

Japan International Cooperation Agency (JICA)
Metropolitan Manila Development Authority (MMDA)
Philippine Institute of Volcanology and Seismology (PHIVOLCS)

Earthquake Impact Reduction Study for Metropolitan Manila, Republic of the Philippines

Final Report Volume 5 Supporting Report

March 2004

Pacific Consultants International
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PASCO Corporation

Formation of the Final Report

The Final Report is comprised of the following volumes:

Volume 1: Executive Summary

Volume 2: Main Report 1

Volume 3: Main Report 2

Volume 4: Main Report 3

Volume 5: Supporting Report

Volume 6: Data Book

Volume 1, Executive Summary, contains the background information of this MMEIRS study, brief information of earthquake damage scenario for Metropolitan Manila, and summary of the master plan for a safer Metropolitan Manila for earthquake impact.

Volume 2, Main Report 1, contains the information of overall study and its results; that is the background information of this study, earthquake damage scenario, and master plan and action plans for safer Metropolitan Manila.

Volume 3, Main Report 2, defines problem of the present condition of Metropolitan Manila, and represents damage estimation results together with its assumptions and methodologies.

Volume 4, Main Report 3, contains supportive components related to master plan to help understanding the development of master plan.

Volume 5, Supporting Report, contains information on GIS Development and Topographic Map Compilation. It also includes other important outputs of the study, such as city ordinance of earthquake disaster management, earthquake disaster mitigation handbook, and earthquake mitigation and response checklists. Those outputs will be utilized when implementing the master plan.

Volume 6, Data Book, contains various data used for analysis in this Study. In addition, data related to earthquake hazard analysis and damage analysis are stored in CD-ROM.

The following foreign exchange rate is applied on this study report;

US\$1.00=P56.055

(February 2004)

Final Report

Table of Contents

Supporting Report

<Part V GIS Development and Topographic Map Compilation>

Chapter 1. Topographic Mapping	1-1
1.1 General	1-1
1.1.1 Introduction	1-1
1.1.2 Objective of Topographic Mapping	1-1
1.1.3 Topographic Mapping Area	1-1
1.2 Collection and Review of Existing Data	1-3
1.3 Compilation of Existing 1:10,000 Scale topographic Maps Data	1-6
1.4 Check Survey for Height of Existing Bench Marks	1-7
1.5 Preparation of Technical Specifications for 1:5,000 Scale Topographic Mapping Works	1-8
1.6 Production of 1:5,000 Scale Topographic Maps	1-8
1.6.1 Aerial Photography	1-9
1.6.2 GPS Survey	1-12
1.6.3 Leveling	1-15
1.6.4 Field Verification	1-18
1.6.5 Aerial Triangulation	1-19
1.6.6 1:5,000 Scale Digital Mapping and Compilation	1-21
1.6.7 Preparation of 1:5,000 Scale Digital Orthophotos	1-26
1.6.8 Final Products	1-27
1.7 User's Guide	1-28
Chapter 2. GIS Database Development	2-1
2.1 Purpose of the Development of the Database	2-1
2.2 Design of the Geographic Database	2-1
2.3 Data Collection and Input	2-2
2.4 Census Data	2-3
2.5 Major Facilities	2-4
2.6 General Characteristics of Existing Data	2-6
2.7 Data Analysis Unit	2-7
2.8 Data Processing	2-8

<Part VI Appendices>

Outputs of the Study

1. City Ordinance on Disaster Management
2. Earthquake Disaster Mitigation Handbook
3. Earthquake Mitigation and Response Checklists – Local Planning Guide –
4. Guide for Managing Information Concerning Disasters
5. Community Activity Guidebook

Other Materials

Records of Workshops and Seminars

Sub contract outputs and other analysis (stored in CD-ROM)

List of Tables

Table 1.1	List of 1:10,000 Scale Topographic Maps	1-4
Table 1.2	List of 1:50,000 Scale Topographic maps	1-5
Table 1.3	Recommended Map Scale	1-7
Table 1.4	Check Survey Results	1-8
Table 1.5	List of 1:10,000 Scale Aerial Photographs	1-10
Table 1.6	List of GPS Station’s Coordinates	1-13
Table 1.7	Accuracy of GPS Network	1-13
Table 1.8	List of GPS Station’s Height	1-15
Table 1.9	Accuracy of Leveling Loops	1-16
Table 1.10	Items of Field Verification	1-18
Table 1.11	Accuracy of Aerial Triangulation	1-21
Table 1.12	Map Legend	1-23
Table 1.13	Cartographic Layer	1-24
Table 1.14	List of 1:5,000 Scale Topographic Maps	1-26
Table 1.15	List of Final Products	1-27
Table 2.1	List of Port Facilities	2-6

List of Figures

Figure 1.1	Mapping Area	1-2
Figure 1.2	Barangay Boundary Index Map	1-6
Figure 1.3	Aerial Photo Index Map (Photo Scale=1:10,000)	1-11
Figure 1.4	Diagram of GPS Network	1-14
Figure 1.5	Diagram of Leveling Network	1-17
Figure 1.6	Aerial Triangulation Mark Index	1-20
Figure 1.7	Map Index and Layout (Map Scale=1:5,000)	1-22

Supporting Report
Part V GIS Development and
Topographic Map Compilation

Chapter 1. Topographic Mapping

CHAPTER 1. TOPOGRAPHIC MAPPING

1.1 General

1.1.1 Introduction

This report is prepared to describe activities relevant to the topographic mapping works covering the whole Metropolitan Manila, which has been carried out by the Study Team for Earthquake Impact Reduction Study for Metropolitan Manila in Republic of the Philippines (the Study), during the period of October, 2002 to March, 2003. Main topographic mapping works executed by the Study Team are summarized as follows.

1. Collection and review of existing data.
2. Compilation of existing 1:10,000 scale topographic maps data.
3. Check survey for height of existing bench marks.
4. Preparation of technical specifications for 1:5,000 scale topographic mapping works.
5. Production of 1:5,000 scale topographic mapping works.
6. Supervision for aerial photography, GPS survey, leveling and field verification works executed by Contractor.
7. Preparation of User's Guide.

1.1.2 Objective of Topographic Mapping

Objective of the topographic mapping is to prepare 1:10,000 scale aerial photographs, 1:5,000 scale topographic maps and orthophotos and its digital data covering the whole Metropolitan Manila to be used for base map of GIS database construction for the Study.

1.1.3 Topographic Mapping Area

The topographic mapping area cover the Study area of entire Metropolitan Manila (composed 13 cities and 4 municipalities) of 636 sq.km as shown in Figure 1.1.

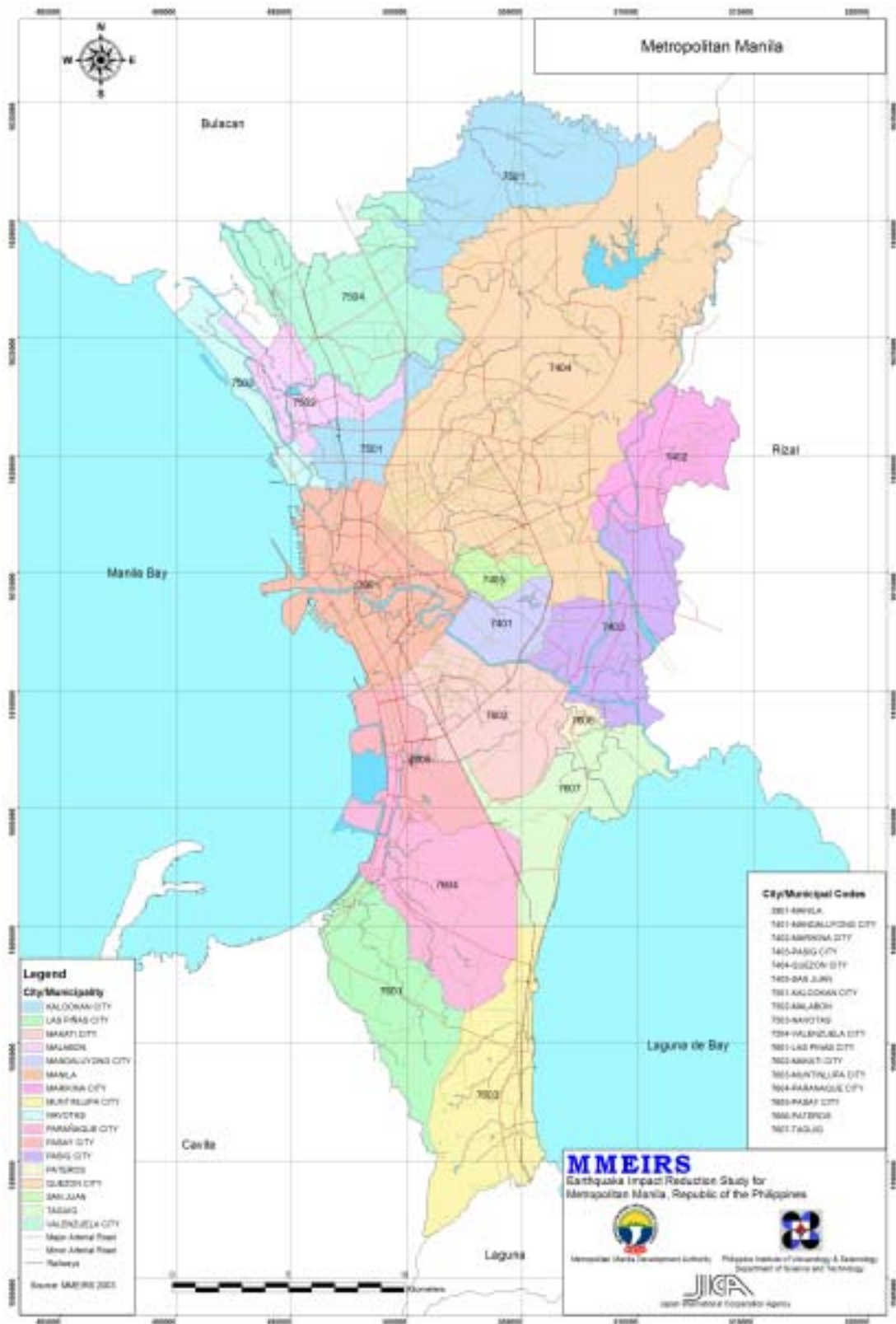


Figure 1.1 Mapping Area

1.2 Collection and Review of Existing Data

Prior to the commencement of the topographic mapping works, existing aerial photographs, topographic maps, digital map data and relevant mapping data were collected and reviewed. The following aerial photographs, topographic maps and digital topographic map data except barangay boundary map data were available at the beginning of the topographic survey and mapping plan of the study.

1) Existing Aerial Photographs

(1) 1:5,000 Scale Aerial Photographs (panchromatic, contact prints)

1:5,000 scale aerial photographs were taken by F. F. Cruz & Co. Inc on March to May 2002 covering the whole Makati city and Taguig. Total number of the aerial photographs is 336. Land use condition and structure location, such as roads, rivers, bridges, buildings/houses and other artificial structures on the aerial photographs were clearly identified.

The aerial photographs were to be able to use for the survey of building and infrastructure inventory of Makati city and Taguig.

(2) 1:8,000 Scale Aerial Photographs (panchromatic, contact prints)

1:8,000 scale aerial photographs were taken by F. F. Cruz & Co. Inc on February and March 2001 covering the whole Quezon city. Total number of the aerial photographs is 290. Land use condition and structure location such as roads, rivers, bridges, buildings/houses and other artificial structures on the aerial photographs were clearly identified.

The aerial photographs were to be able to use for the survey of building and infrastructure inventory of Quezon city.

(3) 1:10,000 Scale Aerial Photographs (panchromatic, contact prints)

1:10,000 scale aerial photographs were taken by Certeza Surveying & Aerophoto System, Inc. on January 2000 covering the along Marikina, Pasing and San Juan River area. Total number of the aerial photographs is 132. Land use condition and structure location such as roads, rivers, bridges, buildings/houses and other artificial structures on the aerial photographs were clearly identified.

The aerial photographs were to be able to use for the survey of building and infrastructure inventory of the along Marikina, Pasing and San Juan River area.

(4) 1:25,000 Scale Aerial Photographs (panchromatic, contact prints)

1:25,000 scale aerial photographs were taken by F. F. Cruz & Co. Inc/ National Mapping and Resources Information Authority (NAMRIA) in 1997 covering the whole Las Pinas and Muntinlupa, and the south part of Paranaque. Total number of the aerial photographs is 32. Land use condition and structure location such as roads, rivers, bridges, buildings/houses and other

artificial structures on the aerial photographs were clearly identified. However, the aerial photographs do not show present ground condition of the whole Las Pinas and Muntinlupa, and the south part of Paranaque due to residential development in recent years.

The aerial photographs could be used for the study of major land marks such as tool way, main highway, railway, hospitals, schools, government and municipal offices and other facilities and infrastructures.

2) Existing Topographic Maps

(1) 1:10,000 Scale Topographic Maps (color prints, contour intervals of 4 m)

1:10,000 scale topographic maps were prepared by JICA in 1982 and reprinted and published by NAMRIA since 1990 covering whole study area. The maps show general features of land conditions as well as existing structures on the ground such as cities, towns, villages, vegetation boundary, airport, roads, railway, rivers, bridges, buildings/houses, water gates, weirs, cuttings, embankments, ponds, marches, culverts, factories, power transmission lines, public buildings, school, etc. and administrative boundaries, name of cities, towns, villages, airport, roads, railway, rivers, bridges, factories, power transmission lines, public buildings, school and other map annotations.

