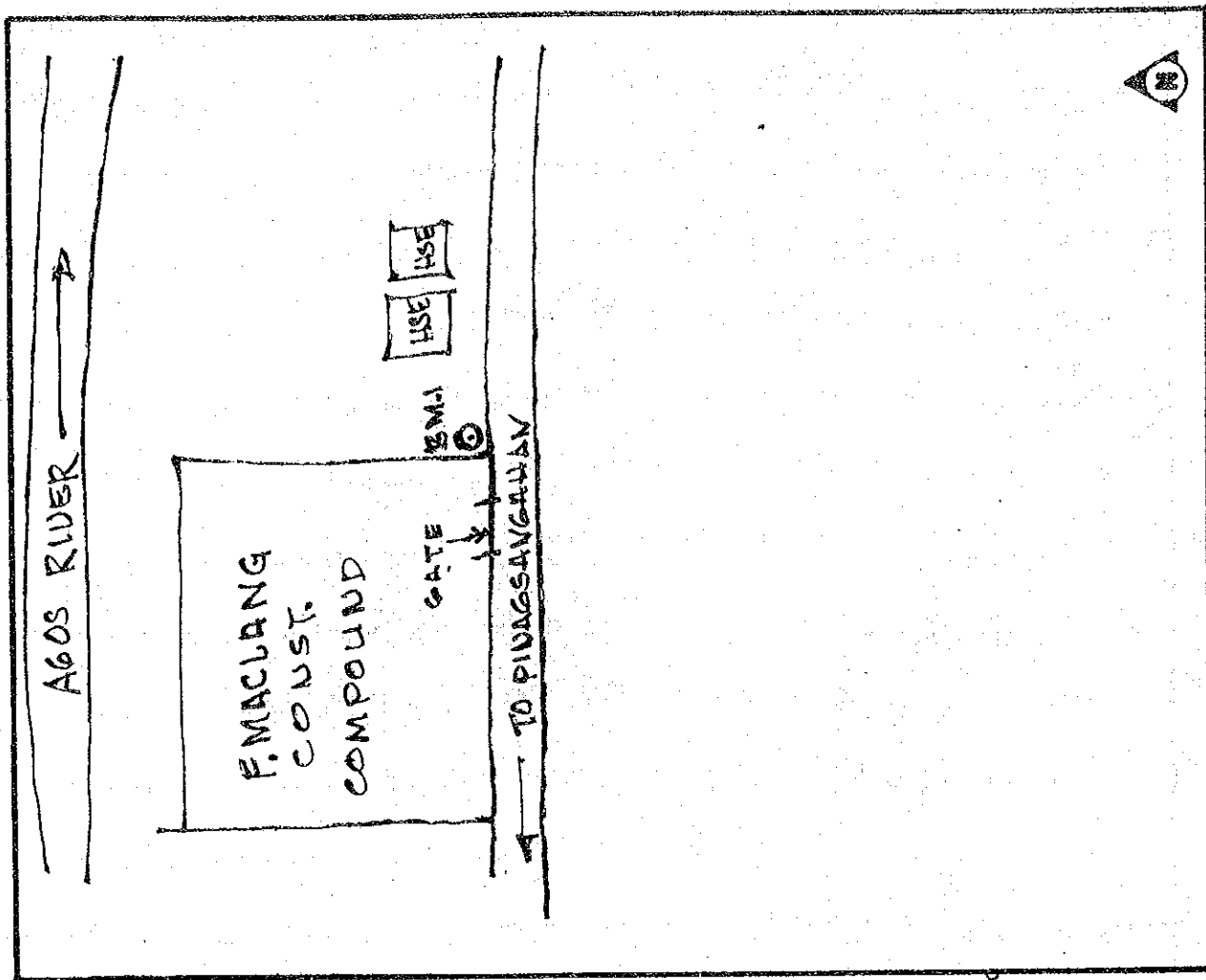
ELEVATION : 29.610

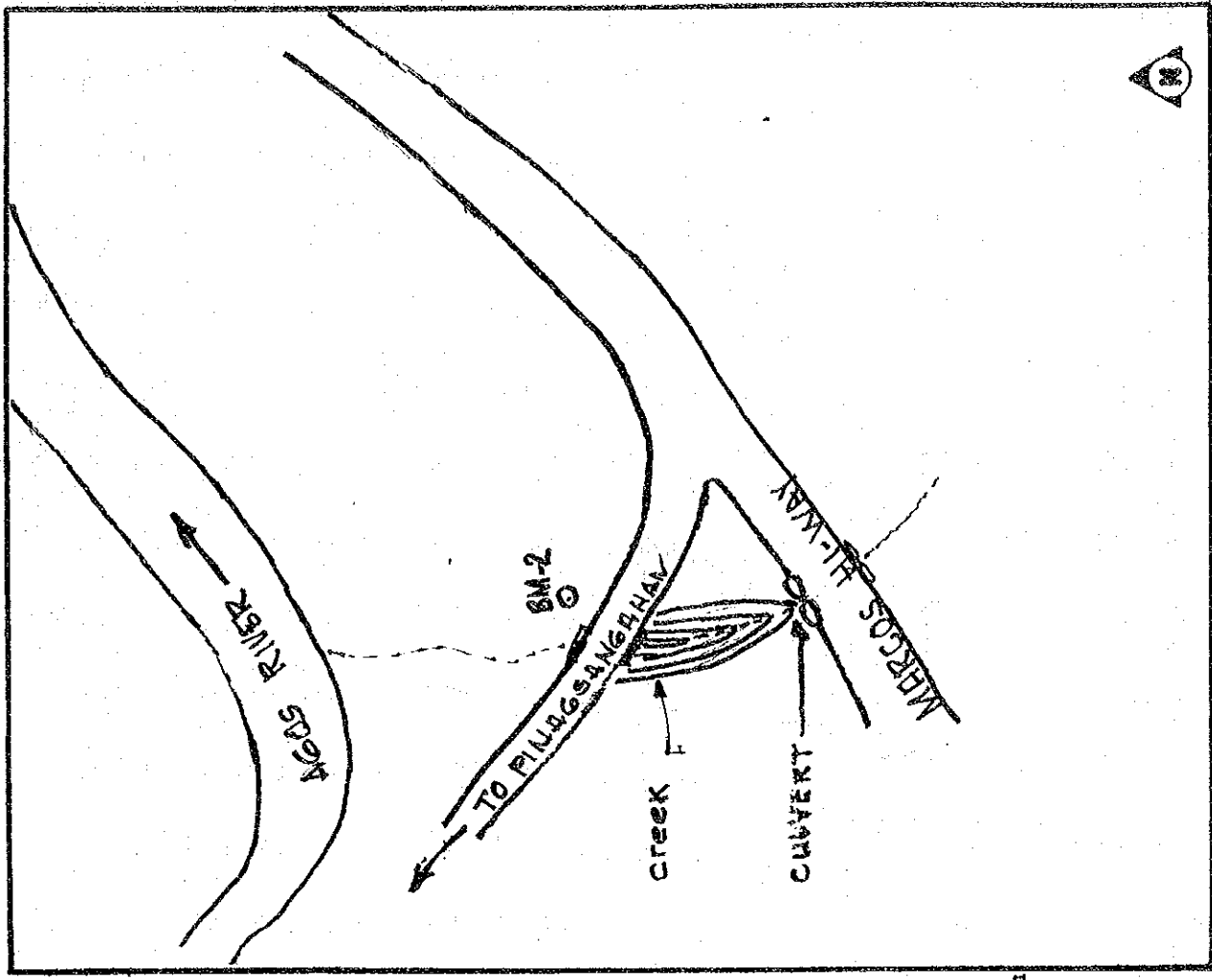
RELATIVE POSITION TO OTHER STATION

STA.	AZIMUTH	DISTANCE	TO STATION
------	---------	----------	------------

DESCRIPTION:

1. It is a concrete monument with an approximate diameter of three (3) inches and is located at the right side of the road with an approximate distance of 1.5 meters going to Pinagsangahan.
2. It is situated at the corner of Macalang Construction with an approximate distance of three (3) M away from the gate of the said Construction.





STATION DESIGNATION : BM # 2

PROJECT : Agos HE Project

LOCATION : Sitio Tablag, Brgy. Magsaysay,
Infanta, Quezon

DATE ESTABLISHED : March, 1979

DATUM - HORIZONTAL :
VERTICAL :

COORDINATES -
NORTHING :
EASTING :
LATITUDE :
LONGITUDE :

ELEVATION : 33.582

RELATIVE POSITION TO OTHER STATION

STA.	AZIMUTH	DISTANCE	TO STATION
------	---------	----------	------------

DESCRIPTION:

