NATIONAL WATER RESOURCES BOARD
THE REPUBLIC OF THE PHILIPPINES

THE STUDY
ON
INTEGRATED WATER RESOURCES MANAGEMENT
FOR
POVERTY ALLEVIATION AND ECONOMIC DEVELOPMENT
IN
THE PAMPANGA RIVER BASIN
IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME II: MAIN REPORT

JANUARY 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

CTI ENGINEERING INTERNATIONAL CO., LTD.

in association with

NIPPON KOEI CO., LTD.

Composition of Final Report

Volume I: **Summary**

Volume II: **Main Report**

Volume III: **Supporting Reports**

Sector A: Topography and Meteo-Hydrology
Sector B: Socio-Economy
Sector C: Agricultural and Fishery Water Management
Sector D: Municipal Water Supply, Sanitation and Sewerage System Management
Sector E: Flood and Sediment Disaster Management
Sector F: Water-related Environmental Management
Sector G: Watershed Management
Sector H: Water Resources Development and Management

Volume IV: **Supporting Reports**

Sector I: Socio-Environmental Consideration
Sector J: Guideline for Formulation of IWRM Plan
Sector K: Formulation of IWRM Plan
Sector L: Plans for Legal and Institutional Framework
Sector M: Water-related Data Management
Appendix: Minutes and Discussion Records on SC, TWG and Stakeholder Meetings

Exchange Rate used in the Report is:

PHP	1.00	= US$ 0.0217	= JP¥ 1.934
US$	1.00	= PhP 46.15	= JP¥ 89.25

(as of 31st December 2009)


Benguet
Nueva Vizcaya
Quirino
Pangasinan
STUDY AREA
Aurora
Nueva Ecija
Tarlac City
Cabanatuan City
Tarlac
Pampanga River
Mount Pinatubo
Angeles City
Zambales
Bulacan
City of San Fernando
Pampanga
Angat River
Pasac River
Malolos City
Quezon
Bataan
Rizal
Metro Manila
Laguna
Cavite
N
W
E
S
0 5 10 20
Kilometers

Pages

Location Map

Table of Contents

List of Tables

List of Tables in Report

List of Annex Tables

List of Figures

List of Figures in Report

List of Annex Figures

List of Appendix

Abbreviations and Acronyms

A&D	:	Alienable & Dispensable
ACC	:	Annual Allowable Cut
AD	:	Ancestral Domain
ADB	:	Asian Development Bank
AL	:	Ancestral Land
AMRIS	:	Angat Maasim River Irrigation System
AO	:	Administrative Order
APS	:	Automated Processing System
ARCDP	:	Agrarian Reform Communities Development Project
ARISPII	:	Agrarian Reform Infrastructure Support Project
ARWR	:	Annual Renewable Water Resources
AWAT	:	Angat Watershed Action Team
AWSOP	:	Angat Water Supply Optimization Project
BAS	:	Bureau of Agricultural Statistics
BBMP	:	Balog-Balog Multipurpose Project
BFAR	:	Bureau of Fisheries and Aquatic Resources
BOD	:	Biological Oxygen Demand
BOT	:	Built Operate Transfer
BRS	:	Bureau of Research and Standards
BSWM	:	Bureau of Soils and Water Management
BWSA	:	Barangay Water and Sanitation Association
CADT	:	Certification of Ancestral Domain Titles
CALT	:	Certification of Ancestral Land Titles
CARP	:	Comprehensive Agrarian Reform Program
CARP-IC	:	Comprehensive Agrarian Reform Program – Irrigation Component
CBFM	:	Community-Based Forest Management
CBFMA	:	Community Based Forest Management Agreement
CBO	:	Community Based Organization
CDA	:	Cooperative Development Authority
CDC	:	Clark Development Corporation
CDM	:	Clean Development Mechanism
CDO	:	Cease and Desist Orders
CDP	:	Capacity Development Program
CENRO	:	Community Environment and Natural Resources Office
CIGAR	:	Covered In-Ground Anaerobic Reactor
CIS	:	Communal Irrigation System
CITES	:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLIP	:	Central Luzon Irrigation Project
CLUP	:	Comprehensive Land Use Plan
CMIPP	:	Casecnan Multipurpose Irrigation & Power Project
CMMD	:	Coastal and Marine Management Division
CMR	:	Compliance Monitoring Report
CNC	:	Certificate of Non-Coverage
CPC	:	Certificate of Public Convenience
CRMP	:	Coastal Resource Management Program
CSEZ	:	Clark Special Economic Zone
CSO	:	Civil Society Organizations
CWA	:	Clean Water Act
CWC	:	Clark Water Corporation

DA	:	Department of Agriculture
DAO	:	Department Administrative Order
DAR	:	Department of Agrarian Reform
DBM	:	Department of Budget and Management
DCC	:	Disaster Coordinating Council
DD	:	Diversion Dam
DE	:	Department of Education
DECS	:	Department of Education, Culture and Sports
DENR	:	Department of Environment and Natural Resources
DEO	:	District Engineering Office
DILG	:	Department of Interior and Local Government
DO	:	Dissolved Oxygen
DOD	:	Department of Defense
DOE	:	Department of Energy
DOF	:	Department of Finance
DOH	:	Department of Health
DOJ	:	Department of Justice
DOST	:	Department of Science and Technology
DOTC	:	Department of Transportation and Communication
DPWH	:	Department of Public Works and Highways
DTI	:	Department of Trade and Industry
ECA	:	Environmentally Critical Area
ECC	:	Environmental Compliance Certificate
ECOSAN	:	Ecological Sanitation
ECP	:	Environmentally Critical Projects
EDC	:	Energy Development Corporation
EIA	:	Environmental Impact Assessment
EIS	:	Environmental Impact Statement
EMB	:	Environmental Management Bureau
ENR	:	Environment and Natural Resource
EO	:	Executive Order
EPIRA	:	Electric Power Industry Reform Act
ERDB	:	Ecosystem Research and Development Bureau
ESWM	:	Ecological Solid Waste Management
ESWMP	:	Ecological Solid Waste Management Program
F.I.S.H.	:	Fisheries Resources Management for Improved and Sustainable Harvest
F/S	:	Feasibility Study
FBI	:	Field Based Investigation
FCSEC	:	Flood Control and Sabo Engineering Center
FFCM	:	Forest Fire Control and Management
FLUP	:	Forest Land Use Plan
FMB	:	Forest Management Bureau
FMP	:	Forest Management Program
FMS	:	Forest Management Service
FPIC	:	Free and Prior Informed Consent
FPLEP	:	Forest Protection and Law Enforcement Program
FRDD	:	Forest Resources Development Division
FUSA	:	Firmed Up Service Area
GA	:	Government Agency
GAA	:	General Appropriations Act
GDP	:	Gross Domestic Product

GFI	:	Government Financing Institution
GHG	:	Greenhouse Gas
GIS	:	Geographic Information System
GIS	:	Groundwater Irrigation System
GNP	:	Gross National Product
GOCC	:	Government Owned and Controlled Corporation
GRDP	:	Gross Regional Domestic Product
GTZ	:	German Technical Cooperation Agency
GVA	:	Gross Value Added
HBC	:	Hacienda Bio-Energy Corporation
HDI	:	Human Development Index
HMS	:	Hydrometric Station
HUDCC	:	Housing and Urban Development Coordination Council
IA	:	Irrigators' Association
IAFD	:	Integrated Agro-Forestry Development Program
IBRD	:	International bank for Reconstruction and Development
ICC	:	Indigenous Cultural Communities
ICC	:	Investment Coordination Committee
ICT	:	Information and Communications Technology
ICWE	:	Information Conference on Water and the Environment
IEC	:	Information, Education and Communication
IEE	:	Initial Environmental Evaluation
IEEC	:	Initial Environmental Evaluation Checklist
IEER	:	Initial Environmental Examination Report
IMO	:	Irrigation Management Office
IMT	:	Irrigation Management Transfer
IP	:	Indigenous People
IPCP	:	Industrial Pollution Control Program
IPO	:	Indigenous People's Organization
IPRA	:	Indigenous People's Rights Act
IRA	:	Internal Revenue Allotment
IRR	:	Implementing Rules and Regulations
ISF	:	Irrigation Service Fee
ISF	:	Integrated Social Forestry
ISP	:	Institutional Strengthening Program
IWMI	:	International Water Management Institute
IWRM	:	Integrated Water Resources Management
JBIC	:	Japan Bank for International Cooperation (presently merged to JICA)
JICA	:	Japan International Cooperation Agency
KMS	:	Knowledge Management System
KPI	:	Key Performance Indicators
LA	:	Line Agency
LGA	:	Local Government Agency
LGC	:	Local Government Code
LGU	:	Local Government Unit
LLDA	:	Laguna Lake Development Authority
LTRIS	:	Lower Talavera River Irrigation System
LWUA	:	Local Water Utilities Administration
M & E	:	Monitoring & Evaluation
M/P	:	Master Plan
MC	:	Memorandum Circular

MCWMC	:	Metro Clark Waste Management Corporation
MDFO	:	Municipal Development Fund Office
MDG	:	Millennium Development Goal
MFCDP	:	Major Flood Control and Drainage Project
MGB	:	Mines and Geo-sciences Bureau
MIS	:	Management Information System
MMDA	:	Metro Manila Development Authority
MPFD	:	Master Plan for Forestry Development
MRF	:	Materials Recovery Facilities
MTIP	:	Medium Term Investment Plan
MTPDP	:	Medium Term Philippine Development Plan
MWCI	:	Manila Water Company Inc.
MWLFI	:	Municipal Water Loan Financing Initiative
MWSI	:	Maynilad Water Service Incorporated
MWSS	:	Metropolitan Waterworks and Sewerage System
NAA	:	Non-Attainment Area
NAMRIA	:	National Mapping and Resource Information Authority
NAPC	:	National Anti-Poverty Commission
NAPOCOR/NPC	:	National Power Corporation
NCIP	:	National Commission on Indigenous People
NCR	:	National Capital Region
NDCC	:	National Disaster Coordination Council
NECA	:	Non-Environmentally Critical Area
NECP	:	Non-Environmentally Critical Projects
NEDA	:	National Economic Development Authority
NEPC	:	National Environmental Protection Council
NEPIS	:	Nueva Ecija Pump Irrigation System
NGA	:	National Government Agency
NGO	:	Non-government Organization
NHRC	:	National Hydraulic Research Center
NIA	:	National Irrigation Administration
NIPAS	:	National Integrated Protected Area System
NIS	:	National Irrigation System
NPAA	:	Network of Protected Area for Agriculture
NPC	:	National Power Corporation
NPCC	:	National Pollution Control Commission
NRW	:	Non-Revenue Water
NSCB	:	National Statistical Coordination Board
NSO	:	National Statistics Office
NWRB	:	National Water Resources Board
NWRC	:	National Water Resources Council
O&M	:	Operations and Maintenance
OCD	:	Office of Civil Defense
ODA	:	Official Development Assistance
OPAPP	:	Office of the Presidential Adviser on the Peace Process
OPMBCS	:	Operational Plan for the Manila Bay Coastal Strategy
P3W	:	President's Priority Program on Water
PA	:	Protected Areas
PACBRMP	:	Protected Area Community- based Resource Management Program
PAGASA	:	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAMB	:	Protected Area Management Board