These maps were to be able to use for the topographic mapping plan, location map of geological investigation the study. List of 1:10,000 scale topographic maps covering Metro Manila and its surrounding areas is as follows.

Table 1.1 List of 1:10,000 Scale Topographic Maps

Sheet No.	Map Name	Map History	Sheet No.	Map Name	Map History
3130 I - 24	MARILAO	JICA in 1982	3230 III - 3	MONTALBAN	JICA in 1982
3130 I - 25	PRENZA	"	3230 III - 6	TANDANG SORA	"
3130 II - 3	BALUARTE	"	3230 III - 7	DILIMAN	"
3130 II - 4	OBANDO	"	3230 III - 8	SAN MATEO	"
3130 II - 5	MEYCAUAYAN	"	3230 III - 11	KAMUNING	"
3130 II - 9	NAVOTAS	"	3230 III - 12	MARIKINA	"
3130 II - 10	VALENZUELA	"	3230 III - 13	SSS VILLAGE	"
3130 II - 15	MANILA (North)	"	3230 III - 16	MANDALUYONG	"
3130 II - 20	MANILA (South)	"	3230 III - 17	PASIG	"
3130 II - 25	BACLARAN	"	3230 III - 18	CAINTA	"
3129 I - 5	LAS PINAS	"	3230 III - 21	MALIBAY	"
3129 I - 10	SAN NICOLAS	"	3230 III - 22	TAGUIG	"
3129 I - 15	PAG-ASA	"	3230 III - 23	MUZON	"
3230 IV - 21	CONGRESSIONAL	"	3229 IV - 1	SUN VALLEY	"
3230 IV - 22	TUNGKONG MANGGA	"	3229 IV - 2	BAGUMBAYAN	"
3230 IV - 23	HACIENDA REMEDIOS	"	3229 IV - 6	ALABANG	"
3230 III - 1	NOVALICHES	"	3229 IV - 11	MUNTINLUPA	"
3230 III - 2	LA MESA DAM	"	3229 IV - 12	SAN PEDRO	"

Source: NAMRIA

(2) 1:50,000 Scale Topographic Maps (color prints, contour intervals of 10 m)

1:50,000 scale topographic maps were reprinted and published by NAMRIA since 1990 covering whole study area. The maps shows general features of land conditions as well as existing structures on the ground such as cities, towns, villages, airport, roads, rivers, bridges and other artificial structures.

The map could be used as a location and guide map for the study. List of 1:50,000 scale topographic maps are as follows.

Table 1.2 List of 1:50,000 Scale Topographic maps

Sheet No.	Map Name	Map History
7172 I (3130 I)	MALOLOS	Reprinted since 1990
7272 IV (3230 IV)	ANGAT	Reprinted since 1990
7172 II (3230 II)	MANILA	Edition 1: March 1995
3130 III	QUEZON CITY	Edition 1: January 2001
3129 I	CAVITE CITY	Edition 1: May 1993
7271 IV (3229 IV)	MUNTINGLUPA	Reprinted since 1990

Source: NAMRIA

3) Existing Digital Map Data

(1) 1:10,000 Scale Digital Mapping Data (DWG files)

1:10,000 scale digital mapping data was prepared by NAMRIA since 1999 covering Manila city, San Juan, Mandaluyong, Makati city, Pasay city, Las Pinas Paranaque, Muntinlupa, Pateros and west part of Taguig of the study area. The mapping data was made in accordance with “legend of 1:10,000 scale topographic maps” by JICA in 1982.

(2) Digitizing Data of 1:10,000 Scale topographic Maps (DWG files)

Digitizing data of 1:10,000 scale topographic maps by JICA in 1982 was prepared by PASCO-CERTEZA Computer mapping Corporation (PACER) in 1992 covering whole study area.

It is decided by the study team that the both of the above digital map data will be able to use for base map of the Disaster Preparedness Plan of the study.

4) Barangay Boundary Data

Barangay boundary maps were gathered from the Urban Planning Department of Manila, Mandaluyong, Marikina, Pasing, Quezon, San Juan, Kalookan, Malabon, Navotas, Valenzuela, Makati, Muntinlupa, Paranaque, Pasay, Pateros and Taguig city/municipal Hall (13 cities and 4 municipal of the Metropolitan Manila) for boating barangay boundary data of 1:5,000 scale topographic maps on February, 2003. All barangay map data covering the whole Metropolitan Manila was digitized and superimposed on the 1:5,000 scale topographic mapping data.

Barangay boundary is as shown below. The barangay boundary maps are as attached in Appendix A of this report.

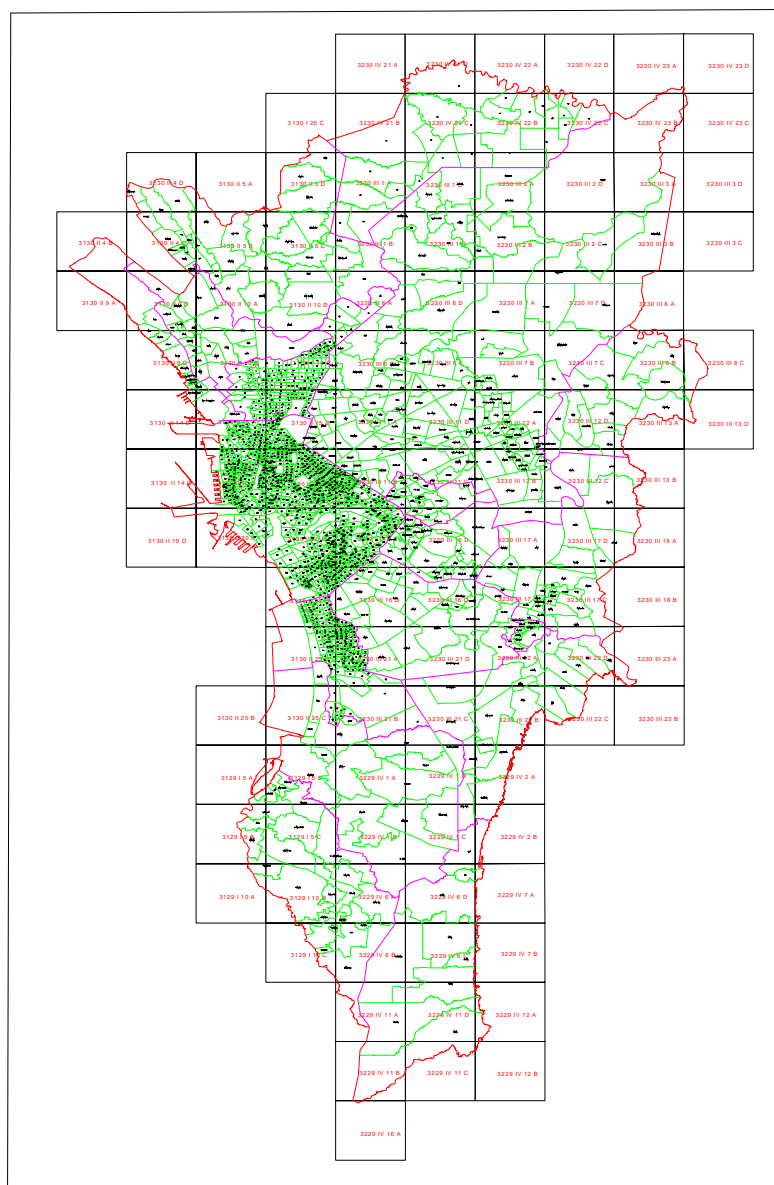


Figure 1.2 Barangay Boundary Index Map

1.3 Compilation of Existing 1:10,000 Scale topographic Maps Data

Before preparing new 1:5,000 scale topographic map for base map of the Study, two different digital map data were compiled by the Study Team for base map of the Disaster Preparedness Plan; one (1) is 1:10,000 scale digital mapping data on UTM (Universal Transverse Mercator Projection) Zone 51, Clarke Spheroid 1866 PRS 92' Datum prepared by NAMRIA since 1999 covering Manila city, San Juan, Mandaluyong, Makati city, Pasay city, Las Pinas Paranaque,

Muntinlupa, Pateros and west part of Taguig and other is digitizing data of 1:10,000 scale topographic maps on UTM(Universal Transverse Mercator Projection) Zone 51, Clarke Spheroid 1866 Luzon Datum prepared by PACER in 1992 covering whole study area.

Both map data was transferred to PTM (Philippine Transverse Mercator Projection) Zone III, Clarke Spheroid 1866 PRS 92' Datum, which was NAMRIA grid system of 1:5,000 scale topographic map. Recommended Map Scale, Projection and Geographical Limits by NAMRIA are as follows.

Table 1.3 Recommended Map Scale

Map Scale	Projection	Geographical Limits
1:1,500,000	CONICAL(0°)	LONG 116°-128°/ LAT 04°-20°
1:250,000	UTM	1°X1.5
1:100,000	UTM	30' X 30'
1:50,000	UTM	15' X 15'
1:25,000	UTM	7.5' X 7.5'
1:10,000	UTM	3' X 3'
1:5,000	PTM	1.5' X 1.5'
1:4,000	PTM	1' X 1'
1:2,000	PTM	30" X 30"
1:1,000	PTM	15" X 15"
1:500	PTM	7.5" X 7.5"

Source: NAMRIA

1.4 Check Survey for Height of Existing Bench Marks

The check survey was carried out for confirm present height accuracy of existing NAMRIA's bench marks in/around mapping area to be used for height of 1:5,000 scale topographic maps in this project. NAMRIA's bench marks in the mapping area were selected by the Topographic Mapping Expert of the Study Team in the field randomly. Of the selected bench marks, the BM-ML 3 was in good condition and decided to use for a starting point of check survey. The Topographic Mapping Expert of the Study Team carried out the check survey and its results of check survey between bench marks are tabulated as follows.

Table 1.4 Check Survey Results

Station/Location	Check Elevation	NAMRIA Elevation	Mis-Closure	Remarks
BM-ML 3 (Quezon City)	57.776	57.776	0.000	2 order, 1951-1969series
BM-C10A (Las Pinas)	4.757	4.763	-0.006	2 order, 1951-1969series
BM-SN-7 (Paranaque)	3.072	3.676	0.026	2 order, 1951-1969series
GMU-4 (Pasay City)	4.730	4.710	0.020	2 order, 1951-1969series
GMW-21(Pasay City)	16.309	16.287	0.022	2 order, 1951-1969series
BM-W2-A (Quezon City)	48.082	48.313	-0.231	2 order, 1951-1969series
QUCI-10B(Quezon City)	28.473	28.809	-0.336	2 order, 1951-1969series
RI-2 (Caloocan City)	11.856	13.300	-1.444	1 order, 1951-1969series
GM-1A (Manila)	3.680	3.859	-0.179	2 order, 1951-1969series
BM 66 (Manila)	1.720	1.986	-0.266	2 order, 1951-1969series

From the above check results, it was confirmed that the difference in height mis-closure between check elevation and NAMRIA elevation of BM-W2-A, QUCI-10B, RI-2, GM-1A and BM 66 at the coastal and industrial area was exceed over 17cm. It is considered that the ground of these bench marks is subsided due to the pumping of groundwater at factories.

The result of check survey was reported to Mapping Department of NAMRIA. The NAMRIA was recommended a fixed datum station method from reliable station BM-ML 3, which is datum height station for 1:5,000 scale topographic maps. The recommended method and datum height of BM-ML3 (57,776m) by NAMRIA were applied and used for the leveling of 1:5,000 scale topographic mapping works.

1.5 Preparation of Technical Specifications for 1:5,000 Scale Topographic Mapping Works

“Specification of Overseas Surveying Works for Development Study” by JICA in 1988 was applied for 1:5,000 scale topographic mapping works composing 1:10,000 scale aerial photography, photo control survey, field verification, aerial triangulation, 1:5,000 scale digital mapping and compilation, and preparation of 1:5,000 scale orthophotos.

1.6 Production of 1:5,000 Scale Topographic Maps

Production of 1:5,000 scale topographic maps comprising the following work items and its quantities have been executed to prepare a base map data for GIS database construction for the Study.

1. Aerial Photography: 636 sq.km
2. GPS Survey: 53 points
3. Leveling: 352.43 km
4. Field Verification: 636 sq.km
5. Aerial Triangulation: 522 models

6. 1:5,000 Scale Digital Mapping and Compilation: 636 sq.km
7. Preparation of 1:5,000 Scale Digital Orthophotos: 636 sq.km

Of the above works, aerial photography, GPS survey, leveling and field verification were carried out by the Contractor; Certeza Surveying & Aerophoto System, Inc. in accordance with the terms, conditions, requirements of the Contract and Technical Specifications for aerial photography and photo control survey under the supervision of the Topographic Mapping Expert of the Study Team during the period of October, 2002 to January, 2003. The aerial triangulation, 1:5,000 scale digital mapping and compilation, and preparation of 1:5,000 scale digital orthophotos were executed by the Study Team in Japan during the period of December, 2002 to March, 2003.

