

Japan International Cooperation Agency (JICA)

National Mapping and Resource Information Authority (NAMRIA)

**The Study  
for  
Mapping Policy and Topographic Mapping  
for  
Integrated National Development Plan  
in  
the Republic of the Philippines**

**Final Report**

**Volume I**

**Summary**

**March 2008**

**Pasco Corporation  
Nomura Research Institute, Ltd.**

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## **PREFACE**

In response to a request from the Government of Philippine, the Government of Japan decided to conduct a study on Study for Mapping Policy and Topographic Mapping for Integrated National Development Plan and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Yutaka KOKUFU of PASCO Corporation and consists of PASCO Corporation and Nomura Research Institute, Ltd. between February, 2006 and March, 2008.

The team held discussions with the officials concerned of the Government of Philippine, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Philippine for their close cooperation extended to the study.

March 2008

Eiji HASHIMOTO,  
Deputy Vice President  
Japan International Cooperation Agency



## Letter of Transmittal

Mr. Eiji HASHIMOTO  
Deputy Vice President  
Japan International Cooperation Agency  
Tokyo, Japan

Dear Mr. Hashimoto

We are pleased to submit herewith the final report—the Study for Mapping Policy and Topographic Mapping for Integrated National Development Plan in the Republic of the Philippines.

This report compiles results of the study which was undertaken in the Republic of the Philippines from February 2006 until March 2008 by the Study Team composed of Pasco Corporation and Nomura Research Institute, Ltd. under the contract with the JICA.

The Final Report is composed of: Summary Report; Main Report; Specifications; and Manuals.

The Study covered: capacity development for topographic mapping at scale of 1: 50,000 of National Mapping & Resource Information Authority (NAMRIA); and pilot projects. The pilot projects included technical verification of mapping methods and technology transfer. Based on the results of the study components, recommendations of the nationwide development plan and action programs were prepared. The topographic mapping at scale of 1:50,000 for technical verification and technology transfer was conducted in the area of the Pampanga watershed using digital mapping methodologies. In addition, the technical specifications, human resource development plan and capacity development plan for nationwide deployment plan were prepared. We believe that these results and transferred technique will support not only the Integrated National Development Plan but also land use planning, environmental management and regional development in the Philippines.

We would like to express our sincere gratitude and appreciation to: your agency; the Ministry of Foreign Affairs; Embassy of Japan in the Philippines; and JICA Philippine Office. We would also like to send our appreciation to all those extended their kind assistance and cooperation to the Study Team, in particular—officials of National Mapping & Resource Information Authority, Philippines—the counterpart agencies.

Yours Faithfully,

March 2008

Yutaka KOKUFU  
Team Leader  
The Study for Mapping Policy and Topographic Mapping for  
Integrated National Development Plan in the  
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## List of Abbreviations and Acronyms

BCGS	Bureau of Coast and Geodetic Survey
BSWM	Bureau of Soils and Water Management
BTSM	Board of Technical Surveys and Mapping
CARP	Comprehensive Agrarian Reform Program
CGSD	Coast and Geodetic Surveys Department
CIS	Communal Irrigation System
CLUP	Comprehensive Land Use Plan
CPDO	City Planning and Development Office
CPO	City Planning Officer
CSC	Civil Service Commission
CSC BVP	Civil Service Commission Bulletin of Vacant Position
DA	Department of Agriculture
DAR	Department of Agrarian Reform
DEM	Digital Elevation Models
DENR	Department of Environment and Natural Resources
DOJ	Department of Justice
DOST	Department of Science and Technology
DOTC	Department of Transportation and Communication
DPSB	Department Promotion & Selection Board
DPWH	Department of Public Works and Highways
GIS	Geographic Information System
GPS	Global Positioning System
HLURB	Housing and Land Use Regulatory Board
IATFGI	Inter Agency Task Force on Geographic Information
IMD	Information Management Department
JAFTA	Japan Forest Technical Association
JICA	Japan International Cooperation Agency
LGU	Local Government Unit
LIS	Land Management System
LMB	Land Management Bureau
LRMIS	Land Records Management Information System
LVP	List of Vacant Position
MD	Mapping Department
MGB	Mines and Geosciences Bureau
NAMRIA	National Mapping and Resources Information Authority
NBI	National Bureau of Investigation
NCA	National Cartography Authority
NCC	National Computer Office NEDA National Economic and Development Authority
NIA	National Irrigation Authority
NIS	National Irrigation System
NMTS	National Topographic Map Series
NPC	National Power Corporation
NRMC	National Resources Management Center
NSCB	National Statistical Cooperation Board
NSO	National Statistic Office
ODA	Official Development Assistance
OIC	Officer in Charge
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PDO	Project Development Officer
PDS	Personal Data Sheet
PENRO	Provincial Environment and Natural Resources Office
PHP	Philippine Peso(s)

PIVOLCS	Philippine Institute of Volcanology and Seismology
PMS	Personnel Management Section
PPDO	Provincial Planning and Development Office
PRS	Philippine Reference System
PSD	Promotion Selection Board
RIMSS	Roads Information and Management System
RSRDAD	Remote Sensing and Resources Data Analysis Department
USCGS	United States Coast and Geodetic Survey







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## CHAPTER 1 INTRODUCTION

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In response to the request of the Government of the Republic of Philippines (hereinafter referred to as “GOP”), the Government of Japan (hereinafter referred to as “GOJ”) decided to conduct the “Study for Mapping Policy and Topographic Mapping for Integrated National Development Plan in the Republic of Philippines (hereinafter referred to as “the Study”).

The Japan International Cooperation Agency (hereinafter referred to as “JICA”), the official agency responsible for the implementation of technical cooperation programs of the GOJ, undertook the Study in accordance with the relevant laws and regulations enforce in Japan.

On the part of the GOP, National Mapping & Resource Information Authority (hereinafter referred to as “NAMRIA”), acted as the counterpart agency to the JICA Study Team (hereinafter referred to as “the Study Team”) and also the coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

### 1-1 Background of the Study

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In the Philippines, topographic maps at a scale of 1:50,000 prepared in the 1950s, except for some areas updated by NAMRIA, are used even now, as base data for the national development policy plans, regional development project planning, and infrastructure development planning. However, the present conditions are largely different from those of 50 years ago due mainly by various degrees of development activities. It became an urgent policy issue to update the topographic maps. In the Philippines, the National Mapping and Resource Information Authority (NAMRIA) undertakes the duty to perform preparation, updating and providing maps. Although the potential of executing such duties exists in NAMRIA, implementation is in a difficult state due to insufficient financial and human resources.

To cope with this situation, the GOP requested the GOJ to conduct a study to strengthen organizations for maintaining and managing geographic information by NAMRIA. By preparing the “Specifications for Topographic Mapping at Scale of 1:50,000” which would strengthen NAMRIA financially and technically, it was expected that NAMRIA develops capability to prepare topographic maps at a scale of 1:50,000 covering the entire area of the Philippines. JICA thereafter dispatched the Preliminary Study Mission headed by Mr. Akira Nakamura to the Philippines to investigate mapping policies and scope of conducting the Topographic Mapping for Integrated National Development Plan in September 2005. The Mission discussed the scope of work including the study area, scope, and requirements of NAMRIA. The Minutes of Meeting (M/M) was signed by the Mission and NAMRIA on September 13, 2005 and the Implementation Arrangement (I/A) was signed on December 2, 2005. The study was carried out based on the I/A.

### 1-2 Scope of the Study

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#### 1-2-1 Objectives

The objective of the Study is "the formulation of an implementation plan for NAMRIA to promote nationwide deployment of topographic maps at a scale of 1:50,000 based on the result of the study." It requires institutional improvement and organizational development. To achieve this objective, the following six project components were conducted.

(1) Formulation of Capacity Development Plan

The Study Team assesses the vitality of organizations of entire NAMRIA. The target of organizational development is selected from the assessment. Based on the assessment “Specifications for Topographic Mapping at Scale of 1:50,000” and “Human Resource Development Program” mainly for Mapping Division will be prepared.

- (2) Establishment of “Specifications for Topographic Mapping at Scale of 1:50,000”

Allowing for map production systems in NAMRIA, the “Specifications for Topographic Mapping at Scale of 1:50,000” will be prepared for economical and practical production of topographic maps at a scale of 1:50,000. Pilot projects will be conducted. The “Specifications for Topographic Mapping at Scale of 1:50,000” will be improving and deepening its contents based on trial and error practices in the Pilot Project.
- (3) Formulation of Human Resource Development Program and Implementation of Technical Training

The “Human Resource Development Program” will be prepared including a technical training program which will enable sustainable operation of topographic mapping at a scale of 1:50,000. This program will be prepared mainly for the Mapping Division, but the Study Team may recommend programs for others based on the result of organizational assessment conducted in the initial stage.
- (4) Implementation of Pilot Projects and Technology Transfer

For the purpose of technical verification on the processes of survey and mapping and for technology transfer, On-the-Job Training (hereinafter referred to as “OJT”), the Pilot Projects will be conducted.

The technical verification will include three fundamental source materials: aerial photographs, satellite images without stereo-pairs, and satellite images with stereo-pairs. Methods, costs, time schedule required, and accuracy will be compared and methods for the future operation will be evaluated.
- (5) Formation of Promotion Mechanism for Topographic Mapping at Scale of 1:50,000 and Associated Products

Working with the Coordinating Committee, the Study Team will prepare a plan to promote uses of maps and associated products among members in the government sector and in the private sector.
- (6) Preparation of Action Program for Nationwide Topographic Mapping at Scale of 1:50,000

Action programs for nationwide topographic mapping at a scale of 1:50,000 will be formulated with the technical verification results from the Pilot Projects, national development plans, and needs from the users.

### **1-2-2 Scope**

The Study involves the following organizational units of NAMRIA on the organizational development scheme.



Table 1-1 Organizations Involved in the Study

Work Component	Target Organization Unit	Level of Involvement
(1) Organization Assessment	Entire NAMRIA	Initiated by administrative units
(2) Organizational Development Analysis	Entire NAMRIA	Dissemination by administrative units. A workshop held by Administrator.
(3) Specifications for Topographic Mapping at Scale of 1:50,000	Mapping Department and other technical departments	Mainly, the Mapping Department, but other departments which will prepare, save, maintain and sell topographic maps at scale 1:50,000 will be involved.
(4) Human Resource Development Program	Mainly for Mapping Department	

The area of the Pilot Projects is the area of the Pampanga watershed including a part of Agno River down-stream region which has about 17,520km<sup>2</sup> equivalent to 24 topographic map sheets at scale 1:50,000.

Available information, Satellite Images, ISO19100, Free Software, SRTM were studied for the purpose of reference; the pieces of information meant not be regarded as the items to be analyzed and reflected to the Sustainable Map Revision Plan.

### 1-2-3 Study Organizations

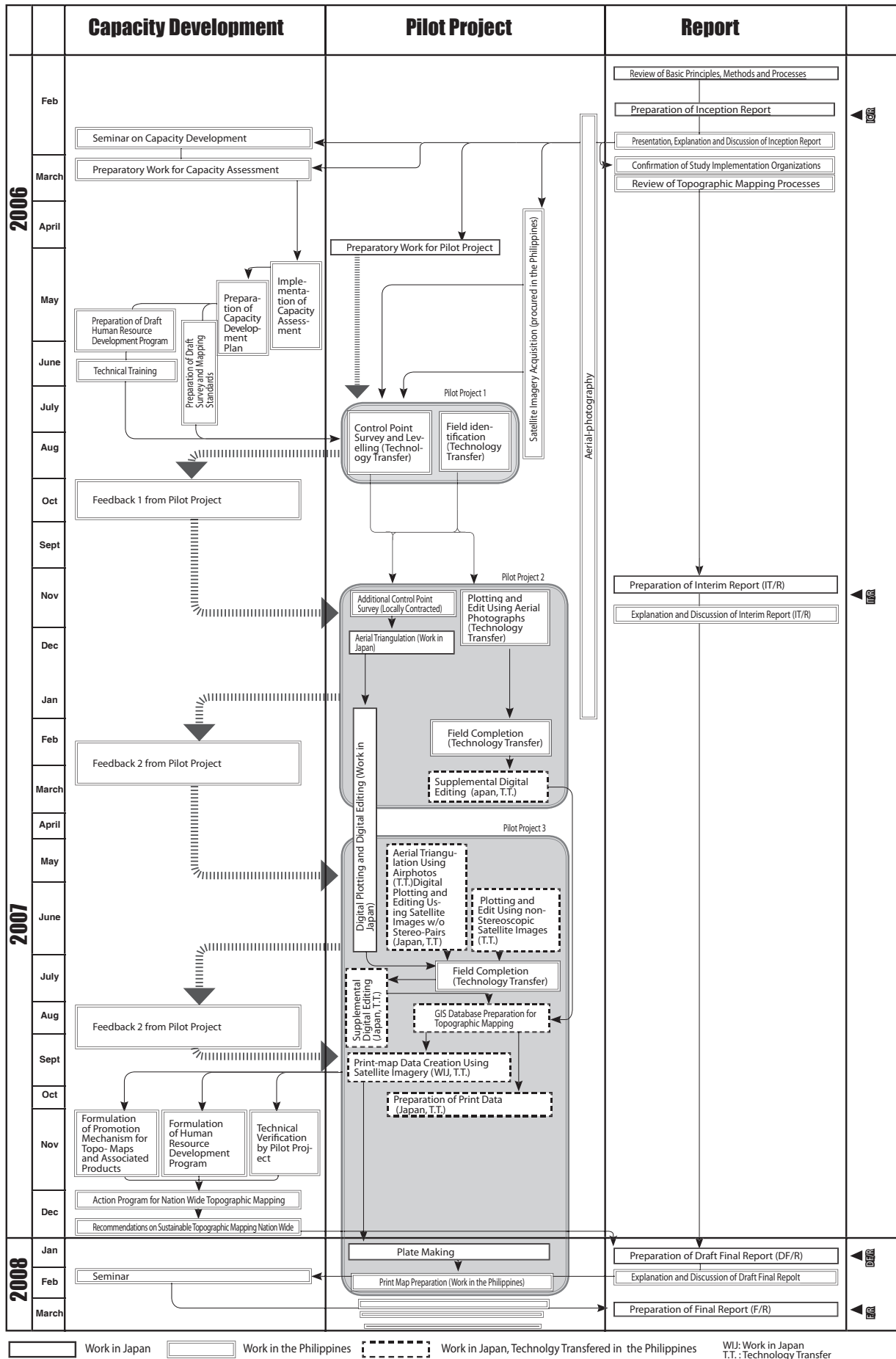
#### (1) Study Team Members

Table 1-2 Composition of the Japanese Study Team

#### Study Team

KOKUFU, Yutaka	Team Leader/ Survey Operation Standards
TAKANO, Masashi	Deputy Team Leader /Organization Analysis /Capacity Development
MORI Hisashi	Human Resource Development /Technology Transfer
KAMIMURA, Kazunobu	Human Resource Development II
KOSEKI, Junichi	Survey Operation Standards (Feb., 2006 – June, 2006)
TAMARI, Kiyofumi	Aerial Photography /Field Identification /Field Completion /Digital Completion
USUDA, Kentaro	Control Point Survey
HATORI, Tomohiko	Leveling
YAMAYA, Kozo	Map Symbolization
KIMURA, Kensuke	Coordination (May, 2006 and Sept., 2006)
MORI, Hisashi	Coordination

Figure 1-1 Study Work Flow



## (2) JICA In-charge

Table 1-3 Composition of JICA

## Members from JICA

NAKAMURA, Akira	Group Director, Group II, Social Development Department
SUGANO, Yuichi	Team Director, Urban and Regional Development / Peace Building Team II, Group II, Social Development Department
ISHIDA, Yukio	Deputy Resident Representative, JICA Philippine Office (Feb., 2006 – May, 2006)
IWAKAMI, Kenzo	Deputy Resident Representative, JICA Philippine Office (May, 2006 - March, 2008)
TSURUOKA, Noriyuki	Urban and Regional Development / Peace Building Team II, Group II, Social Development Department (Feb., 2006 – May, 2007)
SUHARA, Yasuhiro	Urban and Regional Development / Peace Building Team II, Group II, Social Development Department (June, 2007 – March, 2008)
KANOME, Takeshi	Assistant Resident Representative, Program Operation Section, JICA Philippine Office
Mae Salvanette D. Leyson	Program Assistant, JICA Philippine Office (Feb., 2006 – July, 2007)