1. It is a concrete monument with an approximate diameter of three (3) inches and is situated from the junction of Marcos highway and Logging road with an approximate distance of forty (40) meters.
2. It is situated NE from the Culvert installed along Marcos highway with an approximate distance of ten (10) meters.

STATION DESIGNATION : BM # 3

PROJECT : Agos HE Project

LOCATION : Sitio Magipang, Brgy. Magsaysay,
Infanta, Quezon

DATE ESTABLISHED : Apr. 1979

DATUM - HORIZONTAL :
VERTICAL :

COORDINATES -
NORTHING :
EASTING :
LATITUDE :
LONGITUDE :

ELEVATION : 43.159

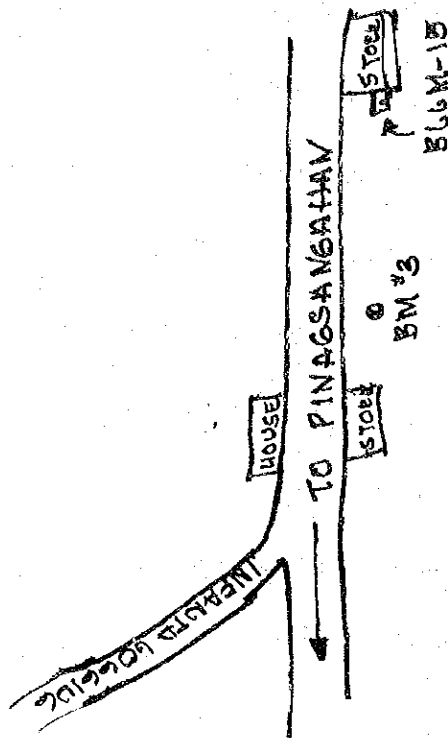
RELATIVE POSITION TO OTHER STATION

STA.	AZIMUTH	DISTANCE	TO STATION
------	---------	----------	------------

DESCRIPTION:

1. It is a concrete monument with an approximate diameter of three (3) inches and is located two (2) meters away from the right edge of the road going to Infanta.
2. It is situated due west of BM # 3 with an approximate distance of six (6) meters.