1.6.1 Aerial Photography

1:10,000 scale aerial photographs covering the whole Metropolitan Manila for 1:5,000 scale topographic mapping were taken and produced by the Contractor during the period from end of October, 2002 to end of January, 2003. Principal data and information of the new aerial photography are as follows.

(1) Equipment Used in Aerial Photography

- | | |
|---------------------|--|
| (a) Aircraft | : Cessna, Aero commander 500U, RP-C621 |
| (b) Aerial Camera | : Wild, RC-10, No.2613 (Lens No. UAg I 6055) |
| (c) Film Processor | : Zeiss, FEIZO |
| (d) Contact Printer | : Zeiss, KG30 Contact Printers |

(2) Data of Aerial Photography

- | | |
|-----------------------------------|--------------------------------|
| (a) Scale of aerial photographs | : Approx.1/10,000 |
| (b) Area covered by aerial photos | : Approx.636 sq.km |
| (c) Focal length of aerial camera | : F=152 mm |
| (d) Over lapping | : Approx.60%±5% |
| (e) Side lapping | : Approx.30%±5% |
| (f) Flight altitude | : Approx. 1,500 m±5% |
| (g) Flight direction | : South – North |
| (h) Aerial film | : Kodak Double X |
| (i) Photo print | : Kodak RC paper |
| (j) Number of photos | : 533 flames (accepted photos) |

(3) Annotation of Aerial Photographs (Film Labeling)

The following title and information were labeled on the outside of each flame of the negative film at the beginning and end.

- (a) MMEIRS
- (b) Date of aerial photographs
- (c) Scale of aerial photographs
- (d) Photo number
- (e) JICA/MMDA

(4) Photo Scanning

All accepted aerial photographs at scale of 1:10,000 were scanned by a photogrammetric scanner for aerial triangulation. The scanning data and information are as follows.

- (a) Scanner : Zeiss, Intergraph Photo Scan TD
- (b) No. of photo : 551 flames
- (c) Pixel size : 25µm
- (d) Gray scale (level) : 8 bits per pixel
- (e) Data Format : TIFF file

(5) List of New Aerial Photographs

The list of 1:10,000 scale aerial photographs is as blow.

Table 1.5 List of 1:10,000 Scale Aerial Photographs

Original Flight			Reflight		Acceptable Photos (S=1:1,000)		
Flight Line	Photo No.	No. of Photos	Photo No.	No. of Photos	Flight Line	Photo No.	No. of Photos
1	7073-7077	5			1	7073-7077	5
2	7067-7072	6			2	7067-7072	6
3	7046-7066	21			3	7046-7059	14
4	7021-7045	25			4	7024-7045	22
5	6982-7020	39	7009-7020	12	5	6982-7003 7012-7020	31
6	6910-6950	41			6	6910-6950	41
7	6863-6909	47			7	6863-6909	47
8	6754-6807	54	7597-7606	10	8	6754-6807	54
9	6808-6862	55	7587-7596	10	9	6808-6862	55
10	7085-7138	54	7433-7461 7129-7138	29 10	10	7085-7099 7461-7433 7129-7138	54
11	7139-7185	47	7219-7256 7245-7254	38 10	11	7139-7165 7219-7226 7245-7254	52
12	7256-7291	36	7557-7572	16	12	7256-7291	36
13	7292-7323	32	7542-7556	15	13	7292-7323	32
14	7324-7352	29	7513-7541	29	14	7324-7352	29
15	7367-7391	25			15	7367-7391	25
16	7392-7411	20			16	7392-7411	20
17	7412-7421	10			17	7412-7421	10
Total=		600		179	Total=		533

(6) Aerial Photo Index Map

The aerial photo index map as shown in Figure 3 was prepared after completion of the photography.

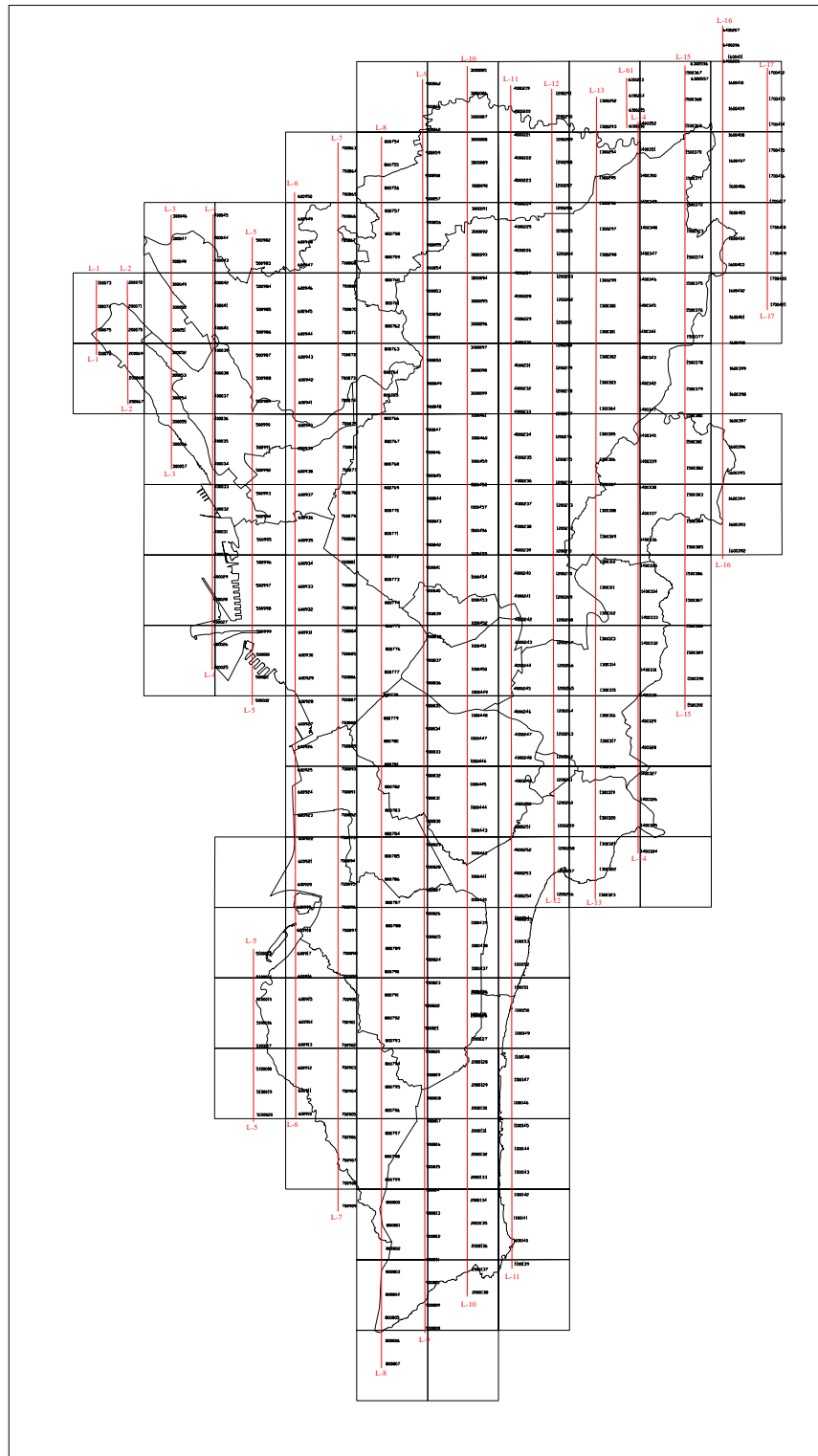


Figure 1.3 Aerial Photo Index Map (Photo Scale=1:10,000)

(7) Inspection of Aerial Photographs

Qualities of all above aerial photographs of original flight and reflight were inspected by the Topographic Mapping Expert of the Study Team referring to the following accuracy and requirement as specified in the Technical Specifications of the Contract.

- (a) Over lapping : within 60%±5%
- (b) Side lapping : within 30%±5%
- (c) Flight altitude : within 1,500 m±5%
- (d) Shifting error value : less than 10degrees
- (e) Tip & tilt error value : less than 10 degrees
- (f) Crab error value : less than 5 degrees
- (g) Cloud cover : less than 3%

It was judged that the inspection results of final 533 photos covering whole were acceptable for preparing the 1: 5,000 scale topographic map.

1.6.2 GPS Survey

GPS survey was executed to determine the N and E plan coordinates of 53 photo control points (GPS stations) to be used for aerial triangulation of the 1:5,000 scale topographic mapping. GPS network was planned to enclose the mapping area. The survey was carried out by the Contractor and completed on December, 2002. GPS survey data and information is summarized as follows.

(1) Datum Coordinates

Geographic WGS-84, Geographic PRS'92 and Philippine Transverse Mercator (PTM) grid coordinates of NAMRIA's BLN 1, CVT 1, MMA 0 and MMA 1 GPS stations in/around mapping area were used for GPS survey. Certification of the used NAMRIA Stations is as attached in Appendix B of this report.

(2) Equipment Used for GPS Survey

- (a) GPS Receiver : Trimble, 4000SSE (6 sets)
- (b) Software : Trimble, GP Survey

(3) Transformation Parameters

Used transformation parameters from WGS-84 coordinates of GPS to PTM coordinates of Zone III (121) on the PRS'92 Datum is as follows.

- Transformation parameters: Latitude of Origin = 0 N
- Central Meridian = 121 E
- False Northing = 0.0 meter
- False Easting = 500,000 meters
- False Height = 0.0 meter
- Scale Factor = 0.99995
- Spheroid =Clark Spheroid of 1866

(4) List of New GPS Station Coordinates

List of PTM coordinates Zone III (121) of GPS stations is as follows.

Table 1.6 List of GPS Station's Coordinates

Station	Northing (m)	Easting (m)	Station	Northing (m)	Easting (m)
GPS 1	1,587,450.07	500,869.00	GPS 30	1,622,010.44	511,386.54
GPS 2	1,588,051.75	503,346.39	GPS 31	1,623,235.67	508,799.95
GPS 3	1,589,971.98	505,796.82	GPS 32	1,625,231.76	505,197.20
GPS 4	1,592,513.03	504,457.19	GPS 33	1,624,864.71	501,732.25
GPS 5	1,594,883.21	499,348.75	GPS 34	1,624,243.18	498,310.44
GPS 6	1,596,471.57	500,962.08	GPS 35	1,624,527.34	493,979.31
GPS 7	1,596,829.23	497,062.63	GPS 36	1,625,832.76	491,968.27
GPS 8	1,599,998.44	495,952.74	GPS 38	1,627,158.08	510,606.61
GPS 9	1,600,248.26	506,023.30	GPS 39	1,629,405.54	493,296.49
GPS 10	1,602,471.18	501,395.31	GPS 40	1,628,583.33	495,588.56
GPS 11	1,610,423.89	504,604.89	GPS 41	1,627,219.24	500,249.49
GPS 12	1,605,003.26	497,472.13	GPS 42	1,630,257.66	497,588.66
GPS 13	1,605,460.84	504,129.34	GPS 43	1,632,512.28	500,921.42
GPS 14	1,604,856.84	509,111.48	GPS 44	1,630,149.44	502,746.51
GPS 15	1,607,531.15	510,768.76	GPS 45	1,635,088.24	503,146.86
GPS 16	1,612,418.67	507,905.81	GPS 46	1,633,269.69	506,271.07
GPS 17	1,613,540.16	507,663.75	GPS 47	1,625,285.12	515,255.46
GPS 18	1,613,498.25	504,356.63	GPS 48	1,626,995.94	514,793.20
GPS 19	1,609,682.16	499,752.31	GPS 49	1,633,363.73	510,006.46
GPS 20	1,615,640.25	501,696.55	GPS 50	1,632,733.95	515,836.54
GPS 21	1,615,376.95	498,317.49	GPS 51	1,637,379.82	513,629.02
GPS 22	1,614,196.69	494,047.33	GPS 52	1,635,668.90	510,511.23
GPS 23	1,618,983.17	495,143.73	GPS 53	1,630,873.24	508,433.60
GPS 24	1,621,111.64	496,762.19	(NAMRIA GPS Stations)		
GPS 25	1,618,837.84	499,139.63	BLN 1	1,652,416.18	487,079.70
GPS 27	1,617,372.09	509,881.36	CVT 1	1,579,452.90	499,525.47
GPS 28	1,617,478.37	513,680.41	MMA 0	1,618,610.53	504,490.73
GPS 29	1,618,563.76	511,018.01	MMA 1	1,607,761.48	504,138.58

(5) Accuracy of GPS Network

Mis-closure of GPS network by block adjustment is as shown in Table 1.7. GPS survey data (values of residuals) and field station record are as attached in Appendix C and D of this report.

Table 1.7 Accuracy of GPS Network

Precision (ppm)	+4.3391 (within <u>±</u> 5 ppm as specified in Technical Specification)
Errors (m)	Northing: +0.4565, Easting: -0.4350 and U: +0.4738

Computation of GPS survey and its data were inspected by the Topographic Mapping Expert of the Study Team. Of the results of inspection, above the precision of the GPS network was not exceed tolerance of mis-closure ± 5 ppm as specified in the Technical Specifications of the Contract. Accordingly it was judged that the coordinates of GPS stations have the enough accuracy for horizontal control of the 1: 5,000 scale topographic mapping.

