

*FEASIBILITY STUDY*  
*ON*  
**BOHOL IRRIGATION DEVELOPMENT PROJECT**  
*(PHASE II)*  
*IN*  
*THE REPUBLIC OF THE PHILIPPINES*

**ANNEX (I)**



*NOVEMBER, 1985*

**JAPAN INTERNATIONAL COOPERATION AGENCY**



JICA LIBRARY



1030547[2]



*FEASIBILITY STUDY*  
*ON*  
**BOHOL IRRIGATION DEVELOPMENT PROJECT**  
*(PHASE II)*  
*IN*  
*THE REPUBLIC OF THE PHILIPPINES*

**ANNEX (I)**



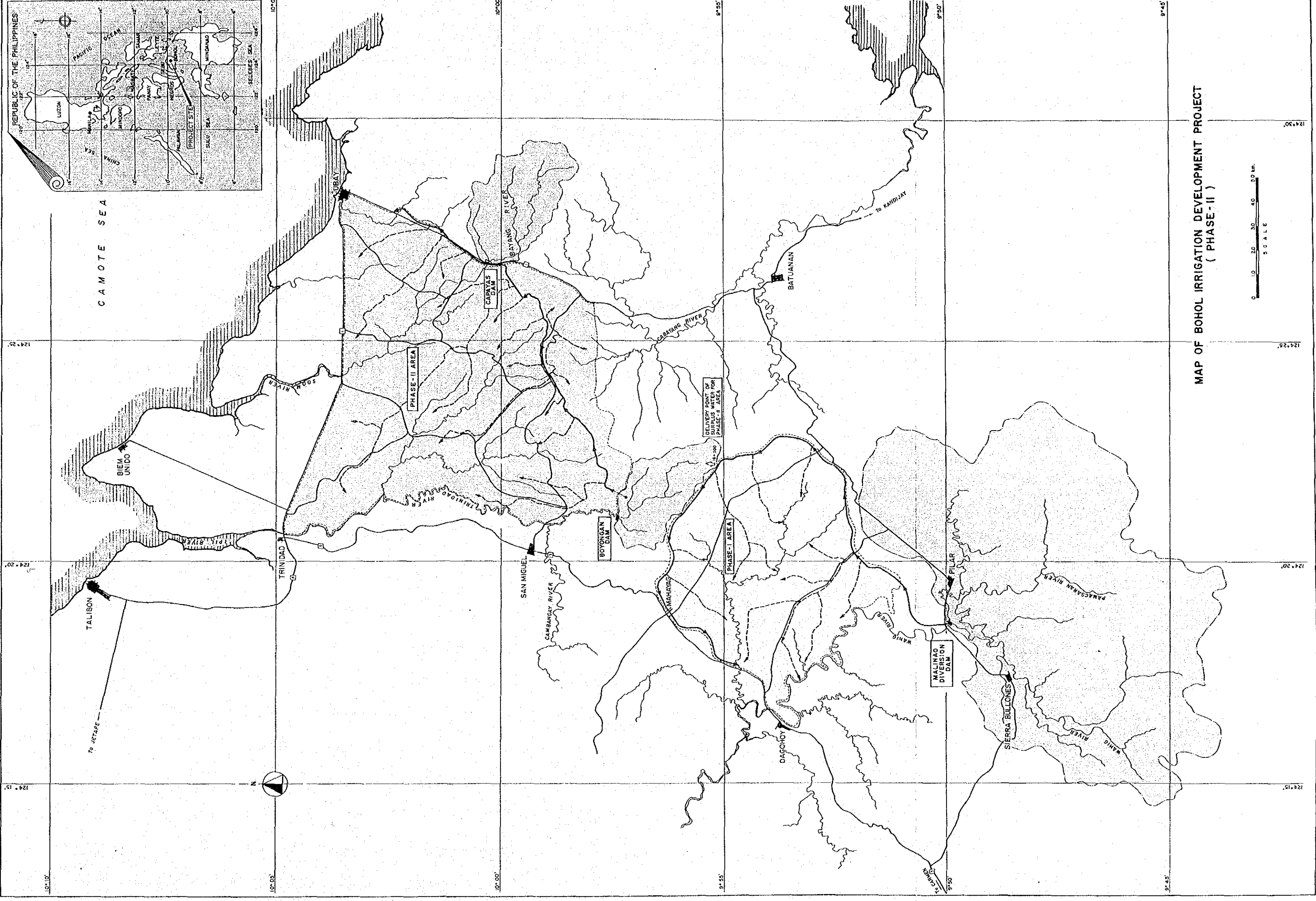
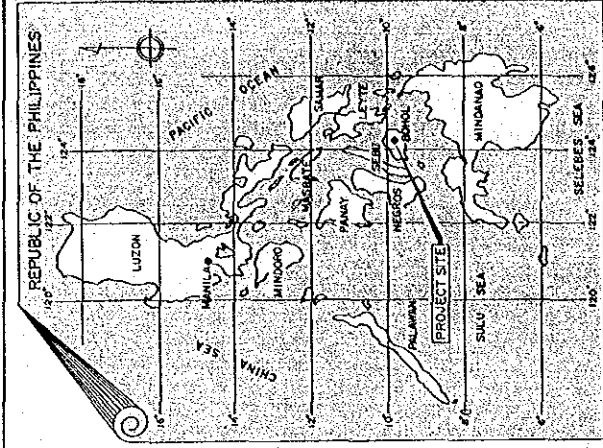
*NOVEMBER, 1985*

**JAPAN INTERNATIONAL COOPERATION AGENCY**

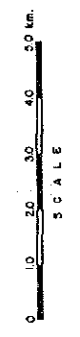
AFT
CR(3)
85-53

国際協力事業団

受入 月日 '86. 1. 31	118
登録No. 12402	833
	AFT



MAP OF BOHOL IRRIGATION DEVELOPMENT PROJECT  
( PHASE-II )



124° 15' 124° 20' 124° 25' 124° 30'

10° 05' 10° 00' 9° 55' 9° 50' 9° 45'

CAMOTE SEA

TALIBON

TRINIDAD

SIERRA BULLONES

BOHUYOGAN DAM

SAN MIGUEL

PHASE-I AREA

PHASE-II AREA

DELIVERY POINT OF SURPLUS WATER FOR PHASE-II AREA

BATUANAN

TO JETAFE

TO KANDILJAY

REPUBLIC OF THE PHILIPPINES

LUCON

MINOR

MAHARAS

SIERRA BULLONES

BOHUYOGAN

TRINIDAD

BOHOL

CELEBES SEA

SULU SEA

HINDANAO

PACIFIC OCEAN

CHINA SEA

0 10 20 30 40 50 km

SCALE





- ANNEX A. TOPOGRAPHICAL SURVEY
- ANNEX B. CLIMATE AND HYDROLOGY
- ANNEX C. GEOLOGY AND CONSTRUCTION MATERIALS
- ANNEX D. SOILS AND LAND USE
- ANNEX E. WATER BALANCE STUDY



CONTENTS (ANNEX A- ANNEX E)

	<u>Page</u>
ANNEX A. TOPOGRAPHICAL SURVEY	
CHAPTER I. GENERAL .....	A-1
CHAPTER II. AVAILABLE TOPOGRAPHIC MAP .....	A-1
CHAPTER III. ITEM OF SURVEY WORKS .....	A-2
CHAPTER IV. SURVEY RESULTS .....	A-3
ANNEX B. CLIMATE AND HYDROLOGY	
CHAPTER I. OBSERVATION DATA .....	B-1
CHAPTER II. RAINFALL DATA AND ANALYSIS .....	B-14
2.1. Correlation Analysis .....	B-14
2.2. Areal Rainfall .....	B-31
CHAPTER III. HYDROLOGICAL DATA AND RUNOFF ANALYSIS .....	B-33
3.1. Rating Curve of Wahig River .....	B-33
3.2. Runoff Analysis for Wahig-Pamacsalan River .....	B-41
3.3. Runoff Analysis for Phase II Project ...	B-49
CHAPTER IV. FLOOD ANALYSIS .....	B-55
4.1. Probable Rainfall .....	B-55
4.2. Traces of Past Flood .....	B-57
4.3. Probable Maximum Precipitation .....	B-58
ANNEX C. GEOLOGY AND CONSTRUCTION MATERIALS	
CHAPTER I. INTRODUCTION .....	C-1
CHAPTER II. GEOGRAPHY .....	C-2
2.1. General .....	C-2
2.2. Project Area .....	C-3
CHAPTER III. GENERAL GEOLOGY AND SEISMOLOGY .....	C-4
3.1. General Geology .....	C-4
3.2. Geology of Project Area .....	C-7
3.3. Seismology .....	C-8

	<u>Page</u>
CHAPTER IV. GEOLOGICAL INVESTIGATION .....	C-11
4.1. Bayongan Dam .....	C-11
4.2. Capayas Dam .....	C-50
CHAPTER V. CONSTRUCTION MATERIALS .....	C-73
5.1. Bayongan Dam .....	C-73
5.2. Capayas Dam .....	C-77
CHAPTER VI. RECOMMENDATIONS .....	C-94
6.1. Bayongan Dam .....	C-94
6.2. Capayas Dam .....	C-95

#### ANNEX D. SOILS AND LAND USE

CHAPTER I. INTRODUCTION .....	D-1
CHAPTER II. TOPOGRAPHY AND GEOLOGY .....	D-2
2.1. General .....	D-2
2.2. Topography .....	D-2
2.3. Geology .....	D-3
CHAPTER III. SOIL SURVEY .....	D-8
3.1. General .....	D-8
3.2. Soil Profile Observation .....	D-8
3.3. Sampling and Analysis .....	D-9
CHAPTER IV. SOIL CHARACTERISTICS .....	D-20
4.1. Soil Horizons and Structure Development .....	D-20
4.2. Soil Color, Texture and Gravel Content .....	D-20
4.3. Soil Reaction (pH) and Base Status .....	D-21
4.4. Electrical Conductivity (EC) .....	D-21
4.5. Soil Fertility .....	D-22
4.6. Water Quality .....	D-22
CHAPTER V. SOIL CLASSIFICATION .....	D-28
5.1. Classification in Higher Categories .....	D-28
5.2. Classification in Lower Categories .....	D-28
5.3. Distribution of Soil Types .....	D-39
5.4. Soil Phases and Final Mapping .....	D-40
CHAPTER VI. LAND CLASSIFICATION .....	D-56
6.1. Land Classification Method .....	D-56
6.2. Results of Land Classification .....	D-57

	<u>Page</u>
CHAPTER VII. PRESENT LAND USE .....	D-66
7.1. General .....	D-66
7.2. Vegetations .....	D-67
7.3. Crops .....	D-68
CHAPTER VIII. LAND USE CATEGORIES .....	D-71
8.1. Results of Former Survey .....	D-71
8.2. Results of Present Survey .....	D-71
CHAPTER IX. SOIL AND LAND DEVELOPMENT PROBLEMS AND RECOMMENDATIONS .....	D-78
9.1. Soil Problems and Its Improvement .....	D-78
9.2. Land Development .....	D-78
9.3. Investigation and Field Trials for Enhanced Crop Production .....	D-80

#### ANNEX E. WATER BALANCE STUDY

CHAPTER I. REVIEW OF WATER BALANCE IN MALINAO DAM .....	E-1
1.1. Operation Rule .....	E-1
1.2. Available Water .....	E-4
1.3. Surplus Water to Phase II Project .....	E-4
CHAPTER II. AVAILABLE WATER FOR PHASE II AREA .....	E-26
2.1. Bayongan Reservoir .....	E-26
2.2. Capayas Reservoir .....	E-26
CHAPTER III. WATER BALANCE STUDY FOR PHASE II AREA .....	E-32
3.1. Water Balance Rule .....	E-32
3.2. Water Balance Study .....	E-32
CHAPTER IV. OTHER WATER BALANCE STUDY .....	E-63
4.1. Water Balance Study in Case of Paddy Double Cropping .....	E-63
4.2. Water Balance Study with Bayongan Reservoir Only .....	E-63
4.3. Water Balance Study with Capayas Reservoir Only .....	E-63



ANNEX A. TOPOGRAPHICAL SURVEY





ANNEX A TOPOGRAPHIC SURVEY

	<u>Page</u>
1. General .....	A-1
2. Available Topographic Map .....	A-1
3. Items of Survey Works .....	A-2
4. Survey Results .....	A-3

LIST OF FIGURE

	<u>Page</u>
FIGURE A-1	Location of Bench Marks ..... A-6
FIGURE A-2	Description of Existing Bench Mark (DBM No.1, No.2) .. A-7
FIGURE A-3	Description of Existing Bench Mark (DBM No.3, No.4) .. A-8
FIGURE A-4	Description of Existing Bench Mark (B-Dam No.L) ..... A-9
FIGURE A-5	Description of Existing Bench Mark (B-Dam No.R) ..... A-10
FIGURE A-6	Description of Existing Bench Mark (C-Dam No.L) ..... A-11
FIGURE A-7	Description of Existing Bench Mark (C-Dam No.R) ..... A-12
FIGURE A-8	Description of Existing Bench Mark (NIA C-3) ..... A-13
FIGURE A-9	Description of Existing Bench Mark (NIA C-5) ..... A-14
FIGURE A-10	Description of Existing Bench Mark (NIA C-7) ..... A-15
FIGURE A-11	Description of Existing Bench Mark (NIA C-8) ..... A-16
FIGURE A-12	Description of Existing Bench Mark (NIA C-9) ..... A-17
FIGURE A-13	Description of Existing Bench Mark (NIA C-10) ..... A-18
FIGURE A-14	Description of Existing Bench Mark (NIA C-13) ..... A-19
FIGURE A-15	Location of Sample Area ..... A-20

LIST OF TABLE

TABLE A-1	Bench-Marks ..... A-5
-----------	-----------------------

## ANNEX A TOPOGRAPHICAL SURVEY

### 1. General

In 1984, the topographic survey was carried out for preparation of the topographic maps covering the whole project area on a scale of 1 to 4,000 with contour interval of one meter under the technical cooperation of JICA. These topographic maps were compiled on the basis of aerial photography which had been taken in 1970 and the results of the survey undertaken in 1984 were incorporated in these maps.