PAMP	:	Protected Area Management Program
PAWB	:	Protected Areas and Wildlife Bureau
PAWCZMS	:	Protected Area, Wildlife and Coastal Zone Management Services
PAWD	:	Philippine Association of Water Districts
PBRIS	:	Pampanga-Bongabon River Irrigation System
PCB	:	Polychlorinated biphenyl
PCPT	:	Per Capita Poverty Threshold
PD	:	Presidential Degree
PDDP-IC	:	Pampanga Delta Development Project –Irrigation Component
PDR	:	Project Description Report
PDRIS	:	Pampanga Delta River Irrigation System
PEIS	:	Programmatic Environmental Impact Statement
PEISS	:	Philippine Environmental Impact Statement System
PEMAPS	:	Project Environmental Monitoring and Aucit Prioritization Scheme
PEMSEA	:	Partnership in Environmental Management for the Seas of South East Asia
PENRIS	:	Penaranda River Irrigation System
PENRO	:	Provincial Environment and Natural Resources Office
PEPP	:	Philippine Environmental Partnership Program
PFPDP	:	Private Forest Plantation Development Program
PHDR	:	Philippine Human Development Report
PhilBIO	:	Philippine Bio-Sciences Company, Inc
PHILRICE	:	Philippine Rice Research Institute
PHIVOLCS	:	Philippine Institute of Volcanology and Seismology
PIDP	:	Participatory Irrigation Development Project
PIMO	:	Provincial Irrigation Management Office
PIS	:	Pump Irrigation System
PMO	:	Program Management Office/Project Management Office
PMO-RWS	:	Project Management Office for Rural Water Supply
PNSDW	:	Philippine National Standards for Drinking Water
PO	:	People’s Organization
POP	:	Persistent Organic Pollutant
PPDO	:	Provincial Planning and Development Office
PPFP	:	Provincial Physical Framework Plan
PRB	:	Principal River Basin
PRBRP	:	Pampanga River Basin Rehabilitation Program
PRIS	:	Pampanga River Irrigation System
PSP	:	Private Sector Participation
PW4SP	:	Provincial Water Supply Sector, Sewerage and Sanitation Plan
PWA	:	Philippine Waterworks Association
PWAT	:	Pantabangan Watershed Action Team
PWRF	:	Philippine Water Revolving Fund
PWSSR	:	Philippine Water Supply Sector Roadmap
PWSU	:	Provincial Water and Sanitation Unit
R&D	:	Research & Development
RA	:	Republic Act
RBC	:	River Basin Committee
RBCO	:	River Basin Control Office
RBO	:	River Basin Organization
RCBFMO	:	Regional Community Based Forest Management Office
RDC	:	Regional Development Council
RDCC	:	Regional Disaster Coordinating Committee

RENRO	:	Regional Environment and Natural Resources Office
RIES	:	Revised Industrial Eco-watch
RIO	:	Regional Irrigation Office
RIS	:	River Irrigation System
RLA	:	Regional Line Agency
RO	:	Regional Office
RPFP	:	Regional Physical Framework Plan
RWDC	:	Rural Waterworks Development Corporation
RWSA	:	Rural Water and Sanitation Association
SAFDZ	:	Strategic Agriculture and Fisheries Development Zone
SALT	:	Sloping Agricultural Technology
SCAD	:	Subic-Clark Alliance for Development
SDC	:	Super Diversion Canal
SEZ	:	Special Economic Zone
SFR	:	Small Farm Reservoir
SLF	:	Sanitary Land Fill
SMORIS	:	San Miguel-O'donel River Irrigation System
SMR	:	Self-Monitoring Reports
SPM	:	Strategic Planning and Management
SRIP	:	Small Reservoir Irrigation Project
SSIP	:	Small Scale Independent Provider
STP	:	Sewerage Treatment Plants
STW	:	Shallow Tube-well
SWIP/SWIMP	:	Small Water Impounding Project
SWIS	:	Small Water Impounding System
SWMA	:	Solid Waste Management Act
TARIS	:	Tarlac River Irrigation System
TASMORIS	:	Tarlac-San Miguel-O'donel River Irrigation System
TDS	:	Total Dissolved Solids
TGIS	:	Tarlac Groundwater Irrigation System
TGISRP	:	Tarlac Groundwater System Reactivation Project
TRIS	:	Talavera River Irrigation System
TSP	:	Total Suspended Particulate
TSS	:	Total Suspended Solids
TWG	:	Technical Working Group
UDP	:	Upland Development Program
UN	:	United Nations
UNFCC	:	United Nations Framework Convention on Climate Change
UPRIIS	:	Upper Pampanga River Integrated Irrigation System
USGS	:	The U.S. Geological Survey
WASCO	:	Water Supply Coordinating Office
WB	:	World Bank
WD	:	Water District
WFR	:	Watershed Forest Reserve
WHO	:	World Health Organization
WM	:	Watershed Management
WQ	:	Water Quality
WQMA	:	Water Quality Management Area
WQMP	:	Water Quality Monitoring Program
WRAP	:	Water Resources Authority of the Philippines
WRC	:	Water Regulatory Commission

WRI	:	World Resources Institute
WSP	:	Water Service Provider
WSSPMO	:	Water Supply and Sanitation Program Management Office
WSSWP	:	Water, Sanitation & Solid Waste Program

Measurement Units

(Length)

mm	: millimeter(s)
cm	: centimeter(s)
m	: meter(s)
km	: kilometer(s)

(Area)

mm^2	: square millimeter(s)
cm^2	: square centimeter(s)
m^2	: square meter(s)
km^2	: square kilometer(s)
ha	: hectare(s)

(Weight)

g, gr	: gram(s)
kg	: kilogram(s)
ton	: ton(s)

(Others)

mw	: megawatt

(Time)

s, sec	: second(s)
min	: minute(s)
h, hr	: hour(s)
d, dy	: day(s)
y, yr	: year(s)

(Volume)

cm^3	: cubic centimeter(s)
m^3	: cubic meter(s)
l, ltr	: liter(s)
mcm	: million cubic meter(s)
mld	: million liters per day

(Speed/Velocity)

cm/s	: centimeter per second
m/s	: meter per second
km/h	: kilometer per hour

Chapter 1. Introduction

1.1 Objectives of the Study

The objectives of "The Study on Integrated Water Resources Management for Poverty Alleviation and Economic Development in Pampanga River Basin" (hereinafter referred to as "the study") are the following items as agreed between JICA and NWRB in November 2008:

(1) To formulate the plan of Integrated Water Resources Management (hereinafter referred to as "IWRM") for the Pampanga river basin in coordination with the other concerned organizations; and

(2) To transfer relevant skills and technologies on IWRM to personnel of NWRB as well as the other concerned organizations.

1.2 Extent of the Study Area

The study area is the entire catchment area of Pampanga river basin covering 10,434 km^2, which is broadly divided into three sub-basins, namely; (a) Pampanga main river basin with a catchment area of 7,978 km^2; (b) Pasac river basin with 1,371 km^2; and (c) Angat river basin with 1,085 km^2 (refer to the General Map). Rivers in these three sub-basins originate in different mountainous areas and have separate river mouths at the Manila Bay. They are interconnected by channels[1] with water resources management works mutually and closely related to each other.

The study area spreads over the administrative area of eleven (11) provinces and 90 cities/municipalities. A substantial part of the study area (about 95%) is, however, within the boundary of four provinces, namely; Nueva Ecija, Tarlac, Pampanga and Bulacan. The remaining fringe area (about 5%) is a part of other seven provinces: Aurora, Zambales, Rizal, Quezon, Pangasinan, Bataan and Nueva Viscaya. The extent of the study area subdivided by the provincial boundaries, and the number of cities/municipalities in the provinces overlapped by the study area are as shown in the table below (refer to Annex-T 1.2.1):

Table 1.2.1 Extent of Study Area and Number of Cities/Municipalities Overlapped

(unit: km^2)

Province	Extent		Number of Cities/Municipalities
	Extent (km^2)	Share (%)	
Nueva Ecija	5013	48.0	30
Pampanga	2022	19.4	22
Bulacan	2021	19.4	18
Tarlac	834	8.0	6
Aurora	195	1.9	3
Zambales	74	0.7	2
Rizal	42	0.4	1
Quezon	30	0.3	1
Pangasinan	26	0.2	1
Bataan	14	0.1	2
Nueva Viscaya	163	1.6	4
Total	10,434	100.0	90

Source: JICA Study Team

There exist the water conveyance systems between the study area and the external areas outside the boundaries. The typical conveyance systems are as enumerated below:

[1] Pampanga River and Pasac River are connected by Bebe San Esteban Shortcut Channel, while Pampanga and Angat rivers are connected by Bagbag River.

(1) The Casecnan Diversion System, which conveys the water from Casecnan River (a tributary of Cagayan River) to Pantabangan dam reservoir located in the northern part of Pampanga river basin;

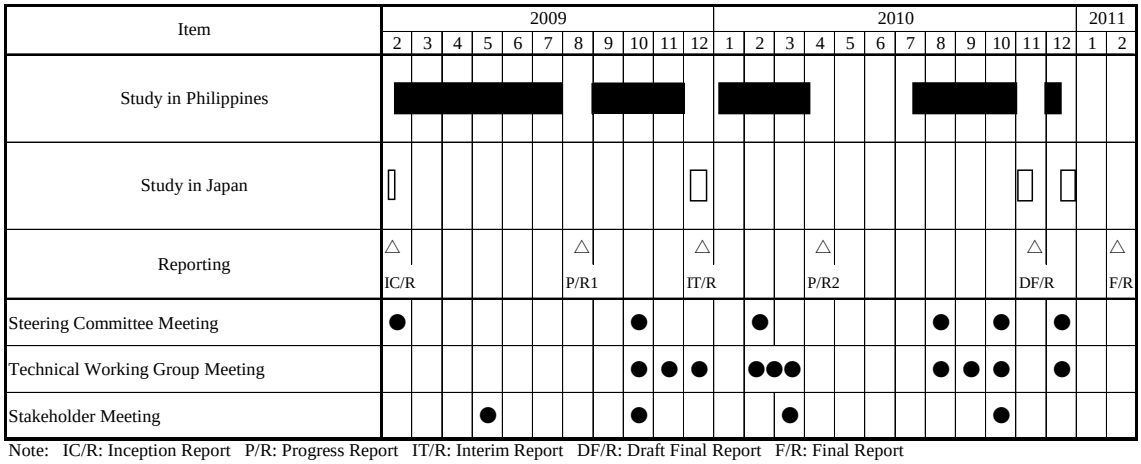
(2) The Umiray-Angat Diversion System, which conveys the water from Umiray River to Angat dam reservoir located in the southeastern part of the Angat river basin; and

(3) The water conveyance system from Angat dam reservoir toward Metro Manila and the several adjacent cities/municipalities in Bulacan Province such as Meycauayan, Obando, Malilao and San Jose Del Monte for domestic water supply.

The Casecnan and Umiray river basins are outside of the study area. However, these two river basins are important water sources for the study area. Likewise, Metro Manila and its adjacent cities/municipalities in Bulacan Province are outside of the study area but about 90% of the domestic water in these areas depends on the supply from the study area.

1.3 Study Schedule

The study was carried out for a period of 25 months from February 2009 to February 2011. During the study period, several official meetings including the steering committee meetings, the technical working group meetings and the stakeholder meetings were held to appraise the progress of the study as shown in Figure 1.3.1.



Note: IC/R: Inception Report P/R: Progress Report IT/R: Interim Report DF/R: Draft Final Report F/R: Final Report

Figure 1.3.1 Study Schedule

1.4 Justification of the Project Proposed in the Study

The study area is confronted with complex and interrelated issues inherent in the various water sectors such as: (a) water allocation and distribution for irrigation, domestic use, municipal use, hydropower generation and other water uses; (b) management of flood and sediment disasters; (c) conservation and improvement of water quality and other water-related environment; and (d) watershed management.

To cope with these issues, the relevant government and non-government agencies had implemented various water resources management and development projects. Many of the issues, however, remain unattended without providing any fundamental solution. Moreover, the completed and/or proposed projects were not always based on adequate coordination with all water-related sectors and, at the same time, the requirements of the stakeholders have not been well reflected.

As the result, the project in a specific water-sector has often caused adverse effect to the other water-related sectors, which led to difficulties in achieving an accountable, effective and sustainable project. Unavoidably, the issues in the water sector would become more significant as the population increases. Economic activities would likewise expand and other socio-economic conditions would change in the future.

In view of the above circumstances regarding the water-related issues, it is indispensable to adapt the concept of IWRM. The IWRM stresses the following four different principles: (a) the integrated and

holistic approach crossing multi-water sectors; (b) the adaptable response to future dynamic changes of socio-economic conditions and the natural conditions affected by climate change and other factors; (c) the involvement of stakeholders at every stage and step of plan formulation and implementation of the water-related project; and (d) the broader focus points such as fairness, economical effect, efficiency and sustainability of the water-related projects.