(6) Diagram of GPS Network

Diagram of GPS Network is as shown below.

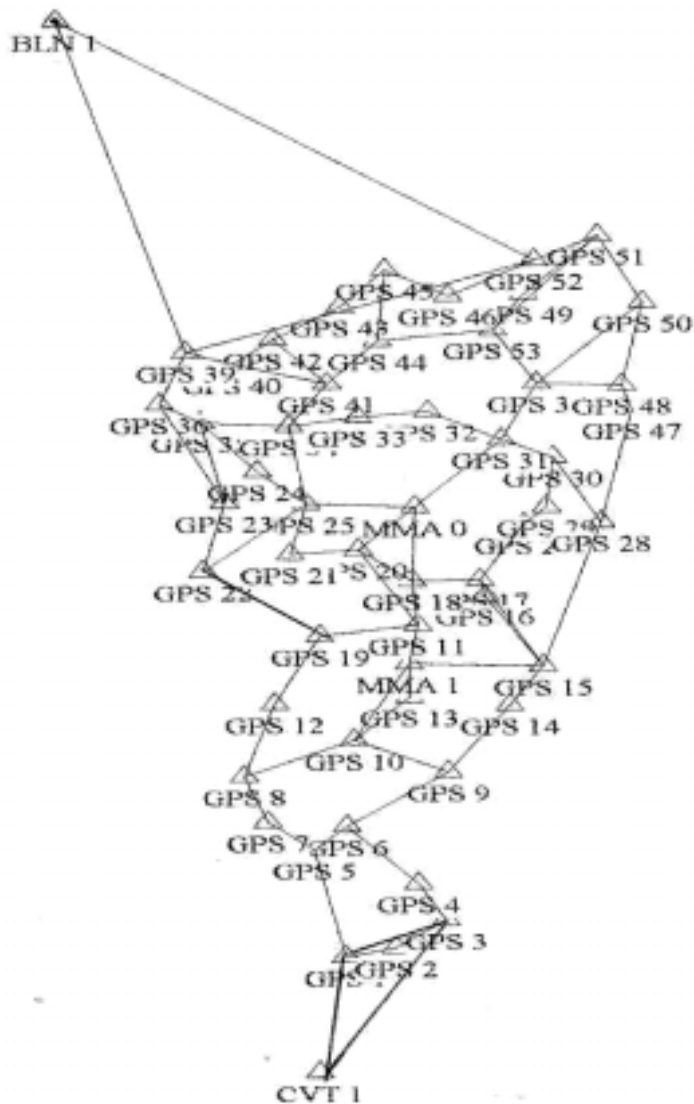


Figure 1.4 Diagram of GPS Network

1.6.3 Leveling

Leveling was executed to obtain the height of GPS stations to be used for aerial triangulation of the 1:5,000 scale topographic mapping. Total distance of leveling network was 352.43 km. The survey was carried out by the Contractor and completed on December, 2002. Leveling data and information are summarized as follows.

(1) Datum Height

Mean Sea Level (MSL) elevation (57,776m) of NAMRIA's BM-ML3 as explained in Section 4 of this report was used for datum height of the leveling. MSL of the NAMRIA's GMW-21, GMW-1, GMU-4, BM-C10A and BM-SN-7 were also used for spot height points of aerial triangulation. Certification of the used NAMRIA Stations (Bench Marks) is as attached in Appendix B of this report.

(2) Equipment Used for Leveling

- (a) Level : Lica, NA 2000 Digital level (3sets)
- (b) Software : Yutokogyo, Leveling Network Adjustment (Reg.No.5.C-36 in Japan)

(3) List of GPS Station Height

List of height of GPS stations is as follows.

Table 1.8 List of GPS Station's Height

Station	Elevation (m)	Station	Elevation (m)	Station	Elevation (m)	Station	Elevation (m)
GPS1	81.906	GPS14	2.436	GPS28	26.309	GPS42	4.592
GPS2	61.579	GPS15	2.751	GPS29	10.134	GPS43	36.573
GPS3	3.769	GPS16	5.299	GPS30	14.495	GPS44	59.537
GPS4	22.457	GPS17	11.833	GPS31	74.053	GPS45	39.516
GPS5	27.168	GPS18	20.319	GPS32	59.275	GPS46	73.762
GPS6	26.063	GPS19	3.109	GPS33	14.119	GPS47	47.297
GPS7	7.867	GPS20	4.41	GPS34	25.994	GPS48	21.077
GPS8	2.802	GPS21	2.092	GPS35	2.311	GPS50	48.59
GPS9	4.067	GPS22	2.533	GPS36	1.028	GPS51	233.993
GPS10	10.25	GPS23	2.26	GPS38	62.031	GPS52	126.896
GPS11	12.319	GPS24	6.459	GPS39	0.481	GPS53	101.433
GPS12	3.809	GPS25	13.01	GPS40	1.611		
GPS13	16.97	GPS27	6.809	GPS41	24.359		

(4) Accuracy of Leveling Network

Height mis-closure of each leveling loops in network is as show in Table 1.8 and Figure 1.5. Leveling data (leveling network computation and adjustment) is as attached in Appendix E of this report.

Table 1.9 Accuracy of Leveling Loops

Loop No.	Distance (km)	Mis-closure (m)	Tolerance of mis-closure(m)
A	49.95	0.092	0.283
B	34.65	0.091	0.235
C	32.51	0.018	0.228
D	29.94	-0.001	0.219
E	49.55	-0.022	0.282
F	19.43	0.000	0.176
G	20.75	0.017	0.182
H	35.35	0.029	0.238
I	37.79	-0.030	0.246
J	42.51	0.007	0.261
Total	352.43		

Note: Tolerance of mis-closure is calculated based on $\pm 40\text{mm}/\text{Distance in km}$ as specified in the Technical Specifications of the Contract.

Mis-closure of the loops was not exceed tolerance of mis-closure $\pm 40\text{mm}/\text{Distance in km}$. From the above the list table, it was judged that height of leveling loops has satisfied the accuracy as specified in the Technical Specifications of the Contract.

(5) Diagram of Leveling Network

Diagram of Leveling Network is as shown in Figure 1.5.

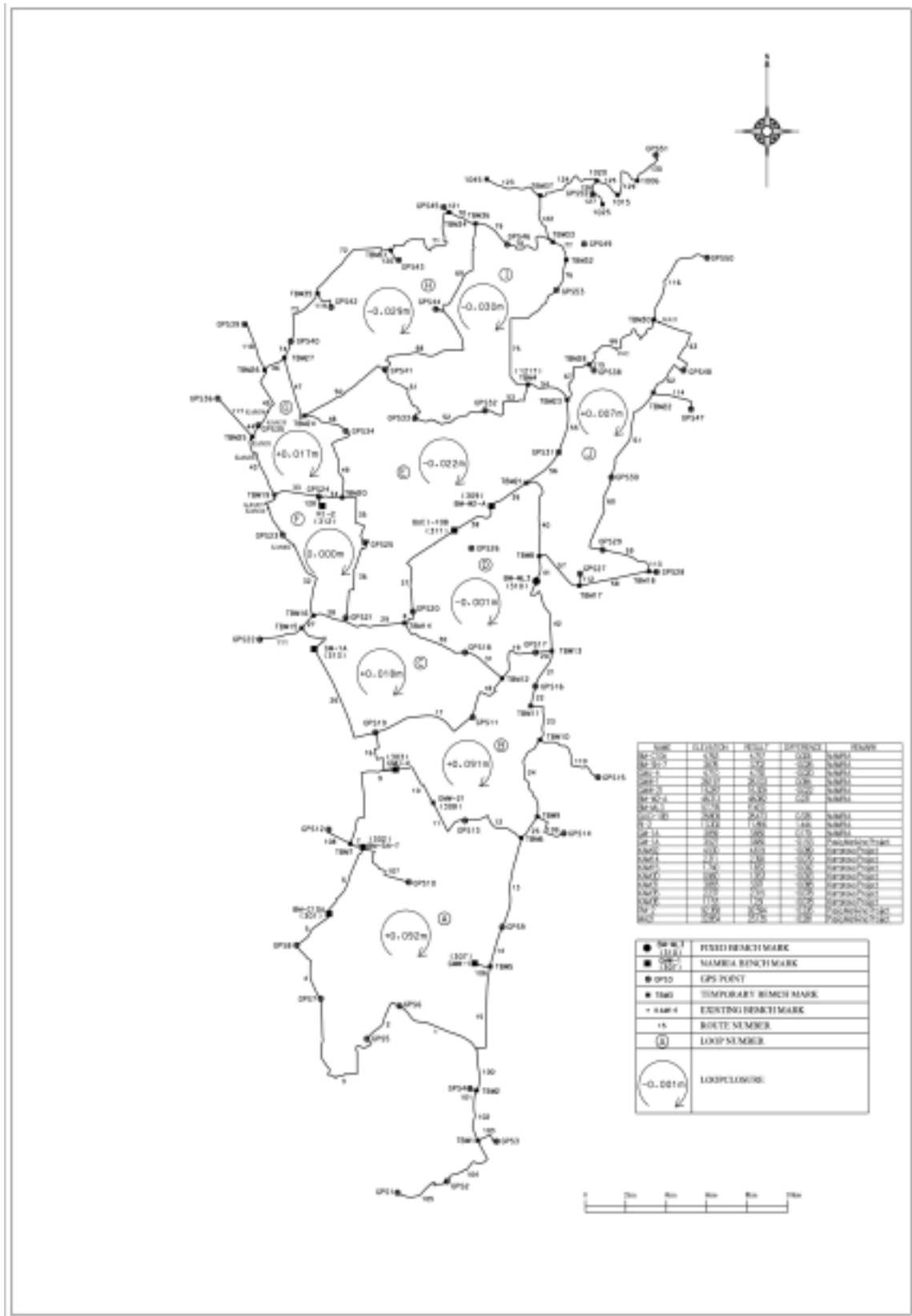


Figure 1.5 Diagram of Leveling Network

1.6.4 Field Verification

Using 1:10,000 scale aerial photographs, 1:10,000 scale topographic maps and 1:10,000 scale digitized maps, following location and name of planimetric details were verified and confirmed on the field by the Contractor and completed on March, 2003.

Table 1.10 Items of Field Verification

Descriptions	Location	Name	Remarks
Bridge	○	○	More than 10m
Culvert	○		Less than 10m
Government Building & Office	○	○	More than 10mx10m
Hospital including General Hospital	○	○	
Fire Station	○	○	
Police Station	○	○	
School, College & University	○	○	
Park & Public Square	○	○	
Cemetery	○	○	
Church	○	○	
Shopping Center	○	○	
Monument	○	○	
Major Private Building	○	○	
Major Hotel	○	○	
Dam	○	○	
Water Gate & Pump Station	○	○	
Railway Station	○	○	
Canal	○	○	
Chemical Factory	○	○	
Petroleum Refinery	○	○	
Gas Tank	○	○	More than 5m
Oil Tank	○	○	More than 5m
Water Tank	○	○	More than 5m
Power Transmission Line & Tower	○		
Major Water Pipe Line	○		
March	○		
Gas Station	○	○	
Major Gas Pipe Line	○	○	

All above location data was represented and marked with points No. on 1:10,000 scale topographic maps (19 sheets in total) and name of road, river, school, factory, public building and etc. was listed up in to the digital file for annotation of the 1:5,000 scale topographic maps. The field verification data is as attached in Appendix F of this report.

The final results of field verification were inspected by the Topographic Mapping Expert of the Study Team referring to manner as specified in the Technical Specifications of the Contract. It was confirmed that the final results were acceptable for using annotation of the 1:5,000 scale

topographic maps. The annotations of 1:5,000 scale topographic maps were also checked by NAMRIA.

1.6.5 Aerial Triangulation

Aerial triangulation for 1:5,000 scale digital mapping was done analytically by the block adjustment method by means of independent models in accordance with the following manner and accuracy. The aerial triangulation works were completed on February 2003

(1) Selection, Observation, Measurement and Data Processing

The large-scale aerial triangulation block covering the mapping area was divided in to 2 separate blocks (North and South) for increasing efficiency of 1:5,000 scale digital mapping works.

Using scanning image of 1:10,000 scale photographs and results of GPS survey and leveling, locations of pass points were selected on the photo images by a manual. The pass points, established control points, leveled spot height points and fiducial marks on each photo image were stereoscopically observed and measured with a stereo image plotter. The photo coordinates obtained by a stereo image plotter measurement were processed by a digital data processing system for analytical aerial triangulation.

Total numbers of photo models and control points used for the computation of aerial triangulation on North and South blocks were as follows.

- | | |
|-------------------------------|--------------|
| (a) Photo models (S=1/10,000) | : 522 models |
| (b) Horizontal control points | : 53 points |
| (c) Vertical control points | : 975 points |

(2) Equipment and Programme Used for Aerial Triangulations

- | | |
|-------------------|----------------------------|
| (a) Image plotter | : DPW (Socket Set) |
| (b) Computer | : DELL, DIMENSION XPST850R |
| (c) Programme | : PAT-B |

(3) Diagram of Aerial Triangulation Mark Index

Aerial Triangulation Mark Index is as show in Figure 1.6.