In connection with this Feasibility Study, additional survey works were conducted to check the elevation of proposed major facilities, discrepancy in elevation between Phase I and Phase II area, etc. and to get detailed information necessary for preliminary design of on-farm and irrigation facilities.

Survey works were carried out by conventional ground survey and vertical controls were established by differential leveling with double rodded lines in close circuit.

Elevations were connected to bench-marks set up by JICA in 1984 being derived from the mean sea level datum.

### 2. Available Topographic Maps

Topographic maps available for study of the project formulation are listed below. These maps cover the whole and/or a part of project area.

- a) Source : U.S. Army map series 733  
Compiled in 1956 by Photogrammetric
- Sheet : 3849I, 3849II, 3849III, 3849IV  
3850II, 3850IV Total 6 Sheets
- Scale : 1:50,000

- b) Source : Bohol Irrigation Development Project Phase II  
prepared by Japan International Cooperation  
Agency  
Aerial Photography ----- June, 1970  
Map Compilation ----- June, 1984  
Sheet : No 1 - No 23            Total 23 Sheets  
Scale : 1:4,000
- c) Source : Topographic map of Bayongan Reservoir Area  
Surveyed by National Irrigation Administration  
in 1981  
Sheet : No 1 - No 2            Total 2 Sheets  
Scale : 1:4,000
- d) Source : Topographic map of Capayas Reservoir Area  
Surveyed by National Irrigation Administration  
in 1982  
Sheet : No 1                    Total 1 Sheet  
Scale : 1:2,000

### 3. Items of Survey Works

Following survey works were executed by JICA study team including counterpart personnel concerned to obtain more detailed information for the project.

- a) Profiling
- Bayongan Damsite Axis : 1,350 m
  - Spillway : 670 m
  - Intake : 1,100 m
  
  - Capayas Damstie Axis : 1,750 m
  - Intake : 300 m

b) Check Leveling

- Bayongan damsite to Capayas damsite  
along the proposed main canal route : 15 km
- Between bench-mark No 107 and No 4,  
former bench-mark located in Phase I  
area and latter is in Phase II area : 3 km

c) Topographic Survey

- Topographic survey of the following sample areas for  
design of on-farm facilities was conducted using the  
plan table.

Sample Area Tubok Site	: 100 ha
Sample Area Hambabaopan Site	: 100 ha

d) Establishment of new bench-mark

- Bayongan damsite : 2 places
- Capayas damsite : 2 places
- Along the proposed main canal route : 7 places

#### 4. Survey Results

Profiles of two dams to be used for dam design were taken with 50 meters intervals of surveyed point and were plotted in a drawing on horizontal and vertical scale of 1 to 1,000. These drawings were compiled two sheets and used for each dam design.

Check levelings were carried out in order to secure the accuracy of elevation in the project area. No significant difference could be found between the JICA maps and the survey results. Existing bench-marks used for survey work and newly established one are shown in TABLE A-1 and FIGURE A-1. Descriptions of existing and new bench-marks are also shown in FIGURE A-2 to FIGURE A-14.

A difference between BM No 107 of Phase I and BM No 4 of Phase II was surveyed as 55.532 m, since original difference is calculated at 55.791 m using the height of each bench-mark shown in TABLE A-1. An error of these results, however, will not cause an evil effect on the project because a big difference of elevation lies in both of the project areas.

Topographic maps of sample areas were prepared as 1 sheet for each sample area and plotted in a drawing on a scale of 1 to 2,000 with a contour interval of 0.25 m. Location of the each model area is shown in FIGURE A-15.

TABLE A-1 BENCH-MARKS

## 1) Existing bench-marks used for the surveying

<u>Bench-Mark</u>	<u>Location</u>	<u>Elevation</u> (m)	<u>Established</u>
BIDP D-BM No.1	Bayongan, San Miguel, Bohol	43.331	JICA
BIDP D-BM No.2	- ditto -	67.633	JICA
BIDP D-BM No.3	- ditto -	57.731	JICA
BIDP D-BM No.4	- ditto -	69.435	JICA
NIA BM No.107	Mahayog, Bohol	125.226	NIA

## 2) Bench-Mark newly established by the study team

<u>Bench-Mark</u>	<u>Location</u>	<u>Elevation</u> (m)
B-DAM No.L	Bayongan, San Miguel, Bohol	63.742
B-DAM No.R	- ditto -	54.083
C-DAM No.L	Lumangog, Ubay, Bohol	34.470
C-DAM No.R	- ditto -	33.311
NIA C-3	Los Angeles, Ubay, Bohol	54.664
NIA C-5	Bulilis, Ubay, Bohol	38.263
NIA C-7	- ditto -	37.284
NIA C-8	Gabi, Ubay, Bohol	33.713
NIA C-9	- ditto -	38.223
NIA C-10	- ditto -	35.919
NIA C-13	Lumangog, Ubay, Bohol	50.124

FIGURE A-1 LOCATION OF BENCH MARKS

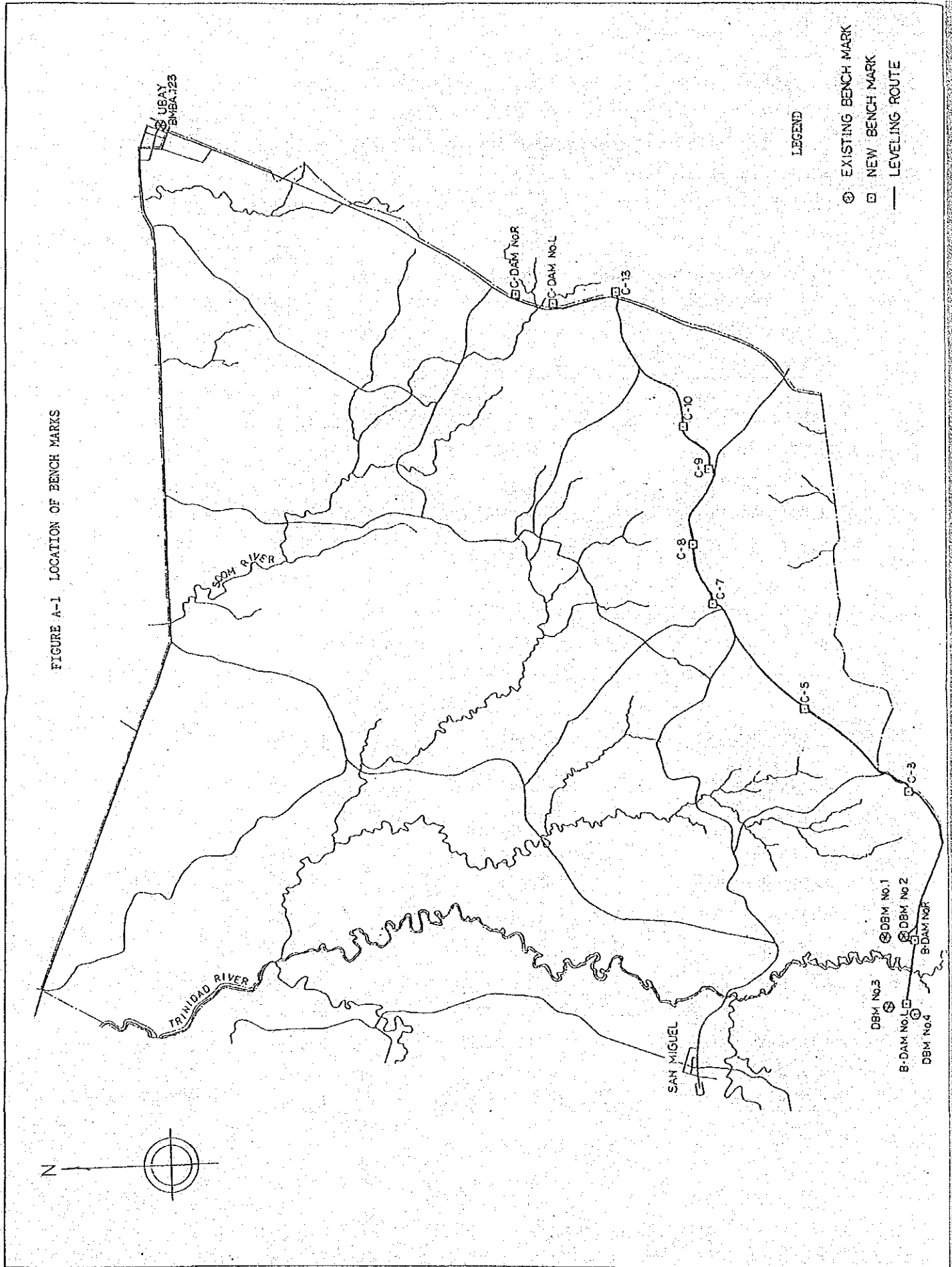




FIGURE A-2

DESCRIPTION OF EXISTING BENCH MARK

Station No.	DBM No. 1 , DBM No. 2
Elevation (m)	43.331 , 67.633
Location	Boyongan , San Miguel , Bohol
Established by :	J I C A
Surveyed by :	J I C A

Sketch-map of B.M and vicinity

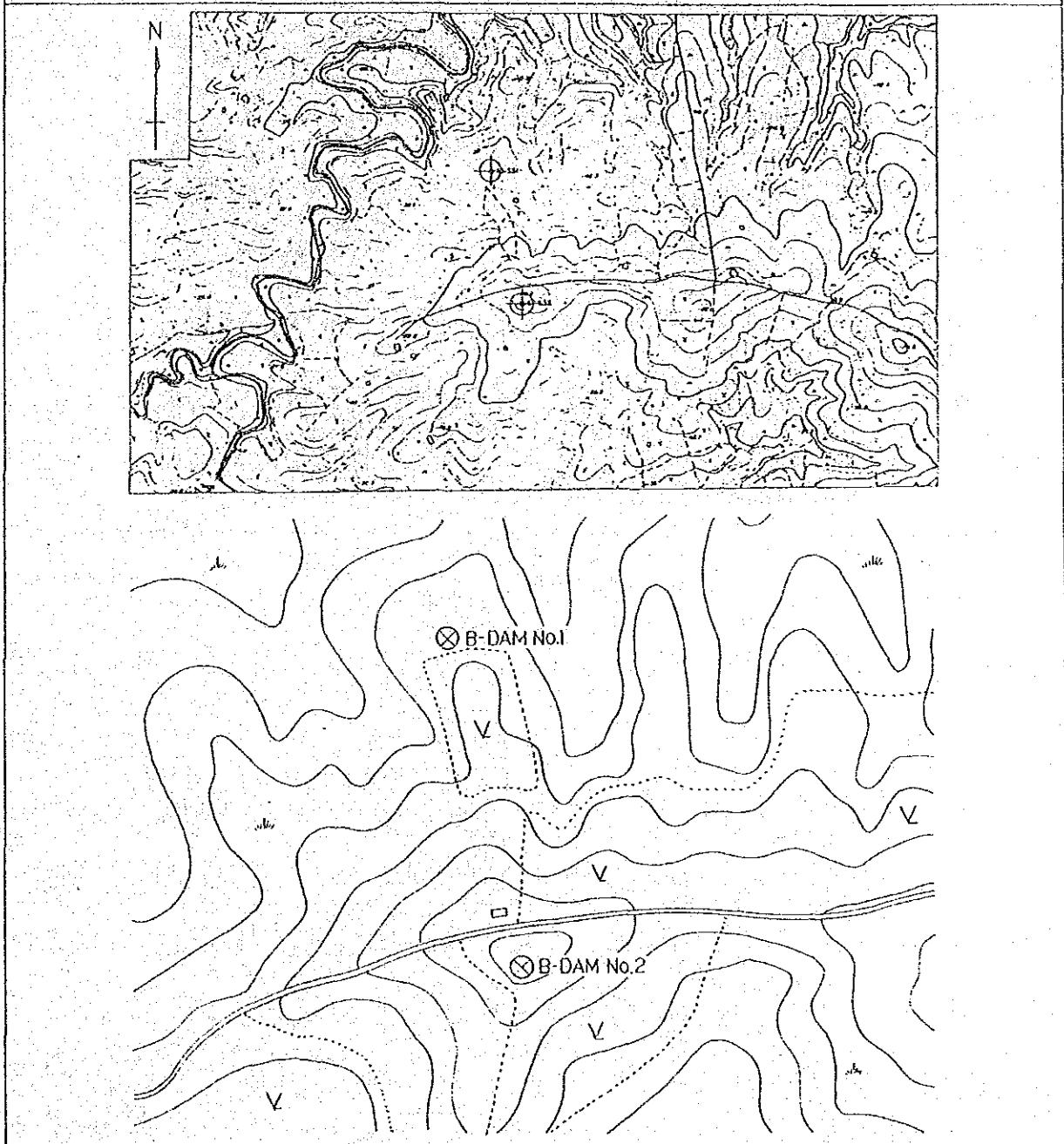


FIGURE A-3

DESCRIPTION OF EXISTING BENCH MARK

Station No.	DBM No. 3 , DBM No. 4
Elevation (m)	57.731 , 69.435
Location	Boyongan , San Miguel , Bohol
Established by :	J I C A
Surveyed by :	J I C A