The IWRM Framework Plan was formulated by NWRB in 2006. Through the formulation process, the Government of the Philippines (hereinafter referred to as "GOP") is deemed to have well-recognized the importance of the plan for IWRM. However, the concept of the IWRM Framework Plan has not yet been well materialized. Hence, the study has been undertaken through the technical assistance of JICA to clarify the definite water-related issues inherent in the study area, together with the interrelationship among the issues, and to propose the IWRM Plan that would cope with these issues.

1.5 Counterpart Agency

The NWRB acted as the counterpart agency to JICA to facilitate the smooth implementation of the Study. NWRB had assigned the following counterpart personnel, who worked together with the JICA Study Team in the course of the Study.

Table 1.5.1 (1/2) Counterpart Personnel for the Study

Assignment	Name and Designation in NWRB
Chairperson of Steering Committee (Acting)	Nathaniel C. Santos OIC, Deputy Exec. Director
Team Leader	Isidra D. Peñaranda OIC, Policy & Program Division
Deputy Team Leader/Water Resources Development Planner	Susan P. Abaño Engineer IV, Policy & Program Division
Organization, Institution/Consensus Building Specialist	Emmie L. Ruales Engineer IV, Policy & Program Division
Organization, Institution/Consensus Building Specialist	Ambrosia Agnes del Rosario Special Investigator II, Water Right Division
Hydrologist/River Management Specialist	Joey C. Castro Engineer III, Policy & Program Division
Hydrologist/River Management Specialist	Ferdie I. Billones Engineer III, Policy & Program Division
Groundwater Specialist	Higino C. Mangosing Engineer IV, Monitoring and Enforcement Division
Groundwater Specialist	Charito M. Menguito Engineer II, Monitoring and Enforcement Division
Agriculture/Irrigation Specialist	Jesusa T. Roque Engineer III, Policy & Program Division
Agriculture/Irrigation Specialist	Milagros M. Velasco Engineer II, Policy & Program Division
Water Supply and Sewerage Planner	Pacita F. Barba Engineer III, Monitoring and Enforcement Division
Water Supply and Sewerage Planner	Evelyn V. Ayson Engineer IV, Monitoring and Enforcement Division
Water Environment/Watershed Management Specialist	Josephine R. Billones Engineer II, Policy & Program Division
Water Environment/Watershed Management Specialist	Arlene C. Diaz Engineer III, Water Rights Division
Economic/Financial Analyst	Florimel R. Balbedina Economist III, Policy Formulation Section
Economic/Financial Analyst	Ma. Cristina B. Arellano Economist II, Policy & Program Division
Environmental and Social Considerations Specialist/Study Coordinator	Francis B. Hilarie Economist III, Policy & Program Division

… Continue to next page

Table 1.5.1 (2/2) Counterpart Personnel for the Study

Assignment	Name and Designation in NWRB
Environmental and Social Considerations Specialist	Lilian P. Gacusan Statistician II, Policy & Program Div
GIS Specialist	Luis S. Rongavilla Engineer III, Policy & Program Division
Web Management Specialist	Ma. Charina Gonzales Systems Analyst III, Policy & Program Division
Study Coordinator	Felisa M. Manlulu Information Officer IV, Policy & Program Division

1.6 Steering Committee

The Steering Committee (SC) has been set up to provide guidance for the smooth implementation of the Study and to coordinate the activities of the relevant government and non-government organizations under the initiative of NWRB. All reports for the Study were presented the SC and discussed by the Study Team at each stage of the Study. The following government agencies acted as permanent members of the SC:

(1) NWRB (Chairman)
(2) DENR
(3) NEDA Central Office
(4) DPWH Project Management Office – Flood Control and Sabo Engineering Center (DPWH-PMO-FCSEC)
(5) Department of Justice
(6) Department of Finance
(7) National Hydraulics and Research Center
(8) Department of Health
(9) Provincial Government of Pampanga
(10) Provincial Government of Nueva Ecija
(11) Provincial Government of Bulacan
(12) NIA
(13) Subic Clark Alliance for Development Council
(14) PAGASA
(15) Department of Interior and Local Government
(16) NEDA Region III
(17) DENR – River Basin Control Office
(18) Provincial Government of Tarlac

1.7 Technical Working Group

The Technical Working Group (TWG) has been set up to provide technical support services to the above Steering Committee. The TWG held coordination meetings with the Study Team to discuss and monitor the progress of the Study. The following government agencies acted as permanent members of the TWG:

(1) NWRB (Chairman)
(2) NEDA Central Office
(3) DPWH-PMO-FCSEC
(4) NIA Central Office

(5) NEDA Region III

(6) DPWH Region III

(7) DENR Region III

(8) DENR Environmental Management Bureau

(9) DENR Forest Management Bureau

(10) DENR Parks and Wildlife Bureau

(11) Provincial Government of Tarlac

(12) Provincial Government of Pampanga

(13) Provincial Government of Nueva Ecija

(14) Provincial Government of Bulacan

(15) NIA Region III

(16) NIA Upper Pampanga River Integrated Irrigation Systems (UPRIIS)

(17) DENR River Basin Control Office

(18) PAGASA

(19) MWSS

(20) NPC

(21) Central Luzon Association of Water Districts (CLAWD)

(22) Bureau of Soils and Water Management

(23) National Commission on Indigenous People

(24) Philippine Institute of Volcanology and Seismology (Phivolcs)

(25) BFAR Region III

1.8 Composition of the Final Report

The Final Report of the Study is composed of: (a) Volume I, Summary; (b) Volume II, Main Report; and (c) Volume III and IV, Supporting Reports. The contents of these Volumes are as listed below:

Table 1.8.1 Composition of the Final Report

Volume No.	Title	Contents
Volume I	Summary	The summary of all study results.
Volume II	Main Report	All of the study results.
Volume III	Supporting Reports	The detailed results of the study in each of the following sectors to support the Main Report: Sector A: Topography and Meteorology Sector B: Socio-Economy Sector C: Agricultural, Irrigation and Fishery Development Sector D: Municipal Water Supply, Sanitation and Sewerage System Management Sector E: Flood and Sediment Disaster Management Sector F: Water-Related Environmental Management Sector G: Watershed Management Sector H: Water Resources Development and Management
Volume IV		Sector I: Socio-Environmental Consideration Sector J: Guidelines for Formulation of IWRM Plan Sector K: Formulation of IWRM Plan for Pampanga River Basin Sector L: Plans for Legal and Institutional Framework Sector M: Water-Related Data Management Appendix: Minutes and Discussion Records on SC, TWG and Stakeholder Meetings
Supplementary Material (Digital file only)		・ Databook ・ Training Material & Manual

Chapter 2. Present Natural Conditions of the Study Area

2.1 Topographic Conditions

The study area borders on Manila Bay in the South, Sierra Madre Mountains in the East, Caraballo Mountains in the North and Zambales Mountains, which includes the well-known Pinatubo Mountains, in the West. Of these boundaries, the western Zambales Mountains are characterized by the volcanic imprint associated with geologically young calderagenic-type of volcanic eruption. In contrast, the eastern Sierra Madra Mountains comprise more of dissected and eroded terrain.

The central part of the study area is relatively flat, forming Central Luzon Plain. The highest elevation of 1,885 m above mean sea level can be seen at the northeast boundary with Sierra Madre Mountains. The lowest elevation, which is almost equal to mean sea level, extends widely at around the river mouth of Pampanga river basin. There are some small peaks in Central Luzon Plain, namely; Mt. Arayat, which has an elevation of 1,026m.

Annex-F 2.1.1 shows the distribution of each elevation zone in the study area, and Table 2.1.1 summarizes the share of each elevation zone. About 15% of the study area has the elevation of less than 10m above mean sea level. This lowland area extends widely from the river mouth toward the middle stretch of the Pampanga River. In more than 50% of the study area, the elevation ranges from 10m to 200m above mean sea level. This consists of Central Luzon Plain. The hilly to low mountain area with elevation of 200-800m surrounds Central Luzon Plain. Almost all portions of Sierra Madre Mountains reside in the range. The area with more than 800m above mean sea level in elevation shares about 5% of the study area. It is mainly located in Pinatubo Mountains and the northeastern boundary of the study area.

Table 2.1.1 Elevation Classification in the Study Area

Elevation Zone	Area (km^2)	Percentage of the Total Area (%)
< 5 m	820.4	7.9
5 – 10 m	581.0	5.6
10 – 50 m	2,899.0	27.8
50 – 200 m	2,772.0	26.6
200 – 500 m	1,896.6	18.2
500 – 800 m	969.7	9.3
800 – 1,200 m	392.9	3.8
1,200 – 1,600 m	96.6	0.9
1,600 m <	6.1	0.1
Total	10,434.4	100.0

Source: JICA Study Team

Slope is one of the important factors for water resources planning. It is usually related to erosion and, consequently, sediment and nutrient yields from a river basin. Annex-F 2.1.1 shows the distribution of each category of slope in the Study Area, and Table 2.1.2 summarizes the share of the each category of slope. More than 65% of the study area is categorized as “level to nearly level” (slope is less than 3%). It extends widely from Manila Bay to Central Luzon plain. The share of the remaining categories is almost evenly distributed to each category. The area with the categories of “steep” and “very steep” covers more than 10% of the study area.

Table 2.1.2 Slope Classification in the Study Area

Description	Percent Slope (%)	Area (km^2)	Percentage of the Total Area (%)
Level to nearly level	< 3	7,045.5	67.5
Gently sloping to undulating	3 – 8	600.2	5.8
Undulating to rolling	8 – 18	706.5	6.8
Rolling to moderately steep	18 – 30	781.4	7.5
Steep	30 – 50	979.6	9.4
Very steep	50 <	321.3	3.1
Total		10,434.4	100.0

Source: JICA Study Team

By integrating the aforesaid elevations and slope classifications, the study area could be classified into the following three (3) regions:

- The alluvial plain with ground elevation of less than 200m and slope of less than 3% spreads over the lower and middle reaches of Pampanga river basin covering about 65% of the study area. The lower part of the Central Luzon Plain, in particular, has the extremely low ground elevation of less than 10m above mean sea, and it is called Pampanga Delta, which accounts for about 15% of the study area.
- The hilly/low-mountain ranges with elevation of 200-800m enclose the above alluvial plain and they form a part of Sierra Madre Mountains. These hilly/low-mountain ranges take about 30% of the entire study area.
- There exist the mountain areas of more than 800m above mean sea level in elevation. They share about 5% of the study area and are mainly located in Pinatubo Mountains and the northeastern boundary of the study area. Mt. Pinatubo erupted in 1991 and the top of the mountain was blown off, which made its height about 500m lower than before. A significant volume of lahar was also produced by the eruption and deposited widely around the mountains.

2.2 Rivers

The study area is largely divided into three (3) river basins, namely; (a) Pampanga river basin, (b) Angat river basin; and (c) Pasac river basin (refer to Annex-F 2.2.1). The principal features of these three river basins are as described below:

2.2.1 Pampanga River Basin

Of the three (3) river basins, Pampanga river basin has the largest catchment area of 7,978km^2 and the longest channel length of 265km. The river originates in Caraballo Mountains on the north of the study area, and flows into Pantabangan storage dam. The upstream stretch of the river above the dam is often called as Pantabangan River. After passing the dam, the river further flows southward meeting with several tributaries and finally empties into Manila Bay. The major tributaries of Pampanga main stream are Coronell River, Peñaranda River and Chico River. Of these tributaries, Chico River has the largest catchment area of 2,895km^2, and it joins the main stream nearby Mt. Arayat and/or Candaba Swamp which has the maximum inundation area of about 330km^2 during rainy seasons. The schematic diagram of the river systems is shown in Annex-F 2.2.2 and the longitudinal profiles of Pampanga main stream as well as its major tributaries are shown in Annex-F 2.2.3.

2.2.2 Angat River Basin

Angat river basin originates in Sierra Madra Mountains and flows into Angat storage dam meandering through a narrow valley. In the lower reaches of the dam, the river flows westward and finally empties into Manila Bay through Labangan Floodway. There is a small connecting channel with Pampanga River, which is called as Bagbag River. The total length of the main stream of Angat River is 153km and the total catchment area is about 1,085km^2. The schematic diagram of the river systems is shown in Annex-F 2.2.4, and the longitudinal profiles of Angat main stream as well as its major tributaries are shown in Annex-F 2.2.5.