AGOS RIVER



STATION DESIGNATION : BM # 4
 PROJECT : Agos HE Project
 LOCATION : Sitio Cacaunayan, Brgy. Magsaysay
 Infanta, Quezon
 DATE ESTABLISHED : April, 1979

DATUM - HORIZONTAL :
 VERTICAL :

COORDINATES -
 NORTHING :
 EASTING :
 LATITUDE :
 LONGITUDE :

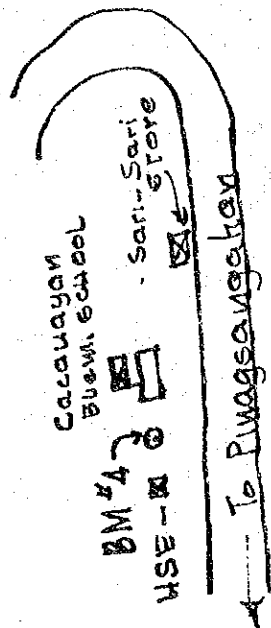
ELEVATION : 48.800

RELATIVE POSITION TO OTHER STATION

STA.	AZIMUTH	DISTANCE	TO STATION
------	---------	----------	------------

DESCRIPTION:

1. It is a concrete monument with an approximate diameter of three (3) inches and is situated at about forty (40) meters at right angle on the right side of the road going to Pinagsangahan.
2. It is situated due west from the Cacaunayan Elementary School with an approximate distance of four (4) meters.



STATION DESIGNATION : BM # 5

PROJECT : Agos HE Project

LOCATION : Sitio Pinagsangahan,
Brgy. Magsaysay, Infanta,
Quezon

DATE ESTABLISHED : May, 1979

DATUM - HORIZONTAL :
VERTICAL :

COORDINATES -
NORTHING :
EASTING :
LATITUDE :
LONGITUDE :

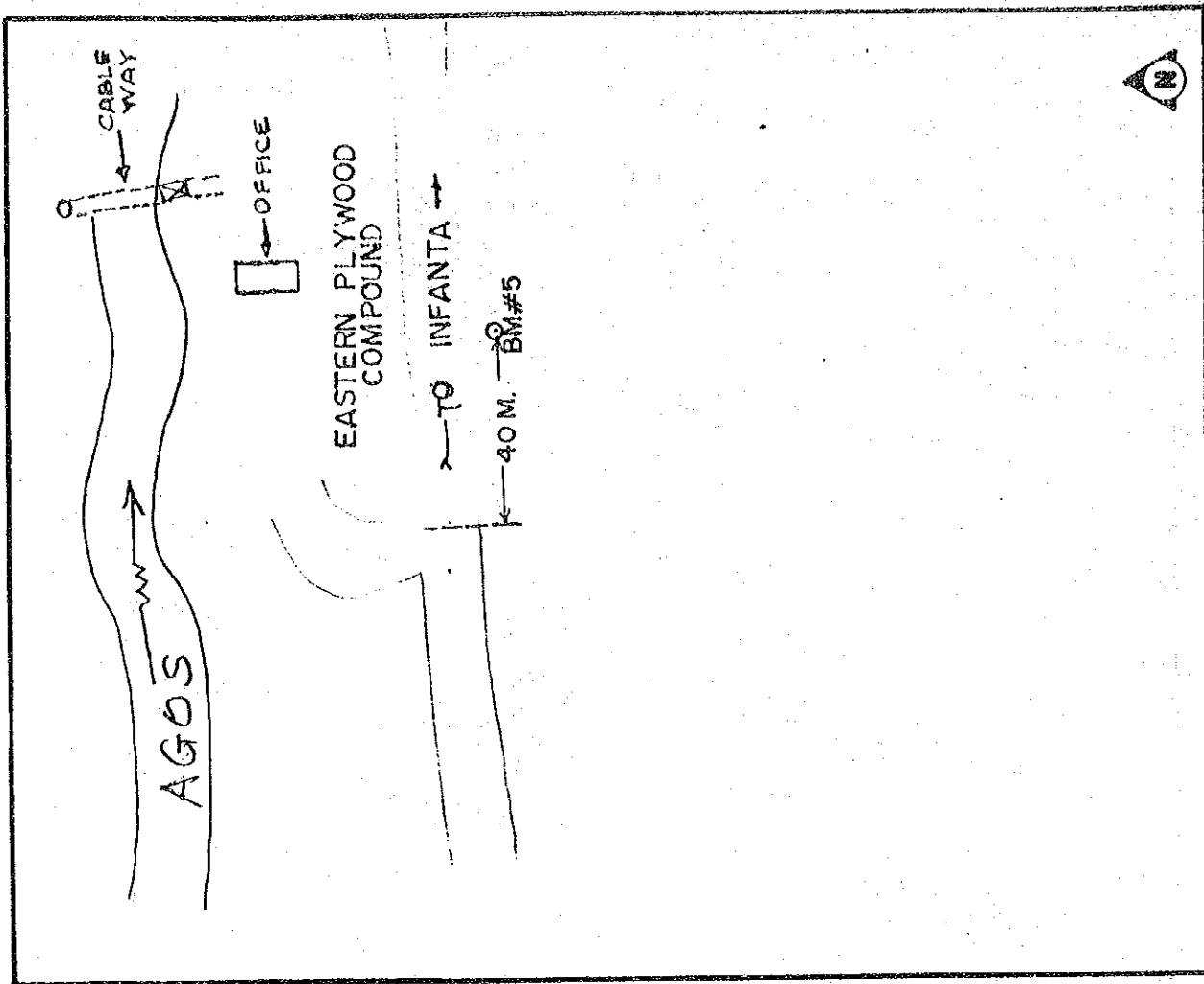
ELEVATION : 58.239 M.