Sketch-map of B.M and vicinity

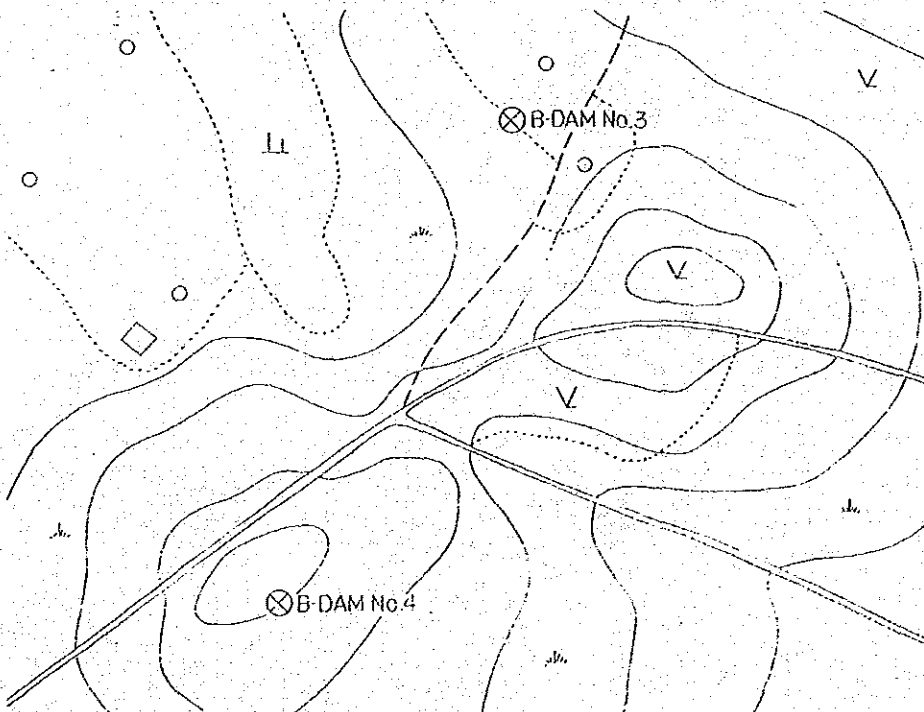
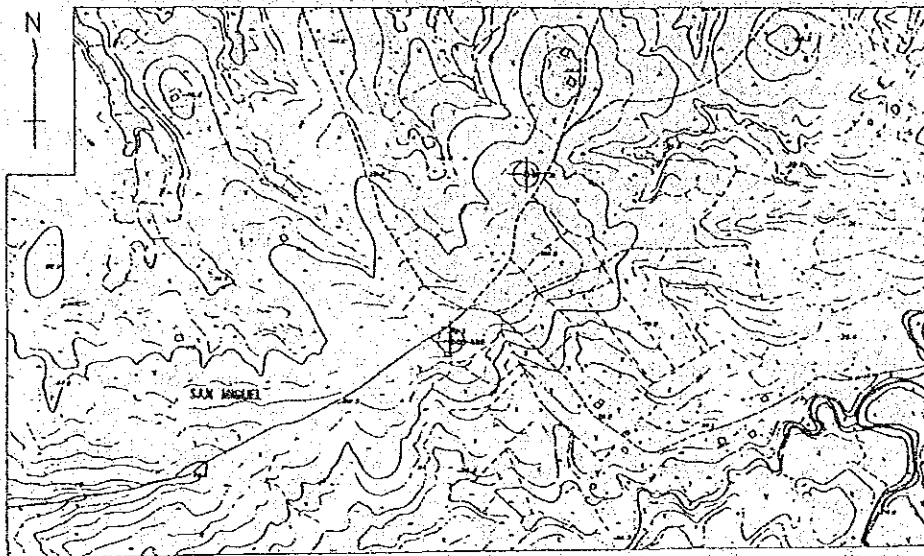
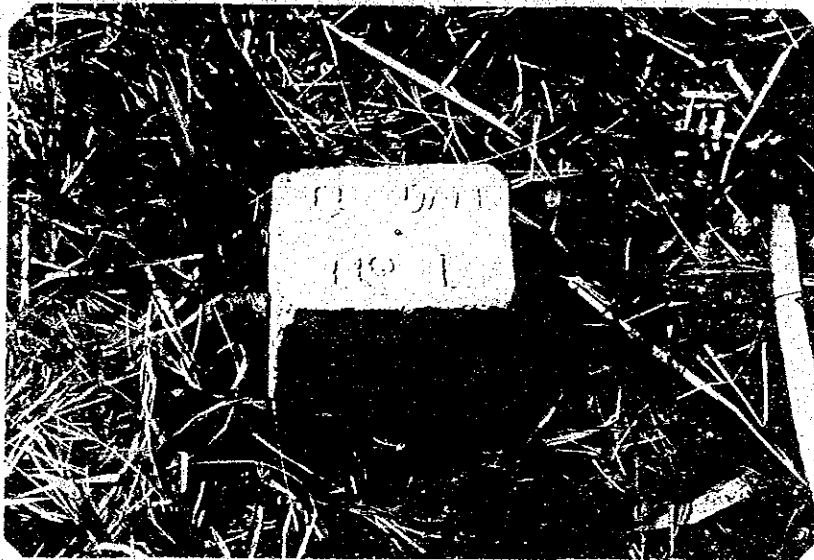


FIGURE A-4

DESCRIPTION OF NEW BENCH MARK

Station No.	B-DAM No. L	
Elevation (m)	63.742	
Location	Boyongan, San Miguel, Bohol	
Established on :	12 February 1985	Established by : Hermanito I Consad
Surveyed on :	14 February 1985	Surveyed by : Hermanito I Consad
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

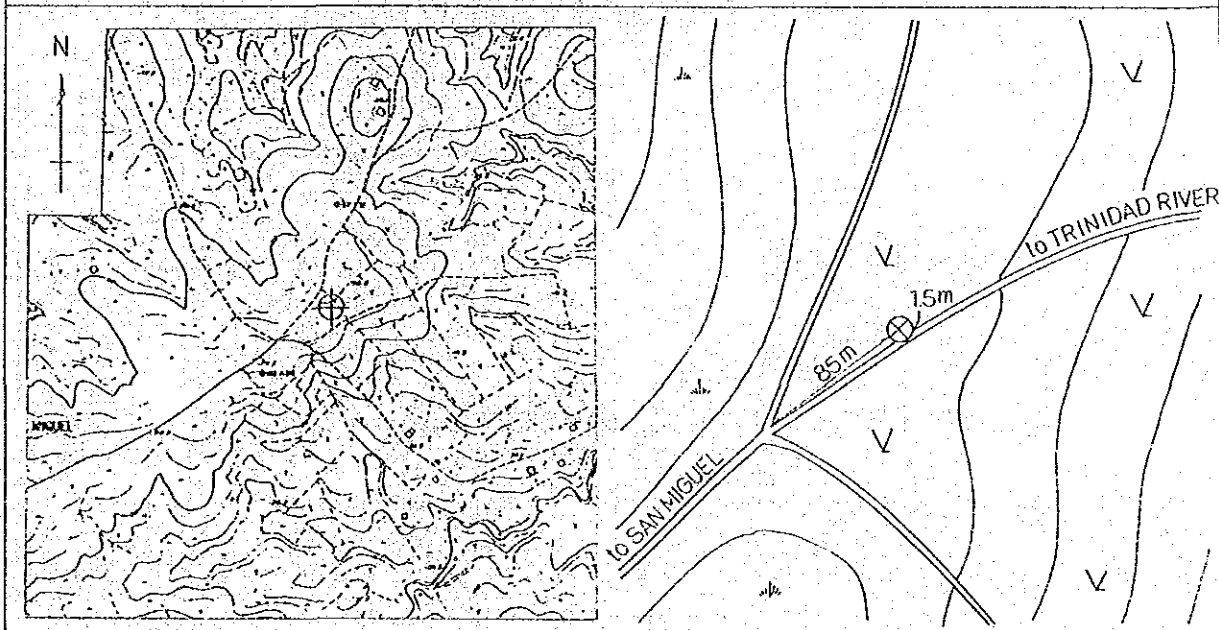
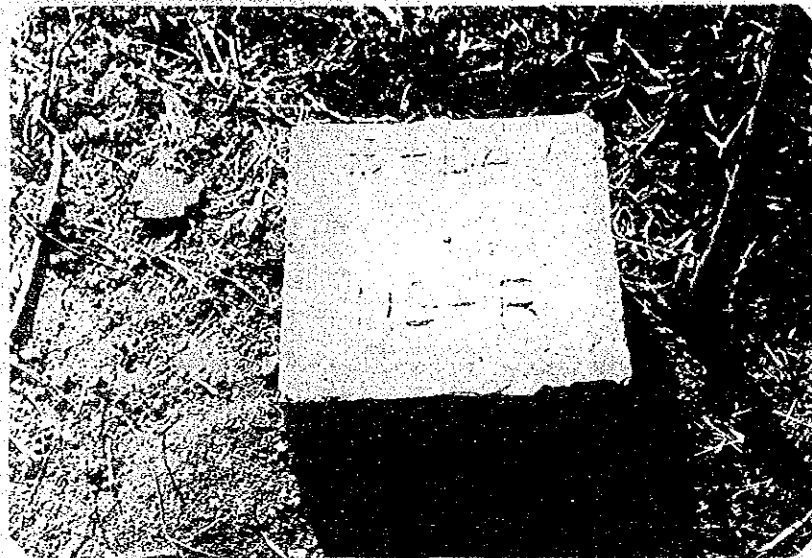


FIGURE A-5

DESCRIPTION OF NEW BENCH MARK

Station No.	B-DAM No. R	
Elevation (m)	54.083	
Location	Boyongan, San Miguel, Bohol	
Established on :	12 · February · 1985	Established by : Hermanito I Consad
Surveyed on :	14 · February · 1985	Surveyed by : Hermanito I Consad
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

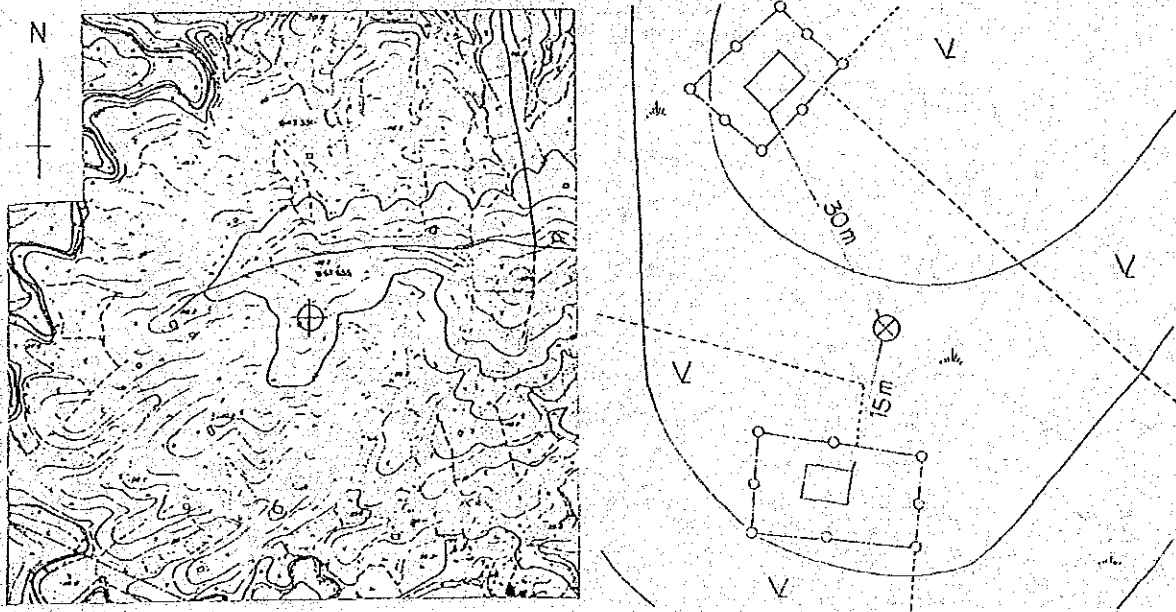
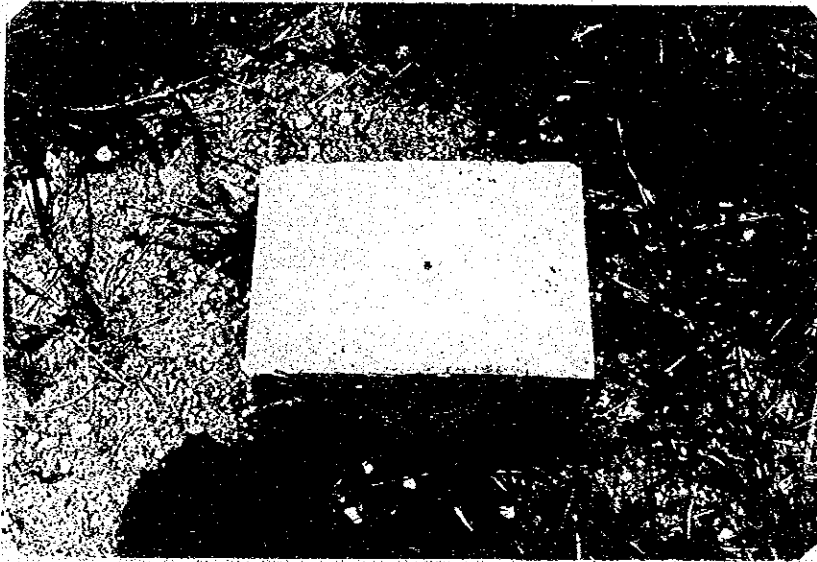


FIGURE A-6

DESCRIPTION OF NEW BENCH MARK

Station No.	C-DAM No. L	
Elevation (m)	34.470	
Location	Lumangog , Ubay , Bohol	
Established on :	15 · February · 1985	Established by : Hermanito I Consad
Surveyed on :	4 · March · 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