2.2.3 Pasac River Basin

Pasac river basin covers various river channels running on the eastern slope of Mt. Pinatubo, such as Abacan-San Fernando River, Pasig-Potrero River and Porac-Gumain River. All of the rivers originate in Mt. Pinatubo, and flow into Manila Bay. The total catchment area of the river basin is about 1,371km^2. In the lower reaches, the river system is connected with Pampanga Main River by Bebe-San Esteban Cutoff Channel. The morphologies of Pasac River have been much affected by the eruption of Mt. Pinatubo in 1991; the river alignments have changed due to the mudflow produced by the eruption and serious sediment deposit in the river channel is still in progress up to the present. The schematic diagram of the river systems is shown in Annex-F 2.2.6 and the longitudinal profiles of the main rivers in Pasac river basin are demonstrated in Annex-F 2.2.7.

2.3 Meteorology

2.3.1 Meteorological Gauging Data

Of the existing climatic data in and around the study area, those gauged at the following stations have been identified as the existing available data for the discussion and analysis in the study. The lists of these stations together with the available gauging duration are given in Annex-T 2.3.1 for the precipitation data, and Annex-T 2.3.2 for the other climatic data. The locations of meteorological stations are as shown in Annex-F 2.3.1.

Table 2.3.1 Climatic Gauging Stations in and around the Study Area

Gauging Item	Classification of Gauging Station	Number of Gauging Stations
Precipitation Data	PAGASA Synoptic Station	9*
	PAGASA Secondary Meteorological Station	9
	PAGASA Telemetry Gauging Station	12
	Others	6
	Sub-Total	36
Other Climatic Data**	PAGASA Synoptic Station	2

Note: * : Of the nine synoptic gauging stations, two (2), namely; CLSU Muñoz and Cabanatuan Gauging stations are located in the study area, while the other seven (7) are outside of the study area.
**: The data include mean air temperature, relative humidity, sunshine duration, wind speed and pan evaporation.

In addition to these gauging data, the data for long-term average monthly temperature are given from the Worldclim Dataset, which is the global dataset in 1km mesh, and they are used for the correction of temperatures caused by variations of altitude.

2.3.2 Temporal Variations of Meteorological Data in the Study Area

The temporal variations of meteorological condition in the study area have been estimated based on the climatic data gauged at the above stations. The changes in the annual total precipitation at the key stations during 1951 to 2007 are presented in Annex-F 2.3.2, which shows no clear tendency of long-term variation of precipitation, although there could be some periodical patterns.

A substantial part of the study area except the eastern mountainous region belongs to the climate area of Type I classified by PAGASA, which is characterized by the pronounced dry season from November to April and wet season during the rest of the year (refer to Annex-F 2.3.3). The maximum rainfall depth is usually recorded from June to September. On the other hand, the eastern mountainous regions belong to Type III, which is characterized by “no very pronounced rainy season.”

The long-term average annual precipitation in the study area has been estimated at about 2,155mm/year, and about 83% of the annual precipitation concentrates on the rainy season from May to October as listed below.

Table 2.3.2 Monthly Variation of Precipitation for the Entire Study Area

(unit: mm)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
31.8	24.1	29.0	46.1	180.4	267.5	363.8	409.7	331.6	230.5	155.5	84.9	2155.0
1.5%	1.1%	1.3%	2.1%	8.4%	12.4%	16.9%	19.0%	15.4%	10.7%	7.2%	3.9%	100.0%

Source: JICA Study Team

The data for the metrological indices other than the above precipitation gauged at the synoptic station, CLSU Muñoz, have been further estimated as shown in Table 2.3.3.

Table 2.3.3 Monthly Variation of Climatic Parameters at CLSU Muñoz

Items	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Air Temperature ( )	25.9	26.1	27.0	28.7	29.4	28.6	27.9	27.5	27.5	27.5	27.4	26.3	27.5
Relative Humidity (%)	76.4	77.6	76.3	74.9	76.2	81.3	84.2	87.0	86.0	82.7	77.8	75.5	79.7
Wind Speed (m/s)	3.2	3.1	2.7	2.5	2.1	2.2	1.8	2.0	1.9	2.0	2.7	3.0	2.4
Sunshine Duration (hrs)	7.9	8.7	8.9	9.3	7.6	6.4	5.3	4.7	5.1	6.2	6.8	7.0	7.0
Pan Evaporation (mm/month)	168	169	203	213	192	147	135	119	120	129	135	153	1,879

Source: JICA Study Team based on PAGASA data

As listed above, there is not much significant change in air temperature throughout the year. The hottest month is May with mean air temperature of 29.4 degree Celsius. On the other hand, January is the coolest with mean air temperature of 25.9 degree Celsius. The difference in the hottest month and the coolest month is just about 3.5 degree Celsius.

2.3.3 Spatial Variation of Meteorological Data in the Study Area

The spatial variation of precipitation in the study area is estimated based on the actual data gauged at the aforesaid 36 stations together with the correction of precipitation by elevation, which was made by the following equation:

$$P = P_0 \exp\left[C_e \left(EL - EL_0\right)\right]$$

Where; P = precipitation volume, P0 = precipitation volume at reference elevation, Ce = Coefficient for correction of elevation (Ce = 0.0003 would fit best in the present study), EL = elevation, EL0 = reference elevation.

Annex-F 2.3.4 shows the spatial distribution of annual total precipitation. The annual total precipitation is higher in mountain areas, in general. The annual total precipitation exceeds 4,000mm/year around the south-east boundary of the study area. In the middle part of Central Luzon Plain, the annual total precipitation is less than 1,500mm/year. Annexes-F 2.3.5 and 2.3.6 show the spatial distribution of averaged monthly precipitation in dry season (November to April) and in wet season (May to October), respectively. Even in dry season, the precipitation volume is kept high around the south-east boundary of the study area.

2.4 Hydrology

2.4.1 Hydrological Gauging Data in the Study Area

The surface water level/discharge data gauged at 76 hydrological stations in total have been collected as the base for hydrological analysis. The locations of the hydrological stations are as shown in Annex-F 2.4.1. It is, however, herein noted that most of these gauging stations have ceased their gauging operations, and only five gauging stations have remained continuing their operations as of 2008 (refer to Annex-T 2.4.1). Of the said five gauging stations, two are for gauging of inflow discharges to Pantabangan and Angat dam reservoirs.

2.4.2 Specific Discharge and Runoff-ratio

Of the aforesaid 76 hydrological gauging stations, 48 stations could provide complete monthly discharge records of more than 5 years. Hence, the specific discharges at these stations against their corresponding catchment areas have been estimated as shown in Annex-F 2.4.2. From the results, it has become clear that specific discharge decreases with the catchment area and tends to converge to about $0.04 m^3/s/km^2$. Moreover, it can be observed that the specific discharge after 1974 is somehow lower than that before 1973. This is presumably because of the impact of abstraction for irrigation in the basin, which became available due to the start of operation of Pantabangan storage dam.

The specific discharge for Angat storage dam catchment is much higher than that in the other catchments in Pampanga river basin. This is due to the much higher volume of precipitation in Angat storage dam catchment area.

Annex-F.2.4.3 shows the runoff rate as to the catchment area. The runoff rate ranges from 0.4 to 0.9. It tends to decrease with the catchment area and converges to about 0.5 to 0.6. Roughly, the runoff volume is about 50 to 60% of the total precipitation volume in the basin, which is equivalent to the runoff volume of about 1,100 to 1,300 mm/year (11,000 – 13,000 MCM/year).

2.4.3 Long Term Variations of Annual River Discharge Volume

Figure 2.4.1 shows the long-term trend of annual average discharge at HMS343 (Arayat in Pampanga River) and HMS334 (Cabanatuan in Pampanga River). Location of these two hydrometric stations is shown in Figure 2.4.2). As shown in Figure 2.4.1, the annual averaged discharge at HMS 334 remarkably decreases after the start of operation of Pantabangan storage dam in 1974. On the other hand, the decrease of the discharge at HMS 343 is minimal. This may be because of more contribution of the runoff discharge from tributaries at HMS 343. It should be noted that at just upstream of HMS 343, Cong Dadong diversion dam started its operation in 2002, which may bring about significant change in the observed discharge at HM S343. However, the observation at HMS 343 was finished in 2002, so that the observed data at HM S343 do not include the effect of the operation of Cong Dadong diversion dam.

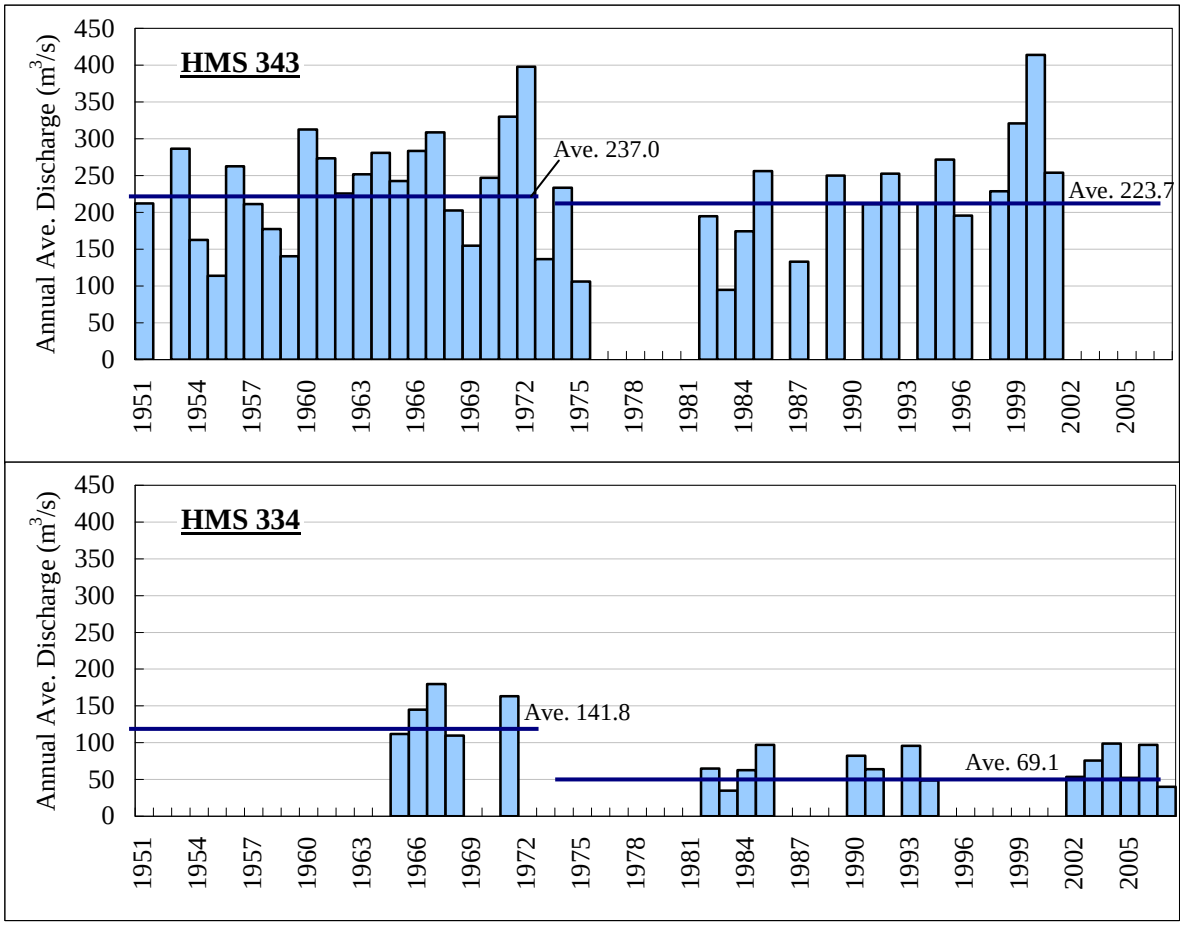
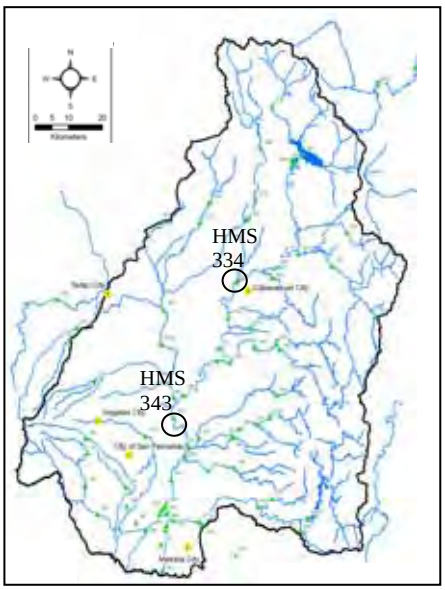


Figure 2.4.1 Long-term Trend of Annual Average Discharge at Gauging Stations HMS 343 and HMS 334



Source: JICA Study Team

Figure 2.4.2 Location of Hydrometric Stations of HMS 334 and HMS 343

2.4.4 Variation of Monthly River Discharge Volume

Figure 2.4.3 shows the monthly variations of discharge of Pampanga River, which were gauged at the aforesaid stations HMS 334 and HMS 343. The minimum and maximum discharge appears in April and September, respectively. It can be observed that the flow regime changes drastically after 1974 both at HMS 343 and HMS 334. At HMS 343, the discharge in dry season increases and that in wet season decreases slightly. At HMS 334, the discharge in both dry and wet seasons decreases. This is presumably related to the abstraction and return flow by irrigation water use. HMS 334 is located at the downstream of the major intake points for irrigation. On the other hand, HMS 343 is located at further downstream in which some return flow from irrigation area is expected.