RELATIVE POSITION TO OTHER STATION

STA.	AZIMUTH	DISTANCE	TO STATION
------	---------	----------	------------

DESCRIPTION:

1. It is a concrete monument with an approximate diameter of three (3) inches and is situated at about 2 meters away at right angle from the right side of the road going to Infanta.
2. It is located SW from Eastern Plywood Office and is approximately 100 meters away from it.



STATION DESIGNATION : BM # 6

PROJECT : Agos HE Project

LOCATION : Brgy. Pinagsangahan
Infanta, Quezon

DATE ESTABLISHED : May, 1979

DATUM - HORIZONTAL :
VERTICAL :

COORDINATES -
NORTHING :
EASTING :
LATITUDE :
LONGITUDE :

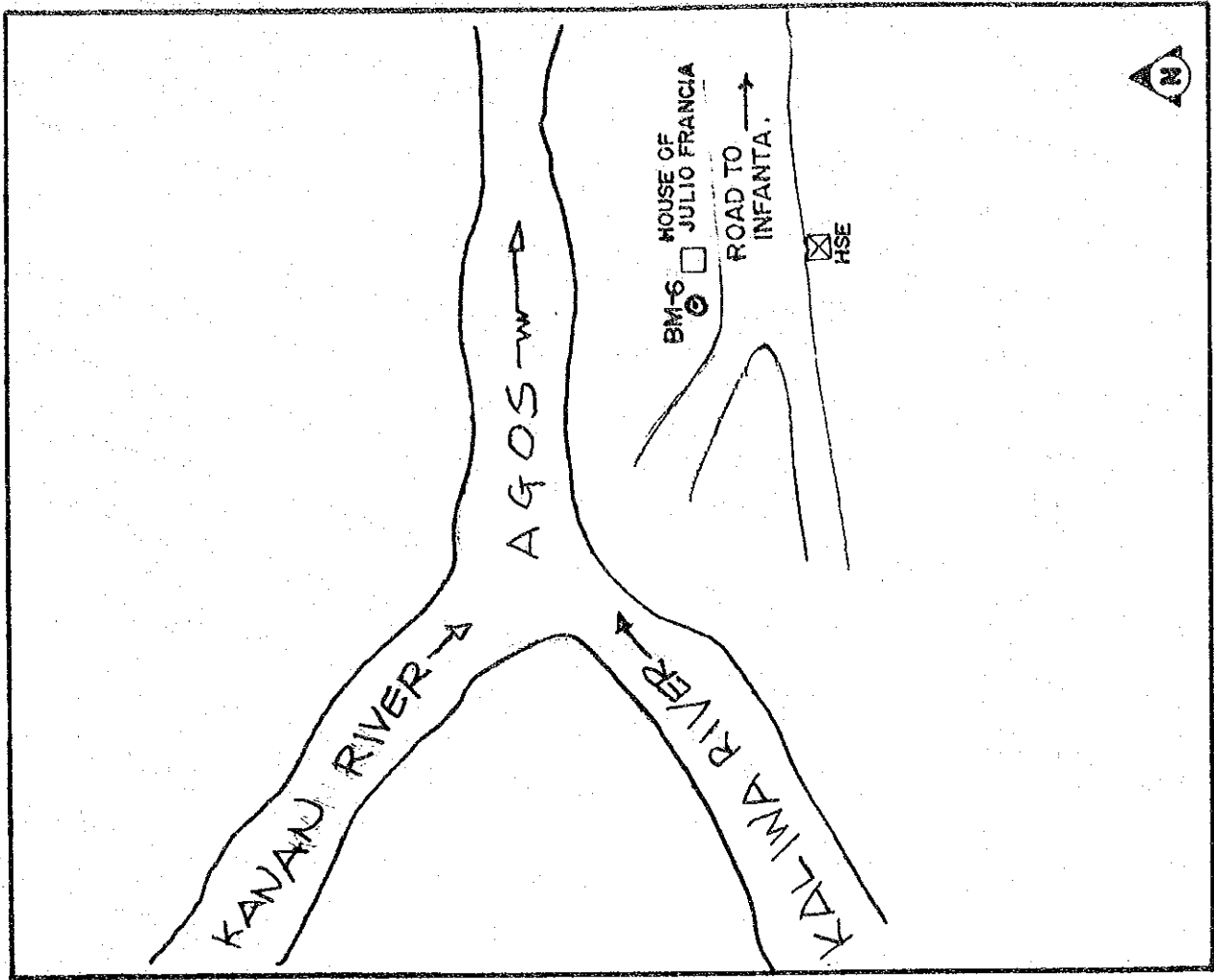
ELEVATION : 54.465 m.