## JICA Technical Advisors

YOSHIMURA, Yoshimitsu	Director of 5 <sup>th</sup> Research Department, Infrastructure Development Institute, Japan (Feb.,2006 – March, 2006)
CHUJO, Kenji	Senior counselor, 5 <sup>th</sup> Research Department, Infrastructure Development Institute, Japan (April, 2006 – March, 2007)
TANAKA, Tsuneo	Senior counselor, 5 <sup>th</sup> Research Department, Infrastructure Development Institute, Japan (April,2007 – March, 2008)

## JICA Expert, NAMRIA

SUZUKI, Akira	JICA Expert (NAMRIA), Geospatial Data Administration
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## (3) Counterpart Personnel

Table 1-4 Technical Working Group

No.	Name	Position	Department / Division
1	Randolf S. Vicente	Assistant Director	Mapping
2	Enrique S. Macaspac	Assistant Director	Coast & Geodetic Survey
3	Ofelia s. Castro	Division Chief	Photogrammetry - Mapping
4	Joaquin B. Borja, Jr.	OIC -Division Chief	Cartography - Mapping
5	Nicandro Parayno	OIC - Division Chief	Aerial & Spatial - Mapping
6	Reynaldo Manuel	OIC - Division Chief	Printing & Reprography - Mapping
7	Alma Arquero	Division Chief	GIS - Remote Sensing and Resource Data Analysis

8	Bobby Crisostomo	Division Chief	Database - Information Management
9	Tita Cruz	Division Chief	Hydrography - Coast & Geodetic Survey
10	Romeo I. Ho	OIC - Division Chief	Geodesy & Geophysics - Coast & Geodetic Survey
11	Joselito Reasol	Engineer	Development Study & Standard Office
12	Trinidad Garbo	Engineer	Director's Office - Mapping
13	Brian Dela Cruz	Engineer	Photogrammetry - Mapping

Table 1-5 Technical Coordinating Committee

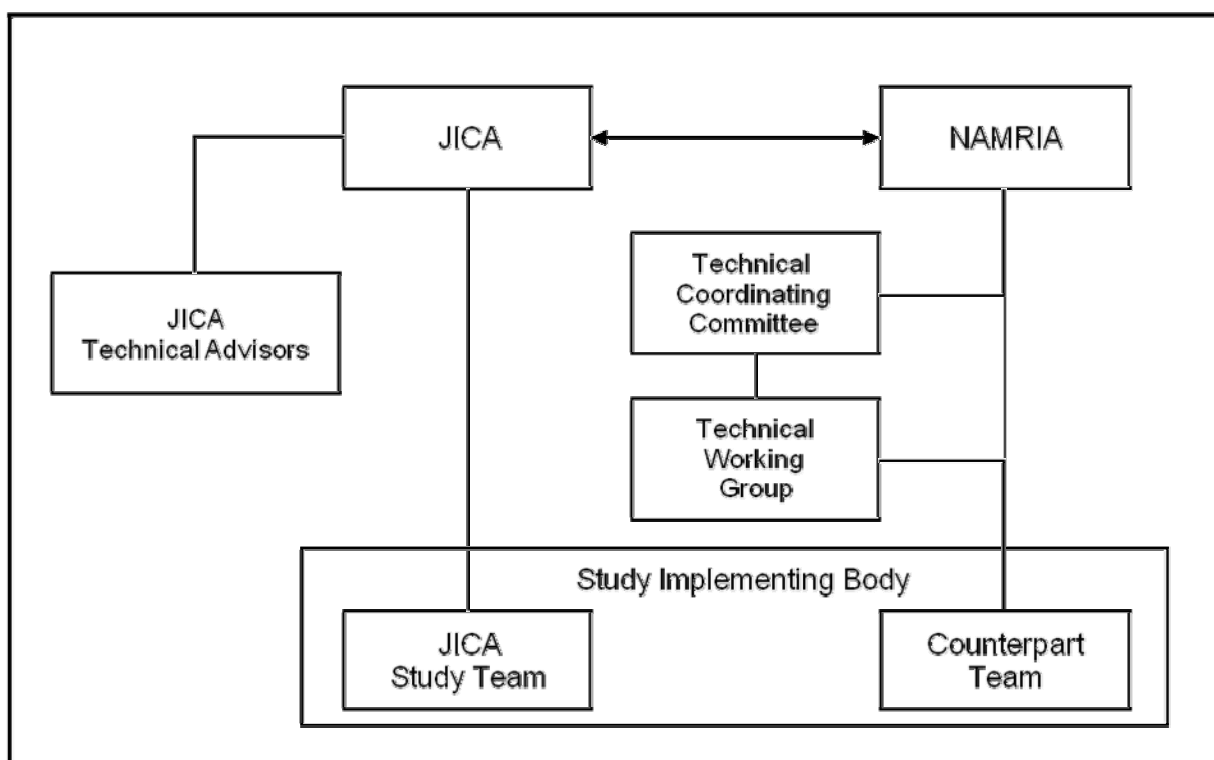
No.	Name	Position	Office / Department
1	Sofio Quintana	Director	Forest Management Services – Region 3
2	Leonardo Z. Aggabao, Jr.	Director	Land Management Services – Region 3
3	Angel Bravo	Director	Mines and Geosciences Bureau – Region 3
4	Alfredo G. Tolentino	Director	DPWH – Region 3
5	Remigio A. Mercado	Director	NEDA – Region 3
6	Lynette Bautista	Asst. Director	NEDA – Region 3
7	Leonardo Quintos, Jr.	Director	NEDA – Region 1
8	Mark Allen Sison	City Administrator	CPDO – Angeles City
9	Angel Tolention	City Planning & Development Officer	CPDO – Angeles City
10	Arch. Tony Kar M. Balde, III	City Planning & Development Officer	CPDO – Olongapo City
11	Engineer. Fernando Lambitco	City Administrator	CPDO – San Fernando City
12	Ludivina Banzon	Project Development Officer	PPDO - Bataan
13	Arlene G. Pascual	Project Development Officer	PPDO - Bulacan
14	Gemilliano Ferrer	Project Development Officer	PPDO – Nueva Ecija
15	Fernando Y. Henson	Project Development Officer	PPDO - Pampanga
16	Norma Untalan	Project Development Officer	PPDO - Pangasinan
17	Engineer. Roberto P. Ventura	Project Development Officer	PPDO - Tarlac
18	Lawag S. Bada	OIC – Project Development Officer	PPDO - Zambales
19	Moises H. Butic	Director	DENR – PENRO, Region 3

Table 1-6 Major Activities

Year	Date	Components
FY2005	Feb. 19, 2006	Starting the Field Activities in the Philippines
	Feb. 22, 2006	Distribution of Inception Report (Director's Office, NAMRIA)
	March 1, 2006	Explanation and Discussion of Inception Report (Director's Office, NAMRIA)
	March 10, 2006	Meeting on Preparations for the Seminar (Director's Office, NAMRIA)
	March 14, 2006	Holding the Seminar (EDSA Shangri-la)
	March 16, 2006	Meeting on Inception Report (Administrator's Office, NAMRIA)
	March 17, 2006	Holding the Technical Coordinating Committee (Clark Holiday Inn)
	July 5, 2006	Regional Seminar on Pilot Project for Technical Coordinating Committee (NEDA Region 3 Office)
	Sept. 13, 2006	Meeting on DCC and PCM results (Director's Office, NAMRIA)
	Sept. 26, 2006	Meeting on Survey Standard Operation, Result of Pilot Projects (Interim report) (Director's Office, NAMRIA)
FY2006	Nov. 20, 2006	Distribution of Interim Report and Meeting on Training on Photogrammetry and Satellite Imagery and Additional Control Points for Field Verification Survey (Director's Office, NAMRIA)
	Nov. 28, 2006	Meeting on Interim Report (Lecture Hall in NAMRIA)
	Feb. 19, 2007	Discussion on the next steps of the Study (Director's Office, NAMRIA)
	Feb. 26, 2007	Meeting on the proposed presentation of the Study progress (Director's Office in NAMRIA)
	March 5, 2007	Meeting on Clarification of the Technical Specifications of the Digital Photogrammetry Systems and Drawing and Printing System for NAMRIA Study (Director's Office, NAMRIA)
	March 6, 2007	Discussion on the result of Spot Image and Mapping Schedule (Photogrammetry Department, NAMRIA)
FY2007	June 6, 2007	Discussion on Training Schedule (Director's Office, NAMRIA)
	June 20, 2007	Meeting on Project Progress, Request and Arrangement of "Map Specification and Standards" and "Human Resource Development", Schedule of Field Completion, Progress Report of OJT and Report of Map Database (Director's Office, NAMRIA)
	July 13, 2007	Meeting on Project Progress, Marginal Information Style and Legend, BM Field Reconnaissance, Contour lines data and so on (Director's Office, NAMRIA)
	Aug. 15, 2007	Holding the Technical Coordinating Committee (Poinsettia Hall, Pampanga)
	Sept. 27, 2007	Meeting on Project Progress, Specification of Extraction rules, Symbolization and Marginal information (Director's Office, NAMRIA)
	Sept. 28, 2007	Holding the Technical Coordinating Committee (Hotel Consuelo Resort and Chinese Restaurant, Pangasinan)
	Nov. 6, 2007	Meeting on Project Progress, Specification of Topographic mapping, Symbolization, Magnetic north and so on (Director's Office, NAMRIA)
	Nov. 26, 2007	Meeting on Project Progress, Arrangements reached during the previous meeting, Progress and Schedule and Remaining Activities (Director's Office, NAMRIA)
	Dec. 13, 2007	Meeting on Technical Specifications for 1:50,000 Topographic Mapping for the JICA Project (Meeting Room, NAMRIA)
	Dec. 28, 2007	Meeting on Schedule of the Project for 2007 and 2008 and Progress Status of the Final Report (Director's Office, NAMRIA)
	Feb. 29, 2008	Distribution, Explanation and Discussion of the Draft Final Report (Director's Office, NAMRIA)
	March 5, 2008	Holding the Seminar (EDSA Shangri-la)
	March 7, 2008	Discussion of the Draft Final Report (Director's Office, NAMRIA)

(4) Study Organization

Figure 1-2 Study Organization



### 1-3 Modifications in Scope of the Study

The following items were revised during the presentation and discussion of the Inception Report (draft) on February 22, 2006 and March 1 2006 and agreed on March 16, 2006 as attached in the Annex "Minutes of Discussions on March 16,2006".

- (1) The phrase "Capacity Development" was changed to "Organizational Development."
- (2) Organizational development on institutional and legal organizational development shall not include external positioning or sectors of institutions. (The reason is that NAMRIA has been discussing its rationalization plan with the Executive Office of the President in accordance with the Executive Order No. 366, as an organization under DENR.)
- (3) The target organization for organizational development shall be the Mapping Department.
- (4) The capacity assessment shall cover the entire NAMRIA.
- (5) The scope of human resource development planning for the Mapping Department will be extended to other department depending on the results of the capacity assessment.
- (6) Organizational development at an individual level shall not be treated officially in the Study.

Director Isada and Team Leader Kokufu have discussed the changed item (1); both agreed that the concept of capacity development had been understood by both parties, and the term capacity development was decided to be used again in the final report.

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## **CHAPTER 2 CURRENT SITUATIONS AND ANALYSES**

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### **2-1 Institutional Capacity**

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#### **2-1-1 Map Related Policies**

The national policies that are related to the Study are:

- Medium-term Philippine Development Plan;
- Philippine National Spatial Data Infrastructure Framework Plan;
- Geo-Hazard Mapping Project; and
- Philippine Reference System of 1992 (PRS92) Program.

#### **2-1-2 Maps and Related Data Usage in the Central Government Agencies**

One of the issues regarding mapping in the Philippine is that mapping data are not produced with the initiative of NAMRIA, but other central government agencies have been producing data independently. The Land Management Bureau has been producing large scale maps. The Department of Public Works and Highways has been preparing roads and other infrastructure data independently. The Department of Agriculture has prepared soil and land used data at scales of 1:50,000 and 1:250,000. In these departments, GIS and database has been in operations. ArcView is the most popular software used; in the Department of Science and Technology uses MapInfo. Almost all the systems are operated as stand-alone system. As far as GIS and related system, there are no case of free-software usage.

#### **2-1-3 Educational Institutions and Other Organizations**

There twenty-five colleges that offer program of geodetic engineering; two-year programs are offered in other institutions. Geodetic engineers as profession are registered after graduations. As for new technologies in the field of cartography and photogrammetry, there are professional associations, but they are not active. Strengthening the professional organization is important in conducting activities with NAMRIA.

#### **2-1-4 Institutional Issues**

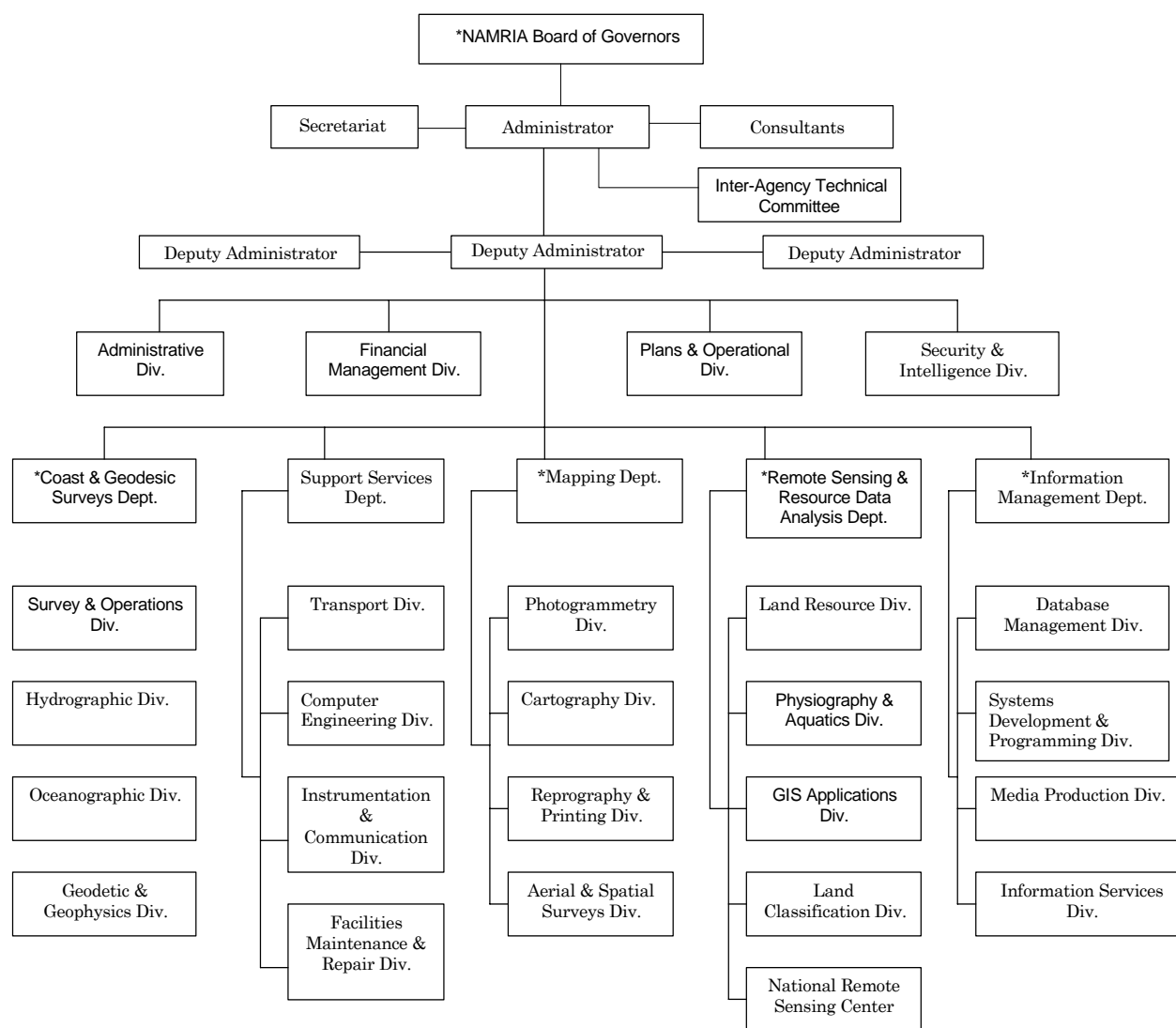
The institutional issues, resulting from document reviews and interviews, can be summarized as follows: (1) Diversified Map Production in the Central Government Agencies; (2) Institutionalization of Professionals; (3) National Development Policies with Basic Maps; (4) Lack of Standards; (5) Copyright; (6) Outflow of Engineers; and (7) Rationalization Plan.