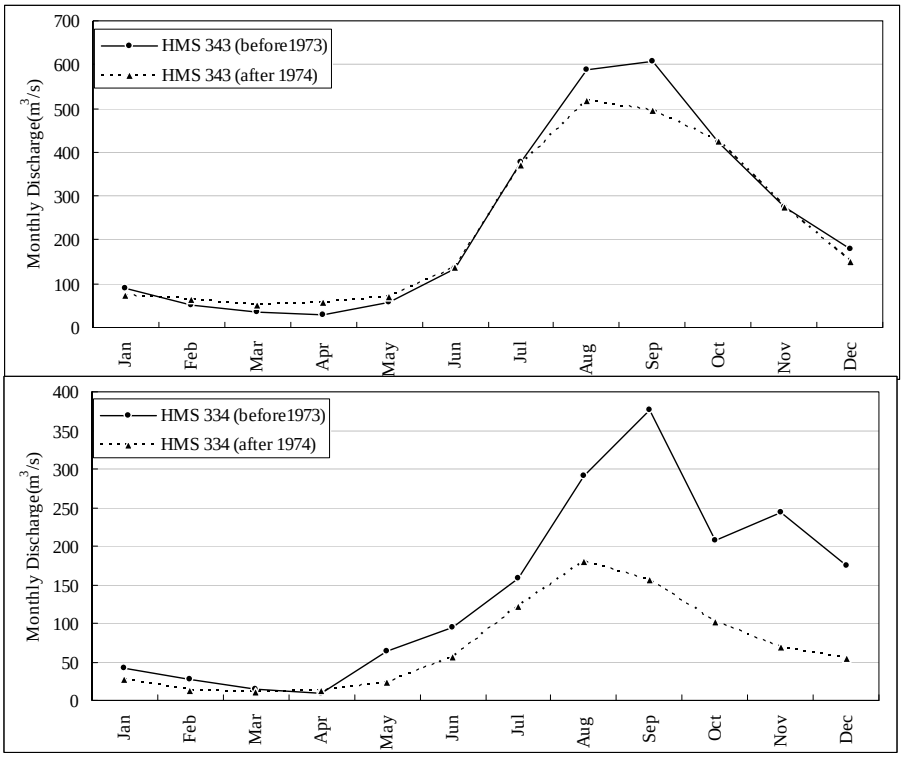


Figure 2.4.3 Variation of Monthly Discharge of Pampanga River

2.5 Geology

The Philippines is situated in and along the Circum-Pacific Volcanic-Earthquake Belt characterized by earthquakes and volcanic activities, some of which are destructive. General geological structure trends north to north north-west faulted by the Philippine Fault System and its splay faults stretches particularly along the Southern Sierra Madre Mountains crossing over the Nueva Ecija and Bulacan provinces. Faults in Nueva Ecija named "Dingalan Fault" are supposed to be active faults and faults distributed in Bulacan are supposed to be probable active faults.

The oldest rocks at the substratum are distributed along the eastern highland of the study area. These rocks are considered to be older than the Cretaceous and composed of amphibolite, mica schist, phyllites, etc. Sedimentary rocks are widely distributed in the eastern mountain area from the age of Cretaceous period to Tertiary-Miocene epoch. They are composed of marine wackes (sandstone) and flysch (shale) intercalated by basalt, andesite flow, and pyroclastics. Oligocene sedimentary rocks are intruded by quarts diorite. Upper-Miocene sedimentary rocks are overlain by pyroclastics and tuffaceous sedimentary rocks. These rocks are not basically aquiclude, which is not expected to be used for groundwater exploitation excluding caves/cavities of limestone and lava flow. The location and scale of caves/cavities is not clear at this moment.

Alluvium (R), which consists of unconsolidated clay, sand gravel, is widely distributed in the Central Luzon Plain with thickness of about 199m based on the existing drilling data. It is considered as a good aquifer. Sand and gravel layers, especially, ensure good aquifer, and they could be widely utilized for domestic water and other uses.

Quaternary pyroclastics (QVP) is overlaid by Alluvium. The possibility of groundwater extraction by an ultra-deep well depends on the depth of the pyroclastics.

The geology in the study area is summarized in Annex-T 2.5.1 and in Annex-F2.5.1.

2.6 Hydrogeology

The groundwater availability and general hydrogeology in the study area have been estimated, as shown in Annex-F 2.6.1, based on the available information on hydrogeological parameters and the geological map. As shown in Annex-F 2.6.1, a substantial part of the alluvial plains in the study area are estimated to show high permeability and contain aquifers, which have high productivity of groundwater. About 5,585km^2 or 53% of the study area is expected to have high productivity of groundwater.

There are the flood plains along the narrow valleys in the hilly and/or low mountain area. These flood plains would also contain rather high productive aquifers of groundwater. The deposits in the flood plains are composed of sand, gravel, and clay, and they are expected to be moderate to high permeability. About 224km^2 or 2.1% of the study area belong to the flood plains containing the rather high productivity of groundwater.

The hilly and/or mountain regions other than the above alluvial plains and flood plains are of low permeability and hardly produce adequate groundwater. Only the loose cracks area and/or limestone area may contain the possible local aquifer. About 4,725km^2 or 55% of the study area belong to the hilly/mountain regions containing the rather low productivity of groundwater.

2.7 Water Quality

2.7.1 Surface Water

DENR defines the classes of surface water quality according to their corresponding applicable usages, as shown in Table 2.7.1. This classification is based on the concept that the quality of waters in the Philippines shall be maintained in a safe and satisfactory condition according to their best uses. The standard concentration of the major parameters applied as the criteria for this classification are as listed in Table 2.7.2.

Table 2.7.1 Water Usage and Classification for Fresh Surface Waters

Class AA	Public Water Supply Class I – Intended primarily for waters having watersheds which are uninhabited and otherwise protected and which require only approved disinfection to meet the Philippine National Standards for Drinking Water (PNSDW)
Class A	Public Water Supply Class II – Intended as sources of water supply requiring conventional treatment to meet the PNSDW
Class B	Recreational Water Class I – Intended for primary contact recreation (e.g., bathing, swimming, skin diving, etc.)
Class C	Fishery Water, Recreational Water Class II, or Water Supply Class I – Intended for propagation and growth of fish & other aquatic resources, boating, manufacturing processes after treatment
Class D	Industrial Water Supply Class I – Intended for agriculture, irrigation, livestock watering, etc.

Source: DENR

Table 2.7.2 Guideline Values for Different Classes of Water for Monitored Parameters

Parameter	Unit	Class AA	Class A	Class B	Class C	Class D
BOD (Max)	mg/liter	1.0	5.0	5.0	7.0 (10.0)	10.0 (15.0)
DO (Min)	mg/liter	5.0	5.0	5.0	5.0	3.0
TDS (Max)	mg/liter	500.0	1,000.0	--	--	1,000.0
TSS (Max)	mg/liter	25.0	50.0	(b)	(c)	(d)

Notes: (a) The numerical limits are yearly average values. Values enclosed in parentheses are maximum values.
(b) Not more than 30% increase, (c) Not more than 30mg/liter increase, (d) Not more than 60mg/liter increase
Source: DENR Administrative Order 90-34

In accordance with the above classifications, DENR broadly categorized the water quality of Pampanga River and its tributaries as listed below.

Table 2.7.3 Classification of Applicable Water Usages of Principal Rivers in Pampanga River Basin

Classification	Name of River	River System
Class AA	No principal river is classified under this category	-
Class A	Pampanga main stream (the upstream), Sacobia River	Pampanga Main
Class B	Pampanga River (Downstream), Pantabangan River, Coronell River, Peñaranda River , Talavera River	Pampanga Main
	Angat River (Upstream)	Angat
	Porac River (Downstream), San Fernando River	Porac
Class C	Rio Chico River	Pampanga Main
	Angat River (Downstream)	Angat
Class D	No principal river is classified under this category	-

Source: DENR-EMB. 2007

As listed above, the majority of the river channels in Pampanga river basin are classified as Class B and none as Class D. Thus, DENR evaluates that Pampanga River and its tributaries are not seriously polluted yet. This general evaluation by DENR could be preliminarily accepted in the present study judging from the results of the field reconnaissance. However, a particular attention should be paid to Abacan River, a tributary of Pasac River, which flows through Angeles City, the largest urban area in Pampanga river basin. The JICA Study Team had observed that the river gives an offensive odor during the dry season and, therefore, it is hardly classified even as Class D.

The DENR-Environmental Management Bureau (EMB) Region III monitors the water quality of Pampanga main stream and San Fernando River, a tributary of Pasac River. Water sampling for Pampanga main stream was made at three (3) stations, all of which are located in Apalit Municipality, Province of Pampanga. As for San Fernando River, the water samples were taken from seven (7) monitoring stations located within the city limits of San Fernando. In addition, the DENR-EMB Region III monitored the Minalin, Porac and Angat rivers in 2007 and 2008. However, the monitoring activities appear to be very sporadic, so that the data sets generated were not applied to the evaluation.

The available records of river water quality are for the years 2003 to 2006 for Pampanga River at Apalit monitoring stations and 2007 to 2008 for San Fernando River, as listed in Annex-T 2.7.1 to Annex-T 2.7.2 and summarized below.

Table 2.7.4 Summary of Over-Year Average Water Quality of Pampanga River and San Fernando River

(unit: mg/liter)

River Monitored/DENR Criteria for Water Usage	Quarter/Year	BOD	DO	TDS	TSS
Pampanga River at Apalit Monitoring Point (Monitoring Period: 2003 -2006)	1st Quarter	3.7	6.4	234.8	74.0
	2nd Quarter	2.7	3.9	322.4	107.8
	3rd Quarter	7.0	5.9	345.9	111.5
	4th Quarter	1.8	6.4	197.0	285.7
	Throughout- Year	**4.3**	**5.7**	**282.1**	**142.2**
San Fernando River in the City Limit of San Fernando (Monitoring Period: 2007 -2008)	1st Quarter	18.6	7.2	429.0	56.3
	2nd Quarter	24.8	5.4	539.0	62.6
	3rd Quarter	10.6	4.7	-	48.3
	4th Quarter	6.9	3.8	-	50.3
	Throughout- Year	**13.0**	**5.0**	**429.0**	**47.9**
DENR Criteria for Water Usage of Class A		**< 5.0**	**>5.0**	**<1,000.0**	**<50.0**

Source : DENR Region III, 2009

As listed above, Pampanga River shows that the parameters except TSS are within the criteria for water usage of Class A. Thus, the upstream of the river from the monitoring point at Apalit could be evaluated to be rather clean and expected as the eligible source of water supply for drinking water on the premise of conventional treatment only. The TSS of the river is, however, over the limit of Class A, which could be related to the deterioration of the watershed in the upper reaches of the river basin.