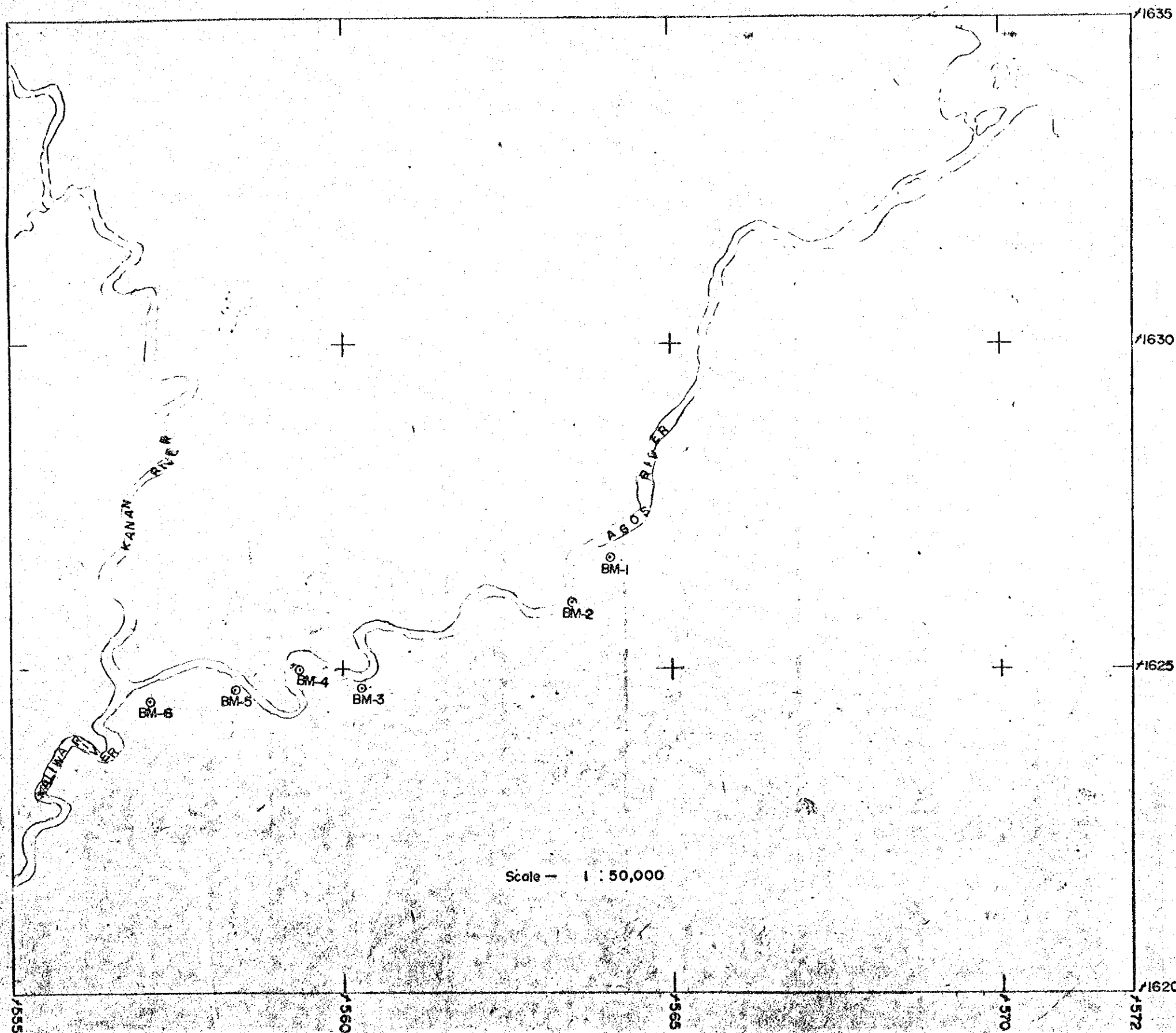
RELATIVE POSITION TO OTHER STATION

STA.	AZIMUTH	DISTANCE	TO STATION
------	---------	----------	------------

DESCRIPTION:

1. It is concrete monument with an approximate diameter of three (3) inches and is located on the left side of the road going to Infanta and is about six (6) meters due west from the house of Mr. Julio Frangia.
2. It is situated approximately fifty (50) meters SE from the confluence of Kaliwa and Kanan River.