The issue of diversified production could be resolved as accelerating the implementation of the NSDI scheme. The professionalism of remote sensing and photogrammetry shall be strengthened. The national development policies without base maps shall be corrected when the topographic maps will be developed as proposed in the nationwide deployment plan. The Study Team has prepared the Specifications for 1:50,000 topographic maps; other standards will have to be developed as in the 1:50,000 topographic maps. The copyright violation issue needs to be addressed in the promotion planning. The outflow of engineers to the private sector or overseas needs to be considered in the human resource development planning. The unapproved rationalization plan, which does not address reduction of the number of the staff, has to be changed; however, since the scope of the organization development plan is limited to the Mapping Department, the issue is treated as a pending condition to the organizational planning in the Study.

## 2-2 Organizational Capacity

An integrated government reorganization by new President Corazon Aquino in 1987 merged all the surveying and mapping functions of BCGS and NCA with National Resources Management Center (NRMC) and the Land Classification teams of the Bureau of Forest Development which were under Ministry of Natural Resources, and formed National Mapping Resources Information Authority (NAMRIA) under Department of Environment and Natural Resources (DENR). NAMRIA is now the central agency of the government responsible for integrated surveys, mapping, charting, oceanography, aerial photography, remote sensing, management of resource information and research development.

Figure 2-1 Organization Structure of NAMRIA



The top of the NAMRIA organizational structure is the NAMRIA Board of Governors chaired by the Secretary of the Department of Environment and Natural Resources. Members of the Board are the Department of National Defense, the Department of Agriculture, the Department of Public Works and Highways, the Department of Transportation and Communication, and the NAMRIA.

The functions of the Coast and Geodetic Surveys Department are: to acquire and analyze hydrographic and oceanographic data for use in promoting safety through nautical charting, maritime publications and broadcast, tide and current prediction and for use in oceanographic



research; and to establish and maintain a national geodetic control network intended to serve as common reference for all surveying and mapping activities.

The Mapping Department's tasks are to provide a base mapping system and to produce maps suitable for use by government agencies and the private sector. It is also responsible for the formulation of mapping standards and the conduct of research and development in the application of new technology in mapping and related activities.

The Remote Sensing and Resource Data Analysis Department is mandated to provide information on the environment and natural resources, as well as to undertake land classification for the country. Its functions are provision of remote sensing services and vital data on the environment, land use, forestry, agriculture, water resources, the coastal zone and other information needed by the government and the private sector, the conduct of researches on remote sensing and GIS applications as well as on resource information processing and handling.

The Information Management Department works toward the sharing, transfer, exchange, packaging and dissemination of environment and natural resources data. It develops and maintains information systems and environment and natural resources databanks) stores data for use not only within the IMD and other departments of NAMRIA but also outside clients.

It also serves as the marketing arm of NAMRIA for all its products and services. As mentioned before in this report, NAMRIA's role to produce maps and GIS data in National level is very important and the information on organization, number of personnel and budgets was collected.

**Table 2-1 NAMRIA's personnel (as of March 2007)**

Department	Number of staff
Coast and Geodetic Survey	283
Mapping	123
Remote Sensing	96
Information Management	77
Support Service	81
Administration	48
Total:	708

NAMRIA's factual budget in total and for topographic base mapping for the past five years appears as follows:

**Table 2-2 NAMRIA's Budget (Total/Base Mapping)**

Year	NAMRIA's Budget	Budget of Topographic Base Mapping (1/50,000)
2003	263,026,000	9,309,000
2004	261,862,000	8,382,000
2005	265,226,000	7,727,000
2006	299,914,000	37,727,000
2007	819,684,000	112,835,000
Total		175,980,000
Average		35,196,000

Note: Budget of Topographic Base Mapping includes updating cost of large-, medium- and small-scale topographic maps, and does not include cost for printing and project cost of geo-hazard mapping and PRS92.

The Mapping Department consists of four divisions: the Photogrammetry Division, Cartography Division, Reprography & Printing Division; and the Aerial and Spatial Survey Division. The Spetila Survey Section was merged with the Photogrammetry Division. The Photogrammetry Division is divided into the three sections, and 26 staffs engage in preparation of plotting of large-scale topographic maps, preparation of ortho-photographs and distortion corrected photographs, DTM, and contour line data for GIS. The Cartography Division's main roles are data

editing of small to medium scale maps, data editing of thematic maps, and preparation of a database. The division has three sub-sections to share the designated tasks. The Reprography & Printing Division consists of three subsections, "Camera section", "Reprography Section", and "Press Section." The main tasks are print film preparation and multi-color printing of topographic and thematic maps based on the finished mapping data from the Cartography Division. The office of the Aerial and Spatial Survey Division was merged by the Photogrammetry Division at present. According to the rationalization plan, the Mapping Department will become the Mapping and Geodesy & Geophysics Department. The current staffs in the Aerial & Spatial Survey Division is partially from the Geodesy section of the Photogrammetry Division. The basic functions of the Aerial & Spatial Survey Division will remain in the Photogrammetry Division: planning and outsourcing of aerial-photography, inspection of photography, index preparation of the existing aerial photographs, and reproduction of satellite imagery and aerial photographs.

### 2-2-1 Results of Capacity Assessment

The Diagnostic of Corporate Culture was conducted to measure an organizational climate quantitatively by a personnel questionnaire. A seminar regarding DCC was held on March 14, 2007. The sample size of the questionnaire survey was 715; the effective replies were 625. The result is summarized in the following table:

**Table 2-3 Results of DCC by Division**

	<Problems>	<Measures>	<Outputs>
Office of Director	<ul style="list-style-type: none"> <li>The problems extracted are: "merit orientation" on the strategic vitality; "influence" "delegation of authority", "respect for dialogue", "respect for individuals", and "failure tolerance" on the organizational vitality, and "influence" on leadership.</li> </ul>	<ul style="list-style-type: none"> <li>Leadership in all occasions of improvement.</li> <li>Clarification of responsible individuals or organizations</li> <li>Implementation of evaluation</li> <li>Information disclosure</li> <li>Others</li> </ul>	<ul style="list-style-type: none"> <li>Operating division of responsibilities</li> <li>Capability evaluation manual</li> <li>Notification on delegation of authority</li> <li>Others</li> </ul>
Photogrammetry Division	<ul style="list-style-type: none"> <li>The problems extracted are: "merit orientation" on the strategic vitality; "respect for dialogue" on the organizational vitality; and "influence" on the leadership.</li> </ul>	<ul style="list-style-type: none"> <li>Clarification of individual roles and operating goals</li> <li>Introduction of a personal-capability evaluation system</li> <li>Delegation of authority from the president NAMRIA and the Mapping-Department division manager</li> </ul>	<ul style="list-style-type: none"> <li>Operating division of responsibilities</li> <li>Notification on delegation of authority</li> <li>Others</li> </ul>
Cartography Division	<ul style="list-style-type: none"> <li>The problems extracted are: "merit orientation" and "education system" on the strategic vitality; "delegation of authorities" and "respect for dialogue" on the organizational vitality. On leadership, there was no apparent problem identified.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction of capability evaluation system</li> <li>Review and introduction of education programs</li> <li>Delegation of authority from the president NAMRIA and the Mapping-Department division manager</li> <li>Others</li> </ul>	<ul style="list-style-type: none"> <li>Operating division of responsibilities</li> <li>Training scheme (to be included in the Human Resource Development Program)</li> <li>Others</li> </ul>
Reprography and Printing Division	<ul style="list-style-type: none"> <li>The problems extracted are: "merit orientation" on the strategic vitality; "appropriate regulations" on the organiza-</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of leadership training</li> <li>Sharing of the existing rule or internal regulations, and documentation</li> </ul>	<ul style="list-style-type: none"> <li>Operating division of responsibilities</li> <li>Individual performance</li> </ul>

	<p>tional vitality; and "consideration", "presentation of goals", "power of influence", and "achievement pressure" on the leadership.</p>	<p>as manuals</p> <ul style="list-style-type: none"> <li>• Introduction of a capability evaluation system</li> </ul>	<p>evaluation criteria</p> <ul style="list-style-type: none"> <li>• Various operating manuals</li> <li>• Others</li> </ul>
<p>Aerial and Spatial Surveys Division</p>	<ul style="list-style-type: none"> <li>• All the indices except for "Aspiration", "definition", and "education system" are raised as issue of the strategic vitality, and also all the indices except for "delegation of authority" and "respect for individuals" are extracted as issues of the organizational vitality. All the indices of leadership was raised as issues. There are many issues in this division.</li> </ul>	<ul style="list-style-type: none"> <li>• The fundamental meaning of the organization including its existence needs to be reexamined.</li> </ul>	<ul style="list-style-type: none"> <li>• Reexamination of the role of the division or rationalization.</li> </ul>

A Project Cycle Management (PCM) study was conducted. Part I had a total of 15 participants, and set the main problem of PCM as "NAMRIA does not update 1:50,000 topographic maps." In addition, Part I also had participation of a JICA consultant, a JICA expert, and the JICA Manila office personnel. The main participating departments are as follows:

Table 2-4 Attributes of PCM Part I Participants

Department	No. of Participants
Coast and Geodetic Surveys Department	1
Engineering Services Department	3
Mapping Department	6
Remote Sensing & Resource Data Analysis Department	4
Information Management Department	1

While Part II classified the problem trees and solution trees created during Part I into four groups, persons to participate in the discussions are selected from sections in charge in NAMRIA. Then, with a small committee type of system, a program or action plan for the initial step was discussed by each group.

**Table 2-5 Issues Raised in PCM**

Area	Description
(1) Policy related issues	<ul style="list-style-type: none"> <li>• Preparation, approval and implementation of 1:50,000 topographic mapping</li> </ul>
(2) Human Resource Issues	<ul style="list-style-type: none"> <li>• Introduction of In-house training courses</li> </ul>
	<ul style="list-style-type: none"> <li>• Introduction of overseas training</li> </ul>
	<ul style="list-style-type: none"> <li>• Implementation of researches and developments by engineering and clerical workers</li> </ul>
	<ul style="list-style-type: none"> <li>• Establishment of a charter for engineering clerical workers</li> </ul>
	<ul style="list-style-type: none"> <li>• Tolerance of the personnel who work out of NAMRIA</li> </ul>
	<ul style="list-style-type: none"> <li>• Promotion of scholarship</li> </ul>
	<ul style="list-style-type: none"> <li>• Personnel allocation by introduction of the merit system</li> </ul>
	<ul style="list-style-type: none"> <li>• Rationalization of human resources</li> </ul>
	<ul style="list-style-type: none"> <li>• Presentation of clear career paths</li> </ul>
	<ul style="list-style-type: none"> <li>• Clarification of operations</li> </ul>
	<ul style="list-style-type: none"> <li>• Application of strict penalty on tardiness and absenteeism</li> </ul>
	<ul style="list-style-type: none"> <li>• Efficient recruitment</li> </ul>
	<ul style="list-style-type: none"> <li>• Clarification of accountability</li> </ul>
	<ul style="list-style-type: none"> <li>• Consistency of position and salary class</li> </ul>
	<ul style="list-style-type: none"> <li>• Appropriate application of individual performance appraisal guideline</li> </ul>
<ul style="list-style-type: none"> <li>• Comprehensive human resource program formulated, implemented and monitored</li> </ul>	
<ul style="list-style-type: none"> <li>• Organizational development of the Human Resource Department for implementation of the human resource development program</li> </ul>	
<ul style="list-style-type: none"> <li>• Enhancement of human resource information system</li> </ul>	
(3) Facilities, Machines & Software	<ul style="list-style-type: none"> <li>• Procurement of required software and workstation</li> </ul>
	<ul style="list-style-type: none"> <li>• The purchase of satellite images</li> </ul>
(4) Internal Problem Management Issues	<ul style="list-style-type: none"> <li>• 1:50,000 topographic base mapping program, formulated, approved and implemented as planned</li> </ul>
	<ul style="list-style-type: none"> <li>• Organizational structure more responsive to present and future requirements</li> </ul>
	<ul style="list-style-type: none"> <li>• Staffs on policy development and research at the department level assigned</li> </ul>
	<ul style="list-style-type: none"> <li>• Monitoring and evaluation system within the department fully implemented</li> </ul>

The organizational issues related to the Study can be summarized as keeping and improving technical capabilities as a specialized organization of mapping and surveying, improvement of quality control system, systemization of human resources development and integration of various systems developed by the Information Management Department.

## **2-3 Human Resources**

Qualification Standard of CSC (Civil Service Commission) specifies fundamental education programs aiming to raise ethical standards as public servants, service improvement, and professional attitudes. This regulation defines the number of training periods according to position and rank. A duty of training of 4 hours is shortest imposed for Engineer I.

For the technical specialized education, NGTC (NAMRIA Geomatic Training Center) is organized in NAMRIA. In this training center, short-term trainings are offered on GIS, CAD, GPS, digital topographic mapping, Remote Sensing and others required for the work. About 11 to 17 persons have participated to the training program of NGTC each year from 2003 to 2005.

One in five years, in general, one staff is sent to ITC (International Institute For Geoinformation and Earth Observation) to be trained as managerial level engineers for acquiring special technologies along with the in-house training.

The Civil Service Commission has issued a new form of the Personal Data Sheet in 2005. The data sheet is the basic data for the civil servants in the Philippines. The Revised Rating Sheet for Selection/Promotion is the form to be used for promotion; The individual appraisal is conducted semi-annually. The NAMRIA Performance Appraisal Form is used to evaluate staff performance. The form is filled out by oneself. Then a supervisor and a peer rate the functional and actual duties. The targets of functions and duties are set by individuals. The appraisal system is used for promotion.

Since the rationalization plan has not put into practice, there has not been any promotion since the plan was submitted for two years. The individual appraisal system of NAMRIA has not been functioning as it was planned because: the objective criteria have been lacking for appraisal; target setting guideline is vague, leading to relatively low targets to be achieved; supervisors and peers tend to rate the same for different staffs.

There are 259-four-year-degree holders out of 353 samples in NAMRIA. The dominant field of study in the Mapping Department is civil engineering; 25 out of 131 staff holds the civil engineering degree. Eleven persons have received post graduate degrees in the Mapping Department. The degree earned are technical and administrative.

In the Mapping Department the average years of service is 15.61 years; the working place is considered stable. Within the range between 16 to 25 years of service, about 40% of the staff is distributed. This is the target of the staff who may require re-training.

The issues of human resources are: improving technical capacity; assigning master degree holders as instructors; and retraining of senior operators. The Study Team identified technical issues in during the Pilot Projects. The eleven master degree holders shall function as instructors for technical training. As discussed, the senior operators who have been in the same work place longer than 16 year will have to retrained especially to improve the quality control function of the Department.

## 2-4 Data and Information in NAMRIA

### 2-4-1 Maps and GIS Data in NAMRIA

The scales of topographic maps produced in NAMRIA are: 1:250,000, 1:50,000, and 1:10,000. There were two series of 1:50,000 scale topographic maps—Series 701 and Series 711. The two series will be integrated as PNTMS. The map sheet available in PNTMS are 103 sheets in 2007.

The basic maps NAMRIA has produced are summarized in the following table:

Table 2-6 Basic Maps in NAMRIA

Type	Series	Scale:	Size (cm)	Coverage :	Number of Sheets:
Topographic		1:250,000	73 x 59	Philippines	55
Topographic	Series 711	1:50,000	73 x 59	Philippines	842
Topographic	Series 701	1:50,000	76 x 61	Luzon Island	151
Topographic	PNTMS	1:50,000	61 x 61	Philippines (selected areas)	103
Topographic		1:10,000	73 x 64 (Neat Line 3' x 3')	Metro Manila and Other Vicinity	57
Topographic		1:50,000	73 x 61	Bacolod City, Iligan City , Metro Iloilo, Metro Cebu	35
Land Use and Forest		1:100,000	82 x 67.3	Luzon and Visayas	108
Land Cover		1:260,000	73 x 63	Philippines (90%)	43

The digital data includes digital map data and GIS data. The digital map data is cartographic data to be used for printing maps. GIS data is the spatial data that can be used by computer-based applications. Metro Manila maps were printed in cooperation with JICA using the 1:32,000 aerial photographs taken in 1982 and 1:10,000 topographic maps as base map. Administrative maps, which show administrative boundaries, road networks and drainage systems, are available.