In contrast to Pampanga River, San Fernando River shows that the parameter of BOD in particular is far beyond the limit of Class A and could not be applicable even to the water usage of Class D. This could be attributed to the effluent from San Fernando City to the river.

2.7.2 Groundwater Quality

The groundwater is the primary source for the potable water supply in the study area. Hence, the present groundwater quality has been preliminarily evaluated against the Philippine National Standards for Drinking Water (PNSDW) by the Department of Health (DOH).

The results of the bacteriological analysis for coliform and the metal analysis for toxic materials contained in the groundwater were collected from sampling points albeit a very few. According to the DOH, impermissible toxic materials such as arsenic, cadmium, and mercury were not detected. As for the results of the bacteriological analysis, impermissible coliform was detected in the raw groundwater at a few wells in Angeles City. Nevertheless, the treated groundwater contains no impermissible coliform. The results of the interview survey further assured that no fatal disease has originated from the groundwater in the study area.

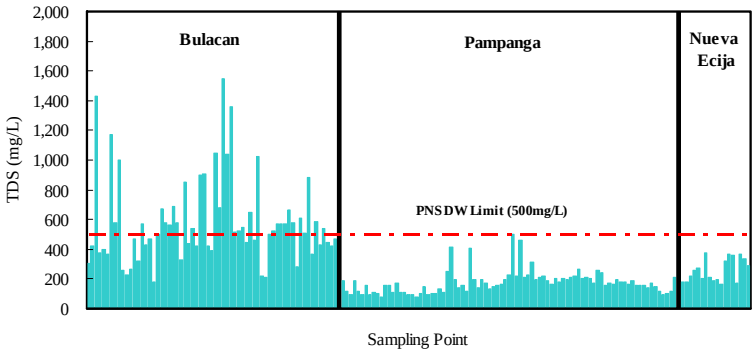
In addition to the results of the above bacteriological and metal analyses, those for physical and chemical analyses by the groundwater quality tests in 2005 to 2008 were collected from 180 sampling points in 21 water districts in and around the study area. The results of the physical and chemical analysis are as shown in Annexes-T 2.7.3 to 2.7.5 and summarized as below.

Table 2.7.5 Results of Water Quality Test for Groundwater Managed by Water Districts in and around the Study Area

Description	Bulacan	Pampanga	Nueva Ecija	Total
1. Total Number of Sampling Points	71	87	22	180
2. Number of Sampling Points above PNSDW Limit				
(1) Turbidity	2	0	0	2
(2) True Color	4	0	0	4
(3) Ph	8	1	0	8
(4) Hardness	3	0	2	3
(5) Total Dissolved Solids (TDS)	35	0	0	35
(6) Chloride	15	0	0	15
(7) Iron	1	1	0	1
(8) Manganese	0	9	1	0

Source: Water Districts

As shown in the above Table 2.7.5, the groundwater at a substantial number of sampling points in the province of Bulacan (35 points out of 71 points in total) shows the high values of TDS and Chloride, which exceed the PNSDW Limits. Moreover, seven samples (or about 10% of all samples) show the extremely high TDS of more than 1,000mg/liter, which is double of the PNSDW Limits (refer to Figure 2.7.1). Both TDS and Chloride could be the indicators for the mixture degree of salinity water, and judging from the said extraordinary values of TDS and Chloride, the groundwater in a part of the province of Bulacan could be hardly used as the source of drinking water.



Source: Water Districts

Figure 2.7.1 TDS of Groundwater in Each Province

Salinity intrusion to the groundwater in general occurs in the shoreline areas. The NWRC (the present NWRB) had estimated the possible extent of the saltwater encroached area as shown in Figure 2.7.2 based on the results of groundwater quality tests made before 1982, the analysis on the resistivity formation of aquifers, and other available relevant data. As shown in this f, the saltwater encroached area spreads over the coastal belt of about 20 to 30km in width.

Source: NWRB

Figure 2.7.2 Possible Extent of Saltwater Encroached Area Estimated by NWRC in 1982

In addition to the TDS and Chloride, the Ph values of the groundwater also exceed the PNSDW Limits at about 11% of the sampling points in the province of Bulacan. Nevertheless, the excess of Ph values are not significant as compared with those of the aforesaid TDS: such excessive Ph value leads to unpalatable water a little, but not fatal disease. A little concern is further given to the impermissible concentration of Manganese detected at nine sampling wells in the province of Pampanga. However, the sample wells, which contain the impermissible concentration, are located within a few water districts only, and reduction in concentration of Manganese could be made through proper treatment.

2.7.3 Coastal/Marine Water Quality

In 2008, the DENR-EMB Region III began monitoring the quality of coastal waters near the mouth of Manila Bay, which is the outlet of Pampanga River. This is in support of the initiative to rehabilitate Manila Bay. Six stations are being monitored in Pampanga Delta, specifically, along the fishpond areas in the towns of Masantol, Macabebe and Sasmuan. The data sets are, however, still inadequate for purposes of this analysis.

Nevertheless, available reports from water quality assessments done in adjoining coastal areas of Manila Bay including Navotas, Metro Manila and Cavite, confirm the risks to human health posed by high fecal and total coliform load and other toxic contaminants contributed by domestic, agricultural and industrial wastes from areas draining into Manila Bay. While it is yet uncertain how much Pampanga river basin contributes in terms of total load, pollutants in the coastal environment are constantly being remobilized.

2.8 Ecologically Sensitive Area

Republic Act No. 7586, which is known as the National Integrated Protected Areas System (NIPAS) Act, prescribes the eight categories of protected areas, namely; (a) strict nature reserve; (b) natural park; (c) natural monument; (d) wildlife sanctuary; (e) protected landscapes and seascapes; (f) resource reserve; (g) natural biotic areas; and (h) other categories, established by law, conventions or international agreements which the Philippine Government is a signatory. In accordance with the Act, the following areas in and around the study area are designated as protected areas established under the NIPAS.

Table 2.8.1 Protected Areas in and around the Study Area under the NIPAS

Protected Area		Area(ha)
1.	National Park (NP)s	
(1)	Minalungao NP	2,018.00
(2)	Biak-na-Bato NP	658.85
(3)	Mt. Arayat NP	3,715.23
2.	Watershed Forest Reserves	
(1)	Angat Watershed Forest Reserve District	55,709.10
(2)	Angat Watershed and Forest Range	6,600.00
(3)	Talavera Watershed Reservation	37,156.00
(4)	Pantabangan-Carrangan Watershed Reservation	84,500.00
(5)	Doña Remedios/General Tiño Watershed	20,760.00
Total		211,117.18

Source: 2004 Statistics on Philippine Protected Areas and Wildlife Bureau (PAWB)

In addition to the above protected areas designated under NIPAS, particular attention should be paid to Candaba Swamp, which has been declared as a bird sanctuary by the Candaba Municipality under Resolution No.51, series of 2004, and the mangrove forest in the study area. Among them, Candaba Swamp is one of the Ramsar candidate sites extending over 33,000ha in the middle reaches of Pampanga river basin. The swamp and Manila Bay were also nominated as Important Bird Area designated by the Bird Life International.

As for mangrove forest, there existed the mangrove area of 1,276ha around Manila Bay, of which 1,007ha extended in the study area in 1994. However, the Environmental Resource Validation by Manila Bay Environmental Atlas identified that the said extent of mangrove area was reduced to 414.15ha, which includes 230ha in the study area, in 2005, as listed below. Thus, the mangrove areas are declining significantly in Manila Bay due to conversion of land use.

Table 2.8.2 Existing Mangrove in the Study Area

(unit: ha)

Province	In 1994	In 2005
Bulacan	259	10
Pampanga	748	220
Total	1,007	230

Source: Manila Bay Area Environmental Atlas, DENR,2007[23)]

2.9 Wildlife (Fauna)

Pursuant to Department of Environment and Natural Resources (DENR) Administrative Order No. 2004-15, The National List of Threatened Fauna was prepared with the aim to determine species of wild birds, mammals, and reptiles which shall be declared as priority concern for protection and conservation. According to the red list, one species of mammal and seven (7) species of birds are listed for Pampanga river basin as shown below.

Table 2.9.1 Species Listed in the Red List for Conservation in and around the Study Area

Taxonomy	Scientific Name	Common Name	Conservation Status	Distribution Area
Mamals	*Acerodon jubatus*	Golden-crowned fruit bat	EN	Tarlac
Birds	*Ptilinopus marchei*	Flame-breasted fruit dove	VU	Aurora
	Ptilinopus merrilli	Cream-bellied fruit dove	VU	Nueva Ecija
	Erythrura viridifacies	Green-faced parrotfinch	VU	Bulacan
	Grus antigone	Sarus crane	CR	Candaba Swamp and Nueva Ecija
	Prinoturus luconensis	Green-headed racket-tailed parrot	VU	Mt.Arayat and Pampanga
	Tringa guttifer	Nordmann's greenshank	EN	Bulacan
	Zoothera cinerea	Ashy thrush	VU	Bulacan

Note: Conservation Status: CR (Critically Endangered), EN (Endangered), VU (Vulnerable). Species under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are categorized as CR, while those in Appendix II of CITES are categorized as EN.

Source: 2004 Statistics on Philippines Protected Areas and Wildlife Resources, Protected Areas and Wildlife Bureau (PAWB)

The following table further shows the number of waterfowls recorded in the study area.

Table 2.9.2 Number of Waterfowls Recorded in the Study Area between 2005 and 2010

Year & Observed Place* / Type of Birds	2005	2006	2007	2008		2009			2010
	a	a	a	b	c	a	d	e	a
Grebes	0	30	21	8	0	3	0	0	24
Herons & Egrets	3,390	2,142	3,093	3,537	2,000	6,769	4,271	197	6,213
Ibises & Spoonbills	0	0	0	1	0	1	0	0	0
Geese & Ducks	3,483	4,193	4,379	10,009	0	1,750	0	1,124	4,875
Rails, Gallinules & Coots	253	187	143	223	52	146	78	3	132
Finfoot & Jacanas	5	0	3	3	0	13	0	0	2
Shorebirds-Waders	3,623	1,703	93	276	1,123	420	12,140	55	680
Gulls, Terns & Skimmers	470	851	70	3,702	800	3,546	11,080	0	1,185
Others	12	5	0	0	0	0	0	0	0
Total	11,236	9,111	7,802	17,759	3,975	12,648	27,569	1,379	13,111

Note:* Observed Place: a = Candaba Swamp, Pampanga b = Brgy. Vizal San Pablo, Candaba, Pampanga
c = Brgy. Paralaya, Candaba, Pampanga d = Consuelo, Macabebe & Sasmuan, Pampanga
e = Pantabangan Dam, Nueva Ecija

Source: Asian Waterfowl Census, Wetland International, compiled by PAWB

As shown in the table, more than 10,000 of the waterfowls migrate to the study area almost every year, and the Candaba Swamp could be identified as important habitat for waterfowls. Moreover, the waterfowls in the study area include the rare species, e.g., Philippine Duck (*Anas luzonica*) and Black-faced Spoonbill (*Platalea minor*), which were observed in Candaba Swamp and Pantabangan Dam and classified as Vulnerable and Endangered under the IUCN Red List.

2.10 Water-Related Disasters in the Study Area

2.10.1 Flood

The Regional Disaster Coordinating Committee (RDCC) for Region III recorded the recent flood damages from 2003 to 2006 in the provinces of Bulacan, Pampanga and Nueva Ecija, which are centrallt located in the study area, as shown in Table 2.10.1 (refer to Annex-T 2.10.1). According to the flood damage records, these three provinces have suffered from extensive flood damage, which include 30 to 750 thousand of population affected by floods every year. In particular, large-scaled flood damages successively occurred three times in 2004.

Table 2.10.1 Recent Recorded Major Flood Damage in Pampanga, Bulacan and Nueva Ecija Provinces

Time of Flood	Typhoon	Affected Population	Number of Casualties		Number of Houses Damaged	
			Dead	Injured	Totally	Partially
Jul. 2003	Haurot	163,309	5			
Aug. 2004	Marce	757,070	14	1	120	1,200
Nov. 2004	Violeta	9,562	2			
Nov. 2004	Winnie	537,058	16	2	602	1,409
Nov. 2004	Toyong	324,498	8	2	94	162
Sep. 2005	Labuyo	43,631				
Jul. 2006	Glenda	30,831				
Oct. 2006	Mienyo	34,045	1	0	274	1,610

Source: RDCC-Region III

The recent largest flood damage was caused by Typhoon Marce in August 2004. The remote sensing analysis by Dartmouth Flood Observatory shows that the flood area by Typhoon Marce spread to over 1,151km^2 or about 11% of the study area, which encompasses Pampanga Delta, a substantial part along the midstream of Pampanga River and its tributary Rio Chico River (refer to Annex-F 2.10.1).