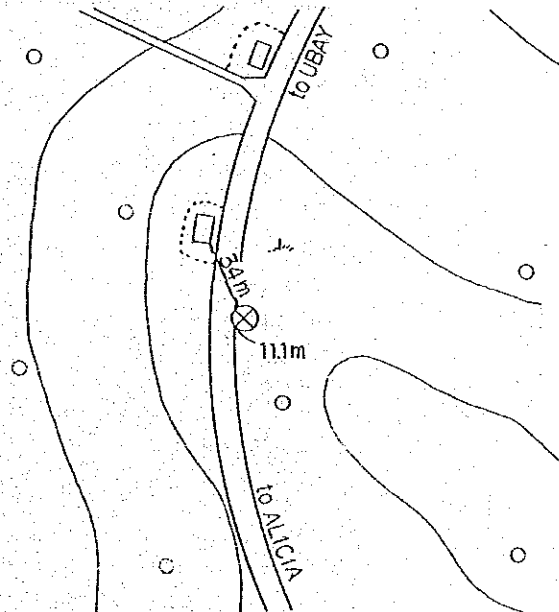
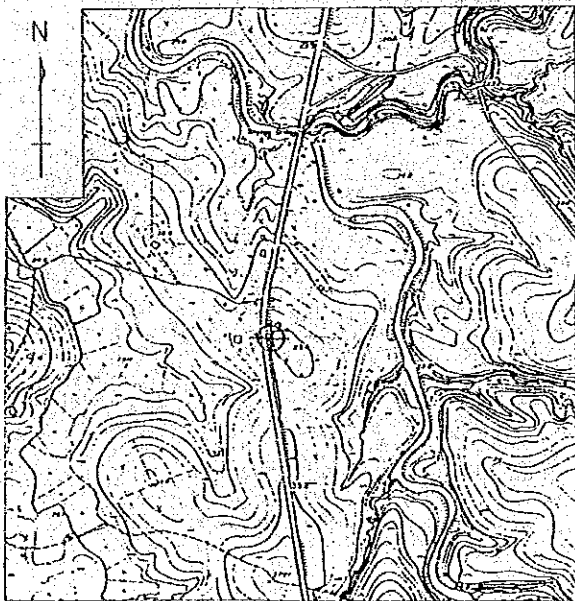


FIGURE A-7

DESCRIPTION OF NEW BENCH MARK

Station No.	C-DAM No. R	
Elevation (m)	33.311	
Location	Lumangog, Ubay, Bohol	
Established on :	15 · February · 1985	Established by : Hermanito I Consad
Surveyed on :	4 · March · 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

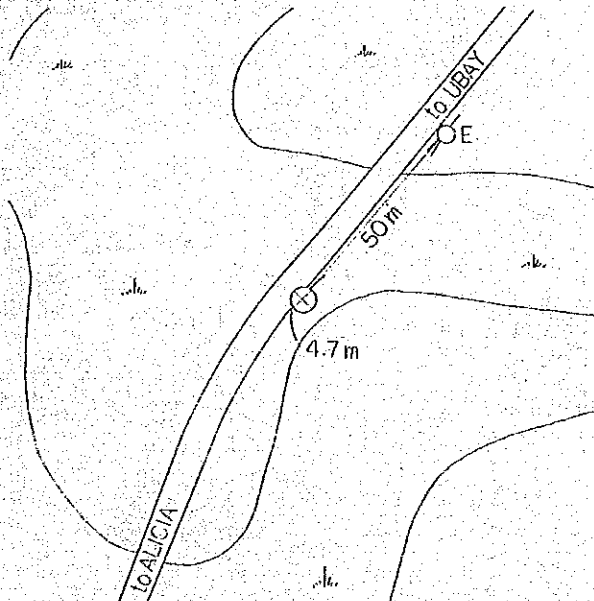
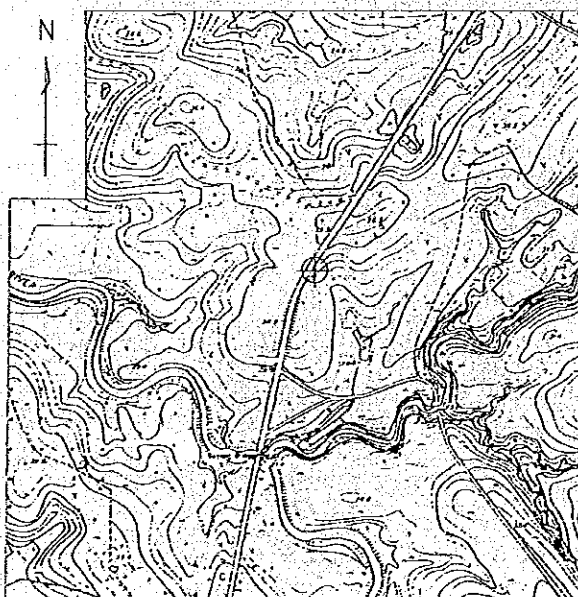


FIGURE A-8

DESCRIPTION OF NEW BENCH MARK

Station No.	NIA C-3	
Elevation (m)	54.664	
Location	Los Angeles, Ubay, Bohol	
Established on :	Established by :	
Surveyed on : 25 February 1985	Surveyed by : Felix R Lozada	
	Checked by :	

Photopicture of B.M



Sketch-map of B.M and vicinity

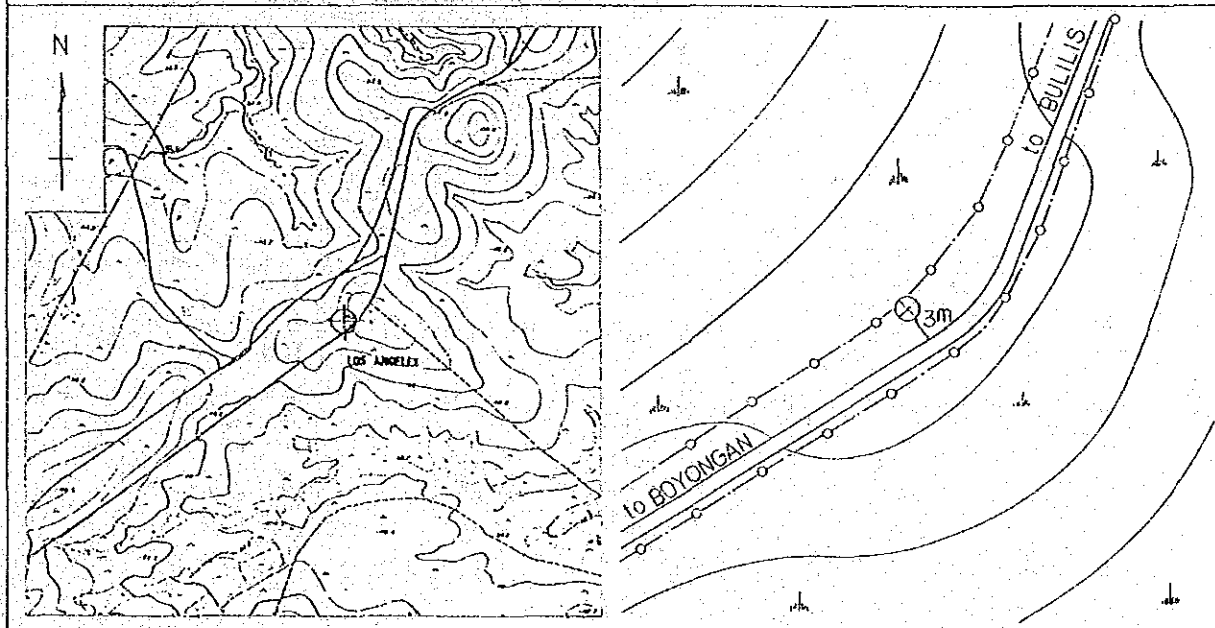


FIGURE A-9

DESCRIPTION OF NEW BENCH MARK

Station No.	NIA C-5	
Elevation (m)	38.263	
Location	Bulilis, Ubay, Bohol	
Established on :	21 February 1985	Established by : Felix R Lozada
Surveyed on :	26 February 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

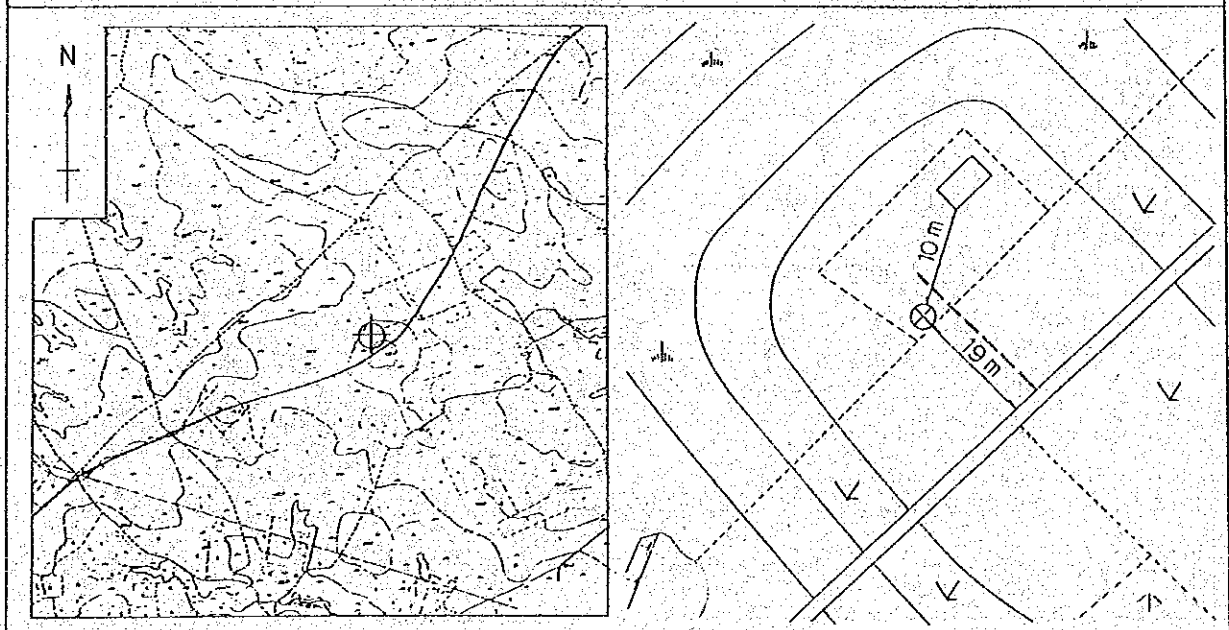


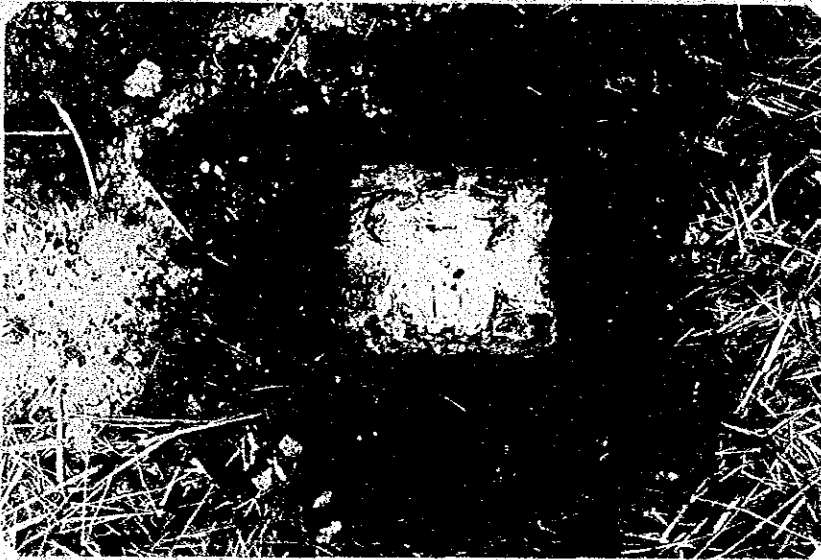


FIGURE A-10

DESCRIPTION OF NEW BENCH MARK

Station No.	NIA C-7	
Elevation (m)	37.284	
Location	Bulilis, Ubay, Bohol	
Established on	: 21 · February · 1985	Established by : Felix R Lozada
Surveyed on	: 27 · February · 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