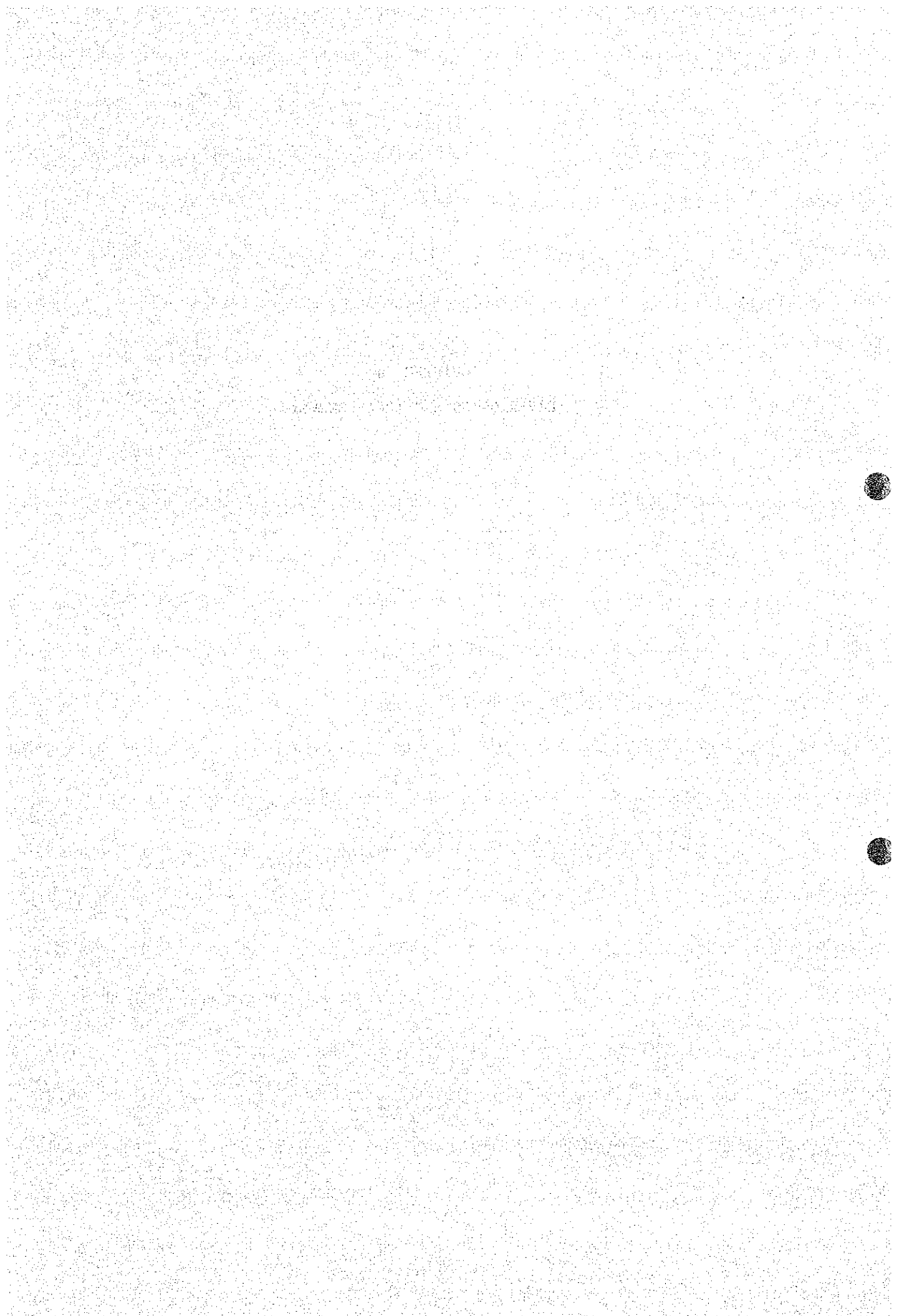


Scale — 1 : 50,000

NATIONAL POWER CORPORATION GEODESY & CARTOGRAPHY DIV.-PROJ.DEVT.DEPT.	
BENCH MARK LOCATION	
AGOS RIVER H.E. PROJECT	
Infanta, Quezon	
DRAWN:	SUBMITTED:
DRAFTED: Larry S. Samonte	RECOMMENDED:
CHECKED:	APPROVED:
DATE	