As stated above, large-scaled flood damages occurs almost every year in the study area, and the most serious damage is in the area of Pampanga Delta. The principal cause of such frequent and large-scaled flood damage could be attributed to the extremely small river flow capacity.

The channel flow capacities of the downstream and midstream sections of Pampanga River were preliminarily estimated, as listed in Table 2.10.2, based on the results of the previous relevant study in 1982. According to the results of estimation, the flow capacities of the whole section of Pampanga River from Masantol to Cabiao (the stretches of about 14km to 54km upstream from the river mouth) are evaluated to hardly cope with even a 5-year return period flood.

Table 2.10.2 River Channel Flow Capacity and Probable Peak Runoff Discharge

(unit: m^3/s)

River	Stretch	Channel Flow Capacity	Probable Peak Flood Runoff Discharge	
			5-year return period	10-year return period
Pampanga	River Mouth – Masantol	4,300 (500)*	2,654	3,517
	Masantol – Sulipan	2,200	2,654	3,517
	Sulipan – Arayat	1,800	2,349	2,731
	Arayat – Cabiao	2,000	2,424	3,071
	Cabiao – San Isidro	2,500	2,408	3,051
Angat	Calumpit – Expressway Bridge	900	737	854
San Fernando	Sexmoan – San Fernando	200	272	363

Note: : * The channel flow capacity was increased from 500 to 4,300m^3/s through PPDP-Phase I in 1993.
Source: Feasibility Report on the Pampanga Delta Development Project, 1982, JICA[1)]

The widening of river channel, together with the construction of embankment was made for the river stretch of 14km in length from the river mouth to Masantol through Pampanga Delta Development Project (hereinafter referred to as "PDDP") Phase I in 1993. As a result of this project, the channel flow capacity of the section from the river mouth to Masantol had increased from 500 to 4,300m^3/s, which could cope with the probable flood of 20-year return period. The PDDP was originally scheduled to continue as Phase II in order to increase the channel flow capacity for the further

upstream sections, but Phase II is being held as a plan examined due to the extremely large scale of house relocation required.

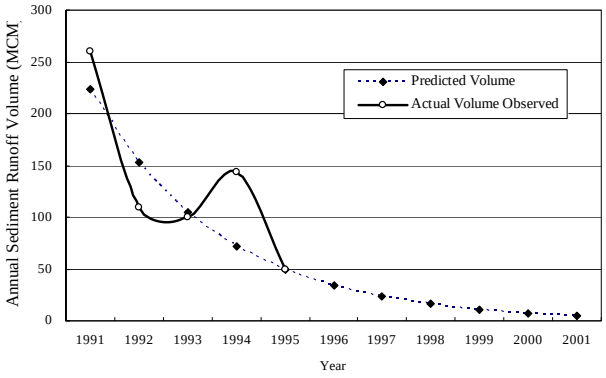
According to the results of field reconnaissance, the fishponds are expanding in Pampanga Delta in particular, and such expansion of fishponds are deemed to narrow the river channel width, which accelerates reduction of the channel flow capacity and induces more frequent occurrence of flood. Moreover, the recent remarkable progress of land subsidence could also aggravate the flooding conditions.

2.10.2 Sediment Disaster

Mt. Pinatubo, which is located in the southwestern part of the study area, erupted in 1991, and produced an extremely large volume of lahar runoff, which flowed down as mudflow to the rivers in the eastern Pinatubo areas such as Sacobia-Bamban River (a tributary of Pampanga River), and the tributaries of Porac River, namely; Abacan River, Pasig-Potrero River and Gumain River.

The runoff volume of lahar immediately after the eruption was estimated at about 1,650 MCM, and since then the annual runoff volume of more than 100 MCM continued for three years from 1992 to 1994. On the other hand, PHILVOLCS predicted that such large volume of lahar runoff would rapidly subside, and the Study Team confirmed that the lahar runoff had substantially subsided, through the field reconnaissance and the interview survey with the relevant organizations (refer to Figure 2.10.1).

Although the runoff of lahar has subsided, the volume of lahar of about 900 MCM still accumulates in the upper reaches of the river basin, and the sediment continues to run-off from the accumulated volume. As the result, the current sediment runoff volume into the river channel is estimated at about four times of those before the eruption of Mt. Pinatubo. The annual specific yield of sediment before the eruption of Mt. Pinatubo was 17m^3/ha/year, while the present yield is 62m^3/ha/year in Pasig-Potrero river basin. Likewise, Porac-Gumain has the annual specific yield of 14m^3/ha/year before the eruption, while it is 56m^3/ha/year at present. These present larger sediment runoff is estimated to continue for more than 100 years, and a substantial part would accumulate in the river channel causing reduction of the channel flow capacity, unless certain countermeasures are taken such as river dredging to remove the sediment and reforestation to reduce the sediment run-off.



Source: The Study on Flood and Mudflow Control for Sacobia Banban/Abacan River Draining from Mt. Pinatubo, 1996, JICA

Figure 2.10.1 Observed and Predicted Runoff Volume of Lahar by PHILVOLCS

In addition to the above problems of sediment runoff, another important issue concerns the drainage of San Fernando River, which functions as the principal drainage channel for San Fernando City. The large volume of mudflow from Mt. Pinatubo had blocked the waterway from San Fernando River to Pasig-Potrero River. As the result, floodwaters flowing into the San Fernando River is hardly drained at present, which induces the frequent and serious flood damage in San Fernando City. In order to cope with this drainage problem, an alternative route called “the Pilot Channel” was newly excavated to drain the floodwater of San Fernando River into Manila Bay. However, the flow capacity of the

Pilot Channel could cope only with the probable flood runoff discharge of less than 2-year return period.

2.11 Land Subsidence

The low-lying Pampanga Delta in the study area in particular is subject to chronic flood damage, and one of the major causes of flood damage could be attributed to the current rapid progress of land subsidence. The JICA Study in 2002 reported that the evidence of land subsidence in Pampanga Delta could be seen at Orani Harbor in Bataan Province which is located northwest of Manila Bay. The dock and market in the harbor was never flooded at the time of its construction. However, they are now flooded to a maximum inundation depth of about 1m every year during the Spring High Tides. The said JICA Study also gives other evidence like the ground floor level of several old buildings in Guagua and Sasmuan municipalities in Pampanga Province which had sunk by 2 to 3m over several decades.

The actual extents of land subsidence were examined in the above JICA Study in 2002, as well as the study by Rodolf and Siringan, University of Philippines, in 2003. With reference to these studies, it is preliminarily presumed that the land subsidence is occurring at least over the coastal area in Pampanga Province from the shoreline to about 40km inland. The coastal area in Bulacan Province could be also affected by the land subsidence judging from the similar geological settings and the excessive abstraction of groundwater compared to those in Pampanga Province, although no relevant previous study has confirmed it yet.

The annual average rate of land subsidence in the coastal area in Pampanga Province is preliminarily presumed, with reference to the above two studies, to be in a range of 0.5cm/year inland to 8cm/year at the coastal side (refer to Figure 2.11.1).

The area of the subject land subsidence in Pampanga Province is a broad tidal-river delta complex formed by the sediment runoff from Pampanga river basin, and its underlying alluvium is composed of consolidated silt or clay, and poor cemented sand and gravel. This geological setting tends to cause land compaction once dewatering of aquifer is made by abstraction of the groundwater. At the same time, the present abstraction volume of groundwater in the subject area far exceeds the estimated groundwater potential in some places. These factors of the geological setting and the excessive abstraction of groundwater could be the principal causes of the present land subsidence.

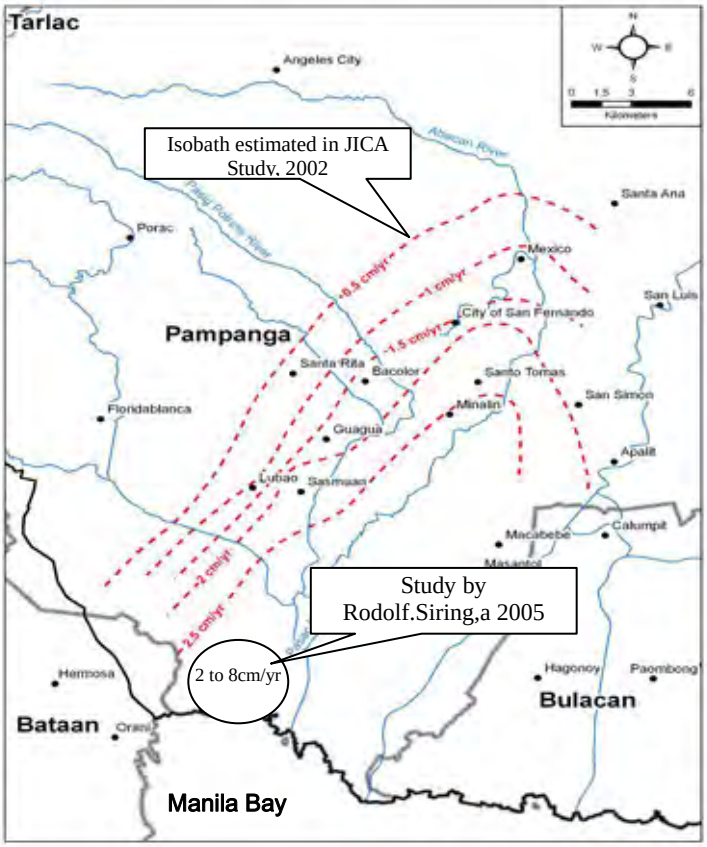


Figure 2.11.1 Annual Average Rate of Land Subsidence Estimated in the Previous Study

The land elevation lowered by land subsidence is hardly recovered once it occurs, and the control of the present excessive abstraction of groundwater is only the solution to avoid further land subsidence. However, the present lack of monitoring system for land elevation in the coastal area would cause difficulties in identifying the precise progressive rate of land subsidence, leading to difficulties in estimating the proper abstraction volume of groundwater. From this point of view, the periodical leveling survey for benchmarks, together with the monitoring of abstraction of the groundwater, would be required to estimate the proper abstraction volume of groundwater.

Chapter 3. Present Socio-Economic Conditions of the Study Area

3.1 Demographic Characteristics

The population in the study area was estimated based on the censuses of NSCB at the city/municipal level in 1980, 1990, 1995, 2000 and 2007. As described in the foregoing Section 1.2, the study area wholly or partially covers ninety (90) cities/municipalities. Most of them (i.e., 76 cities/municipalities) are concentrated in the four (4) provinces of Bulacan, Pampanga, Nueva Ecija and Tarlac, while the remaining 14 cities/municipalities are dispersed in the fringes of the other seven (7) provinces: Quezon, Aurora, Nueva Viscaya, Pangasinan, Rizal, Bataan and Zambales.

The population within the study area was assumed as the population of each city/municipality multiplied with the percentage of administrative area covered by the study area. On this assumption, the population in the study area in 2007 is estimated at about 5.8 million, which corresponds to about 59.2% of the total in Region III and/or 6.5% of the national total (refer to Table 3.1.1 and Annex-T 3.1.1). Pampanga Province takes the largest population of 2.2 million (about 38% of the total) in the study area. After Pampanga Province, Nueva Ecija has the second largest population of 1.7 million (30% of the total); Bulacan, 1.3 million (23%) and Tarlac 0.5 million (8%).