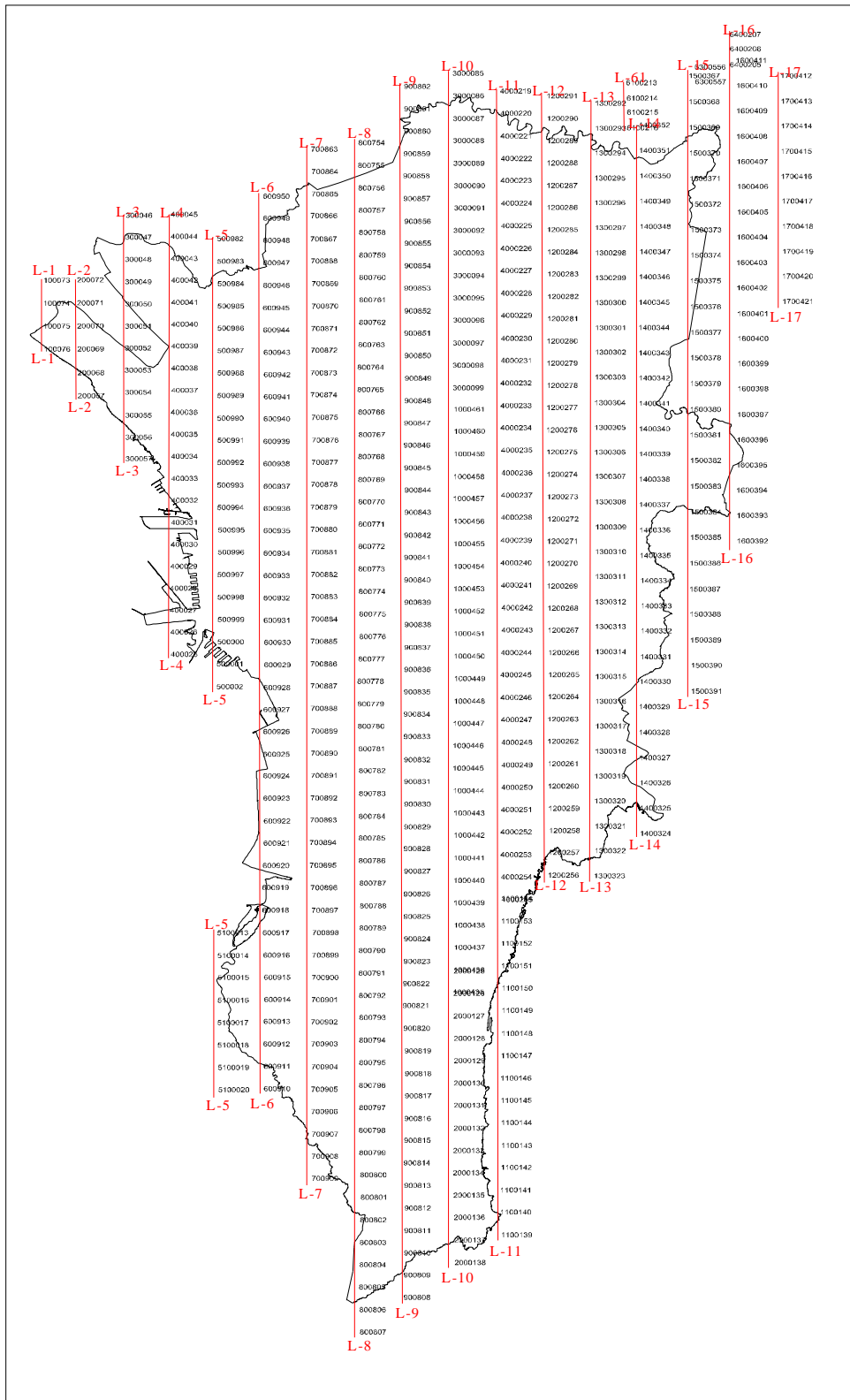


Figure 1.6 Aerial Triangulation Mark Index

(4) Accuracy of aerial triangulation

Residuals of image points and control points are as follows. The aerial triangulation data is as attached in Appendix G of this report.

Table 1.11 Accuracy of Aerial Triangulation

Image Points	
Root mean square value (Rms) of residuals of photogrammetric observations.	
(South Block)	(North Block)
Rms x: ± 0.046	Rms x: ± 0.047
Rms Y: ± 0.056	Rms Y: ± 0.056
Control Points	
Root mean square value (Rms) of residuals of non-photogrammetric observations.	
(South Block)	(North Block)
Rms x: ± 0.208	Rms x: ± 0.277
Rms Y: ± 0.292	Rms Y: ± 0.285
Rms z: ± 0.112	Rms z: ± 0.160

The above accuracy (residuals) of aerial triangulation for both planimetric (x and y) and height (z) were within values of 0.06‰ of the flight altitude (within ± 0.9 m) as specified in “Specification of Overseas Surveying Works for Development Study” by JICA . Accordingly it was confirmed that the results of aerial triangulation had enough accuracy for 1:5,000 scale topographic mapping.

1.6.6 1:5,000 Scale Digital Mapping and Compilation

In compliance with the following map legend, cartographic standard (code table) and its application rules, digital mapping at a scale of 1:5,000 with 1 m contours was carried out based on scanned aerial photo image at a scale of 1:10,000, results of GPS survey, leveling, and aerial triangulation and completed on March, 2003. Planimetric details on the ground such as roads, railway, rivers, bridges, buildings/houses, ponds, culverts, factories, schools, etc. and contour lines on the photo image were digitalized using a stereo image plotter in accordance with the following manner and accuracy. Height of more than 5 stories buildings was measured at the same time of the digitizing of buildings.

(1) Map Projection, Map Size and Layout

PTM projection (Philippine Transverse Mercator Projection) Zone III, Clarke Spheroid 1866 PRS 92' Datum specified in “Revised Manual of Land Surveying Regulations” in 1998 of NAMRIA and map size (net size: 1.5' x 1.5' and gross size: about A0) and layout of 1:5,000 scale topographic maps of NAMRIA 's internal standard was applied for 1:5,000 scale topographic maps. Map index and layout are as show in Figure 1.7.

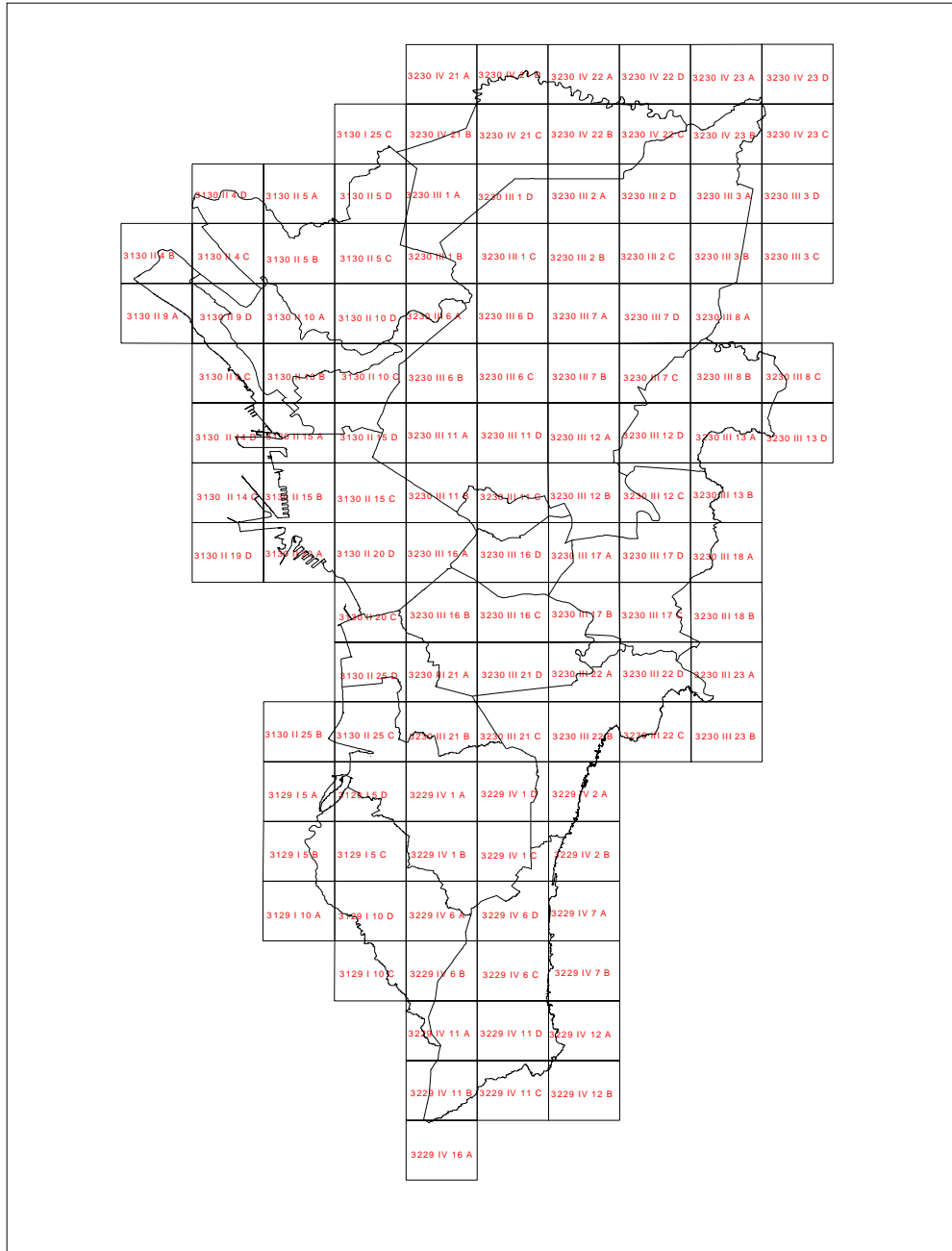


Figure 1.7 Map Index and Layout (Map Scale=1:5,000)

(2) Map Legend and Cartographic Layer for Mapping

Map legend and cartographic layer for mapping are as follows.

Table 1.12 Map Legend

Administrative Boundary		Water Area	
Provincial Boundary		More than 2.0m in Width	
City and Municipal Boundary		Less than 2.0m in Width	
Approximate Barangay Boundary		Indefinite (More than 2.0m in Width)	
Roads		Indefinite (Less than 2.0m in Width)	
Highway		Channel / Causeway (More than 2.0m in Width)	
Toll Gate		Channel / Causeway (Less than 2.0m in Width)	
More than 2.0m in Width		Lake / Pond / Shoreline	
Road Under Construction		Falls	
Less than 2.0m in Width		Weir	
Footpath		Dam	
Sidewalk		Slipway	
Road Island		Flood Gate	
Bridge / Grade Separation (More than 2.0m in Width)		Flow Arrow	
Bridge (Less than 2.0m in Width)		Pier / Jetty	
Pedestrian Overpass		Breakwater	
Road Underpass		Fishpen	
Road Underpass (Culvert)		Wreck	
Route Marker (National / Provincial)		Salt Bed	
Railways		Face of Slope	
Railway (Single Track / Double Track)		Concrete Revetment	
Railway Under Construction		Encircling Features	
Bridge / Grade Separation		Wall / Fence	
Railway Underpass		Land Use	
Railway Underpass (Culvert)		Military	
Railway Station		Cemetery	
Buildings		Park	
Independent Building (More than 13m in Height)		Vegetation Boundary	
Other Independent Building / Houses		Boundary of Cultivated Area	
Abandoned House		Broad Leaf Tree (Area)	
Landmarks		Broad Leaf Tree	
Monument		Grass Field	
Water Tank		Swamp / Marsh	
Storage Tank		Coconut	
Radio Tower		Paddy Field	
Tower		Upland Field	
Power Transmission Line		Orchard	
Power Plant Sub-station		Mangrove	
Lighthouse		Sand	
Airport / Airfield		Contours	
Aero Beacon		Index Contour	
Gas Station		Intermediate Contour	
Helipad		Supplementary Contour	
Water Supply Sewerage		Depression	
Pipeline		Control Points	
Control Points			
Horizontal Control Station			
Control Point			
Bench Mark			
Direct Leveling Point			
Spot Height by Photogrammetry			