#### **2-4-2 Products and Available Data**

Topographic maps at scales of 1:250,000, 1:50,000, 1:10,000 and 1:5,000 are available, but the data do not cover the entire Philippines. The Map Sales Offices control all the sales of 1:50,000 topographic maps. The total sale of the Map Sales Offices in the fiscal years in 2005 and 2006 was reduced by 12.52 percent.

IFSAR (Interferometric Synthetic Aperture Radar) data is the latest multiple-purpose mapping technology which determines elevations of topography by interference processing using two synthetic aperture radar (SAR) image data. NAMRIA has acquired the SPOT images for the Geo-Hazard Project. The Advanced Land Observing Satellite (ALOS) is another satellite imagery, which can be utilized for topographic mapping in the future.

#### **2-4-3 Analysis of the Topographic Maps (1:50,000)**

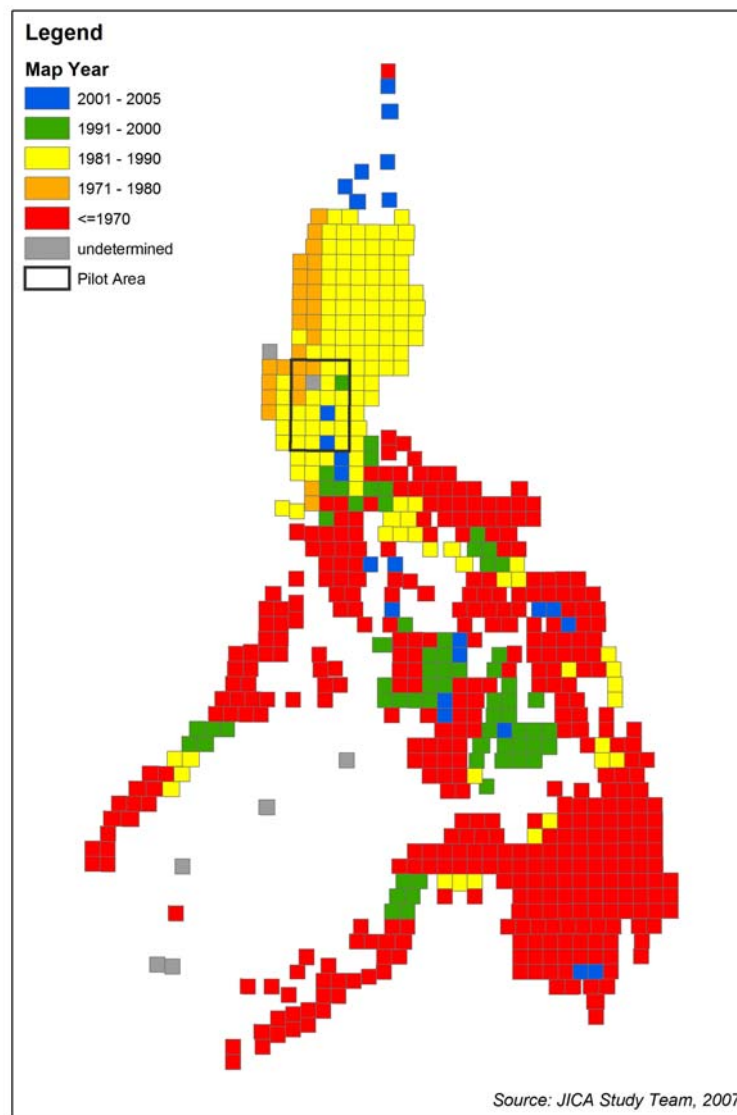
The three series of 1:50,000 topographic maps were overlaid and the oldest section was determined as the years of the PNTMS maps series. The result shows that over 50% of the map information was produced before 1959. The oldest part was defined as the determinant of the map year for the PNTMS series. In the southern part of the Philippines, revision work of the 1:50,000 topographic maps have been delayed.

**Table 2-7 Map Age**

Year	Frequency	Percent
-1959	374	57.3
1960-1969	22	3.4
1970-1979	26	4.0
1980-1989	126	19.3
1990-1999	74	11.3
2000-	24	3.7
Total	646	98.9
Missing	7	1.1
Total	653	100.0

The following thematic map shows the map year distribution based on the analysis. In the southern part of the Philippines, revision work of the 1:50,000 topographic maps has been delayed.

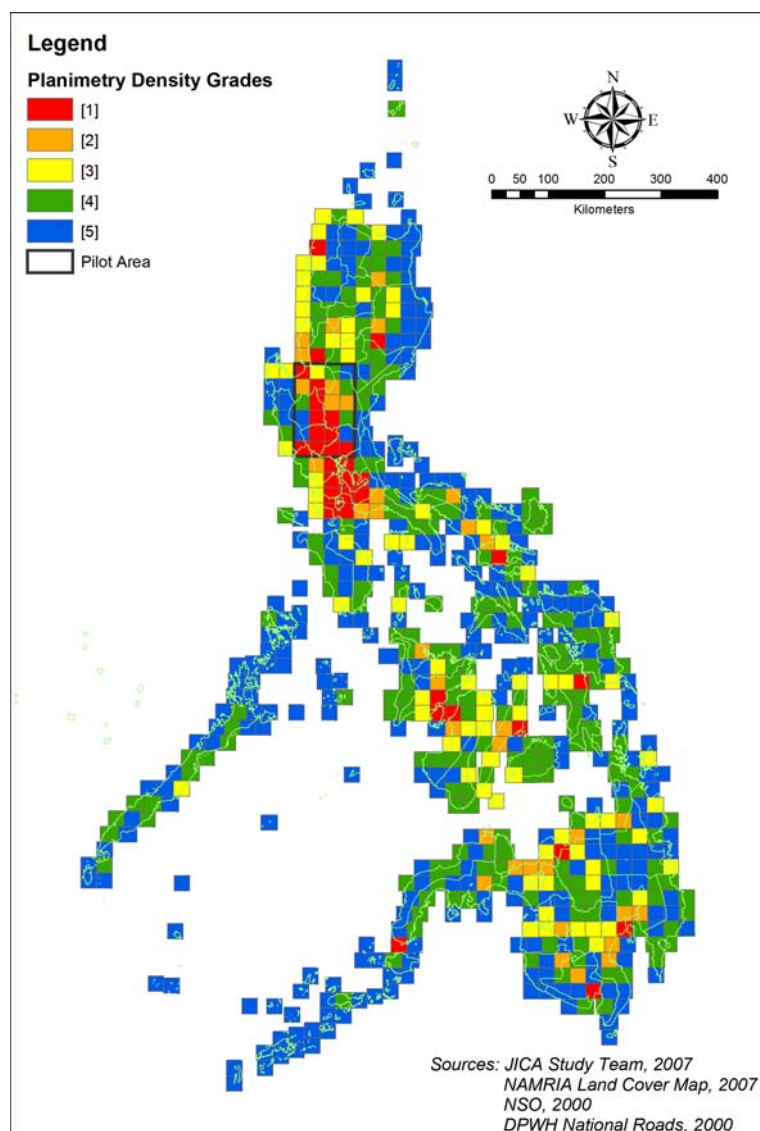
Figure 2-2 Map Year



(1) Analyses of Planimetry Density

Planimetric density assessment was conducted from aspects of population, road density and built-up area information. Population data were provided by the National Statistic Office, existence of major roads: by Department of Public Works and Highways, and built-up area information; and by NAMRIA in its Land cover maps. Utilizing the result of the Pilot Projects, which are described in Chapter 3, the time required for extracting planimetric features, was estimated. As seen in parameters, Metro Manila and adjoining areas in the South, and Davao and vicinities have dense planimetric-features, and it is expected to take long time to update planimetric-features of red and orange colored areas in the map.

Figure 2-3 Planimetric Density Grades



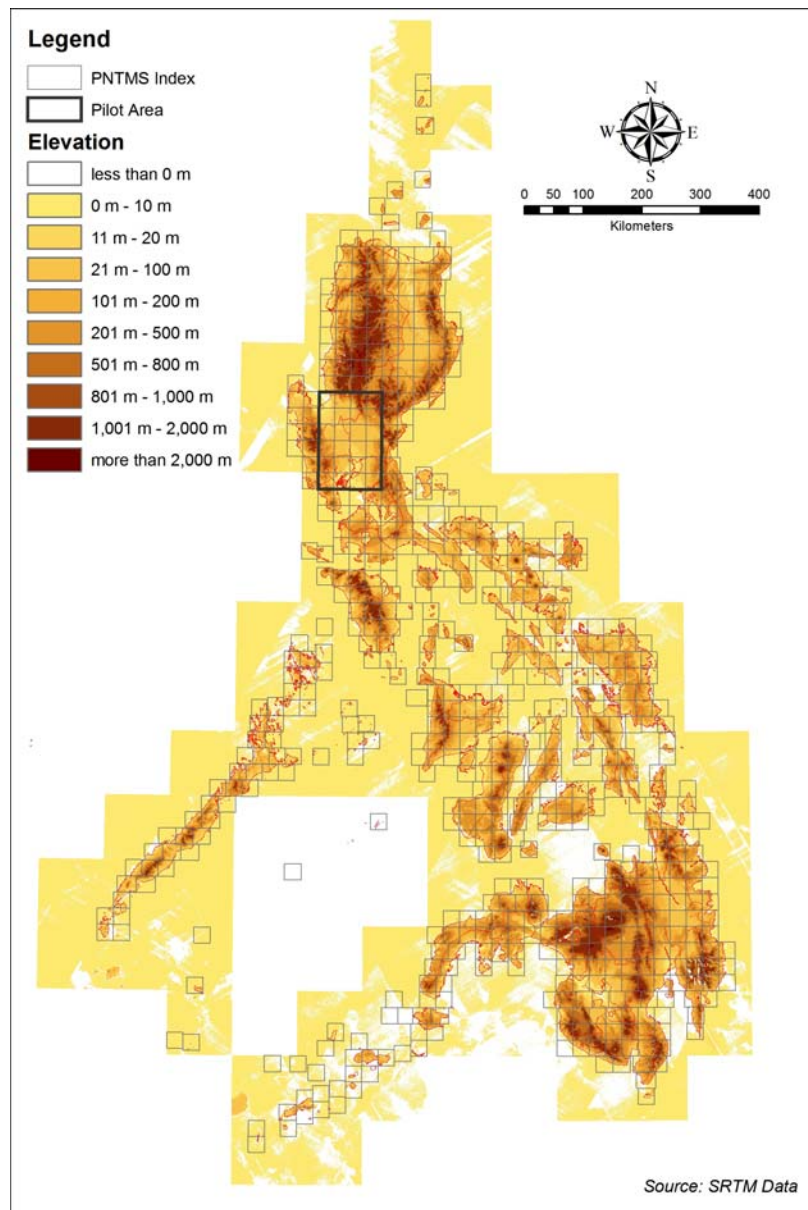
(2) Contour Density

The Contour Density Grade was estimated using Shuttle Radar Topography Mission (SRTM)<sup>1</sup> elevation data for the whole country downloaded from the US Geological Survey's EROS Data Center website. The SRTM data contains elevations at 90 m intervals. Using these elevation data, contours at 20 m intervals were generated. As seen, the contour densities in the north-eastern part of Luzon and in the southern part of Mindanao are higher than other places, indicating that contour line updating would take longer than other places.

<sup>1</sup> The Shuttle Radar Topography Mission (SRTM) data are produced by the National Aeronautics and Space Administration (NASA) and the National Geospatial-Intelligence Agency (NGA)—the German and Italian space agencies are involved in the effort. The mission is to acquire three dimensional data for the globe. There are two types of data available: one is SRTM-1—one second (about 30 meters) mesh and three second (about 90 meters) mesh. The data are downloadable at [ft://e0srp01u.ecs.nasa.gov](http://e0srp01u.ecs.nasa.gov). The Jet Propulsion Laboratory, California Institute of Technology has a comprehensive web site regarding the SRTM technology.



Figure 2-4 Elevation Map of the Philippines based on SRTM data



#### 2-4-4 Issues of Data and Information

##### (1) Maps and GIS Data in NAMRIA

The Mapping Department of NAMRIA started the National Topographic Base Mapping Program in 1988 that will produce a new topographic map series (NTMS) to replace outdated 711 and 701 series 150,000 topographic maps. Until now, 62 maps sheets or 9.2% of NTMS have been produced for selected areas where new aerial photographs to cover such areas became available with NAMRIA. Digitalization of 1:50,000 topographic base maps also started a few years ago. 45 maps or 6.7% of the country had been digitalized for selected areas.

Meanwhile, IATFGI lead by Information Management Department of NAMRIA has promoted programs to establish National Geographic Information Infrastructure which will consist of fundamental GIS datasets, data sharing system and networking system.

The Mapping Department and Information Management Department needs to coordinate regarding data preparation. The Mapping Department needs to raise its capacity of producing the topographic maps and digitization of the base maps.

(2) Products and Sales Systems

The very fundamental problem of products are the years produced. What customers need is recent spatial information.

All the product information is said to be included in the web site of NAMRIA; however, the Flash based information dissemination system function slow when the internet connection is not the broadband.

In 2006, the sale dropped by about 12 % from the previous year; however, no strategic measures were formulated to encounter the loss.

## CHAPTER 3 THE PILOT PROJECTS

### 3-1 General

The JICA Study Team carried out the Pilot Projects in three stages: Pilot Project I was conducted from June 2006 to September, 2006, Pilot Project II was conducted from of November 2006 to March, 2007; Pilot Project 3 was conducted from May 2007 to December, 2007. The objectives were: (1) technological verification of the Specifications for Topographic Mapping at Scale of 1:50,000; and (2) Technology Transfer.

The Pilot Project area is the Pampanga river basin of the Region 3 including PAMPANGA, TARLAC, BATAAN, ZAMBALES and NUEVA ECUJA provinces and Agno River down-stream of Region 1 including PANGASINA province covering about 17,520km<sup>2</sup> with 24 topographic maps at scale of 1:50,000.

In order to execute the technological verification of Pilot projects, the aerial photography at scale of 1/40,000 for topographic mapping at Scale of 1:50,000 covering the south part of Pilot Project area of 5,840sq.km was carried out by a local contractor, FFC Cruz Inc., and completed at the end of January 2007. The results of aerial photography were 13 flight runs with 647 photos in total. The SPOT5 satellite images (single, 2.5m Panchromatic and 10m color) for topographic mapping at scale of 1:50,000 covering the center and north part of Pilot Project area of 12,410sq.km were acquired from Tokyo SPOT Image on May, 2006. The acquired single SPOT5 satellite images were six full scenes and two sub scenes. The SPOT5 satellite images (Stereo, 2.5m Panchromatic) for topographic mapping at scale of 1:50,000 covering the south east part of the Pilot Project area of 730 sq.km sheets at scale of 1:50,000 were acquired from CERTEZA Infosys Co. on March, 2007. The acquired stereo SPOT5 satellite images were two sub scenes.

The survey and mapping criteria of the reference ellipsoid-- Clarke 1866; the horizontal control datum, PRS92; the vertical control datum, Mean sea level refer to existing BM; and map projection, Universal Transverse Mercator (UTM) Projection defined by NAMRIA-- was used for the survey and topographic mapping work in the Pilot Projects.

### 3-2 Survey and Mapping Criteria

#### 3-2-1 Elements of the geodetic survey

The following geodetic and mapping elements are used for topographic mapping.