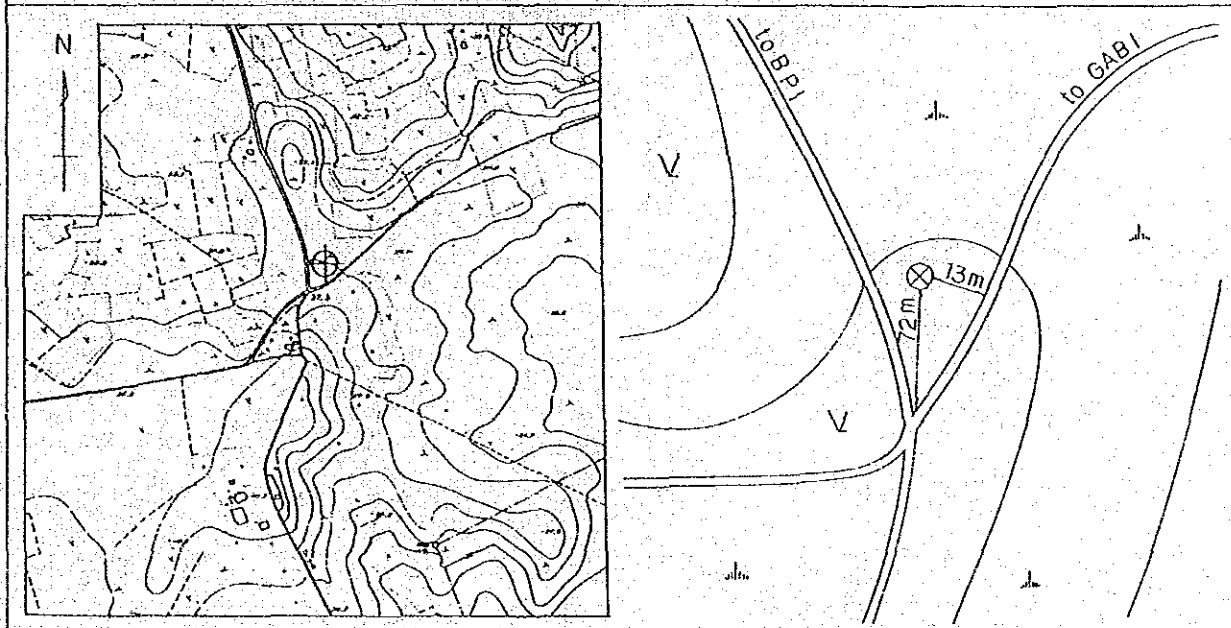
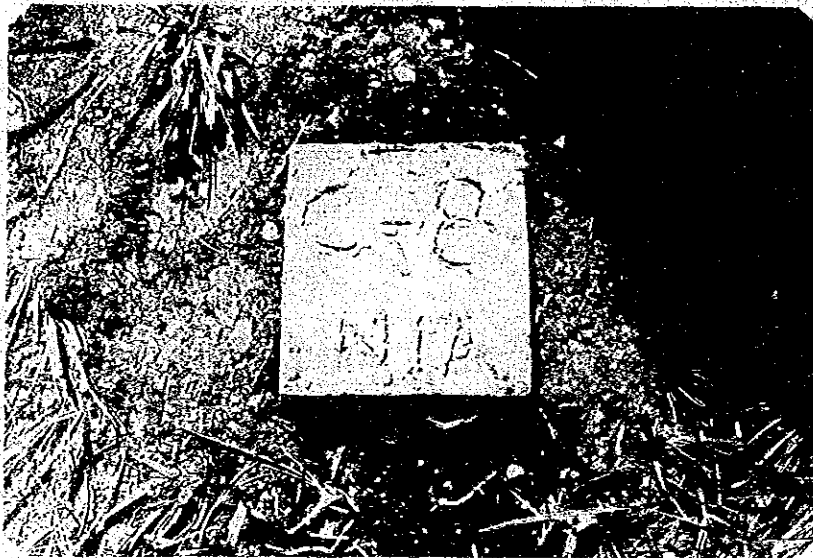


FIGURE A-11

DESCRIPTION OF NEW BENCH MARK

Station No.	NIA C-8	
Elevation (m)	33.713	
Location	Gabi, Ubay, Bohol	
Established on	21 February 1985	Established by : Felix R Lozada
Surveyed on	27 February 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

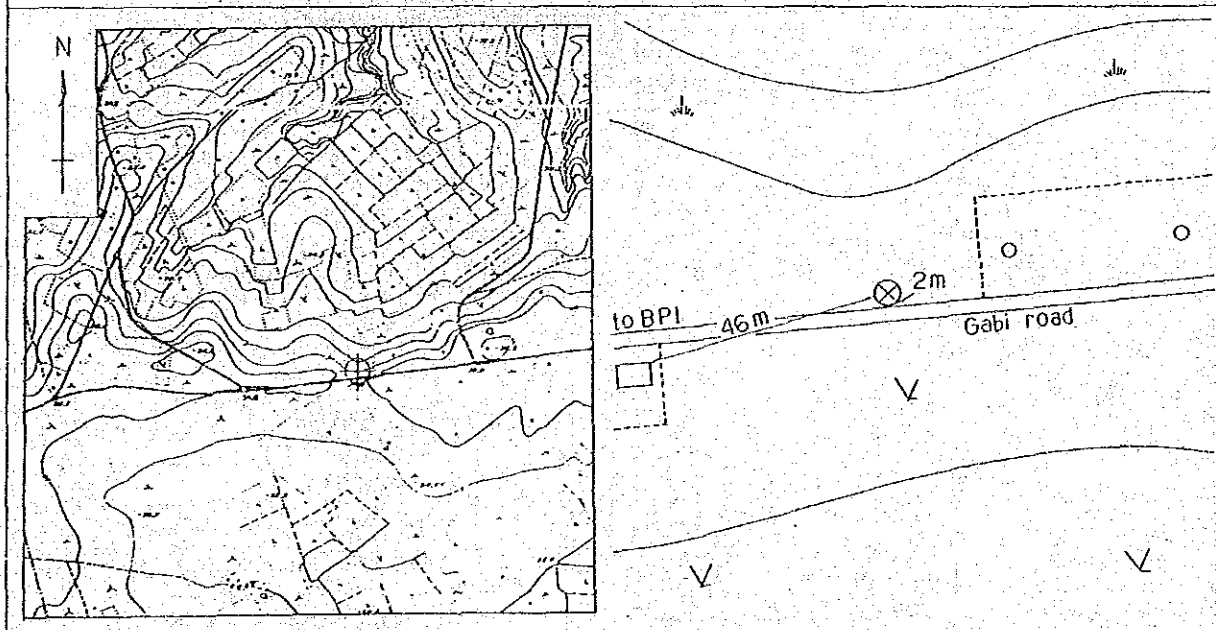


FIGURE A-12

DESCRIPTION OF NEW BENCH MARK

Station No.	NIA C-9	
Elevation (m)	38.223	
Location	Gabi, Ubay, Bohol	
Established on	21 · February · 1985	Established by : Felix R Lozada
Surveyed on	28 · February · 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

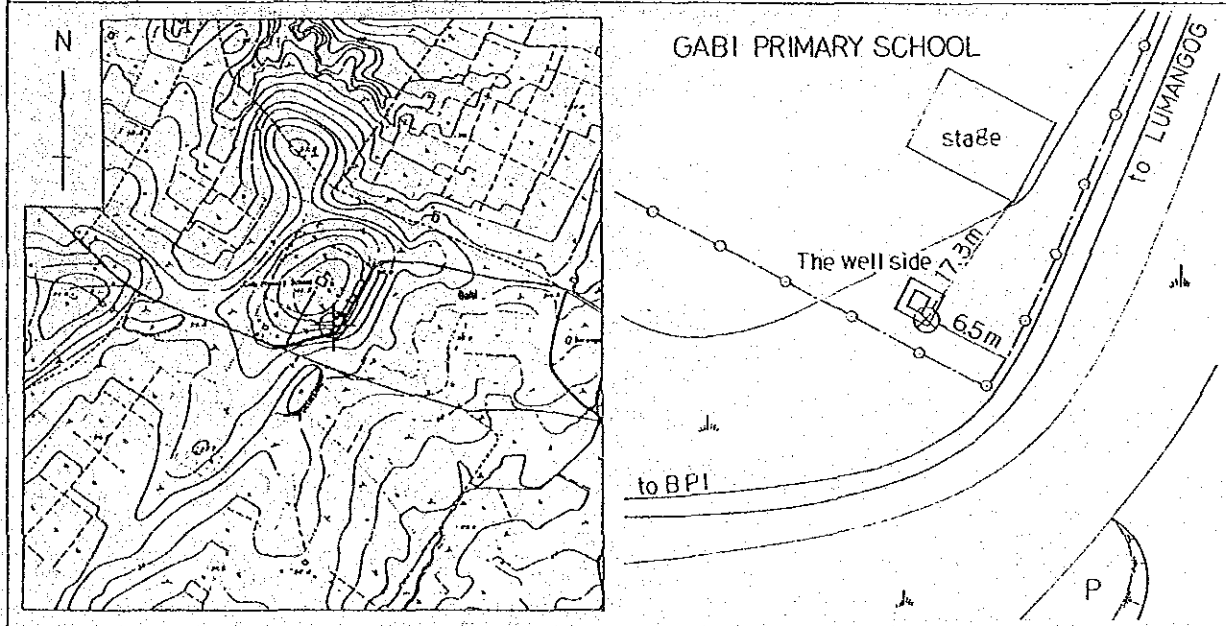
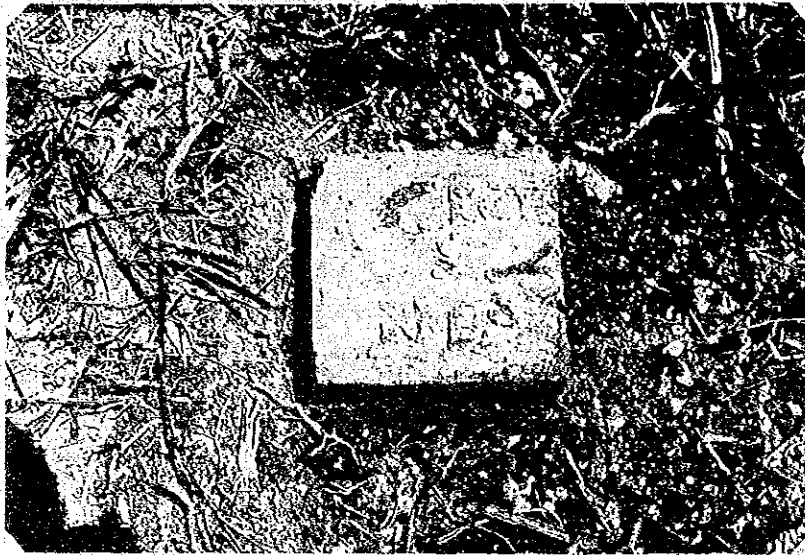


FIGURE A-13

DESCRIPTION OF NEW BENCH MARK

Station No.	NIA C-10	
Elevation (m)	35.919	
Location	Gabi, Ubay, Bohol	
Established on :	21 · February · 1985	Established by : Felix R Lozada
Surveyed on :	23 · February · 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

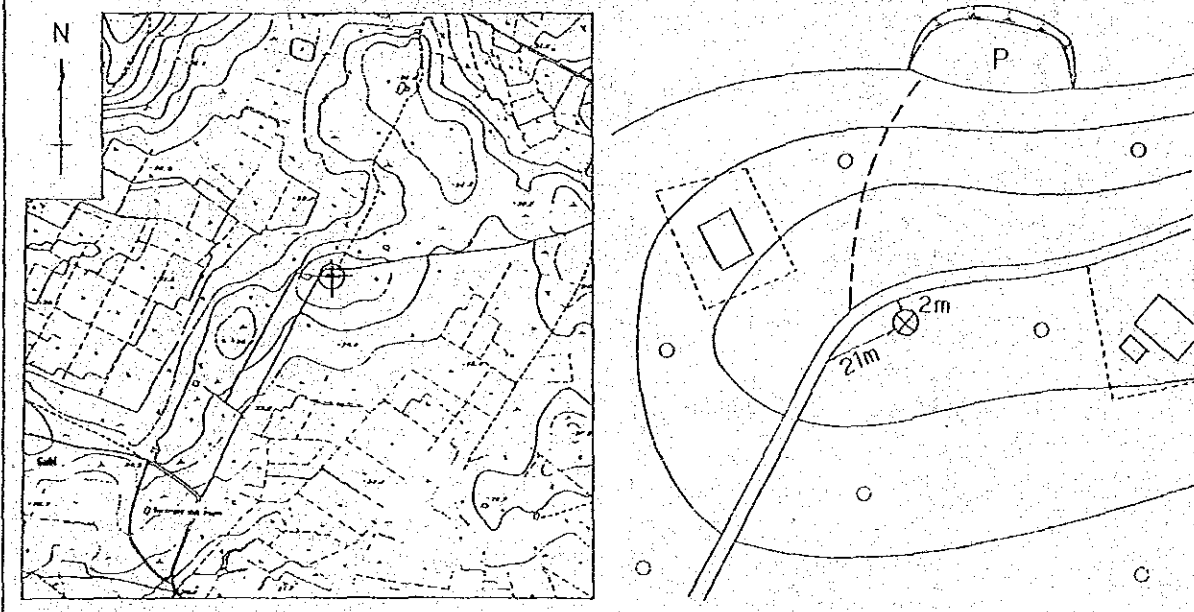
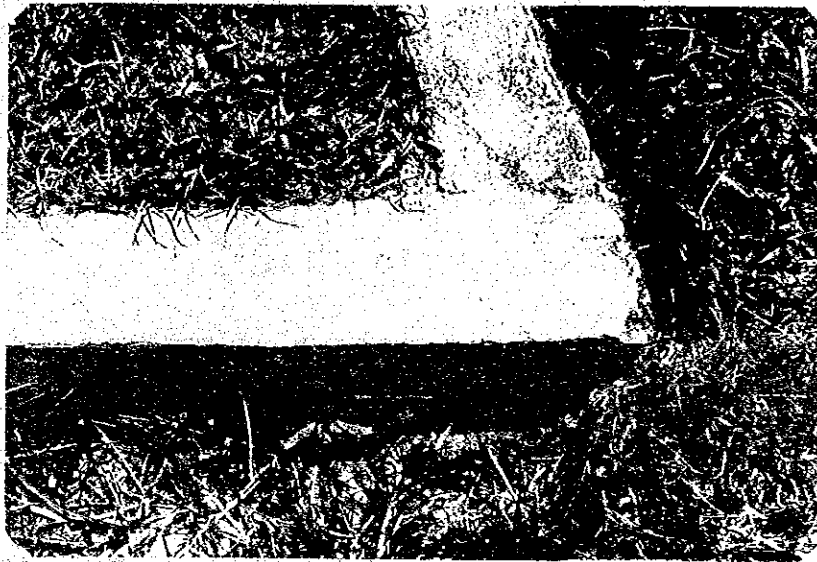