Table 1.13 Cartographic Layer

Category	Item	Acad Layer	Style
Administrative Boundary	Provincial Boundary	11020	PL
	City/Municipal Boundary	11030	PL
	Barangay Boundary	11040	PL
Road	Highway	21010	PL
	Highway Center Line	21011	PL
	Toll Gate	21020	PL
	Road (more than 2M width)	21030	PL
	Road under construction (more than 2m width)	21040	PL
	Road (more than 2M width) Center line	21031	PL
	Road (less than 2M width)	21050	PL
	Footpath	21060	PL
	Sidewalk	21070	PL
	Road island	21080	PL
	Highway bridge, Grade Separation (More than 2M width)	22010	PL • Txt
	Highway Bridge (less than 2M width)	22020	PL
	Pedestrian Overpass	22030	PL
	Culvert	22040	Sym
	Route Marker (National Road)	22050	Sym • Txt
Route Marker (Provincial Road)	22060	Sym • Txt	
Railway	Railway	23010	PL • Txt
	Railway under construction	23020	PL
	Railway Bridge, Grade Separation	24010	PL
	Railway Station	24020	PL
Building	Prominent Building (more than 5 floors (more than 13m Height))	30010	PL
	Relative Height of Prominent Building	30011	Sym & Txt
	Independent Building House	30020	PL
	Abandoned House	30030	PL
Annotation of the building	31000	Txt	
Landmark	Monument	42010	Sym
	Water Supply Tower	42030	Sym
	Storage Tank	42040	PL • Cir • Txt
	Radio Tower	42050	Sym
	High Tower	42060	PL
	Power Transmission Line	42070	PL
	Transformer Station	42080	Sym • PL • Txt
	Lighthouse	42090	Sym
	Ran way	42100	PL
	Aviation Beacon	42110	Sym
	Gas Station	42120	Sym
	Heliport	42130	Sym
	Filtration Plant/Sewage Disposal Plant	42140	PL • Txt
	Pipeline	42150	PL • Txt
Water Area	River (more than 2M width)	51010	PL • Txt
	River (less than 2M width)	51020	PL • Txt
	Indefinite River (more than 2M width)	51030	PL • Txt
	Indefinite River (less than 2M width)	51040	PL • Txt
	Channel (more than 2M width)	51050	PL • Txt
	Channel (less than 2M width)	51060	PL • Txt
	Lake • Pond • Shoreline	51070	PL • Txt
	Waterfall	51080	PL • Txt
Weir	52010	PL	

	Dam	52020	PL· Txt
	Slipway	52030	PL
	Flood Gate	52040	PL· Txt
	Flow Arrow	52050	Sym
	Pier· Jetty	52060	PL
	Breakwater	52070	PL
	Fishpen	52080	PL
	Wreck	52090	Sym
	Salt Pan	52100	PL
Face of Slope	Revetment	61010	PL
Encircling features	Wall, Fence	61020	PL
Land Use	Military facilities	62010	PL· Txt
	Cemetery	62020	PL· Txt
	Park	62030	PL· Txt
	Vegetation Boundary	63010	PL
	Boundary of Cultivated Area	63020	PL
	Trees	63030	PL
	Grass	63040	Sym
	Swamp· Marsh	63050	Sym
	Palm Tree	63060	Sym
	Rice Field	63100	Sym
	Track Farm	63110	Sym
	Orchard	63120	Sym
	Mangrove	63130	Sym
	Sand	63140	Sym
Topography	Index Contour	71010	PL
	Intermediate Contour	71020	PL
	Supplementary Contour	71030	PL
	Index Contour for Depression	71040	PL
	Intermediate Contour for Depression	71050	PL
	Supplementary Contour for Depression	71060	PL
	Contour Value	71070	Txt
Control Point	Triangulation Point	73010	Sym· Txt
	Control Point	73020	Sym· Txt
	Bench Mark	73030	Sym· Txt
	Direct Leveling point	73040	Sym· Txt
	Spot Height	73050	Sym· Txt
Annotation	Annotation	81100	Txt
Marginal Information	Neat line	90000	PL
	Marginal Information· grid values	91000	PL

Note: PL: poly line, Sym: symbol, Cir: circle and Txt: text.

(3) Equipment and Programme Used for Digital Mapping.

- (a) Image plotter : DPW and SUMMIT EVOLUTION
- (b) Workstation : DELL, PRECISIOL420
- (c) Programme : DPW and SUMMIT, photogrammetric mapping system
- (e) Data Format : DWG file

After the digital mapping, planimetric details, contour lines, barangay boundary and name of cities/municipalities, roads, rivers, bridges, government buildings, hospitals, fire stations, police stations, factories, school and other map annotations data on the 1:5,000 scale topographic maps were compiled by digital editing system of Auto CAD map. Total number of 1:5,000 scale topographic maps is 120. The list of 1:5,000 scale topographic maps is as below.

Table 1.14 List of 1:5,000 Scale Topographic Maps

Map No.							
3129 I 05 A	3130 II 09 A	3130 II 20 C	3229 IV 07 A	3230 III 02 C	3230 III 08 B	3230 III 16 C	3230 III 22 D
3129 I 05 B	3130 II 09 C	3130 II 20 D	3229 IV 07 B	3230 III 02 D	3230 III 08 C	3230 III 16 D	3230 III 23 A
3129 I 05 C	3130 II 09 D	3130 II 25 B	3229 IV 11 A	3230 III 03 A	3230 III 11 A	3230 III 17 A	3230 III 23 B
3129 I 05 D	3130 II 10 A	3130 II 25 C	3229 IV 11 B	3230 III 03 B	3230 III 11 B	3230 III 17 B	3230 IV 21 A
3129 I 10 A	3130 II 10 B	3130 II 25 D	3229 IV 11 C	3230 III 03 C	3230 III 11 C	3230 III 17 C	3230 IV 21 B
3129 I 10 C	3130 II 10 C	3229 IV 01 A	3229 IV 11 D	3230 III 03 D	3230 III 11 D	3230 III 17 D	3230 IV 21 C
3129 I 10 D	3130 II 10 D	3229 IV 01 B	3229 IV 12 A	3230 III 06 A	3230 III 12 A	3230 III 18 A	3230 IV 21 D
3130 I 25 C	3130 II 14 C	3229 IV 01 C	3229 IV 12 B	3230 III 06 B	3230 III 12 B	3230 III 18 B	3230 IV 22 A
3130 II 04 B	3130 II 14 D	3229 IV 01 D	3229 IV 16 A	3230 III 06 C	3230 III 12 C	3230 III 21 A	3230 IV 22 B
3130 II 04 C	3130 II 15 A	3229 IV 02 A	3230 III 01 A	3230 III 06 D	3230 III 12 D	3230 III 21 B	3230 IV 22 C
3130 II 04 D	3130 II 15 B	3229 IV 02 B	3230 III 01 B	3230 III 07 A	3230 III 13 A	3230 III 21 C	3230 IV 22 D
3130 II 05 A	3130 II 15 C	3229 IV 06 A	3230 III 01 C	3230 III 07 B	3230 III 13 B	3230 III 21 D	3230 IV 23 A
3130 II 05 B	3130 II 15 D	3229 IV 06 B	3230 III 01 D	3230 III 07 C	3230 III 13 D	3230 III 22 A	3230 IV 23 B
3130 II 05 C	3130 II 19 D	3229 IV 06 C	3230 III 02 A	3230 III 07 D	3230 III 16 A	3230 III 22 B	3230 IV 23 C

(4) Accuracy of Digital Map

Digital maps have the following accuracy.

- (a) Accuracy of planimetric details: within ± 0.2 mm from true position on the maps.
- (b) Accuracy of contour lines: within one third between contours on the maps.

All above digital data of 1:5,000 scale topographic maps has been used for base map of GIS database for the Study.

1.6.7 Preparation of 1:5,000 Scale Digital Orthophotos

Using 1:10,000 scale photo scanning image and contours data of 1:5,000 scale digital mapping, 1:5,000 scale digital orthophotos were prepared. The mapping work consists of automatic DTM generation, orthophoto image generation and digital compilation. City /municipality boundaries with name and annotations on the orthophotos were compiled by image plotter in accordance with the following manner.

(1) Othophoto Projection, Size and Layout

Map projection and layout of 1:5,000 scale topographic maps were used for preparation of 1:5,000 scale orthophotos. Sheet net size is 1.5' x 1.5' and gross size is about A1. The map layout is shown in Figure 1.7.

(2) Equipment and Programme Used for Digital Orthophotos.

- (a) Image plotter : SUMMIT EVOLUTION
 (b) Workstation : DELL, PRECISIOL420
 (c) Programme : SUMMIT, MATCH-AT
 (d) Data Format : TFW with TIFF file

(3) Sheet Number

Sheet number of 1:5,000 scale orthophotos is as same map number of the 1:5,000 scale topographic map, which is tabulated in Table 1.14.

1.6.8 Final Products

Final products of 1:5,000 scale topographic mapping works are listed up as follows.

Table 1.15 List of Final Products

Description	Quantity
1. Aerial Photography	
(a) Negative films	4 rolls
(b) Contact prints	2 sets
(c) Aerial photo index and its data in CD (TIFF file)	1 set
(d) Photo scanning data in HD	1 set
(e) List of photos and its data in CD	1 set
2. GPS Survey	
(a) Diagram of GPS network	1 set
(b) Computation Sheets	1 set
(c) List of coordinates of GPS stations	1 set
(d) Field station record	1 set
3. Leveling	
(a) Leveling network diagram	1 set
(b) Computation Sheets	1 set
(c) Diagram of Leveling network	1 set
(d) List of height of GPS stations	1 set
4. Field Verification	
(a) List of annotations table	1 set
(b) List of field verification data	1 set
5. Aerial Triangulation	
(a) Computation file data in HD	1 set
(b) Aerial triangulation mark index	1 set
6. 1:5,000 Scale Digital Mapping	
(a) Map index	4 sets
(b) 1:5,000 scale topographic maps	4 sets
(c) Digital data of 1:5,000 scale topographic maps in CD	3 set
7. Preparation of 1:5,000 Scale Digital Orthophotos	
(a) 1:5,000 scale orthophoto maps	2 sets
(b) Digital data of 1:5,000 scale orthophoto maps in CD	3 sets
8. Barangay boundary data	1 set
9. Topographic Mapping Report	2 sets

1.7 User's Guide

This user's guide describes the contents of the 1:5,000 scale topographic maps and orthophotos, and its digital data covering the Metropolitan Manila. The map data show general features of land conditions as well as existing structures on the ground of the Metropolitan Manila in 2003. Type of data format use for the maps and orthophotos are as follows.

(1) Type of Data Format

- (a) 1:5,000 scale topographic map data: AutoCAD 2000 DWG file
- (b) 1:5,000 scale orthophoto data: 2000 AutoCAD DWG file consisting of DWG (net grid line, sheet layout, marginal information and annotations), TIFF (orthophoto images) and TFW (orthophoto image coordinates).

In order to open and print the maps and orthophotos, the following computer specifications and software are recommended.

(2) Recommended Computer Specifications

- (a) OS: Windows 2000 or XP professional
- (b) CPU: Pentium III 700 megahertz or equivalent type
- (c) SDRAM: more than 256 mega byte (512 mega byte gives much better performance)

(3) Recommended software

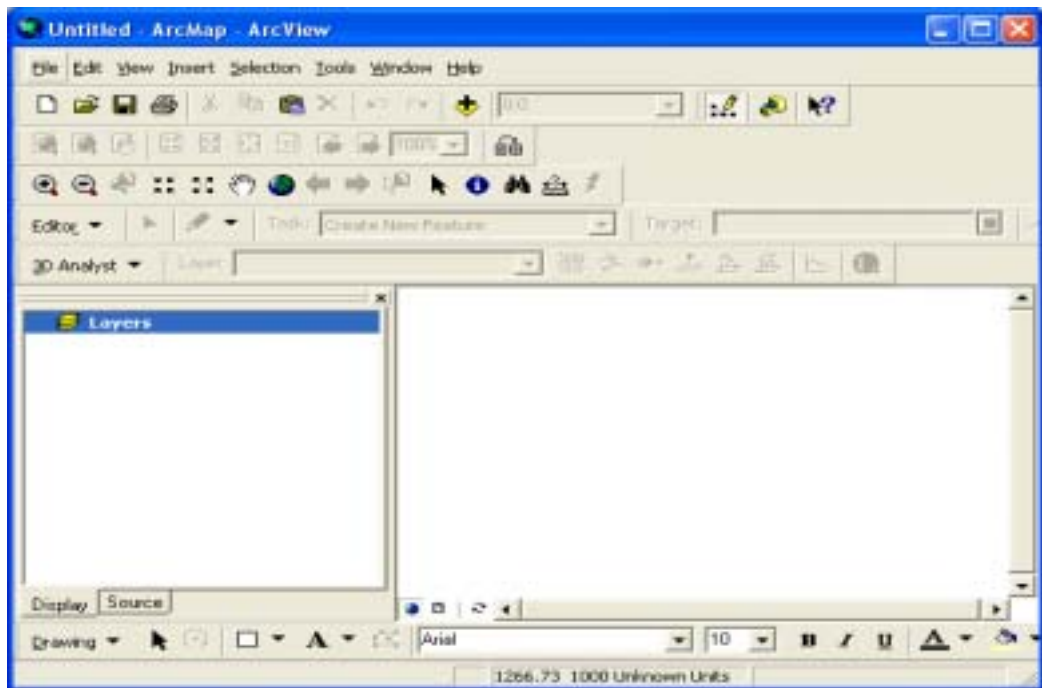
- (a) Auto CAD 2000LT, AutoCAD Map 2000 or AutoCAD Map 5, Arc/View, Arc/info or Micro Station.

The opening and printing operations are as follows.