Table 3-1 Geodetic and Mapping Elements

Item	Element	Description
Reference Ellipsoid	Clarke1866	Semi major radius: 6378,206.400m Flattening: 1/294.9786982
Horizontal Datum	PRS92	
Vertical datum	Mean sea level	Refer to existing BM
Geoid Model	EGM96	OSU
Transformation parameters WGS84 to PRS92	127.62195 m 67.24478 m 47.04305 m -3.06762 sec 4.90291 sec 1.57790 sec 1.06002 x 10 <sup>-6</sup>	Delta X Delta Y Delta Z Rotation around X axis Rotation around Y axis Rotation around Z axis Delta Scale

### **3-2-2 Mapping elements**

The accuracies of plane and elevation of the topographic maps are defined as follows:

**Table 3-2 Accuracies of Plane and Elevation of Topographic Maps**

Item	Element	Description
Map projection	UTM	Zone 50, 51, 52
Size of map	15 min x 15 min	Refer to Map index
Map symbols	PMS50K (Philippine Map Symbols for 50K)	prepared by this project
Representation of terrain	Contour	20 m interval
Accuracy of Plane	Less than 0.5 mm on map	In USGS
Accuracy of Elevation	$\sigma_0=10$ m $\sigma_0=7$ m	1/2 of contour interval for contour line 1/3 of contour interval for spot height
Numbering System of Map sheet		Index of Topographic maps at a scale of 1:50,000 in 701 series

### **3-3 Pilot Project I (Technical Transfer)**

The Pilot Project I was carried out through On-the-Job Training (hereinafter referred to as “OJT”). The field work of the Pilot Project I was carried out by NAMRA in accordance with the Draft Technical Specifications under the Supervision of the JICA Study Team from June 25, 2006 and completed September 3, 2006 and the indoor work was completed at the end of September, 2006.

The GPS survey by the static method for 39 control points were carried out for aerial triangulation of digital plotting and editing at scale of 1:50,000 using aerial photographs covering Area A of the eight topographic map sheets at scale of 1:50,000 (sheet No.: 3031-II, 3131-III, 3131-II, 3231-III, 3030-I, 3130-IV, 3130-I, 3230-IV). By point positioning for 60 control points were measured for satellite image rectification of digital plotting and editing at scale of 1:50,000 using satellite image covering Area B of the 12 topographic map sheets at scale of 1:50,000 (sheet No.: 3033-I, 3133-III, 3133-II, 3253-III, 3032-I, 3132-IV, 3132-I, 3232-IV, 3032-I, 3132-III, 3132-II, 3232-III as area B).

The minor order leveling of 179 km of the existing leveling route and 144 km of new leveling route were measured for aerial triangulation of digital plotting and editing at scale of 1:50,000 using the aerial photographs covering Area A.

Field identification of 14,600sq.km was carried out for digital plotting and editing at scale of 1:50,000 using aerial photographs and using satellite images covering area.

Technology transfer through OJT was conducted on control point survey, minor order leveling and field identification in the field in accordance with the Draft Technical Specifications under supervision of the JICA Study Team. Twenty NAMRIA engineers (counterparts) in total were attended on the field works.

### **3-4 Pilot Project II and III (Technical Transfer and Work in Japan)**

The Pilot Project II and III were carried out in Japan and through OJT in accordance with the Draft Technical Specifications under supervision of the JICA Study Team from November 2006 to December, 2006.

The GPS survey by the static method for nine control points at the Mount Pinatubo and mountainous area of Bulacan province of Area A were carried out by a local contractor; CERTEZA Infosys Co., in accordance with the terms, conditions, requirement of the Contract and Technical Specifications under supervision of the JICA Study Team from 18 December, 2006 to the end of January, 2007.

Digital plotting and editing at scale of 1:50,000 using single satellite images was conducted in accordance with the technological verification plan using six scenes of SPOT Imagery (Pan Sharpen), results of GPS survey, leveling and field identification, SRTM (three-second-mesh data), digitized contour line data digitized of the existing topographic maps for Area B. The works consist of acquisition of satellite images, rectification of satellite images, preparation of orthophotos, digital plotting, digital editing and field compilation.

Digital plotting and editing at scale of 1:50,000 using aerial photographs was conducted in accordance with the technological verification plan using 647 aerial photographs. The works consist of acquisition of aerial photographs images, aerial triangulation, digital plotting, digital editing and field compilation.

The Study Team conducted the printing data preparation work and printing film in the process of topographic printing work. The printing of topographic maps were conducted by NAMRIA.

The technology transfer through OJT was conducted on the field compilation in the field in accordance with the Draft Technical Specifications and under supervision of the JICA Study Team. Basic training of aerial triangulation, digital plotting and editing, digital map symbolization and satellite image processing by the JICA Study Team using the training manuals were conducted during the period from June 12, 2007 to October 10, 2007. Forty-two NAMRIA engineers (counterparts) in total attended the field works.

The Study Team has conducted the basic training of aerial triangulation, digital plotting and editing, digital map symbolization and satellite image processing using the digital photogrammetry system; digitizing and editing system; and the printing system provide by JICA. The training sessions were conducted from February 1, 2007 to September 27, 2007. The courses of the training with instructor and number of attendance are: 1) Basic Training Course in Digital Photogrammetry on SOCET SET version 5.3 (No. of attendance of counterpart: 6 engineers); 2) Basic Training Course in Digital Map Editing by Auto CAD version 2008 (No. of attendance of counterpart: 1 engineer); 3) Basic Training Course in Digital Map symbolization by Adobe Illustrator CS2 (No. of attendance of counterpart: 4 engineers); and 4) Basic Training Course in Image Processing using ERDAS Imagine (No. of attendance of counterpart: 4 engineers).

The Study Team had prepared the Draft Technical Specifications, and the Pilot Projects were conducted. According to the work processes for technology transfer technical issues of the counterpart personnel were identified and listed during the Pilot Project. The essence of the issues identified was used to revise the Draft Technical Specifications and used inputs for human resource development programming.

The data creation and editing system was installed in one of the rooms in NAMRIA to conduct the technology transfer sessions. The equipment and software installed and used for the technology transfer were ArcGIS 9.2 (ArcView), AutoDesk Map 3D, AutoDesk Raster Design 2008, Adobe Photoshop CS2, Adobe Illustrator CS2, Map Publisher, ERDAS Imagine 9.1 and SOCET SET 5.3.

During the Pilot Projects, the Study Team identified technical issues based on the Specifications for Topographic Mapping (Draft). The Study Team revised the Specifications based on the results of the analysis; the results are also used for preparation of training program in the human resource development plan.

### **3-5 Technical Coordinating Committee**

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The Technical Coordinating Committee (TCC) was formed on March 14, 2006 when the Study was commenced. The function of TCC was to support the local operations of the Study.

On July 5, 2007, the Study Team notified the commencement of field work in the Region I to TCC and requested cooperation. TCC responding to the request from the Study Team submitted required information for field identification. TCC also inspected the preliminary maps on annotations and planimetric features. The inspection work was completed at the end of July 2007.

On August 15, 2007, the Study Team started the field work in Region III. The Study Team with the staff from NAMRIA requested coordination and cooperation from TCC. In the Region III, TCC inspected preliminary maps on annotations and planimetric features. The inspection lasted about a month.

The Mines and Geosciences Bureau offered office space; the region offices of NEDA and DPWS mainly worked on infrastructure information, while the city and provincial development offices have worked on annotations and other planimetric features.

### **3-6 Examination of Mapping Methods**

#### **3-6-1 Mapping Methods for Accuracy Inspection**

The Study Team conducted accuracy inspection of mapping methods in the Pilot Projects: using aerial photography, single SPOT5 satellite imagery and stereo-pair-SPOT5 imagery; and by comparative analysis and evaluation of coordinate and elevation data in the newly prepared 1:50,000 topographic maps and existing maps. The area of the comparative study of coordinate and elevation data is in the Pilot Project area.

#### **3-6-2 Comparative Analysis of Coordinates (Aerial Photography and Single SPOT5 Imagery)**

Comparative analysis of coordinates was implemented to cover the 1:50,000 topographic map Sheet No. 3130 I according to the technical verification plan of the Study. Measurement of coordinates was done at the points, which could be clearly identified in 1:50,000 topographic data created by aerial photography and 1:50,000 topographic data created by single SPOT5 imagery, such as at road intersections, bridges, road transition points. Sixty-seven control points were selected and data on coordinates were compared, based on assumption that horizontal coordinates in the 1:50,000 topographic data created by aerial photography are absolutely correct.

**Table 3-3 Horizontal Coordinate Data Comparison**

	1:50,000 Topographic Map Data by Aerial Photographs and Single Satellite SPOT5 Images
No. of points compared	67 points
Average discrepancy	4.2 m
Max. discrepancy	14.1 m

The same control points were used for aerial triangulation for preparation of 1:50,000 topographic maps by aerial photographs and single satellite images. The residuals of the common control points used by aerial triangulation were compared to verify accuracy of horizontal coordinates:

The result of accuracy verification demonstrated that residuals of control point aerial triangulation by aerial photographs were within 0.02% (1.2m) of flying height above ground (6,000m) in standard deviation of horizontal coordinates. This falls into the limit value (tolerance level) of control point residual in single block, as prescribed in operation standard of aerial triangulation in the Draft Technical Specifications prepared by the Study Team.

#### **3-6-3 Comparative Analysis of Elevations (Aerial Photography, Existing Maps and Stereo SPOT5 Imagery)**

Comparative analysis of elevations was conducted in the area covering mainly two 1:50,000 topographic maps – Sheet No. 3131 III and adjoining 3131 II – as the targeted area for technical verification of the Study, by selecting points where stereo SPOT5 imagery is clear and not interrupted with clouds. Data compared were 20-meter DEM digitalized from contour lines and spot heights in the existing 1:50,000 topographic maps, 20-meter DEM extracted from contour lines and spot heights of aerial 1:50,000 topographic data, and 20-meter DEM extracted from contour lines and spot heights of stereo satellite 1:50,000 topographic map data.

Table 3-4 DEM Data Comparison

	1:50,000 Topographic Map Data by Aerial Photographs and Existing 1:50,000 Topographic Map Data (m)	1:50,000 Topographic Map Data by Aerial Photographs and by Single SPOT5 Images (m)
DEM grid interval	20m	
No. points compared	Approximately 540,000 points	
Average discrepancy	7m	2m
Max. discrepancy	64 m	35 m

The results of data comparison of horizontal positions showed that the average-error of scale 1:50,000 topographic-map data and scale 1:50,000 existing-map data created with the aerial photograph had an average error of 25.4 m; roads other than arterial roads had the maximum error of 94.7m. There are areas with high error values in the topographic maps. The errors were generated probably because: the existing topographic maps were prepared using the analogue method; the topographic maps using aerial photographs used the current digital technology; and there are discrepancies in the Specifications of topographic maps.

### 3-6-4 Evaluation

As described above, the residuals of control point aerial triangulation by single SPOT5 images with resolution of 2.5m/pixel (SPOT5) turned out to be 6.4m in standard deviation of horizontal coordinates. However, the Draft Technical Specifications prepared by the Study Team do not prescribe operation standard (tolerance level of control point residuals) of aerial triangulation by satellite images. The Study Team, therefore, based on the prescription in the Draft Technical Specifications about horizontal coordinate accuracy of planimetric features on 1:50,000 topographic maps, defined as 0.5mm ( $\pm 25$ m), and considered that the 1:50,000 topographic map data by single SPOT5 images have sufficient horizontal coordinate accuracy. The Study Team recommends NAMRIA, therefore, to adopt the topographic mapping method through obtaining planimetric data from single SPOT5 images for the Nationwide Deployment Plan to update 1:50,000 topographic maps.

As for elevations, the maximum discrepancy between 20-meter DEM of 1:50,000 topographic maps prepared from aerial photography and 20-meter DEM of the existing 1:50,000 topographic maps resulted in 64m, with the average discrepancy of 7m. The maximum discrepancy in 20-meter DEM of 1:50,000 topographic maps prepared from stereo SPOT5 imagery was 35m with the average discrepancy of 2m. Both methods did not meet the Draft Technical Specifications which requires accuracy for contour lines and spot heights as 1/2 of contour interval (not more than  $\pm 10$ m) for contour lines and 1/3 of contour interval (not more than  $\pm 7$ m) for spot heights.

## 3-7 Technical Training Needs Assessment

### 3-7-1 Technical and Managerial Level

The Study Team has categorized the individual technical and managerial capacity levels for implementation of Nationwide Deployment of topographic maps into three categories: A, B, and C.

#### A (Chief Engineer)

Staff in this category shall be able to survey plans, prepare technical specifications, estimate costs, manage processes, and manage quality.

#### B (Engineer)

Staff in this category shall be able to conduct overall survey works based on plans and technical specifications and progress management.

C (Assistant Engineer)

Engineering capacity required for this category of staff is to assist B (Engineer).

In light of these criteria for technical and managerial capabilities and the positions required by the JICA Study Team, the technical and managerial capacities of the staff of Cartography and Photogrammetry Divisions for Nationwide Deployment of 1:50,000 topographic maps were identified through OJTs during the Pilot Projects as follows:

**Table 3-5 Technical and Managerial Capacity Level Necessary for Nationwide Deployment of 1:50,000 Topographic Maps**

Technical and Managerial Capacity Level	Major responsibilities and tasks in charge
A	<ul style="list-style-type: none"> <li>To assume the leadership of Division and manage its activities and functions</li> <li>Production management</li> <li>Quality control</li> <li>Coordination with other departments and divisions</li> <li>Improvement of current situations by reviewing existing methods</li> <li>Technical implementation management and administration</li> </ul>
B	<ul style="list-style-type: none"> <li>General production control. Coordination with other divisions. Control over editing works.</li> <li>Assistance in work planning, adjustment controls</li> <li>Assistance in work planning, collection and organization of information for works</li> </ul>
C	<ul style="list-style-type: none"> <li>Control over subordinates in plotting works</li> <li>Self quality check before reporting to superiors</li> <li>Self quality check, general works in the group</li> <li>General works in topographical and thematic maps</li> </ul>

**3-7-2 Technical Needs Assessment**

Base on the technical and managerial levels described, the Study Team has identified technical needs and directions during the Pilot Projects. Overall, the cartography has weak capacity level. In the process of field identification, control point survey, digital plotting and editing, self-examination of outputs are weak; the processes are vaguely understood. The level B staff has problems on quality control. The level A staff, there are problems regarding improvement of overall quality control.

**Table 3-6 Technical Directions for Organizational and Human Resource Development**

Process	Issues	Direction	Division	Technical/ Managerial Capacity Level
Field Operation Planning	Lack understanding in flight planning	The theory and principle of photography time and landform conditions, and the interpretation capacity of specification are to be raised.	Aerial Survey Division	B, A
	Insufficient preparation on equipment usage	Establishing preparation procedure with recording rules on equipment usage	Aerial Survey Division , Photogrammetry Division	C
	Lack of the attainment nature which took the local landform into consideration in photo-control-point site planning, and rational arrangement knowledge	It is necessary to make knowledge and basic business of the contents of field work of a photo control point surveying master.	Aerial Survey Division , Photogrammetry Division	B
Control Point Survey	Observation of GPS is not performed intentionally but effectiveness is bad.	An understanding of the methodology of an observation plan, acquisition of an actual plan-preparation technique	Photogrammetry Division (Aerial Survey Division )	B, A