FIGURE A-14  
 DESCRIPTION OF NEW BENCH MARK

Station No.	NIA C-13	
Elevation (m)	50.124	
Location	Lumangog, Ubay, Bohol	
Established on	21 • February • 1985	Established by : Felix R Lozada
Surveyed on	2 • February • 1985	Surveyed by : Felix R Lozada
		Checked by :

Photopicture of B.M



Sketch-map of B.M and vicinity

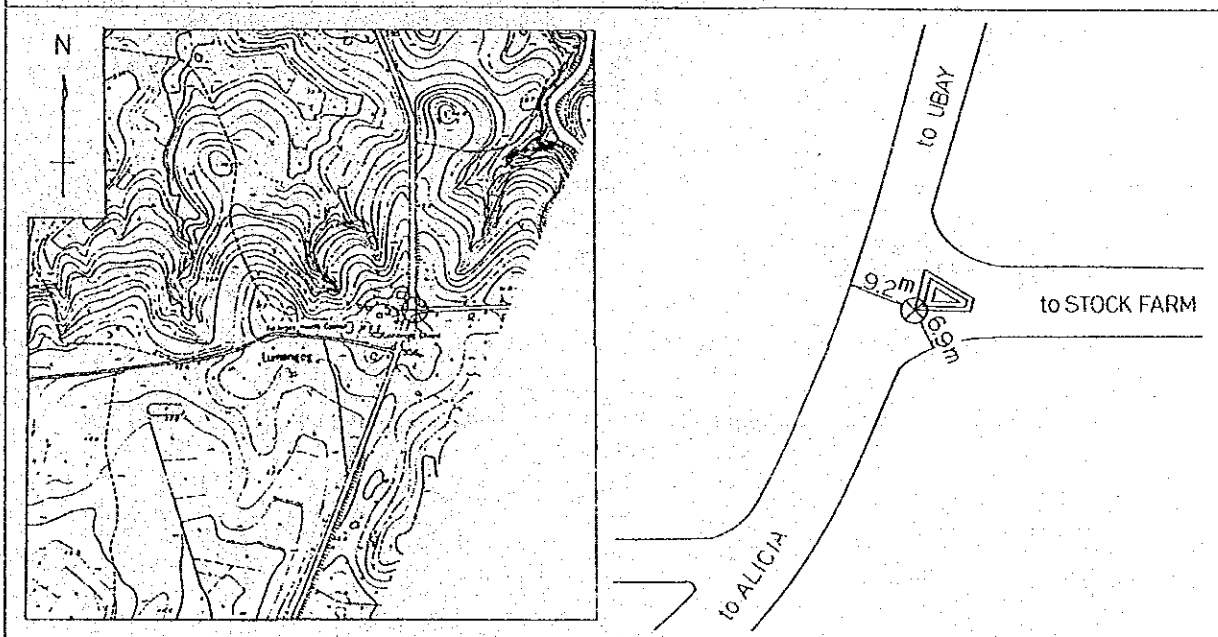
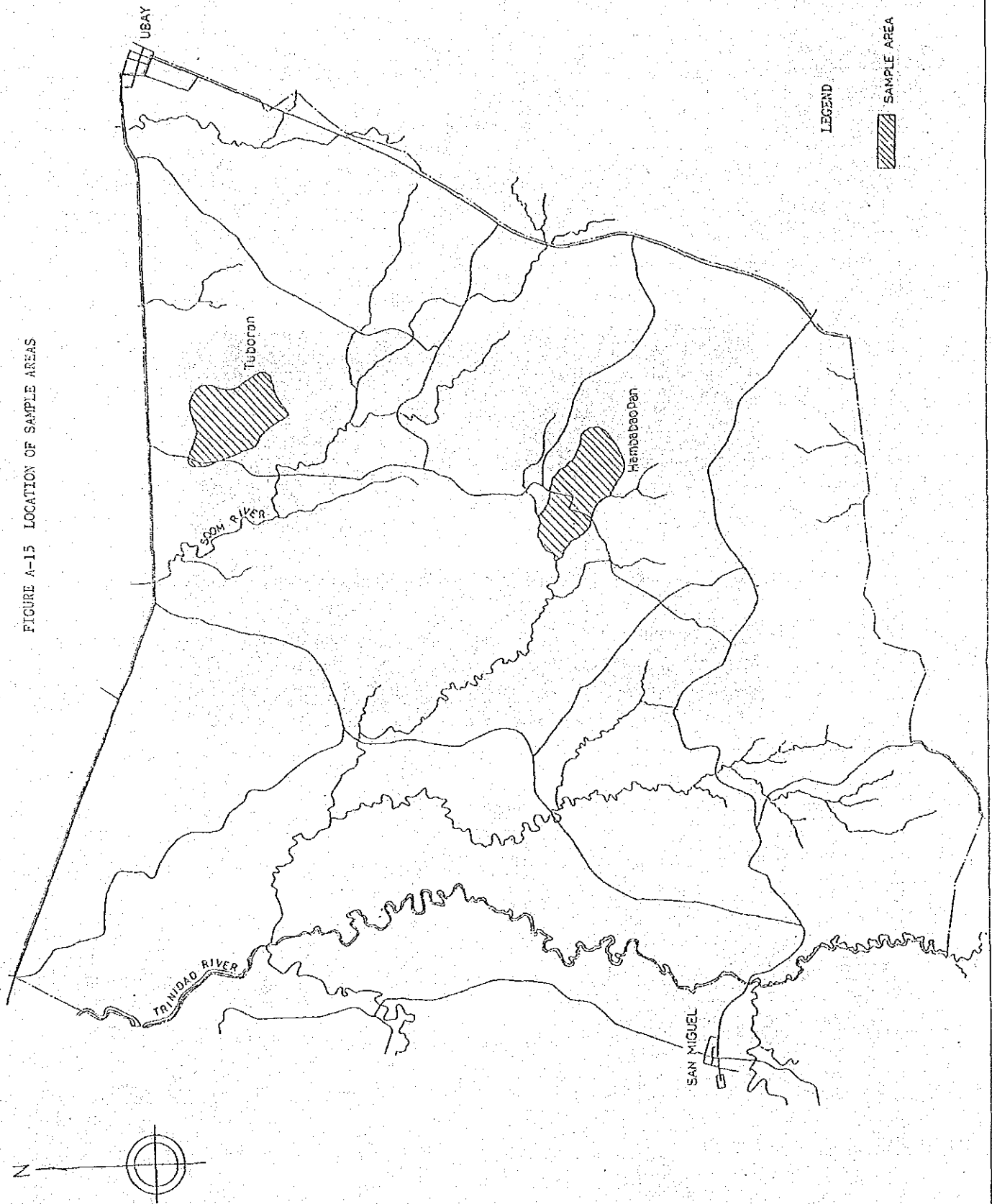


FIGURE A-15 LOCATION OF SAMPLE AREAS



## ANNEX B. CLIMATE AND HYDROLOGY





ANNEX B CLIMATE AND HYDROLOGY

		<u>Page</u>
CHAPTER I	OBSERVATION DATA .....	B-1
CHAPTER II	RAINFALL DATA AND ANALYSIS .....	B-14
2.1	Correlation Analysis .....	B-14
2.2	Areal Rainfall .....	B-30
2.2.1	Phase I Protect .....	B-30
2.2.2	Phase II Protect .....	B-30
CHAPTER III	HYDROLOGICAL DATA AND RUNOFF ANALYSIS .....	B-33
3.1	Rating Curve of Wahig River .....	B-33
3.1.1	Lower Stage Curve .....	B-34
3.1.2	Higher Stage Curve .....	B-35
3.1.3	Compounded Rating Curve .....	B-35
3.2	Runoff Analysis for Wahig-Pamacsalan River .....	B-41
3.2.1	Establishment of Tank Model .....	B-42
3.2.2	Estimation of Runoff Discharge .....	B-43
3.3	Runoff Analysis for Phase II Project .....	B-49
3.3.1	Rainfall Data for Runoff Analysis .....	B-51
3.3.2	Runoff Analysis .....	B-51
CHAPTER IV	FLOOD ANALYSIS .....	B-55
4.1	Probable Rainfall .....	B-55
4.1.1	Rational Method .....	B-56
4.2	Traces of Past Flood .....	B-57
4.3	Probable Maximum Precipitation .....	B-58
4.3.1	Historical Storm .....	B-58
4.3.2	Estimation of Precipitable Water for Each Storm .....	B-58
4.3.3	Adjustment Factor and PMP .....	B-59
4.3.4	Probable Maximum Flood (PMF) .....	B-59

LIST OF TABLE

		<u>Page</u>
TABLE B1-1	Climatological Data at Tagbilaran (1960-1984) ....	B-2
TABLE B1-2	Monthly Mean Temperature .....	B-3
TABLE B1-3	Monthly Mean Maximum Temperature .....	B-4
TABLE B1-4	Monthly Mean Minimum Temperature .....	B-5
TABLE B1-5	Monthly Mean Relative Humidity .....	B-6
TABLE B1-6	Monthly Maximum Relative Humidity .....	B-7
TABLE B1-7	Monthly Minimum Relative Humidity .....	B-8
TABLE B1-8	Monthly Mean Dew Point Temperature .....	B-9
TABLE B1-9	Monthly Mean Cloudness .....	B-10
TABLE B1-10	Monthly Mean Wind Velocity .....	B-11
TABLE B2-1	Summary Table of Daily Rainfall Data at Dagohoy Station .....	B-17
TABLE B2-2	Summary Table of Daily Rainfall Data at Pamacsalan Station .....	B-18
TABLE B2-3	Summary Table of Daily Rainfall Data at Catagda-an .....	B-19
TABLE B2-4	Summary Table of Daily Rainfall Data at Abachanan.	B-19
TABLE B2-5	Summary Table of Daily Rainfall Data at Matinao ..	B-20
TABLE B2-6	Summary Table of Daily Rainfall Data at Danicop ..	B-20
TABLE B2-7	Summary Table of Daily Rainfall Data at Ubay Central .....	B-21
TABLE B2-8	Summary Table of Daily Rainfall Data at Ubay Bayang .....	B-21
TABLE B2-9	Summary Table of Daily Rainfall Data at Ubay Gabi .....	B-22
TABLE B2-10	Summary Table of Daily Rainfall Data at Gov. Boyles .....	B-22
TABLE B2-11	Estimated Areal Rainfall in Catchment Area in Wahig River .....	B-31
TABLE B2-12	Estimated Areal Rainfall in Phase II Service Area.	B-32
TABLE B3-1	Discharge Measurement Data of Wahig-Pamacsalan River .....	B-36

	<u>Page</u>
TABLE B3-2 Rating Curve at Higher Stage .....	B-37
TABLE B3-3 Estimated Annual Runoff of Wahig-Pamacsalan River.	B-45
TABLE B3-4 Estimated Runoff Discharge of Wahig-Pamacsalan River .....	B-46
TABLE B3-5 Estimated Runoff Discharge for Bayongan Reservoir.	B-52
TABLE B3-6 Estimated Runoff Discharge for Capayas Reservoir .	B-53
TABLE B4-1 Precipitable Water above Sea Level .....	B-60

LIST OF FIGURE

	<u>Page</u>
FIGURE B1-1	Meteorological and Hydrological Station ..... B-12
FIGURE B1-2	Historic Meteorological and Hydrological Records. B-13
FIGURE B2-1	Monthly Mean Rainfall at Six Station in Phase I Area ..... B-23
FIGURE B2-2	Annual Mean Rainfall at Six Stations in Phase I Area ..... B-24
FIGURE B2-3	Monthly Mean Rainfall at Three Stations in Phase II Area ..... B-25
FIGURE B2-4	Annual Mean Rainfall at Three Stations in Phase II Area ..... B-26
FIGURE B2-5	Correlation Analysis between Dagohoy Station and Central Ubay Station ..... B-27
FIGURE B2-6	Correlation Analysis between Dagohoy Station and Bayang Ubay Station ..... B-28
FIGURE B2-7	Correlation Analysis between Dagohoy Station and Gabi Station ..... B-29
FIGURE B3-1	Gage Height-Discharge Curve ..... B-38
FIGURE B3-2	Cross Section of Wahig River at National Highway Bridge ..... B-39
FIGURE B3-3	Rating Curve at Malinao Damsite ..... B-40
FIGURE B3-4	Coefficient of Tank Model ..... B-47
FIGURE B3-5	Rainfall and Runoff Pattern for Phase I Area .... B-48
FIGURE B3-6	Estimated Monthly Mean Runoff Discharge ..... B-54
FIGURE B4-1	Variation of Vapour Pressure with Temperature at Percentage of Saturation ..... B-61
FIGURE B4-2	Nomograph for Precipitable Moisture in Atmospheric Mass between 1,000 mb Surface and Various Altitude ..... B-62
FIGURE B4-3	Specific Runoff on Spillway Design ..... B-63

## CHAPTER I      OBSERVATION DATA

Meteorological and hydrological data related to the Phase I and Phase II Projects have been collected. The location of each station is shown in FIGURE B1-1, and their items and observation periods are indicated in FIGURE B1-2.

General successive climatological data observed in Tagbilaran have been collected as shown in TABLE B1-1 to TABLE B1-10.

There are ten rain gauge stations around the Phase I and Phase II Project areas as shown in FIGURE B1-1 and FIGURE B1-2.

The longest successive observation data are available at the Dagohoy station since 1956. FIGURE B1-2 makes it clear that another nine rain gauge stations are not sufficient to meet the various analysis. Therefore, first of all, the correlation analysis between the Dagohoy station and the other stations has been made to complement all the missing data.