CHAPTER 4

RIVER CROSS SECTIONAL SURVEY



River cross section

成果表

GA-1

点 名	X	Y	H	
R 1	1633 287.300	569 967.225	2.879	
L 1	416.854	721.518	1.749	
R 2	1632 466.254	015.984	3.231	
L 2	1632 718.101	569 016.520	3.848	= T 27
R 3	1631 813.939	568 160.790	6.476	= T 24
L 3	1632 025.898	567 847.925	6.559	
R 4	1631 250.209	019.358	8.717	= T 22
L 4	554.928	116.637	8.273	
R 5	569.778	236.245	9.009	= T 17
L 5	736.434	327.874	.	= T 18
R 6	1630 964.089	565 644.96	10.320	
L 6	1631 094.793	418.937	10.945	
R 7	1630 247.326	506.700	.	
L 7	264.922	244.388	13.305	
R 8	1629 059.256	253.230	12.934	
L 8	123.571	075.471	13.483	
R 9	1628 554.925	564 778.101	14.025	
L 9	477.611	567.939	17.107	
R 10	1627 464.289	484.113	16.111	
L 10	474.476	380.479	16.705	
R 11	.	.	.	
L 11	.	.	.	
R 12	.	.	20.176	

品類

River cross section

2

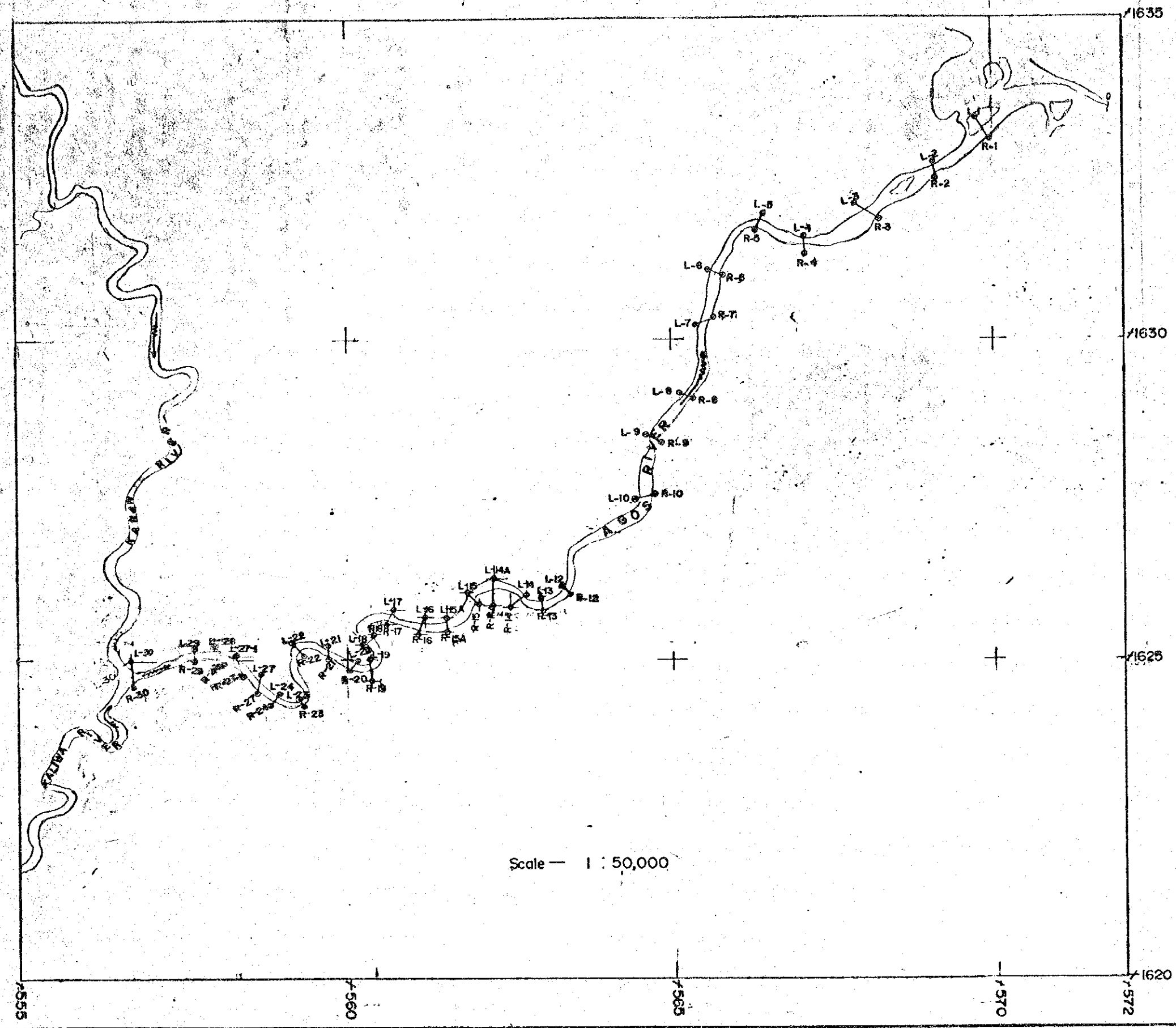
成果表

GA-1

点 名	X	Y	H	
	m	m	m	
L 12	.	.	23.891	
R 13	.	.	47.280	
L 13	.	.	23.170	
R 14	.	.	27.257	
R 14A	.	.	30.453	
L 14	.	.	22.866	
R 15	.	.	24.788	
15A	.	.	24.179	
L 15	.	.	26.525	
R 16	.	.	24.311	
L 16	.	.	27.854	
R 17	.	.	26.804	
L 17	.	.	29.576	
R 18	.	.	30.737	
L 18	.	.	29.106	
R 19	.	.	29.214	
L 19	.	.	35.257	
R 20	868.194	013.946	30.388	
L 20	986.838	072.324	37.904	
R 21	1625 020.629	559 560.767	33.154	
L 21	128.640	668.099	43.800	
R 22	031.060	225.461	37.290	
L 22	117.657	128.891	.	