Process	Issues	Direction	Division	Technical/ Managerial Capacity Level
(A photo control point surveying, leveling)	Processing of observational data and inspection of a result are not made, but there is much re-survey.	The technical specification and training manual for recognition of the necessity for fulfilling a specification and the improvement in degree of comprehension are fixed.	Aerial Survey Division	B, A
	Scrupulous [ such as creating the list of outputs ] is missing.	The judgment of baseline analysis output cannot be performed.		Level B
	The observation result file is not created.	It is necessary to study the meaning of result file creation as adjustment of a result, contents, and an approach.	Photogrammetry Division	Level C
Field identification	The reference material carried there cannot be preparing within the date.	It is necessary to study how to construct the appearance provision finished intentionally beforehand for a local reference material and a preliminary photo interpretation.	Photogrammetry Division Cartography Division	Level C
	The association to consecutiveness work is not recognized but arrangement of local data is inadequate.	Since the leakage of a field identification and recognition of inspection of quality are sweet, accumulation of these improvement in consciousness and experience is a subject.	Photogrammetry Division Cartography Division	Level C
Aerial triangulation	There are many defects in a preliminary step and the relation between a photography specification and a workload is not understood.	Manual preparation of the principle of an aerial triangulation, and an execution procedure. Exact knowledge acquisition of a required reference material	Photogrammetry Division Cartography Division	Level B
	In standardization work, an index may not look clear. (A scan is imperfect)	Upgrading of the scanning data of an original image, experience accumulation		
	In image-coordinate measurement work, it is an observation mistake in planimetric-feature decipherment difficult parts, such as a forest.	Examination of input data is included and they are the improvement in skill for the improvement in a precision of observation, and the complement of knowledge.	Photogrammetry Division Cartography Division	C, B
	The system of calculation and accuracy inspection is not established.	Theory of accuracy management, and thoroughness of a business manual	Photogrammetry Division Cartography Division	C
	There is no conduct on preparation of output lists.	Improvement in the processing technique as an output by preparation of a result book	Photogrammetry Division Cartography Division	C
Digital Plotting	A person in charge is not assigned in planimetric-feature data acquisition.	Stuffing for deepening specialty nature is introduced.	Photogrammetry Division Cartography Division	C
	In planimetric-feature data acquisition, it cannot perform seeing a planimetric feature by three dimensions well. Moreover, a diagrammatic understanding is inadequate.	A 3-dimensional stereoscopy needs an exact understanding of a symbol required for plotting work, and to be improvement in technical trained.	Photogrammetry Division	C
	The person in charge is not decided in acquisition of topographical data.	Stuffing for deepening specialty nature is introduced.	Photogrammetry Division	C
	In an inspection process, a diagrammatic understanding is inadequate and the principle of 1:50,000 is unfamiliar.	It is necessary to become skilled in the fundamental knowledge of the symbol of 1:50,000, and the criteria of application.	Photogrammetry Division	C
	The inspection paper (plotting map) arrangement which is the result of plotting data is not made enough.	The check function of the list of plotting results and inspection paper is systematized. Moreover, the evaluation system of a result is established.		B
	In plotting data file creation, the data origination in a sheet unit is unripe (a clearance produces).	Data origination is carried out not only in the plotting of a model unit but in a sheet unit, and feedback of result data is routinized.	Photogrammetry Division	B
Digital Compilation	A person in charge is not assigned in the input of plotting data.	Stuffing for deepening specialist nature is introduced.	Photogrammetry Division	C

Process	Issues	Direction	Division	Technical/ Managerial Capacity Level
	In the cleaning process of data, the theory of topology and the reflection to work are mismatches in many cases.	The essence of a landform database, the configuration of data, a layer, and its principle are systematically familiarity-put into practice.	Photogrammetry Division	C
	The additional leakage of local supplement data etc. is not checked in the case of an annotation of topographical data.	An inspection system is established while mastering systematically the procedure of an exact understanding of the process of a digital editing, and implementation.	Photogrammetry Division Cartography Division	C
	In the annotation data addition process, preparation of creation of annotation data etc. is inadequate in advance.	The procedure of an exact understanding of the process of a digital editing and implementation is mastered systematically.	Photogrammetry Division Cartography Division	C
	Understanding of technique runs short in the creation phase of polygon data; polygon data include errors.	Fundamental understanding of a polygon, and acquisition of the practical application technique	Photogrammetry Division Cartography Division	C
	There is no conducts on preparation of the list of outputs.	The system with the list work rule of a plotting result and Spec compared and evaluated is built with stuffing.	Photogrammetry Division Cartography Division	B
Field completion	The preliminary step of a preliminary photo interpretation is inadequate. Moreover, the defect of a reference material is accepted.	Manual maintenance and an understanding of a preliminary operation The meaning of a preliminary photo interpretation, point familiarity	Photogrammetry Division Cartography Division	C
	In an execution of a field completion, a map cannot be read well (its position cannot be recognized in many cases).	Training in fundamentals of a map, a symbol, and a correspondence technique with a spot is continued.	Photogrammetry Division	C
	Arrangement of a field-completion result is not used.	An understanding of the meaning of a field-completion result and the directions in indoor work is deepened.	Photogrammetry Division Cartography Division	C
Printing	Treatment of digital data is not procedure-ized in a preliminary step.	Acquisition of the required knowledge for digital data handling	Printing Division	C
	At a symbol-ized process, a soft use experience is shallow and required knowledge and skill are not equipped.	Accumulation of experience with symbolization software is a pressing subject.	Printing Division , Cartography Division (Photogrammetry Division)	C
	In creation of a platemaking film, since the imagesetter is not introduced, it depends outside.	Maintenance of the work manual by introduction of an imagesetter	Printing Division	C, B
	Increase in efficiency of a galley proof	Reexamination of the conventional work	Printing Division	C
	In inspection and correction, it depends on experience, and routine-ization is not carried out.	Maintenance of the inspection manual of completion and the correction approach of digital data are mastered themselves.	Cartography Division	C, B
	Printing Implementation	The quality control system of a printed map is established.	Cartography Division	A
Quality control of a result	The system of inspection of a result, accuracy management, and quality evaluation is not established on the way from a local survey data to a plotting, edit, and printing data origination.	It is a subject to study reconstruction of the work of each division, the necessity for quality control, and the theory, and to build the evaluation system of a result.	All sections,	Manager room A

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## **CHAPTER 4 SUSTAINABLE MAP REVISION PLAN FOR 1:50,000 TOPOGRAPHIC MAPS**

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### **4-1 Preparatory Work**

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The Sustainable Revision Plan for 1:50,000 Topographic Maps is composed of the Capacity Development Plan and the Nationwide Deployment Plan. The Capacity Development Plan includes Institutional/Social Capacity Development, Organizational Development, Human Resource Development, and Promotion.

The Nationwide Deployment Plan is the final output of the Sustainable Map Revision Plan. The Specifications, the results of the Pilot Projects, the technical examination of revision methods, topographic database that were produced in the process, and the Capacity Development Plan are all input to the Nationwide Deployment Plan.

### **4-2 Capacity Development Plan**

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The capacity development plan has three components: Institution; organization; and individual. The important concept is a holistic approach and ownership. The holistic approach means to consider institutional/societal aspects into consideration in the capacity development plan. The Study Team has studied the institutional aspects intensively as included in Chapter 2. The institutional has incorporated to the strategic direction of the capacity development plan which is the basis of the organizational development plan and the human resource development plan. The ownership lays more in the process of plan making. In this Study, the Pilot Projects (Technology Transfer), PCM, preparation of the Specifications were the aspects to encourage ownership of the plans and the various outputs produced through the courses of the Study. At the time of the writing the Draft Final Report, the Specifications were being revised by the division chiefs; technology transferred was used in the process of map symbolization and in other processes. The nationwide deployment plan has been prepared rather independently to become the condition or goal for organizational and human resource development.

Three institutional/social issues can be raised regarding topographic mapping in NAMRIA: labor market; copyright; and rationalization. The labor market in the Philippines is an export oriented labor market; skilled workers are trained and experienced in the Philippines and work overseas. Unless the fundamental labor market structure is changed, skilled geodetic engineers or photogrammetrists will not remain in NAMRIA unless competitive salaries are paid to the skill workers. Copyright tends to be less protective in the Philippines; unless copyright is protected, it is very hard to sell maps especially map related products in a digital form. Rationalization is a national agenda. How to reduce government employees is hard to discuss even among politicians. It would be hard to formulate a plan to reduce the number of staffs among themselves in the public sector. Under the circumstances, basic policy measures for NAMRIA are: to make training efficient; to research and formulate licensing schemes; and to retrain existing staffs to adapt to new technologies.

### **4-3 Institutional/Social Capacity Development Plan**

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The institutional/social capacity development with regard to the survey and mapping industry can be positioned from three perspectives by three major entities. Data, people (human resources) and technology are inter-related to the three entities of the public sector, private sector including professional organizations, and educational institutions.

The public sector includes the central government agencies and LGUs. They are the major users of 1:50,000 topographic maps. As some of the agencies are preparing their own thematic maps, they can be considered as data producers. Human resources may be exchanged among the central government agencies. They are the user of technology developed by the private sector or educational institutions.

The private sector/professional organizations are the users of the topographic maps; the role of technology provider is relatively high. The private sector can be considered as human resource users from the point of NAMRIA. An interview survey suggests that one career path for geodetic engineer is to have some experiences in NAMRIA and move to a private sector seeking higher salaries.

The educational institutions are general human resource providers. Geodetic engineers or other remote sensing specialists receive professional education in institutions of higher learning. When research functions of educational institutes are considered, they can be considered as the technology provider for NAMRIA. As for elementary and secondary schools, they are data users (map users) that have potential to provide human resources to NAMRIA. Educating students are to raise promotional aspect topographic mapping and at the same time to raise the level of potential human resources for NAMRIA.

The positions of institutions and the Study with regard to the three elements, data, human resource, and technologies, were identified. What NAMRIA needs to do is to take leadership in institutional/social endeavor. Institutional/social capacity development are to collaborate and lead other institutions to raise overall capacities of the survey and mapping industry in the Philippines with the focus of topographic mapping.

#### **4-3-1 Data Creation and Usage**

The Information Management Department is the leading agency in the NSDI project. The Department shall take leadership in preparing the specifications other than the Specifications for 1:50,000 Topographic Maps. The draft of the GIS standards shall be prepared in the department as soon as possible. The specifications shall be used by the LGUs for preparing land use plans and physical framework plans. The data exchange standards shall be backed by the data exchange infrastructure being implemented as in the broadband internet connection. By the time internet connections will have reached to remote areas in the Philippines, the spatial standards need to be ready and used by all the government agencies and the LGUs.

The proposed Research and Development Section shall continue researching, examining and using privately available data. The SPOT satellite images are already in use; other high-resolution satellite images are available. The private sector will be providing higher resolution satellite images and weather free data such as in the IFSAR data. The technology in the field of survey and mapping including remotes sensing is very rapid. The proposed Research and Development Section shall find the best and appropriate technologies for producing 1:50,000 topographic data and data in other scales.

The Information Services Division in the Information Management Department shall study possibilities of developing data to be used for educational purposes. The Map Sale Office shall study and plan different pricing scheme for educational users of the data.

#### **4-3-2 Human Resource**

The proposed Human Resource Management Section shall conduct a human resource exchange program with the government agencies. The proposed Human Resource Management Section shall

plan an internship and scholarship program for potential engineers from the institutes of higher learning to secure human resource in advance.

The proposed Human Resource Management Section shall start an instructor registration program as soon as possible as collaborating with the education sector. Instructors in vocational schools are also potential instructors for the human resource development plan proposed in this Study.

The proposed Human Resource Development Section shall start a professional registration program as collaborating with survey and mapping companies in the Philippines.

The proposed Human Resource Development Section shall plan a nationwide certificate program in collaboration with representatives from professional associations in the Philippines. Geodetic engineers shall be more motivated by such certificate program when they are to be established. The certificate program shall include each software used in the process of 1:50,000 topographic mapping. Remote sensing work shall be included in such certificate programs.

### **4-3-3 Technology**

The proposed Research and Development Section in collaboration with the Information Management Department shall study all the technologies available and development in the government agencies in the Philippines. The Research and Development Section shall select advanced methods of mapping, including thematic mapping, in other agencies when they are available. The Research and Development Section shall organize a seminar on the selected advanced technologies and award annually to encourage the staffs in NAMRIA.

The Research and Development Section shall hold seminar and workshops outside of NAMRIA to raise awareness and availability of data and technology associated to data creation.

The Research and Development Section shall produce a collaborative technological research project with institutes of higher learning. Such technology shall not be limited to survey and mapping or remote sensing. They shall include operation management, quality control, human resource management or others.

As discussed, the advancement of technologies is very rapid. Such advanced technologies are generally available in the private sector. The proposed Research and Development Section shall assign a personnel for research and testing advanced technologies that will foster increasing capabilities of units of organizations in NAMRIA. The areas of research are in new software or new versions of available application software used in map related data creations. The research shall include not only the production technologies; it shall include management technologies.

## **4-4 Organizational Development (Mapping Department) Plan**

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The fundamental direction of the organization shall follow the national policy of rationalization. The organization shall raise the function of production management than in actual production itself. In this regard, production management, especially quality control, becomes significant; human resources to handle the tasks will become necessary.

What needs to be kept in NAMRIA is the research and development function. NAMRIA shall possess and develop the latest technologies for survey and mapping--remote sensing and GIS are also significant technologies to maintain and develop. The knowledge base shall have the central function that provides standards and specifications on all the aspects on survey and mapping. As NAMRIA aims to become an research institute while maintaining a fundamental functions of map revisions, human resource development functions become significant, since NAMRIA will attract researchers and academics from educational institutions.

As an organization, it needs to provide continuous at the same time efficient training for skilled staffs, since the retention level will not be raised in a certain period of time. Seminar/workshop type of training with instructors were effective, but e-learning shall be more efficient as far as long-term cost and benefit are taken into consideration.

The four divisions, under the rationalization policy, shall aim to do things more and faster with given resources. The current structure of Photogrammetry and Cartography may not be ideal separation, for their activities are similar except for the scale of maps they are dealing.

To strengthen the organizational structure, the Study Team proposes three new sections directly within the Mapping Department: Quality Control and Data Management; Human Resource Management; and Research and Development. The functions of the three sections are discussed in the organizational development plan.

Acknowledging a person's achievement motivates the staffs. At the completion of the course or expert training on software, a certificate shall be issued. The certificates shall become mile stones for individuals. The division chiefs and assigned instructor chiefs for the courses shall encourage the staff to acquire necessary skills of their work and to encourage competition among the staffs. The training records shall be written onto the Personal Data Sheet; it is the fundamental source of information for promotion. Linking the human resource development program to the personnel system can simply be achieved using the existing system of promotion--when the rationalization plan will have been approved.

Data management is a fundamental in the digital age of mapping. Necessary systems shall be developed with qualified individuals who manage data and information. As well as the physical data for topographic mapping, memos and instructions shall be managed efficiently. The Information Department has been providing various systems internally in NAMRIA; it shall have total data management system with a holistic view. System analysis for all the department and sections will be necessary for small system development plans may not have effective results.

The basic policies of the Mapping Department are to become the highest research and development section in terms of mapping in the Philippines; to raise quality and efficiency of mapping; to develop human resources. To achieve these ends, organizational strengthening will be required. The new sections proposed are: research and development section; and quality control and data management section; human resource management section. All sections are proposed to be placed under the Office of Director.

The lateral coordination between the Photogrammetry and Cartography Division will be required for functional integration. To maintain technological competence and to conduct the sustainable map revision work, continuous human resource development shall be required. To assure quality and efficiency with qualified personnel, administrative and operational system tools will have to be developed.

For efficient operation enhancement, operational tools were proposed: the time management system; map management system; quality control tables; and file management system.

#### **4-5 Human Resource Development Plan**

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The individual capacity development can be achieved through the human resource development plan. Expert training shall be provided to seek higher career paths in NAMRIA. Also, as mentioned in the organizational capacity development, research and development functions of NAMRIA shall attract higher skilled individuals from outside even without offering higher salaries. The research and development function of NAMRIA is significant in this respect. The personal appraisal system, which emphasizes less in technical aspects, shall be reviewed to reflect objective skills levels of individuals. For this purpose, training skill levels needs to be measured periodically by an independent section in NAMRIA.

The basic policies are to raise technical skills on the issues identified in the Pilot Projects and to develop sufficient skill pool to meet the Sustainable Map Revision Plan (Phase II) proposed in the nationwide deployment plan.

The methods of providing the programs are: OJT and hands-on-session; seminars and workshops, and self-learning. Instructors shall be both internal and external. Senior engineers shall take a role of an instructor in NAMRIA. The external instructors are academics in the Philippines and from overseas.

The targets are classified into three groups: Level A, Level B, and Level C in the same way used in the technological capacity assessment section. Level A includes Engineer V-IV and Cartographer IV; Level B includes Engineer III-II and Cartographer IV; Level C includes Engineer II-I, Cartographer IV-I, Photographer III, Photo Lab Technician II, Photographic Processor.

The required staffs for the sustainable map revision are: Level A, 7 staffs; Level B, 22 staffs; Level C, 8 staffs. As stated in Chapter 2, the total number of Level C staffs in the Mapping Department is 61 persons; 59 persons will have to be assigned to sections other than the sustainable revision of 1:50,000 topographic maps.

Training materials such as the Specifications and manuals were developed by the Study Team; others need to be developed under the leadership of the proposed Human Resource Development Section.

All the courses are targeted according to the three levels disregarding the positions for flexibility. The course names, targets, and pre-requisites are summarized in the following table.