On the other hand, there are several runoff observation stations in the neighborhood of Phase I and Phase II Project area as shown in FIGURE B1-1. But the available observation data are only at the Malinao damsite for the runoff analysis.

TABLE B1-1 CLIMATOLOGICAL DATA AT TAGBILARAN (1960 - 1984)

Data	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
<b>Rainfall (mm)</b>													
Mean	103	83	78	65	83	140	121	111	128	179	208	112	1,411
Maximum	249	183	155	234	181	303	231	186	327	385	383	192	3,009
Minimum	18	3	8	10	19	9	10	57	41	71	76	51	379
<b>2. Temperature (°C)</b>													
Mean	26.1	26.2	26.8	27.6	28.4	28.2	28.0	28.3	28.1	27.6	27.3	26.7	27.4
Mean Maximum	30.4	30.8	31.7	32.8	33.1	32.6	32.3	32.6	32.5	32.1	31.8	31.2	32.0
Mean Minimum	21.7	21.6	21.8	22.5	23.6	23.8	23.7	23.9	23.7	23.3	22.8	22.5	22.9
<b>3. Relative Humidity (%)</b>													
Mean	82.9	81.3	79.2	77.4	78.8	81.5	81.0	79.0	80.8	83.0	84.5	83.9	81.1
Mean Maximum	93.3	90.8	90.5	86.8	89.1	90.7	91.5	90.5	90.8	92.4	93.5	93.5	91.1
Mean Minimum	72.1	70.3	69.8	68.0	71.3	72.6	71.4	70.4	72.7	73.5	75.0	74.4	71.8
<b>4. Mean Dew Point (°C)</b>													
	22.6	22.4	22.5	23.3	24.3	24.4	24.2	24.1	24.1	24.1	24.0	23.6	23.6
<b>5. Mean Cloudness (0-10)</b>													
	7.2	7.1	6.3	5.6	6.7	7.8	7.9	8.0	8.0	7.6	7.3	7.5	7.3
<b>6. Wind</b>													
Mean Velocity (km/hr)	5.5	5.7	5.4	5.0	4.4	4.0	4.7	5.3	4.8	4.2	4.5	4.9	4.9
Mean Direction	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	-

Note: 1/ Average of observation periods of 1960 - 1975 and 1978 - 1981.

TABLE BI-2 MONTHLY MEAN TEMPERATURE

Station:	Tagbilaran												(Unit: °C)
Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1960	-	-	-	-	-	27.4	27.7	28.8	27.5	27.4	26.9	25.9	27.4
1961	25.1	26.2	26.4	27.4	28.1	27.7	27.7	28.2	28.4	27.4	27.2	26.9	27.2
1962	26.0	25.5	26.4	27.8	28.7	28.0	27.9	27.7	27.8	28.1	27.7	26.8	27.4
1963	25.3	25.3	26.3	27.4	28.7	29.1	28.5	27.9	28.5	27.5	27.2	27.2	27.4
1964	27.0	26.1	26.7	27.4	28.1	27.6	27.7	28.6	27.9	27.7	27.3	26.9	27.4
1965	25.5	26.0	26.5	27.4	27.9	28.0	27.3	27.7	27.9	27.6	27.3	26.9	27.2
1966	26.6	26.5	28.4	26.6	28.7	28.2	27.4	28.4	28.8	27.7	26.9	26.0	27.5
1967	25.8	26.1	26.0	27.0	28.2	28.5	28.5	28.6	28.6	27.6	26.9	26.0	27.3
1968	26.1	25.8	26.9	27.3	28.4	28.2	28.6	28.3	28.8	27.6	26.5	26.4	27.4
1969	26.0	26.3	26.9	28.0	29.3	28.0	28.4	28.3	28.7	28.2	28.0	27.4	27.8
1970	27.1	27.0	27.7	28.5	28.8	28.5	28.5	29.3	28.9	28.2	27.8	-	28.2
1971	25.7	26.0	26.0	27.1	27.8	-	27.7	-	28.1	26.8	26.7	26.7	26.9
1972	25.7	26.4	26.1	26.8	27.8	27.7	29.2	27.8	27.4	25.5	26.9	26.4	27.0
1973	25.5	25.7	26.7	27.8	28.1	28.4	28.0	28.0	27.5	27.8	27.0	26.8	27.3
1974	25.7	26.1	26.1	27.4	27.7	27.5	27.5	28.8	28.0	27.4	27.1	26.4	27.1
1975	25.7	26.0	26.8	28.0	27.7	27.8	-	28.4	27.6	27.6	26.9	26.6	27.2
1976	26.0	25.7	26.5	27.2	27.9	27.1	27.9	27.7	26.7	27.6	27.3	24.8	27.0
1977	26.8	26.2	26.5	27.4	28.5	28.0	27.6	27.9	27.8	27.3	27.5	26.9	27.4
1978	25.9	26.1	27.6	28.3	29.1	28.9	28.7	28.7	27.9	27.9	27.5	27.0	27.8
1979	26.5	27.1	26.9	28.2	28.8	28.9	28.0	28.6	28.3	28.1	27.7	26.7	27.8
1980	26.6	26.3	26.6	27.8	28.5	27.8	27.7	27.8	28.4	27.8	27.6	27.1	27.5
1981	25.9	26.1	27.6	28.5	28.7	29.2	28.3	29.0	28.2	27.8	27.5	26.8	27.8
1982	26.4	26.6	27.1	28.0	28.5	28.1	28.1	28.2	28.2	27.8	27.8	27.4	27.7
1983	26.7	26.6	27.3	27.8	29.1	29.1	28.0	28.4	28.1	27.8	27.8	26.7	27.8
1984	26.3	26.4	-	-	-	-	-	-	-	-	-	-	26.4
Mean	26.1	26.2	26.8	27.6	28.4	28.2	28.0	28.3	28.1	27.6	27.3	26.7	27.4

TABLE B1-3 MONTHLY MEAN MAXIMUM TEMPERATURE

Year	Station: Tagbilaran												Total
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
1960	-	-	-	-	-	31.4	32.1	33.3	31.7	31.9	31.4	30.9	31.8
1961	29.1	30.7	31.9	32.5	32.9	31.9	32.5	32.7	33.3	32.0	32.0	31.6	31.9
1962	30.0	29.0	30.8	33.2	33.7	32.8	32.3	32.0	32.1	33.0	32.5	31.7	31.9
1963	28.8	29.0	30.8	33.4	34.2	34.0	33.6	32.1	33.0	32.2	31.9	32.2	32.1
1964	32.0	30.7	32.1	32.2	32.4	32.1	32.5	33.6	32.6	32.5	32.0	31.5	32.2
1965	30.0	30.7	30.9	32.2	33.3	32.6	31.7	32.5	32.5	32.5	32.0	31.8	31.9
1966	32.1	32.1	32.4	34.2	33.4	32.9	31.5	32.9	33.5	32.6	32.4	31.7	32.6
1967	30.2	30.3	30.7	32.7	33.4	33.5	32.0	33.0	33.4	32.4	31.8	31.0	32.0
1968	30.3	30.9	32.3	32.8	33.5	33.0	33.1	32.6	33.5	32.4	31.6	30.6	32.2
1969	31.4	31.9	32.6	33.2	34.2	33.4	32.7	32.9	32.9	33.4	33.1	31.9	32.8
1970	32.0	31.5	33.1	33.9	33.7	33.1	33.2	34.1	33.9	32.6	32.3	-	33.0
1971	29.8	30.0	30.5	32.4	32.2	-	31.9	-	32.9	30.7	30.9	31.4	31.3
1972	29.7	31.3	30.8	32.1	33.2	32.4	33.5	32.7	31.7	32.5	31.9	31.5	31.9
1973	31.6	31.8	31.7	32.3	32.5	32.6	31.9	31.9	31.4	31.9	30.7	30.5	31.7
1974	29.6	30.0	30.6	32.2	32.2	31.5	31.4	33.0	32.6	31.0	31.1	30.1	31.3
1975	29.7	30.3	31.3	32.3	31.9	31.9	-	32.8	31.7	31.8	31.9	80.5	31.5
1976	29.9	30.2	31.3	32.3	32.0	31.0	31.8	31.7	31.9	32.0	31.5	30.7	31.4
1977	31.0	30.1	31.1	32.8	33.3	32.3	31.5	31.9	31.6	31.5	31.8	31.6	31.7
1978	30.1	30.7	33.0	33.3	33.6	33.0	32.6	32.6	31.8	31.6	31.7	31.1	32.1
1977	31.1	32.1	31.7	32.8	33.2	33.4	31.9	32.6	32.3	32.1	31.9	30.9	32.2
1980	30.2	31.1	32.3	32.3	38.0	31.6	31.8	31.7	32.5	31.8	31.7	30.8	31.7
1981	29.6	30.8	33.1	33.8	33.1	33.2	32.5	33.2	32.5	32.0	31.8	31.2	32.2
1982	30.5	30.9	31.5	32.8	33.0	32.2	32.3	32.3	32.3	32.3	32.4	31.8	32.0
1983	31.8	32.4	32.5	33.1	33.9	33.1	31.8	32.8	32.0	32.0	31.5	30.4	32.2
1984	30.0	30.4	-	-	-	-	-	-	-	-	-	-	30.2
Mean	30.4	30.8	31.7	32.8	33.1	32.6	32.3	32.6	32.5	32.1	31.8	31.2	32.0



TABLE B1-4 MONTHLY MEAN MINIMUM TEMPERATURE

Station: Tagbilaran (Unit: °C)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1966	-	-	-	-	-	23.4	23.3	24.2	23.2	22.9	22.4	20.8	22.9
1961	21.1	23.8	20.9	22.2	23.2	23.4	22.9	23.6	23.4	22.7	22.3	22.2	22.6
1962	22.0	22.0	21.9	22.3	23.6	23.2	23.5	23.3	23.4	23.1	22.9	21.9	22.8
1963	21.7	21.5	21.8	21.4	23.1	24.1	23.4	23.6	23.9	22.7	22.4	22.1	22.6
1964	21.9	21.5	21.3	22.6	23.7	23.0	22.9	23.5	23.2	22.9	22.6	22.3	22.6
1965	21.0	21.3	22.1	22.6	22.5	23.3	22.9	22.9	23.3	22.7	22.5	22.0	22.4
1966	21.0	20.8	21.4	22.6	24.0	23.4	23.2	23.8	24.1	22.8	22.9	22.5	22.7
1967	21.3	21.8	21.2	21.3	23.0	23.5	23.5	24.1	23.7	22.8	21.9	21.0	22.4
1968	21.9	20.6	21.4	21.8	23.2	23.3	24.0	23.9	24.0	22.9	21.4	22.2	22.6
1969	20.7	20.6	21.2	22.8	24.4	24.2	24.1	23.6	24.4	22.9	22.8	22.8	22.9
1970	22.2	22.4	22.3	23.1	23.9	23.9	23.8	24.4	23.8	23.8	23.2	-	23.3
1971	21.5	22.0	21.5	21.7	23.4	-	23.4	-	23.3	23.8	22.4	22.0	22.5
1972	21.7	21.6	21.4	21.4	22.5	23.1	24.8	23.0	23.1	22.5	22.0	21.3	22.4
1973	19.4	19.5	21.7	23.3	23.6	24.1	24.0	24.1	23.5	23.7	23.2	23.1	22.8
1974	21.9	22.1	21.5	22.7	23.2	23.5	23.6	24.6	23.4	23.9	23.1	22.7	23.0
1975	21.6	21.7	22.3	23.6	23.5	23.7	-	24.0	23.4	23.4	22.5	26.7	23.3
1976	22.1	21.2	21.6	22.1	23.7	23.1	24.0	23.6	23.6	23.2	23.1	22.9	22.9
1977	22.6	22.3	22.0	22.1	23.7	23.6	23.8	23.9	24.0	23.1	23.2	22.2	23.0
1978	21.6	21.5	22.2	22.5	24.6	24.8	24.8	24.9	24.1	24.1	23.2	22.8	23.4
1979	21.8	22.0	22.1	23.6	24.4	24.4	24.1	24.5	24.2	24.0	23.5	22.5	23.4
1980	22.9	21.5	22.0	23.3	24.1	23.9	23.6	23.8	24.3	23.9	23.5	23.4	23.4
1981	22.3	21.5	22.1	23.2	24.3	25.1	24.1	24.8	24.0	23.6	23.2	22.3	23.4
1982	22.3	22.3	22.6	23.1	23.9	24.0	23.8	24.1	24.0	23.2	23.1	22.9	23.3
1983	21.6	20.7	22.0	22.5	24.4	24.9	24.1	24.4	24.2	23.6	24.1	22.9	23.3
1984	22.5	22.4	-	-	-	-	-	-	-	-	-	-	22.5
Mean	21.7	21.6	21.8	22.5	23.6	23.8	23.7	23.9	23.7	23.3	22.8	22.5	22.9