点検者

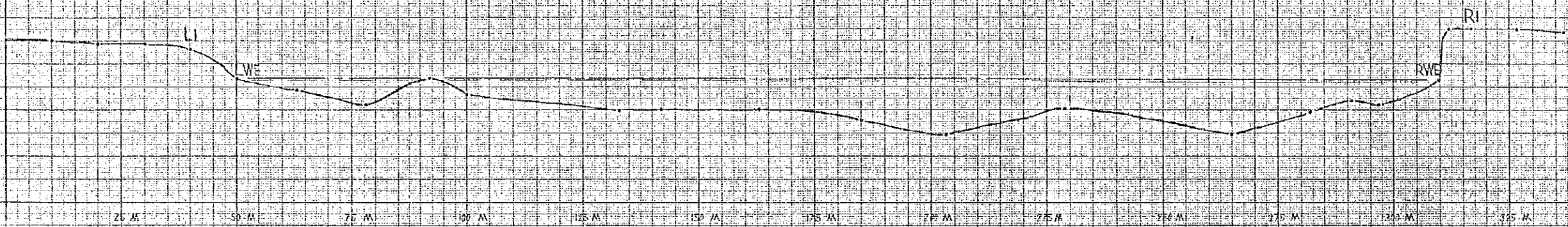
国際航業株式会社



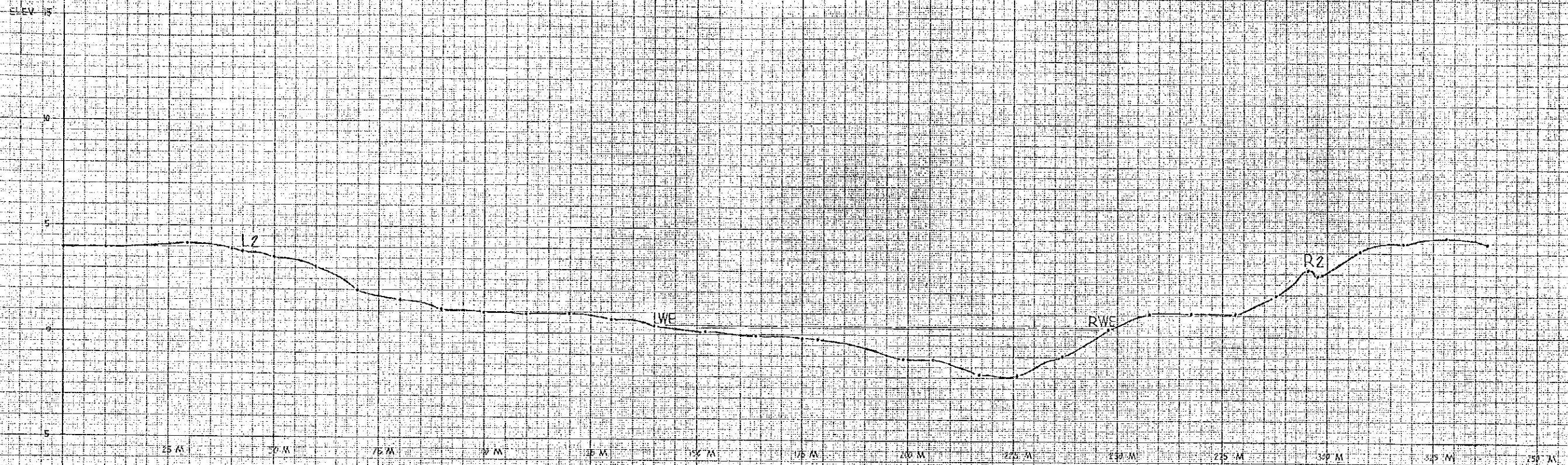
Scale — 1 : 50,000

NATIONAL POWER CORPORATION			
GEODESY & CARTOGRAPHY DIV.-PROJ.DEV.IDEPT.			
RIVER CROSS-SECTION			
AGOS RIVER H.E. PROJECT			
Infanta, Quezon			
DRAWN:		SUBMITTED:	
DRAFTED: L.S. Samonte Jr.		RECOMMENDED:	
CHECKED:		APPROVED:	
SHEET	OF		

ELEV. M



RI LI
SCALE
HORIZONTAL 1:500
VERTICAL 1:100



R2-12

SCALE

HORIZONTAL 1:500

VERTICAL 1:100

Elevations

L3

LW4

LW5

RWE2

25 M

50 M

75 M

100 M

125 M

150 M

175 M

200 M

225 M

250 M

275 M

300 M

325 M

350 M

375 M

400 M

R3 L3

SCALE

HORIZONTAL 1" = 500'

VERTICAL 1" = 100'