Table 4-1 Courses, Targets, and Methods

Course Name	Target	Method	Prerequisite
Technical Training I	C	OJT/Hands-on	
Technical Training II	B	OJT/Hands-on	Technical Training I
Management Training I	B	Seminar/Workshop	Management Training I
Management Training II	A	Seminar/Workshop	
Quality Control I	C	Seminar/Workshop	Specifications
Quality Control II	B	Seminar/Workshop	Quality Control I
Specification	C	Seminar/Workshop	Administration Basic
Administration Basics	C	Seminar/Workshop	
E-Learning (Internet)	C	Self-Learning	
E-Learning (Intranet I)	C	Self-Learning	
E-Learning (Intranet II)	B	Self-Learning	E-Learning (Intranet I)
E-Learning (Intranet III)	A	Self-Learning	E-Learning (Intranet II)

The training need assessment shall be conducted through dialogue: Supervisors assess their operators' training needs; Division chiefs assess the supervisors' training needs; The assistant director assesses the training needs of the division chiefs. All the training needs assessment sheets are stored and managed by the Officer in Charge for Human Resource Development.

For evaluation and assessment, all the staffs in the Mapping Department, the individual training needs assessment shall be conducted. The assessment sheet shall be filled initially by an individual and then it is to be approved by the division chiefs. After a staff participated a training session, the training management sheet shall be recorded by the officer in charge of human resource development.

The human resource development program needs to be reviewed annually after measuring the effectiveness of OJT, seminar/workshop, and self-study. As stated the human resource development program needs to be reviewed annually by evaluating the effectiveness of subjects to be learned. The program needs to be in line with the needs derived from the staffs and the strategies of the revising the topographic maps at a scale of 1:50,000.

The human resource development includes the feedback process. The subjects to be learned and scheduling shall be reviewed annually at the beginning of a fiscal year to renew an annual human resource development program. The monitoring and evaluation process is also included so that the results of OJT and seminars will be fed back to the manager of the human resource development program to re-evaluate the subjects and instructors.

The officer in charge for human resource development shall have the following duties: 1) Formulation of an annual implementation program including securing budget; 2) Selection of trainers and lecturers for each curriculum; 3) Arrangement of seminar/lecture rooms and required materials such as projector, screen, markers, etc.; 4) Notification of the program to the staffs; 5) Administration of the training assessment sheets; 6) Administration of the training records; 7) Preparation of an

annual accomplishment report; 8) Annual implementation programming; 9) Developing and updating teaching materials; and 10) Developing and updating teachers' manuals.

The training program needs to be linked to promotion to encourage the staffs to attend the courses. For this purpose, a certificate system is proposed. When a staff completes a course, a certificate shall be issued by the OIC of human resource development. The title of the certificate shall be recorded to the Personal Data Sheet. The hierarchically designed courses encourage the staffs to take part in the courses.

NAMRIA has internal instructors. Generally, the division chiefs are the Resource of human resource development include academics and trainers from software vendors. Also, to keep the program sustainable, a trainer training will be necessary.

The training or teaching manuals shall be maintained by each division. Whenever necessity arises, the current operation manuals shall be updated. For each manual, a responsible individual shall be assigned, the contents shall be updated.

The finance and logistics shall include the cost of developing software operation manuals, training manuals (textbook), trainer-training manuals, costs of conducting seminars and others.

#### **4-6 Promotion Plan**

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All the sale information are recorded. The client information has not been used to the maximum extent. Demand creation plan to promote current products needs to be refined according to the targets. The demand of maps are shifting more and more towards digital products as the central government agencies and local government units will develop their own GIS systems. In order to meet the demand for digital projects, the Mapping Department needs to accelerate updating the topographic data, for out dated data will not meet the demand. Copyright is the issue of selling digital products. A licensing scheme shall be explored in the proposed Research and Development Section in the Mapping Department to realize installation of 1:50,000 topographic maps in a digital format to all the local government units as well as to all the central government agencies.

Before conducting any promotional activities, a marketing study needs to be conducted. The Information Management Department shall lead in this work to identify appropriate targets, products, appropriate prices. The targets are classified into public, private and education. For each targets, products shall be promoted. Lower prices could be set for educational institutions, academics and students. When revised, old versions of topographic maps could be sold at a lower price also.

Digital products shall be licensed to protect copyrights of mapping products. With the HLURB's GIS promotion scheme to the LGUs, demand of digital version, especially vector data, will be expanded. The schemes proposed are: legal study for licensing; privatization of map sales; and product registration.

In a private marketing scheme, branding is a key concept of selling. NAMRIA's image as technological center shall be enhanced through exhibitions; geography or map knowledge contests; and free promotional DVD distribution.

#### **4-7 The Specifications for Topographic Mapping at Scale of 1:50,000**

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Upon preparing the Specifications for Topographic Maps, the JICA's overseas survey and mapping standards created using the standards from the Geographical Survey Institute, were reviewed. And based on the JICA's overseas' specifications, the Study Team prepared draft specifications. The Technical Working Group reviewed the Specifications and the Manual for Orthophotograph Creation.

At the beginning of the Study, the product standards were presented. NAMRIA requested the revised the Standards to the process standards. The Study Team, with the request from NAMRIA, has prepared the process specifications. Since the Cartography Division initiated its own ortho-photo creation, the division chief requested strongly that the ortho-photo manual or specifications be included to the Specification. The Study Team acknowledge the request and prepared the



ortho-photo preparation manual as a part of the draft Specifications. The NAMRIA side accepted the Specifications and began a reviewing procedure in the Technical Working Group.

## **4-8 Nationwide Deployment Plan**

### **4-8-1 Preparation of Cost Estimate Material**

#### **(1) SPOT5 Imagery and Contour Data**

The Study Team came to a conclusion as the result of technical evaluation of the Pilot Projects (Section 3-5-5) that SPOT5 images have sufficient accuracy and can be used for 1:50,000 topographic mapping. In addition, NAMRIA already acquired SPOT5 images to cover 70% of whole the Philippines for preparation of the base maps for the geo-hazard mapping project. The Study Team, therefore, recommends to adopt the topographic mapping method through obtaining planimetric data from single SPOT5 images for the Nationwide Deployment Plan to update 1:50,000 topographic maps, and the cost of SPOT5 images already acquired is treated as a sunk cost and will be deducted from the total cost calculation.

Meanwhile, as the result of the technical evaluation of the Pilot Projects in Section 3-5-5, accuracy of contour lines and spot heights of existing 1:50,000 topographic maps did not satisfy the Draft Technical Specifications. However, 70% of contour data processed and digitalized from existing 1:50,000 topographic maps are already acquired by NAMRIA. The Study Team, therefore, recommends, though having significant errors in contour data in mountainous areas, in the light of cost and period for NAMRIA, to utilize the digitalized data processed from existing 1:50,000 topographic maps for further nationwide deployment of 1:50,000 topographic maps. The contour and spot height data already acquired will also be deducted from the total cost calculation.

#### **(2) Preparation of Cost Estimate Materials**

The Pilot Projects compared and verified technologies to be adopted for 1:50,000 topographic maps (method, accuracy, cost, work period, resource). For the cost, time, and resource comparison, the data (required days and persons) by work items were extracted.

During the Pilot Projects, the existing contour data were edited. The Study Team confirmed that the contour digitizing work period for an existing map sheet is twelve days on the average; the longest case was 36 days.

The data for days required by work items and the grades using the aerial photograph method and single-satellite image are used for the comparative analysis of cost and work period per sheet and engineers and equipment required for the nationwide deployment plan. As for the percentage changes on the plotting editing works and the required days per work item, the Study Team derived the figures from the results of OJT on plotting and editing and the verification (comparison of vertical elements) using the stereo satellite images.

### **4-8-2 Nationwide Deployment**

The Nationwide Map Revision Plan has two phases: the capacity development phase (Phase I) and the Sustainable Map Revision Phase (Phase II). The scenarios set for evaluation were: NAMRIA conducts all the topographic mapping work; NAMRIA and the private sector conducts the work; and all the work are conducted by the private sector. Initially, the implementation periods of five, ten and fifteen years were simulated. The method factors studied were: aerial photographs; single-satellite images; and stereo satellite images.

The Study Team has developed a database containing all the 653 maps sheet including the attribute data on planimetric density and contour density. The results of the densities and the work days derived from the Pilot Projects are used to estimate days required for revising topographic maps per sheet.

The results of the time, resource, and cost calculation by the method are summarized in the following table:

**Table 4-2 Summary of Results of Time/Resource/Cost Calculations**

	Single Spot	StereoSpot	AerialPhoto
Total Work Days	44,509	61,984	67,613
Total Work Years	142.66	198.67	216.71
Work Days/Sheet	68.16	94.92	103.54
Engr A Total Mandays	11,322	15,389	16,713
Engr B Total Mandays	44,509	61,984	67,613
Engr C Total Mandays	11,734	18,828	22,160
Engr A Mandays/sheet	17	24	26
Engr B Mandays/sheet	68	95	104
Engr C Mandays/sheet	18	29	34
NAMRIA Total Cost	PHP 446,429,450	PHP 890,815,431	PHP 1,187,210,642
NAMRIA Cost/Sheet	PHP 683,659	PHP 1,364,189	PHP 1,818,087
Private Total Cost	PHP 703,628,532	PHP 1,320,354,117	PHP 1,694,914,007
Private Cost/Sheet	PHP 1,077,532	PHP 2,021,982	PHP 2,595,580

The Study Team prepared the cost estimation by the methods of utilizing aerial photographs, single-satellite images, and stereo-satellite images. The results of the Pilot Projects and quotations are the major inputs for the cost estimates. The derived results conclude that the method of utilizing the single-satellite images is the most cost effective way of revising the data.

The financial situation from 2003 and 2007 are as in the following table. From the budget information, the Study Team has set the average annual budget for topographic mapping as PHP35 million.

**Table 4-3 NAMRIA's Budget (Total/Base Mapping)**

Year	NAMRIA's Budget	Budget of Topographic Base Mapping
2003	263,026,000	9,309,000
2004	261,862,000	8,382,000
2005	265,226,000	7,727,000
2006	299,914,000	37,727,000
2007	819,684,000	112,835,000
Total		175,980,000
Average		35,196,000

Note: Budget of Topographic Base Mapping includes updating cost of large-, medium- and small-scale topographic maps, and does not include cost for printing and project cost of geo-hazard mapping and PRS92.

The budget situation of NAMRIA is taken into consideration to come up with the 13-year-revision plan; the details are as in the following table:

Table 4-4 Selected Scenario

NAMRIA		
	Item	Single Spot
NAMRIA	Time Limit (years)	13
	Time Limit (Work Days)	4,056
	Available WorkStations in NAMRIA (WorkStations)	5
	Max Teams working in 2 shifts in NAMRIA (Teams)	10
	Sheets that can be finished within Target Duration (Sheets)	595
	% of Total Sheets	91%
	Engr A Total Mandays	10,316
	Engr B Total Mandays	40,556
	Engr C Total Mandays	10,692
	Number of Engineer A needed	3
	Number of Engineer B needed	10
	Number of Engineer C needed	3
	Cost NAMRIA	PHP 406,777,217
Private Sector		Single Spot
	Sheets to be done by Private Sector	58
	% of Total Sheets	9%
	Required WorkDays to finish Target sheets (WorkDays)	3,953
	Required Teams working for Target Duration (Teams)	1
	Required Workstations working in 2 shifts for Target Duration (WorkStations)	1
	Engr A Total Mandays	1,006
	Engr B Total Mandays	3,953
	Engr C Total Mandays	1,042
	Number of Engineer A needed	1
	Number of Engineer B needed	1
	Number of Engineer C needed	1
	Cost Private Sector	PHP 62,496,868
Grand Total Cost	PHP 469,274,085	

The initial approach to the Sustainable Map Revision was to calculate the time, resource, cost requirements by prioritized land uses. The land uses are classified into three: urban; agriculture; and others based on the land cover data of NAMRIA. The result is summarized in Table 4-3. The fixed time scenario is set in line with the land-use planning requirement; the revision cycle was set: urban-five years; agriculture-ten years; others-fifteen years.

Table 4-5 Time, Resource, Cost Requirements for Sustainable Map Revision (Phase II)

Mapsheet Classification	Total Map-sheets	Revision Cycle (Years)		Single Satellite Image	Stereo Satellite Image	Aerial Photo
Urban	140	5	Total Work Days	8,281	9,980	10,904
			Total Work Years	26.54	31.99	34.95
			Work Days/Sheet	59.15	71.29	77.89
			Engr A Total Man days	2,169	2,508	2,750
			Engr B Total Man days	8,281	9,980	10,904
			Engr C Total Man days	2,709	4,390	5,209
			NAMRIA Total Cost	105,970,227.84	168,965,691.60	242,288,053.33
			NAMRIA Cost/Sheet	756,930.20	1,206,897.80	1,730,628.95
			Time limit (work days)	1,560	1,560	1,560
			Required Teams to finish	6	7	7
			Required Workstations to finish	3	4	4
			Engr A Needed	2	2	2
			Engr B Needed	6	7	7
			Engr C Needed	2	3	4
Agricultural	330	10	Total Work Days	19,087	22,843	24,754
			Total Work Years	61.18	73.21	79.34
			Work Days/Sheet	57.84	69.22	75.01
			Engr A Total Man days	5,037	5,802	6,287
			Engr B Total Man days	19,087	22,843	24,754
			Engr C Total Man days	6,147	9,763	11,506
			NAMRIA Total Cost	245,557,377.86	381,477,264.33	537,667,162.70
			NAMRIA Cost/Sheet	744,113.27	1,155,991.71	1,629,294.43
			Time limit (work days)	3,120	3,120	3,120
			Required Teams to finish	7	8	8
			Required Workstations to finish	4	4	4
			Engr A Needed	2	2	3
			Engr B Needed	7	8	8
			Engr C Needed	2	4	4
Others	183	15	Total Work Days	9,542	10,712	11,257
			Total Work Years	30.58	34.33	36.08
			Work Days/Sheet	52.14	58.54	61.51
			Engr A Total Man days	2,642	2,939	3,066
			Engr B Total Man days	9,542	10,712	11,257
			Engr C Total Man days	2,782	3,887	4,407
			NAMRIA Total Cost	117,442,385.13	158,723,035.41	204,929,941.49
			NAMRIA Cost/Sheet	641,761.67	867,338.99	1,119,835.75
			Time limit (work days)	4,680	4,680	4,680
			Required Teams to finish	3	3	3
			Required Workstations to finish	2	2	2
			Engr A Needed	1	1	1
			Engr B Needed	3	3	3
			Engr C Needed	1	1	1

The engineers and workstation required for the work is summarized in the following table:

Table 4-6 Engineers and Workstation Requirement (Urban, Agriculture, Others)

	Map sheets	Engineer A	Engineer B	Engineer C	Work-station	Cost (million PHP)
Urban	140	2	6	2	3	106.0
Agriculture	330	2	7	2	4	245.6
Others	183	1	3	1	2	117.4
Total	653	5	16	5	9	469.0

The Study Team has conducted on two other scenarios. The second scenario is the fixed budget scenario: the budget is fixed at PHP35 million; other assumption is the same. The revision of urban, agricultural and others will take 7.5, 15.5 and 23 years respectively. The third scenario disregarded the land use priorities. The revision cycle is 13.5 years; all the land uses are assumed to be revised at the same time.

The following table summarizes the cost per year and years to complete for the three scenarios: fixed time; fixed budget; and fixed budget/same duration.

Table 4-7 Cost/Year, Revision Cycle by Scenario

		Cost/year (million PHP)	Years
Fixed Time Scenario	Urban	21.2	5.0
	Agriculture	24.6	10.0
	Others	7.8	15.0
	Total	53.6	15.0
Fixed Budget Scenario	Urban	14.1	7.5
	Agriculture	15.8	15.5
	Others	5.1	23.0
	Total	35.1	23.0
Fixed Budget Scenario/ Same Duration	Urban	7.8	13.5
	Agriculture	18.2	13.5
	Others	8.7	13.5
	Total	34.7	13.5

## 4-9 Action Programs

The action programs were selected; implementing parties and responsible persons are assigned.