(1) How to open data

(a) ArcMap 8.2

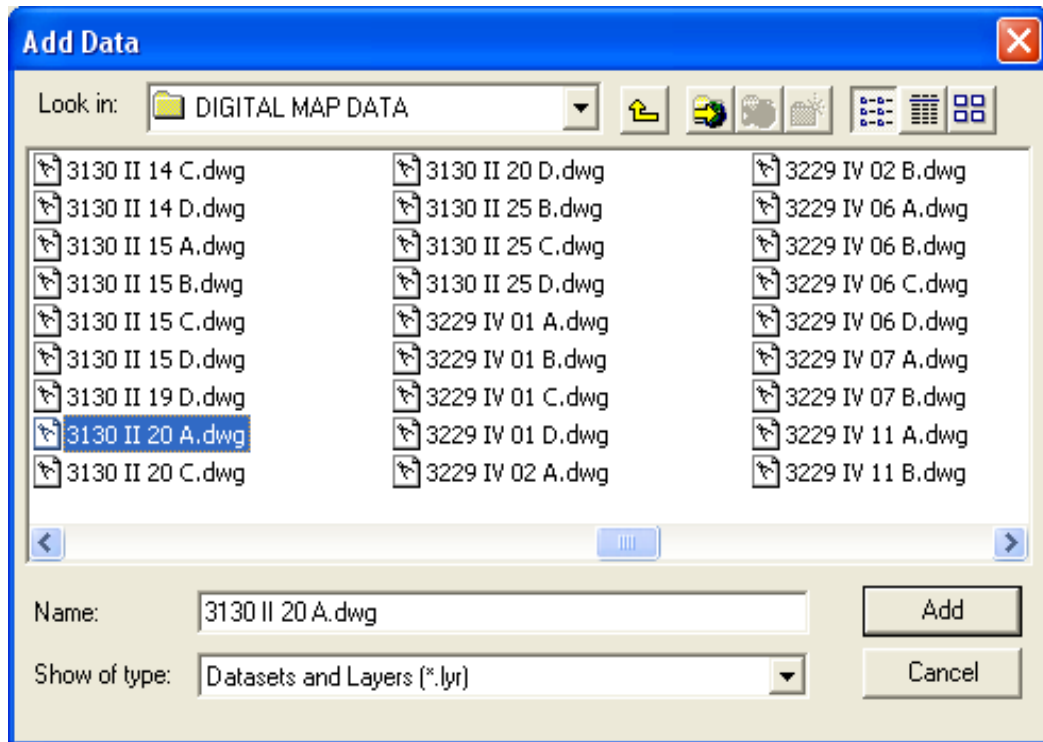
* Start ArcMap 8.2



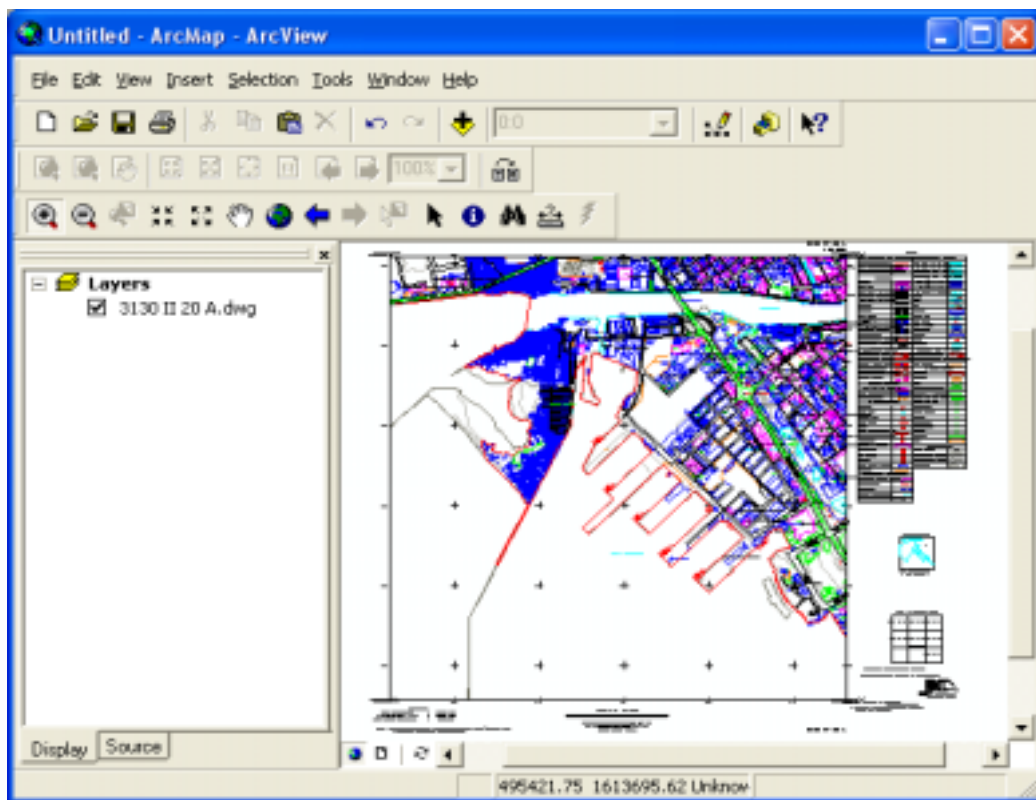
* From the ArcMap 8.2 screen click on Add Data



- * In the Add Data Input screen, select the Map sheet that you would like to open.



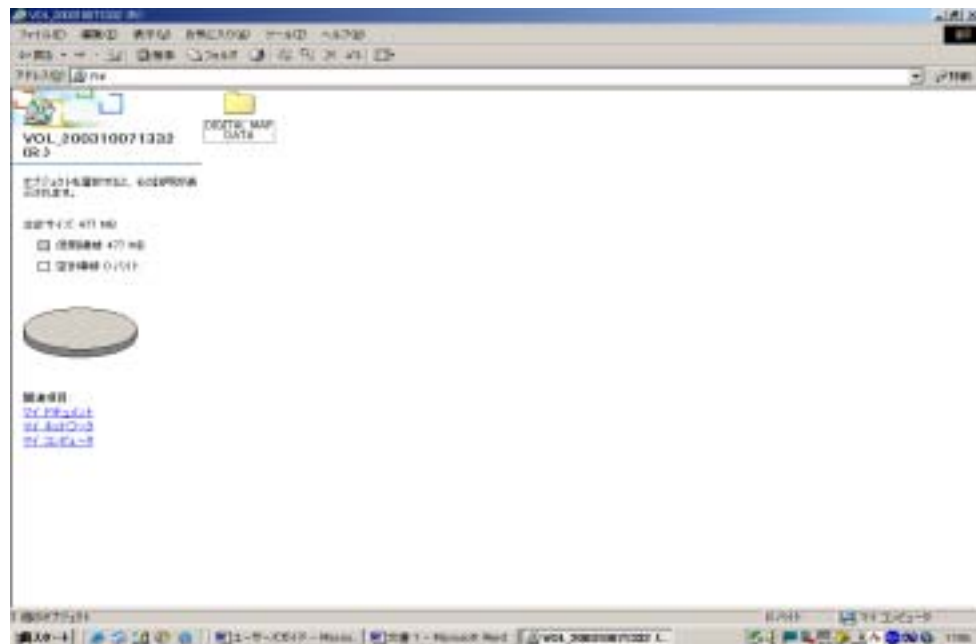
- * The selected map sheet will be displayed.



(b) AUTO CAD

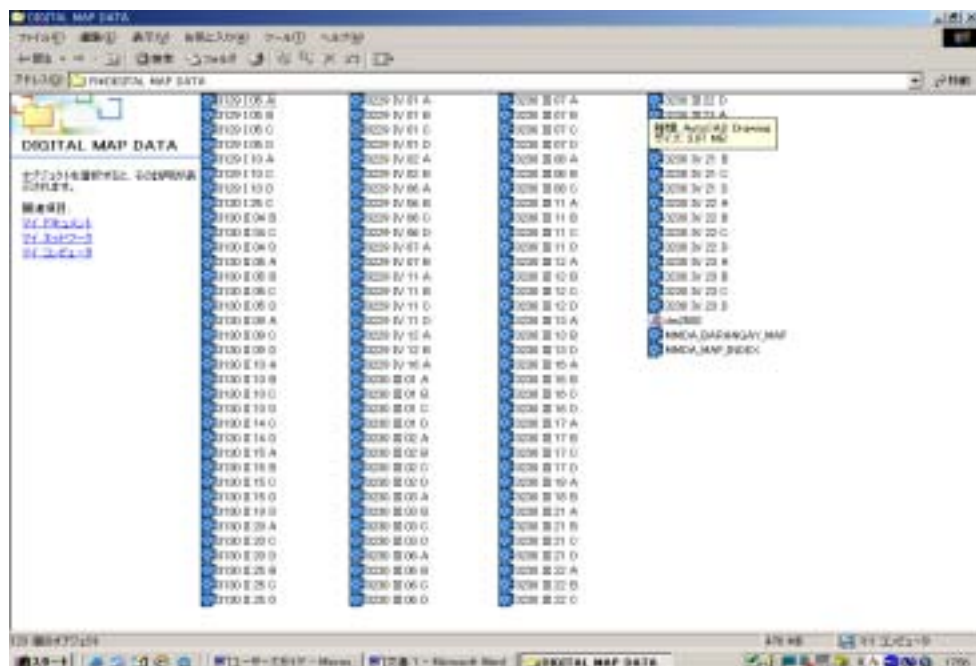
This section describes the steps to open **DIGITAL MAP DATA** using AUTOCAD MAP 5 Dialog Box.

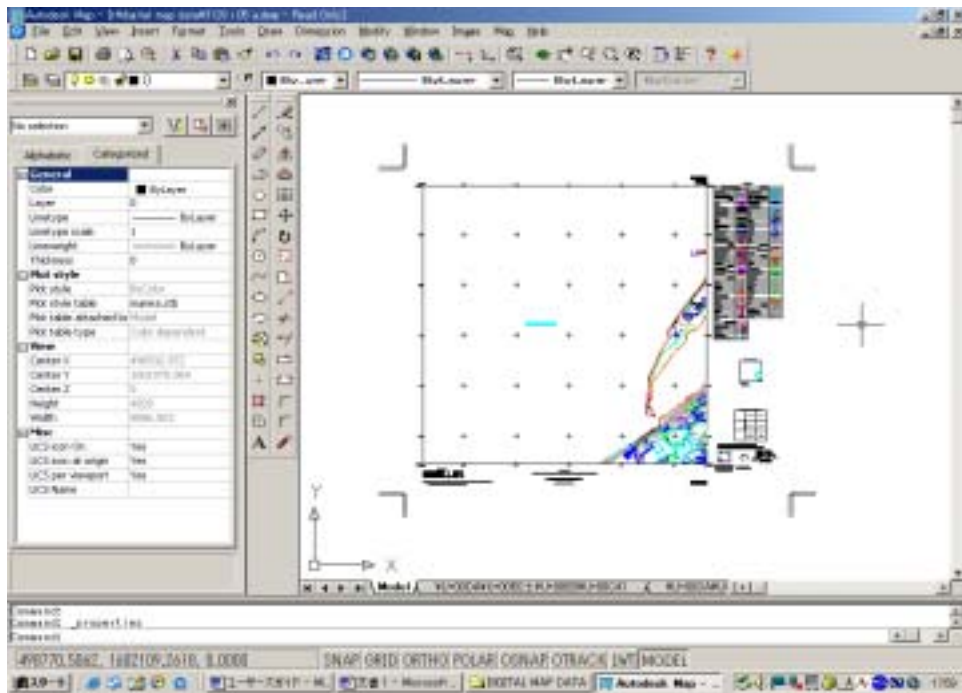
* Open **DIGITAL MAP DATA** folder in CD



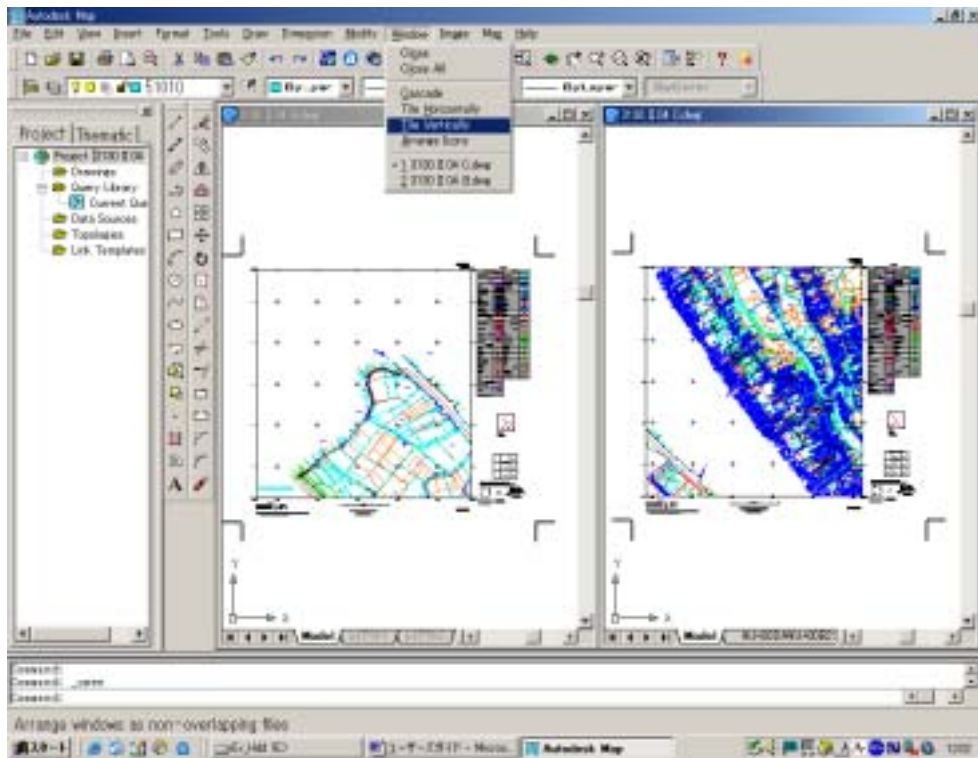
* Then click to open list of **DIGITAL MAP DATA** as shown below.