TABLE B1-5 MONTHLY MEAN RELATIVE HUMIDITY

Station: Tagbilaran. (Unit: %)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1966	-	-	-	-	-	90	85	77	86	85	89	85	85.3
1961	80	82	81	85	82	84	80	78	78	82	84	85	81.8
1962	83	84	85	79	78	84	84	83	84	84	84	85	83.1
1963	87	84	84	77	76	74	78	83	81	84	87	85	81.7
1964	83	83	77	84	83	84	84	76	84	85	85	85	82.8
1965	86	82	85	83	82	82	81	83	81	85	85	82	83.1
1966	78	78	78	72	76	80	84	80	75	84	85	86	79.7
1967	85	82	82	77	78	76	80	76	75	80	82	83	79.7
1968	81	81	76	74	77	79	78	77	74	81	79	82	78.3
1969	78	74	73	71	75	80	78	74	73	71	75	80	75.2
1970	82	80	77	72	76	82	79	75	78	83	84	-	78.9
1971	80	85	80	76	84	-	81	-	79	86	87	84	82.2
1972	84	81	81	78	78	81	71	79	83	81	83	81	80.1
1973	81	73	77	77	78	80	82	82	88	83	87	88	81.3
1974	84	85	83	84	83	84	83	77	83	85	86	88	83.8
1975	83	81	80	77	78	80	81	79	79	83	83	84	80.7
1976	88	87	85	82	82	86	83	84	84	85	94	86	85.5
1977	86	84	82	75	79	85	85	82	84	86	85	81	82.8
1978	83	82	75	76	80	81	81	78	84	83	82	84	80.8
1979	80	77	76	76	82	84	83	78	82	83	84	80	80.4
1980	86	83	76	78	76	85	81	82	80	83	85	85	81.7
1981	83	82	75	74	79	76	81	74	81	85	86	81	79.8
1982	80	82	81	79	79	82	79	80	80	81	84	84	80.9
1983	82	74	73	73	71	75	83	80	82	84	84	86	78.9
1984	86	85	-	-	-	-	-	-	-	-	-	-	86.0
Mean	82.9	81.3	79.2	77.4	78.8	81.5	81.0	79.0	80.8	83.0	84.5	83.9	81.1

TABLE B1-6 MONTHLY MAXIMUM RELATIVE HUMIDITY

Year	Station: Tagbilaran												Total
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
1966	-	-	-	83	90	87	93	95	89	93	94	96	91.1
1967	94	96	93	90	88	94	93	96	85	94	96	-	92.6
1968	94	95	87	86	87	88	85	88	87	91	94	92	89.5
1969	90	80	86	86	89	88	93	93	87	94	91	94	89.3
1970	94	92	91	88	86	96	92	87	93	94	95	94	91.8
1971	95	92	92	87	91	92	93	91	88	96	95	92	92.0
1972	97	93	96	89	86	88	88	94	94	89	93	92	91.6
1973	90	78	88	85	90	88	92	86	95	93	97	93	89.6
1974	92	93	94	93	93	94	91	92	91	95	94	95	93.1
1975	98	93	93	95	94	92	-	93	93	90	94	96	93.7
1976	94	94	93	88	93	95	93	90	89	92	94	95	92.5
1977	93	94	96	84	86	91	94	94	94	93	94	93	92.2
1978	96	-	-	-	-	94	90	86	91	90	91	93	91.4
1979	89	89	89	88	92	90	90	84	91	91	93	88	89.5
1980	94	92	87	89	-	92	91	89	94	93	-	95	91.6
1981	93	94	85	82	85	84	91	89	90	93	91	93	89.2
1982	92	94	91	86	91	91	94	93	92	90	90	94	91.5
1983	89	82	87	76	85	88	92	89	91	93	94	94	88.3
1984	95	92	-	-	-	-	-	-	-	-	-	-	93.5
Mean	93.3	90.8	90.5	86.8	89.1	90.7	91.5	90.5	90.8	92.4	93.5	93.5	91.1

(Unit: %)

TABLE B1-7 MONTHLY MINIMUM RELATIVE HUMIDITY

(Unit: %)

Station: Tagbilaran

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1966	-	-	-	66	68	74	76	72	65	74	76	75	71.8
1967	75	69	73	68	70	62	70	68	69	72	75	-	70.1
1968	72	70	71	67	66	72	68	69	66	74	71	66	69.3
1969	69	67	64	62	67	71	68	71	73	71	74	75	69.3
1970	72	70	63	65	69	72	70	67	66	74	75	76	70.1
1971	68	69	67	66	79	78	71	67	69	68	81	74	71.4
1972	74	71	72	70	70	73	63	65	75	73	70	69	70.4
1973	70	65	67	72	71	74	70	77	82	71	80	82	73.4
1974	76	75	73	74	74	73	75	69	75	75	80	80	74.9
1975	72	73	75	68	78	76	-	70	76	81	70	77	74.2
1976	78	77	78	72	76	69	73	73	80	76	74	72	74.8
1977	75	73	74	69	70	76	76	73	74	74	70	74	73.2
1978	72	-	-	-	-	73	72	70	78	74	70	75	73.0
1979	68	66	69	65	71	77	75	73	72	68	77	71	71.0
1980	75	76	64	70	-	80	74	76	71	76	-	77	73.9
1981	73	72	67	66	73	66	70	66	74	73	79	71	70.8
1982	71	66	73	71	73	73	70	70	70	72	77	75	71.8
1983	67	64	66	65	65	67	72	71	74	75	76	76	69.8
1984	71	72	-	-	-	-	-	-	-	-	-	-	72.0
Mean	72.1	70.3	69.8	68.0	71.3	72.6	71.4	70.4	72.7	73.5	75.0	74.4	71.8

TABLE B1-8 MONTHLY MEAN DEW POINT TEMPERATURE

Station: Tagbilaran (Unit: °C)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1966	-	-	-	-	-	-	25	24	24	25	24	23	24.2
1961	22	23	23	24	25	24	24	24	24	23	23	23	23.5
1962	22	22	23	23	24	25	24	24	24	25	24	23	23.6
1963	23	22	23	23	24	24	24	25	24	24	24	24	23.7
1964	23	22	23	23	25	24	24	24	24	24	24	23	23.6
1965	23	22	23	23	24	24	23	24	24	24	24	23	23.4
1966	22	22	23	23	24	24	24	24	24	24	24	24	23.5
1967	-	22	22	23	24	24	24	23	23	24	23	-	23.2
1968	22	22	22	22	24	24	24	24	24	24	23	23	23.2
1969	22	21	22	22	24	25	24	24	24	24	24	24	23.3
1970	23	22	23	23	24	25	24	24	24	24	24	24	23.7
1971	22	23	22	23	25	24	24	24	24	24	24	23	23.5
1972	23	23	22	23	24	24	24	24	24	24	24	23	23.5
1973	22	20	22	24	24	24	24	24	24	24	24	24	23.3
1974	22	23	22	24	24	24	24	24	24	24	24	24	23.6
1975	22	23	23	24	24	24	-	24	24	24	24	24	23.6
1976	23	23	23	24	24	24	24	24	24	24	25	24	23.8
1977	24	23	23	23	24	25	25	24	24	24	24	23	23.8
1978	22	-	-	-	-	25	25	24	25	24	24	24	24.1
1979	22	23	22	24	25	25	25	24	24	24	24	23	23.8
1980	24	23	22	23	-	25	24	24	24	24	-	24	23.7
1981	22	22	22	24	25	25	24	24	24	24	24	24	23.6
1982	22	23	23	24	25	25	24	24	24	24	24	24	23.8
1983	23	22	23	23	24	25	25	25	25	25	25	24	24.1
1984	24	23	-	-	-	-	-	-	-	-	-	-	23.5
Mean	22.6	22.4	22.5	23.3	24.3	24.4	24.2	24.1	24.1	24.1	24.0	23.6	23.6

TABLE B1-9 MONTHLY MEAN CLOUDNESS

(Unit: 0 - 10)

Station: Tagbilaran

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1966	-	-	-	-	-	8	7	7	8	7	7	7	7.3
1961	8	8	5	6	8	9	7	8	7	8	6	8	7.3
1962	8	9	8	5	7	9	10	9	10	9	8	8	8.3
1963	10	10	9	4	7	9	9	10	9	9	8	7	8.4
1964	7	8	7	7	8	9	8	7	8	8	9	8	7.8
1965	8	8	8	7	7	8	9	7	9	7	6	7	7.6
1966	6	6	6	6	8	7	9	8	8	8	8	8	7.3
1967	9	9	7	6	7	7	8	9	8	8	7	7	7.7
1968	8	8	5	4	6	8	8	9	8	8	7	8	7.3
1969	6	6	6	5	7	9	9	9	9	8	8	8	7.5
1970	7	7	7	6	7	8	8	9	9	9	8	9	7.8
1971	8	8	8	8	9	9	9	8	9	9	9	9	8.6
1972	9	8	7	6	6	8	8	9	9	6	6	6	7.3
1973	5	6	7	6	6	7	9	9	9	9	9	9	7.6
1974	8	9	7	8	7	8	9	8	8	9	8	9	8.2
1975	8	8	7	7	7	8	8	9	8	8	8	9	7.9
1976	8	7	7	7	9	8	8	9	9	8	8	8	8.0
1977	8	8	7	5	6	8	8	9	8	7	7	6	7.3
1978	5	5	4	4	5	6	6	7	7	6	6	6	5.6
1979	5	4	5	4	5	7	7	7	7	7	6	7	5.9
1980	6	5	4	5	5	7	6	7	7	6	6	7	5.9
1981	7	6	5	4	6	6	6	6	6	6	6	6	5.8
1982	7	7	6	5	6	7	6	6	6	6	6	6	6.2
1983	5	4	4	4	4	6	7	7	7	6	7	7	5.7
1984	7	7	-	-	-	-	-	-	-	-	-	-	7.0
Mean	7.2	7.1	6.3	5.6	6.7	7.8	7.9	8.0	8.0	7.6	7.3	7.5	7.3

TABLE B1-10 MONTHLY MEAN WIND VELOCITY

(Unit: km/hr)

Station: Tagbilaran

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1960	-	-	-	-	-	5/VRBL	5/VRBL	6/VRBL	5/VRBL	6/VRBL	5/VRBL	6/VRBL	5.4
1961	11/NNE	8/NE	6/VRBL	6/VRBL	5/VRBL	5/VRBL	5/VRBL	10/SW	6/S-QVAO	6/NE	6/NE	5/NE	6.6
1962	6/NE	8/NNE	6/NNE	5/NNE	5/NNE	5/NNE;SE6/SW	5/SSW	5/SSW	5/SW	5/NE	5/NE	5/NE	5.5
1963	6/NNE	6/NNE	5/NNE	3/VRBL	5/NE	6/SW	5/SE	5/SE	6/SW	3/VRBL	3/NNE	3/NE	4.7
1964	5/NE	5/NNE	5/NE	5/VRBL	5/NE	3/SE	3/VRBL	6/SW	5/VRBL	3/VRBL	5/SW	5/NE	4.6
1965	7/NNE;NE	7/NE	6/NE	6/NE	6/NE	4/WSW	6/WSW	4/NE;WSW	6/WSW	4/NE	4/NE	4/NE	5.3
1966	6/NE	6/NE	4/NE	6/NE	4/ESE	4/NE	4/WSW	4/WSW	6/WSW	2/NE	4/NE	4/NE	4.5
1967	4/NE	6/NE	4/NE	4/NE	4/NE	4/NE	4/WSW	4/WSW	4/WSW	4/WSW	4/NE	4/NE	4.2
1968	4/NE	4/NE	4/NE	4/NE	2/VRBL	2/NE	4/SW	6/WSW	6/WSW	4/NE	4/NE	4/NNE	4.0
1969	4/NE	4/NE	4/NE	4/VRBL	4/SE	4/SE	6/SW	4/NE	6/WSW	4/NE	4/NE	4/NE	4.3
1970	4/NE	4/NE	6/NE	6/NE	4/NE	4/SE	4/SW	4/SW	4/NE	4/NE	4/NE	4/NE	4.4
1971	6/VRBL	6/NE	6/NE	4/VRBL	4/VRBL	-	6/SW	-	4/VRBL	6/NE	4/NE	4/NE	5.0
1972	6/NE	6/NE	6/NE	6/NE	4/NE	4/NE	9/SW	6/SW	4/SW	4/NE	6/NE	6/NE	5.6
1973	6/NE	7/NE	6/NE	6/NE	4/NE	4/NE	4/NE	6/SW	4/NE	6/NE	6/NE	6/NE	5.4
1974	6/NE	6/NE	6/NE	4/NE	4/NE	4/SW	4/SW	7/SW	6/NE	7/SSW	6/NE	6/NE	5.5
1975	7/NE	7/NE	6/NE	7/NE	4/NE	4/NE	-	6/SW	4/NE	2/SE	4/NE	4/N	5.0
1976	6/NNE	6/N	7/N	6/VRBL	6/ESE	4/S	4/S	4/SW	4/S	4/VRBL	4/N	6/N	5.1
1977	4/N	6/N	7/N	4/NE	4/N	2/N	4/SW	6/SW	6/SW	2/VRBL	4/VRBL	6/N	4.6
1974	6/N	5/N	5/VRBL	5/VRBL	5/SSE	4/SSE	4/SSW	6/SSW	4/SSE;SW	5/SSW	4/VRBL	5/NE	4.8
1979	6/NNE	6/VRBL	6/VRBL	6/VRBL	6/VRBL	4/VRBL	7/SSW	6/SSW	6/VRBL	7/SSW;SW	6/VRBL	6/N	6.0
1980	5/N	6/N	4/VRBL	4/VRBL	4/VRBL	3/VRBL	4/SSW	3/S	4/SSW	3/VRBL	3/N	4/N	3.9
1981	6/N	6/N	6/N	6/N	4/VRBL	4/VRBL	4/SSE	6/SSW	4/VRBL	4/NNE	4/VRBL	6/N	5.0
1982	4/N	4/N	4/VRBL	4/W	4/W	4/S	4/SW	4/S	4/SSW	4/S	4/N	4/VRBL	4.0
1983	4/VRBL	4/VRBL	4/NNE;NE	4/W	4/VRBL	4/SSE	2/VRBL	4/VRBL	2/VRBL	2/VRBL	4/VRBL	6/N	3.7
1984	4/N;NE	4/NNE;N	-	-	-	-	-	-	-	-	-	-	4.0
Mean	5.5/NE	5.7/NE	5.4/NE	5.0/NE	4.4/NE	4.0/	4.7/SW	5.3/SW	4.8/SW	4.2/NE	4.5/NE	4.9/NE	4.9