**Table 4-8 Action Programs: Implementing Organizational Unit and Person in Charge**

Code	Action	Implementing individual/party	Person in Charge
I-1	Legalize the Specifications for 1:50,000 topographic maps	Board of Governors	-
I-2	Develop specifications for GIS data and other spatial data at different scales so that other agencies will adopt the same standards and specifications	Research and Development Section	OIC
I-3	Formulate spatial data exchange schemes among LGUs and NAMRIA	Research and Development Section	OIC
I-4	Develop a human resource exchange programs or internship among the private sector and educational institutions	Professional Associations/NAMRIA/Educational Institutions	-
I-5	Establish a professional licensing system for geodetic engineers and remote sensing experts.	Professional Associations	-
I-6	Collaborate with educational institutions to develop text books and other educational materials for school children.	NAMRIA/Ministry of Education	Administrator
H-1	Preparation of Specification Training Manual (text material)	Human Resource Management Section	OIC
H-2	Preparation of quality control table user manual (text material)	Human Resource Management Section	OIC
H-3	Preparation of Rules and regulations for using facilities and equipment in NAMRIA	Human Resource Management Section	OIC
H-4	Selecting and converting of text materials in the pdf format	Human Resource Management Section	OIC
H-5	Selection of lecturers and determination of fees	Human Resource Management Section	OIC
H-6	Development of contents of e-learning and establishing e-learning sites (intra and internet sites)	Human Resource Management Section	OIC
H-7	Conducting interview sessions with the staffs to conduct individual training need assessment and to develop individual training program	Human Resource Management Section	OIC
H-8	Assigning a training record personnel and development of training recording system	Human Resource Management Section	OIC
H-9	Location selection and infrastructure study	Human Resource Management Section	OIC
H-10	System Design and Layout Design	Human Resource Management Section	OIC
O-1	Preparation of manuals with work flow diagrams by divisions	Research and Development Section	Director, Mapping Department
O-2	Integration of the manuals and work flow diagrams by functions	Research and Development Section	Director, Mapping Department
O-3	Conducting knowledge sharing session among the technical working groups	Research and Development Section	Director, Mapping Department
O-4	Development of quality control table user manuals	Quality control section	Director, Mapping Department
O-5	Formulate a working group to review and revise the Specifications;	Quality control section	Director, Mapping Department
O-6	Formulate a working group to review the operation manuals;	Quality control section	Director, Mapping Department
O-7	Development of an error recording and reporting system	Quality control section	Director, Mapping Department
O-8	Development of an integrated data management system for the Photogrammetry and Cartography Divisions	Quality control section	Director, Mapping Department

Code	Action	Implementing individual/party	Person in Charge
O-9	Facility planning for quality control and data management.	Quality control section	Director, Mapping Department
O-10	Development of collaborative research programs with academics and professional organizations	Research and Development Section	Director, Mapping Department
O-11	Organizing legal experts to develop a map sales licensing plan	Research and Development Section	Director, Mapping Department
O-12	Preparation and implementation of a marketing study	Research and Development Section	Director, Mapping Department
O-13	Development of new products for sales promotion	Research and Development Section	Director, Mapping Department
O-14	Map Management Database	Quality control section	OIC
O-15	Time Management System	Planning Department	OIC
O-16	Document Viewing System	Record Section	OIC
O-17	Human Resource Management System	Human Resource Management Section	OIC
P-1	Organizing a marketing group in NAMRIA	Information Services Division, Information Management Department	OIC
P-2	Formulation of a marketing study plan	Information Services Division, Information Management Department	OIC
P-3	Preparation of questionnaire by targets (public, private, and education)	Information Services Division, Information Management Department	OIC
P-4	A text based map search function development in the NAMRIA web site	Information Services Division, Information Management Department	OIC
P-5	Development of a form mail function	Information Services Division, Information Management Department	OIC
P-6	Brochure development for digital products	Information Services Division, Information Management Department	OIC
P-7	Html based email message development	Information Services Division, Information Management Department	OIC
P-8	Organization of a legal study team to establish a licensing scheme for digital product promotion	Research and Development Section	OIC
P-9	Development of copy protection system to the digital products	Research and Development Section	OIC
P-10	Development of product registration and licensing system	Research and Development Section	OIC
P-11	Preparation of a map sale privatization plan	Research and Development Section	OIC
P-12	Brand development planning	Information Services Division, Information Management Department	OIC
N-1	Selection of funding method (Phase I)	Office of the Administrator	Administrator
N-2	Preparation of TOR (Phase I)	Office of the Administrator	Administrator
N-3	System Design (Phase II)	Office of the Administrator	Administrator
N-4	Procurement of Equipment (Phase II)	Office of the Administrator	Administrator

Note: I (Institutional/social)  
H (Human Resource Development)  
O (Organizational)  
P (Promotion)  
N (Nationwide Deployment)

## **CHAPTER 5 RECOMMENDATIONS**

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(1) Formulation of Capacity Development Plan

At the institutional level of capacity development, the NSDI is the direction for efficient data exchange at the central level of the governments. The local governments will have to join this endeavour for their local land use planning. At the organizational level of capacity development, the Mapping Department shall augment its functions on: quality control and data management; human resource management; and research and development. At the individual level of capacity development, efficient and continuous human resource development shall be implemented.

(2) Establishment of “Specifications for Topographic Mapping at Scale of 1:50,000”

Continuous review and revision of the Specifications shall be established under the Director’s initiative. A responsible person for maintaining the Specification shall be assigned for this purpose.

The Specification for Topographic Mapping at Scale of 1:50,000 was prepared; the division chiefs shall review and revise the Specifications when necessary. The division chiefs shall prepare specifications for other scales and other products.

(3) Formulation of Human Resource Development Program and Implementation of Technical Training

The Study Team recommends that the OIC for HRD in the Mapping Department conduct an individual-training-needs assessment. The OIC for HRD shall prepare an annual training programming based on the individual training needs assessment.

(4) Implementation of Pilot Projects and Technology Transfer

Through the Pilot Projects, the Study Team has identified issues of operations. NAMRIA shall conduct individual evaluation the same way the Study Team has evaluated.

As for technical verification, the proposed Research and Development Section shall conduct such technical verification when NAMRIA needs to incorporate new technologies.

The Study Team has transferred technologies to individuals; the manuals—teaching materials—were prepared so that the technologies will retain in the organization. The Study Team recommends that NAMRIA shall train the staff using the manuals developed. NAMRIA shall develop additional operation manuals in the same way that the Study Team has prepared.

(5) Formation of Promotion Mechanism for Topographic Mapping at Scale of 1:50,000 and Associated Products

The number of Map Sale Office shall be increased to increase accessibility of maps and map related products. The Information Management Department needs to conduct marketing studies to capture the needs of customers—the process of marketing is to set direction of NSDI strategies along with defining data needs of local government units.

(6) Preparation of Action Program for Nationwide Topographic Mapping at Scale of 1:50,000

The Study Team has developed a cost estimate program for the Nationwide Deployment Program. The Study Team has presented the usage and transferred the map database to NAMRIA; NAMRIA now has the capacity of conducting cost estimate of its own by using the map database with cost factors. The Study Team recommends that NAMRIA examine the validity of the cost estimate for the Nationwide Deployment Plan. As the cost and schedules are refined, the human resource of NAMRIA will have to capacitated during or prior to the implementation of the capacity development phase of the nationwide deployment plan.



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- (7) **Coordination and Cooperation with the Technical Coordinating Committee (TCC)**  
TCC functioned well during the Pilot Project. The coordination and cooperation with the local authorities will be inevitable in pursuing implementation of the Nationwide Deployment Plan. The Study Team recommends that after the completion of the Study, the structural formation shall be remained to conduct further topographic mapping projects.
- (8) **Mapping Technology**  
The Study Team recommends the single satellite images for planimetric feature revision for 1:50,000 topographic mapping with thorough application of quality control based on the Specifications. When more funds are available, utilization of stereo satellite images and aerial photographs shall be considered.  
As for other technologies, there are examples of success with IFSAR data obtained. This technology should be applied for updating contour lines in the future after their updating by single satellite images. ALOS, satellite imagery, is another alternative to the IFSAR and SPOT combination to be explored in the future.
- (9) **Revision of and Exemption to the Rationalization Plan**  
The rationalization plan needs to be revised. The revision needs to address higher technical requirement for managers' positions and quality control positions. The overall number of staff will have to be reduced or re-training measures to relocated staff need to be addressed. If the approval of the current rationalization takes longer, there shall be certain exemptions of promotion and recruitment to fill critical positions.
- (10) **Manual Preparation**  
A documentation skill in English is necessary for all the staff in the Mapping Department. Especially, the division chiefs shall have the sufficient documentation skills to prepare manuals and specifications for operational management, so that each process of operation shall be standardized with operators and supervisors located at appropriate places at appropriate time.  
The manual preparation skills will require systematic and logical thinking with technological understandings on each process of operation. The human resource development program shall cover management training which includes operation manual preparation.
- (11) **Comprehensive System Design**  
The Database Management Division has developed useful tools for management for other departments. The system development effort needs to be linked with overall organizational direction of NAMRIA. The Database Management Division shall coordinate with the Mapping Department, Administrative Division, and Plans & Operational Division to establish overall system design for entire NAMRIA. The initial design cost may be high; overall development cost shall be substantially lower than the case without the comprehensive system design. The roles and process of operations will have to be defined before the comprehensive system design analysis.
- (12) **Staff Retraining**  
As the personnel analysis identified, some of the staff in the Cartography Division will have to be assigned to other divisions. The proposed Quality Control and Data Management Section will be a candidate section for those staff. The Human Resource Management Section shall select the staff in the Cartography Division and target the training efforts to quality control and data management.
- (13) **Securing Funds**  
The Study Team prepared the nationwide deployment plan together with NAMRIA. For the initial phase of the nationwide deployment plan to update nationwide 1:50,000 topographic maps, in order to implement the proposed 13-year updating plan, NAMRIA has to secure the total budget of 446 million pesos. The Study Team recommends that NAMRIA secures the amount and implement the nationwide deployment program.

## **CHAPTER 6 CONCLUSION**

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The six objectives were: (1) Formulation of Capacity Development Plan; (2) Establishment of “Specifications for Topographic Mapping at Scale of 1:50,000”; (3) Formulation of Human Resource Development Program and Implementation of Technical Training; (4) Implementation of Pilot Projects and Technology Transfer; (5) Formation of Promotion Mechanism for Topographic Mapping at Scale of 1:50,000 and Associated Products; and (6) Preparation of Action Program for Nationwide Topographic Mapping at Scale of 1:50,000. All the objectives were achieved; the Study was completed in time.

A policy study in the field of survey and mapping was the first attempt as an international cooperation project of JICA. The capacity development plan component was vaguely understood in the initial phase of the Study. The diagnostics of corporate culture (DCC) was also new to the counterparts. The Study Team had explained the new concepts through continuous dialogue with the counterparts.

DCC identified the organizational characteristics of NAMRIA. Although the organizational culture cannot be changed in a short period within a scope of the Study, a common goal of completing the Geo-hazard mapping project at the Mapping Department has raised “vitality” of the organization. The same vitality shall be attained while the mission of revising the topographic maps at scale of 1:50,000 will have been prioritized in the national development planning which requires updated geographic information at least at a scale of 1:50,000 for land use planning at the provincial and the city/municipal levels.

The results of the PCM helped to organize organizational issues involved in the Study. At the same time, it showed certain organizational directions by showing the actions programs as outputs.

The capacity-development-plan concept included the institutional, organizational, and individual aspects. In the initial phase of the study, the Study Team has reviewed legal aspects, educational institutions, and interviewed key informants in the private sector. Significant institutional issues identified were on rationalization of the public sector, international labor market, and copyright. The Study Team has formulated the capacity development plan considering those institutional issues. As rationalization process is already put into practice as in the consolidation of the Aerial and Spatial Survey Division to the Photogrammetry Division. Losing skilled and experienced staff are a common concern for the division chiefs; Protecting intellectual property of maps and map related products, is a vital for promoting maps and map related products. The Study Team has proposed efficient operation and human resource development and licensing, product registration, as key concepts to resolve the institutional issues.

Development of the topographic map management database was critical in the Study. The database was used for analyzing current conditions of the topographic maps. It was used for the formulation of the nationwide deployment plan. It approximated the costs of development as well. The database was also used as a tool for internal efficiency of the human resource development plan to strengthen the ownership concept of the capacity development. The database is transferred to the Mapping Department to be used for project management which is to be included in the monthly reporting system of projects in NAMRIA. The database is to be integrated to the current database in the Information Management Department.

The ownership concept of capacity development was fully considered in the process of technology transfer. The project of Layte initiated by NAMRIA using the method recommended by the Study Team was the another sign of ownership. Socetec, introduced through OJT by a member of the Study Team in charge of digital mapping and editing, became the technology of NAMRIA to be used even before the completion of the Study is remarkable accomplishment of the NAMRIA side. The mono-satellite planimetric data revision method, which is introduced by the JICA Study Team, will remain in the Cartographic Department as long as the revision of the topographic maps will be continued. The map symbolization technology was further strengthened especially in the area of library creation for objects and patterns. The method of object library contributed to efficient work

in the process of map symbolization in the Photogrammetry Division and Cartography Division. The Specifications were discussed or even argued among the division chiefs and related staff of the Mapping Department several times. The staff in NAMRIA has already started to use the study materials which the Study Team had prepared.

Two phases: the initial short-term revision phase and the long-term cyclical revision phase were planned for the nationwide deployment plan. The short-term revision planning period (capacity development phase) is set at 13 years due to restricted financial resources of NAMRIA. In the long-term cyclical revision planning period (sustainable map revision phase), the period of the first scenario is 5 years for urban, 10 years for agricultural and 15 years for others, based on the revision cycles by land use and in line with regional development plans of the Philippines. Regarding the period of the second scenario, it is 7.5 years for urban, 15.5 years for agricultural and 23 years for others calculated from the budget for map revision. The third period is 13.5 years for urban, agricultural and others respectively, based on the budget for map revision and same duration. Future revision plans were recommended in consideration of the above second and third revision cycles. The mapping method for the period of capacity development phase shall be single satellite imagery for updating planimetric features and utilization of contour data processed from existing maps. IFSAR technology was also recommended for long-term cyclical revision of contour lines in the future. Based on the short-term revision and the long-term cyclical revision, the human resource requirement was calculated for implementation of map revision works.

The 1:50,000 topographic maps are the basis of national level planning. Planning activities by cities and municipalities, ideally, conducted using 1:10,000 or larger; however, in the meantime until all the 1:10,000 topographic maps will be prepared in urban area, the scale of 1:50,000 will become the base map for most cities and municipalities. The scale would be most appropriate in formulating provincial physical framework plans. The GIS ready data or topology added data shall be provided through the Map Sales Office. The revision cycle is sustainable within the capacity of NAMRIA, with nine (9) workstations after finishing the initial phase of revising all the topographic maps in 13 years.

The organizational direction of NAMRIA was set forth to be technological core of spatial data production and management. NAMRIA shall be equipped with higher capacity of intelligence; database and its application to serve more with less manual operation. The shift of paradigm mentioned in the rationalization is not only a policy statement, but also an inevitable future of NAMRIA.

The Study has focused on the effort to 1:50,000 topographic maps, but the method of research and development in other scales can be explored by NAMRIA itself. The Study Team would be grateful, if NAMRIA would expand its horizon of human resource development in other department, other scales and other technologies.

The direction of NAMRIA is become the human resource development center with a research and development function in geodetic engineering and remote sensing. The Study Team has recommended the single satellite imagery method with the IFSAR contour line data acquisition (existing contour data will be used in the initial phase); however, the technologies may become obsolete in the future when new replacement technologies will have been advanced. NAMRIA as the institute that have all the technological bases for survey and mapping shall continue to update not only the topographic maps at scale of 1:50,000 but also technologies of the staff with flexible organizational system that could adapt to new technologies.

Each member of the counterpart was very cooperative in conducting the Study. The Study Team is sure that the Study and the Sustainable Topographic Map Revision Plan for 1:50,000 Topographic Maps shall be fully incorporated to the existing plans and programs in NAMRIA under leaderships of the Administrator, Directors and Division Chiefs. The ownership of the plan now is under NAMRIA.

The Study Team has developed a database for 1:50,000 topographic maps. When it is integrated into other spatial data available and developed in other government agencies, such spatial data will become a powerful tool for planning and development at the national, provincial, city/municipal levels of

governments. The applications of using the integrated data will have substantial positive effects to the nation's economy. In this manner, the Study shall become the basis of spatial data integration which the Philippines intend to achieve in the future.

The Study was completed; the implementation is yet to come. As recommended, the implementation of the nationwide deployment plan in proposed 13-year period of updating topographic maps will require a large total budget of estimated 446 million pesos. The Study Team strongly hopes that the Government of the Philippines, who ordered NAMRIA to update topographic maps, will take budgetary steps for this project to put the nationwide deployment plan into practice in the near future.