* Choose the **DIGITAL MAP DATA FILE** (e.g. 3129 I 05 A) you wish to open then double click to open the map.





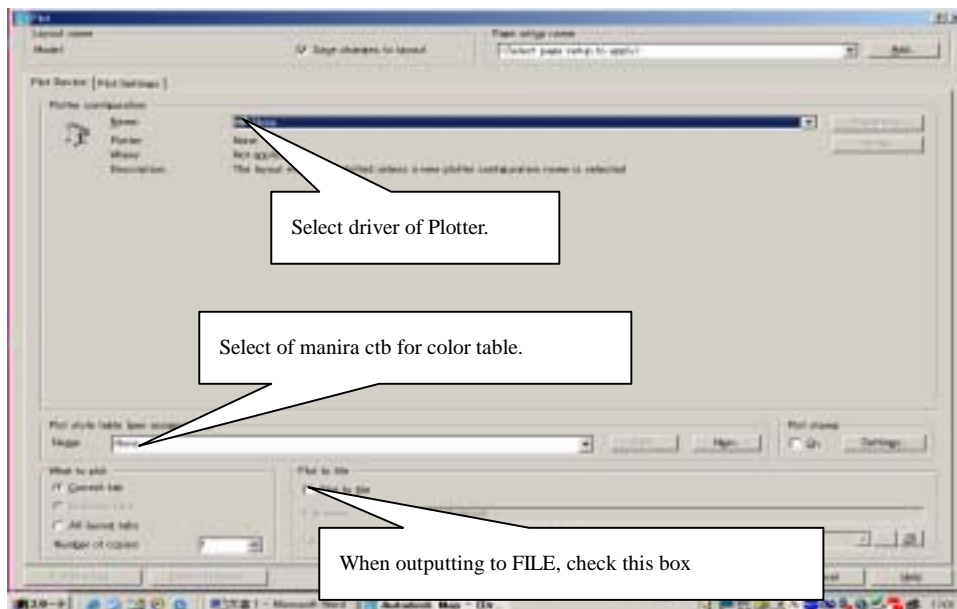
* When you want to view multiple **DIGITAL MAP DATA FILES**, open the files first as described in the previous step, then select the **Window MENU**, then select either **TILE HORIZONTALLY** or **TILE VERTICALLY** whichever is appropriate.



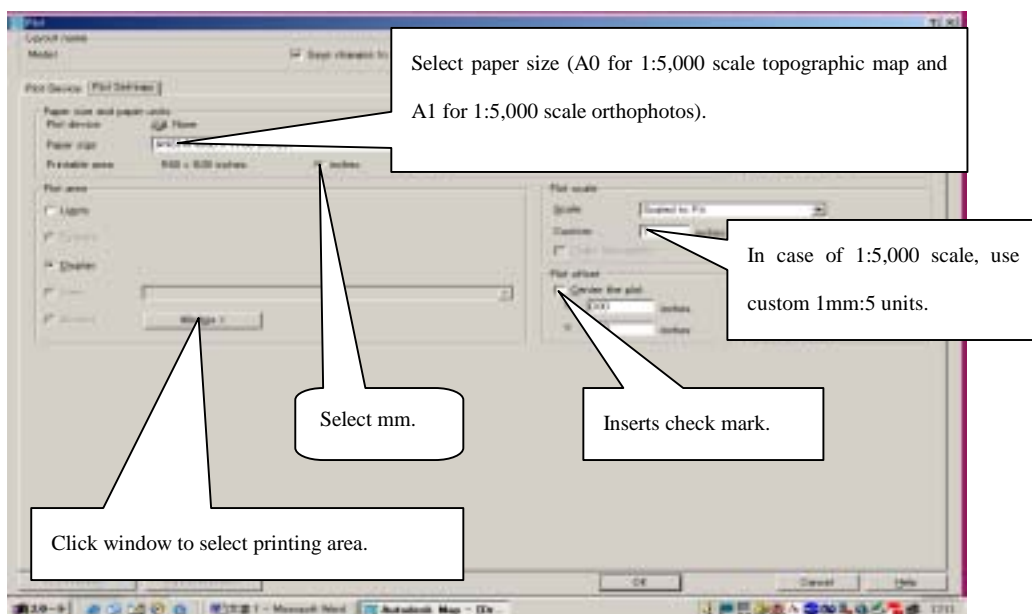
(2) How to print out

(a) Print out by AUTO CAD (Using of AUTOCAD MAP 5 Dialog Box)

- * Open FILE. select PLOT then the Plot Dialog box will appear.
- * Select driver and color table as follows.



Note: COLOR TABLE can be edited using by AUTO CAD. The prepared COLOR TABLE have to be copied to the PLOT STYLES folder of AUTODESK MAP 5holder in the program file folder. (In case of using AUTOCAD MAP 5)

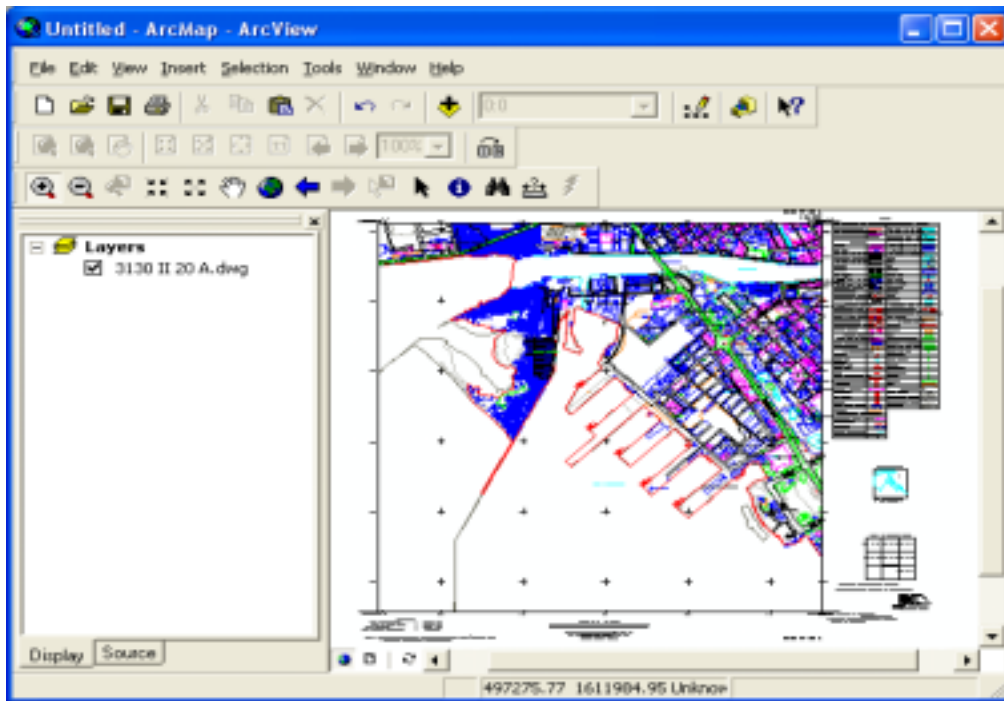


After setting up the all the above and check marks, click OK to start printing.

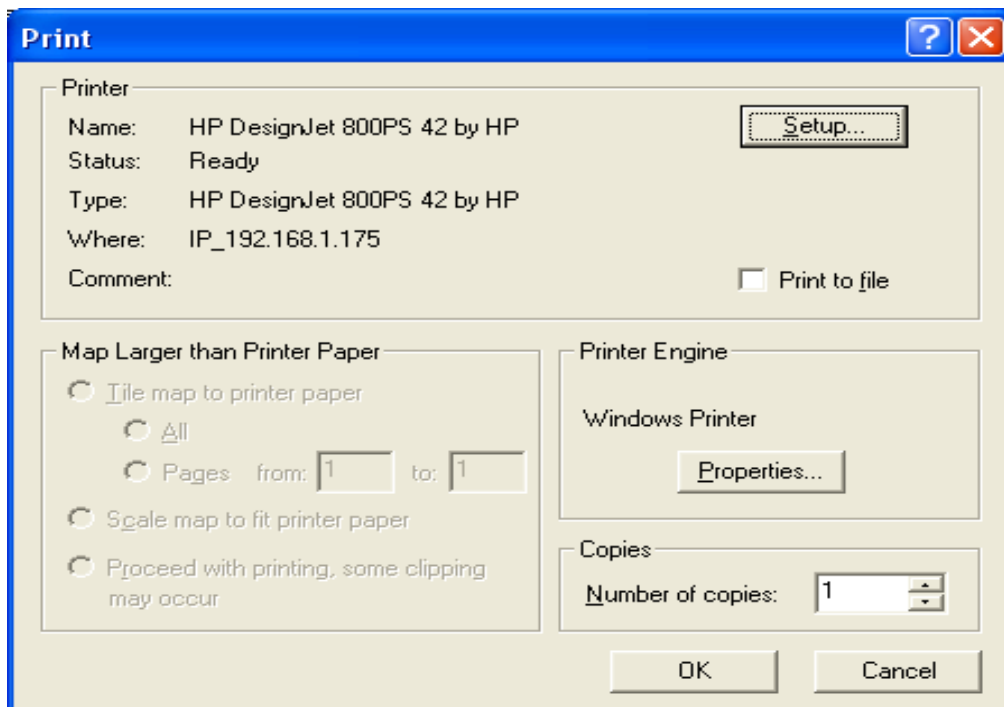
* If you are using other versions of AUTO CAD, dialogue may change but printing parameters are the same.

(b) Printing in ArcMap 8.2

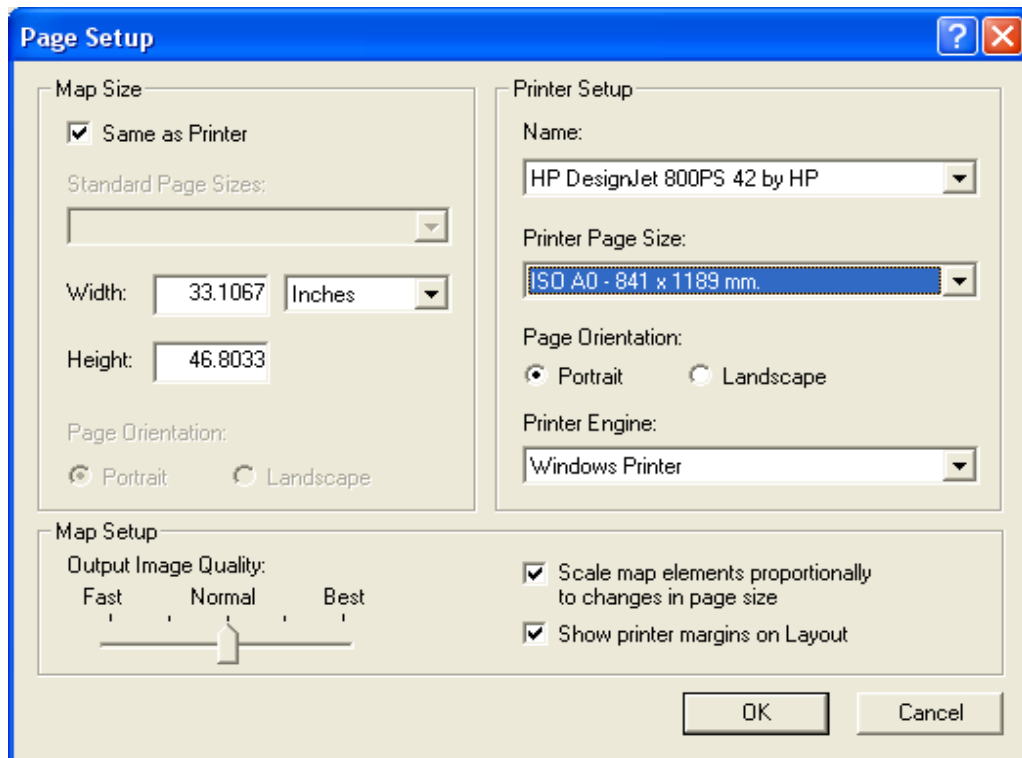
* From the ArcMap window, select File->Print



* From the Print dialogue window, click on Setup



- * In the page setup dialog box, enter the appropriate values for the printer to use. The Mapsheet will fit into A0 size paper if the plotting scale is 1:5000



- * Click on OK to go back to the Printer dialogue window and the click on OK again to start printing

The map data could be used for.

- (a) 1:5,000 scale topographic map data can be used as base map for a GIS database for urban planning of the Metropolitan Manila.
- (b) 1:5,000 scale topographic map data can be enlarged to maximum scale of 1:2,500 topographic map data.
- (c) 1:5,000 scale orthophoto data can be used for producing land use map for the Metropolitan Manila.