Table 3.1.1 Estimated Population in the Study Area

Province	1980	1990	1995	2000	2007
Bulacan	594,920	769,921	908,081	1,072,923	1,299,400
Nueva Ecija	990,542	1,222,034	1,402,016	1,549,715	1,733,849
Pampanga	1,159,123	1,503,152	1,602,261	1,839,706	2,180,084
Tarlac	260,839	322,431	345,794	396,042	472,676
Others	28,922	40,365	43,744	51,150	70,148
Whole Study Area	3,034,346	3,857,903	4,301,897	4,909,536	5,756,156

Source: (1) Population Census in 1980, 1990, 1995, 2000, and 2007 by NSCB (for basic population data)
(2) JICA Study Team (for overlapping ratio of study area with cities/municipalities)

The past population growth in the study area was estimated based on the above population censuses. The annual average growth from 1980 to 2007 in the study area is 2.40%, which is slightly higher than the national average of 2.35% as listed in Table 3.1.2 (refer to Annex-T 3.1.1). Among the major four (4) provinces in the study area, Bulacan currently is undergoing intensive urbanization in the southeastern part of the province, which faces Metro Manila, in particular. Due to such intensive urbanization, the province recorded the highest growth of 2.94% from 1980 to 2007 among those in the four (4) provinces, while Nueva Ecija, the lowest growth of 2.1%.

Table 3.1.2 Estimated Annual Average Population Growth in the Study Area

Province	1980-1990	1990-2000	2000-2007	1980-2007
Bulacan	2.61%	3.37%	2.77%	2.94%
Nueva Ecija	2.12%	2.40%	1.62%	2.10%
Pampanga	2.63%	2.04%	2.45%	2.37%
Tarlac	2.14%	2.08%	2.56%	2.23%
Whole Study Area	2.43%	2.44%	2.30%	2.40%

Source: (1) Population Census in 1980, 1990, 1995, 2000, and 2007 by NSCB (for Basic Population Data)
(2) JICA Study Team (for Overlapping Ratio of study area with Cities/Municipalities)

The population density in the study area in 2007 is 552 persons/km^2, which is more than double of the national average of 258 persons/km^2 (refer to Table 3.1.3). Among the major four (4) provinces in the study area, Pampanga Province has the highest average population density of 1,078 persons/km^2 in 2007 followed by 643 persons/km^2 in Bulacan Province, 567persons/km^2 in Tarlac and 346 persons/km^2 in Nueva Ecija, as shown in Table 3.1.3. Among the ten (10) cities/municipalities having a higher rank of population density in the study area, four (4) are in Pampanga Province and six (6) are in Bulacan Province, as shown in Table 3.1.4 (refer to Annex-T 3.1.2). The cities/municipalities with higher population density of more than 2,000 are Malolos City/its vicinities in Bulacan Province and Angeles/San Fernando cities and their vicinities in Pampanga Province. as

shown in Annex-F 3.1.1. Angeles City has the highest population density of 5,008 persons/km^2 followed by San Fernando City in Pampanga Province with 3,928 persons/km^2 and Guiguinto in Bulacan Province with 3,598 persons/km^2 of (refer to Table 3.1.4).

Table 3.1.3 Estimated Population Density in the Study Area

Province	Area (km^2)	Population Density (persons/km^2)				
		1980	1990	1995	2000	2007
Bulacan	2,021	294	381	449	531	643
Nueva Ecija	5,013	198	244	280	309	346
Pampanga	2,022	573	743	792	910	1,078
Tarlac	834	313	387	415	475	567
Whole Study Area	10,434	291	370	412	471	552

Source: (1) Population Census in 1980, 1990, 1995, 2000, and 2007 by NSCB (for Basic Population Data)
(2) JICA Study Team (for Overlapping Ratio of study area with Cities/Municipalities)

Table 3.1.4 Ten Cities/Municipalities with Higher Rank of Population Density in the Study Area

Rank	Name of City/Municipality	Name of Province	Area (km^2)	Population Density (persons/km^2)				
				1980	1990	1995	2000	2007
1	Angeles	Pampanga	63	3,007	3,769	3,726	4,203	5,008
2	San Fernando	Pampanga	69	1,617	2,302	2,815	3,235	3,928
3	Guiguinto	Bulacan	2	1,119	1,796	2,120	2,725	3,598
4	Baliuag	Bulacan	44	1,617	2,057	2,362	2,743	3,140
5	Malolos City	Bulacan	73	1,318	1,725	2,031	2,415	3,073
6	Plaridel	Bulacan	20	1,104	1,494	1,872	2,271	2,816
7	Santo Tomas	Pampanga	14	1,725	2,303	2,048	2,260	2,618
8	Santa Maria	Bulacan	1	747	1,163	1,285	1,834	2,610
9	Guagua	Pampanga	49	1,484	1,804	1,949	1,979	2,131
10	Pulilan	Bulacan	44	874	1,105	1,368	1,563	1,949

Source: (1) Population Census in 1980, 1990, 1995, 2000, and 2007 by NSCB (for Basic Population Data)

3.2 Economic Characteristics

3.2.1 Gross Regional Domestic Product

Due to the inadequate census on Gross Value Added (hereinafter referred to as GVA)[1] in each of the industrial origin at the municipal and/or provincial levels, the general view on the current regional domestic product of the study area was accessed based on the economic census at the regional level.

As described above, about 60% of the population in Region III is within the study area and, out of 117 cities/municipalities located in the region, the study area overlaps wholly or partly with 90 cities/municipalities. Judging from these socio economic features of the study area, the peculiarities of regional domestic product in the study area could be substantially delineated through the economic census of the region.

(1) Contribution Rate of GRDP of Region III to GNP

Region III recorded the GRDP of 501 billion pesos in 2007, which takes 7.5% of the GNP, and ranks third next to the National Capital Region (NCR) and Region IV (CALABARZON) (refer to Table 3.2.1). These three (3) regions in the higher rank of GRDP (i.e., NCR, Region IV and Region III) are tied together with the North and South Super-Highways and produce 56.1% of GNP in total. Thus, the regions form the core economic block in the Philippines, and Region III plays a part of the important economic activities in Philippines.

[1] The aggregate of the gross value added from each industrial sector is defined as the Gross Regional Domestic Product (GRDP).

Table 3.2.1 GRDPs of Three Regions in a Higher Rank and their Shares to GNP

Region	GRDP (billion pesos/year)	Share to GNP
NCR	2,479	37.30%
Region IV-A	752	11.30%
Region III	**501**	**7.50%**
Total	3,732	56.10%

Source : "Gross Regional Domestic Product" by National Statistical Coordination Board, 2005-2007

Among the industrial sectors in Region III, the Agricultural Sector shows the highest share of GVA to the national total (10% of the national total) in 2007 followed by 8.3% in the Industrial Sector and 6.4% in the Service Sector (refer to Table 3.2.2). This 10% of the Agriculture Sector is ranked 2nd among all regions in the Philippines next to Region IV, CALABARZON (refer to Figure 3.2.1).

Moreover, the GVA in the Agriculture Sector of Region III tends to increase its share to the national total unlike the Industrial and Service Sectors, which tend to decrease their shares to the national total (refer to Figure 3.2.2).

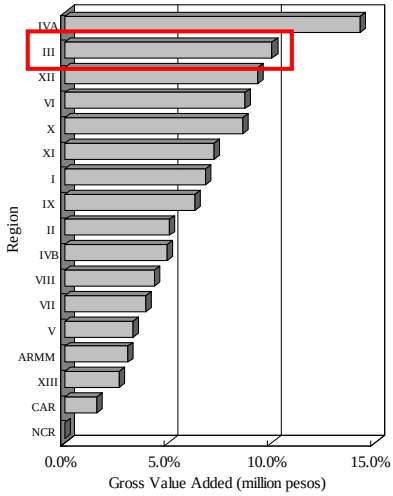


Figure 3.2.1 Share of Gross Value Added by Region to National Total in the Agricultural Sector (year 2007)

Table 3.2.2 Share of Gross Value Added of Region III to National Total in 2007

(unit: million pesos/year)

Description	Agricultural Sector	Industrial Sector	Service Sector	Total
Gross Value Added in Region III	93,539	175,857	231,959	501,356
Gross Value Added in the whole Country	936,415	2,107,287	3,604,542	6,648,245
Share of Gross Vale Added of Region III	**10.0%**	**8.3%**	**6.4%**	**7.5%**

Source : "Gross Regional Domestic Product" by National Statistical Coordination Board, 2005-2007"

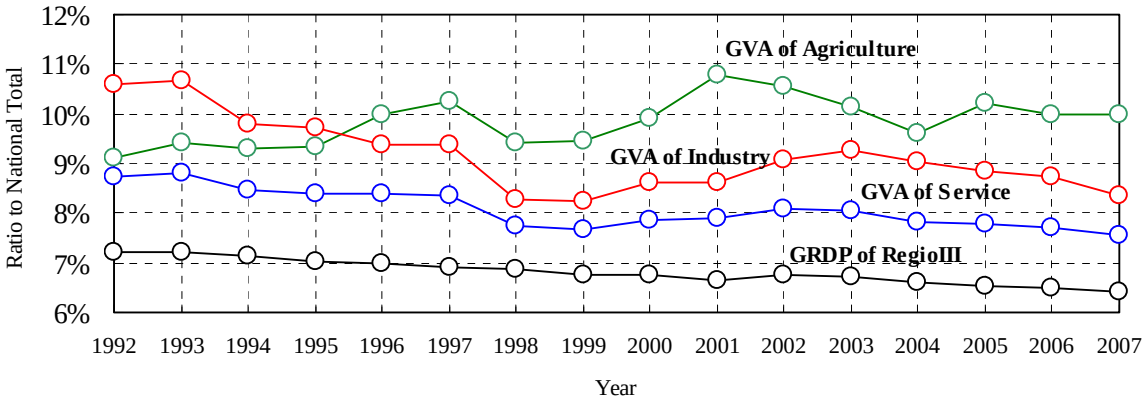


Figure 3.2.2 Long Term Variation of Contribution Ratio of GRDP and GVA of Region III to National Total

As described above, Region III contributes to the GNP of the Philippines especially in the Agricultural Sector. It is further noted that the Philippines produced paddy of 16.8 million

metric tons in total, out of which about 3.0 million metric tons or about 18% was produced in Region III in 2007 (refer to Table 3.2.3). This production volume in Region III is the largest in all of the regions. Thus, Region III is the principal staple rice-producing district contributing to increment of self-sufficient ratio in flood, which is one of the national development strategies in the Philippines.

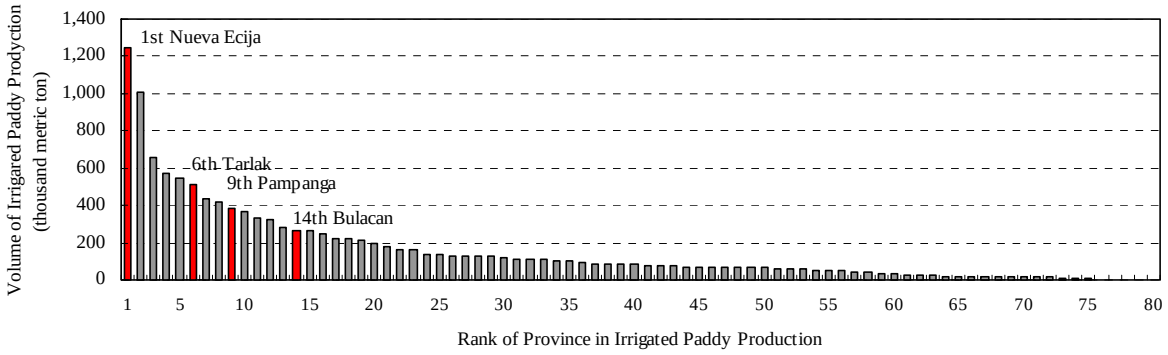
Of the above paddy production volume in the country, 12.6 million metric tons or about 75% is irrigated-paddy production. Again, Region III is the largest irrigated paddy-producing district taking the share of about 22% of the national total. Moreover, the provinces of Nueva Ecija, Tarlac, Pampanga and Bulacan, the substantial part of which are within in the study area, are ranked as the 1st, 5th, 9th and 14th largest irrigated paddy-producing provinces among 80 provinces in the whole country (refer to Figure 3.2.3). These four (4) provinces produced the irrigated paddy of 2.4 million metric tons in total, which corresponds to about 19% of the country total in 2007. Judging from these irrigated-paddy productions, the sustainable water supply for paddy irrigation in the study area is deemed to be one of the important issues for not only the regional economy but also for the national economy.

Table 3.2.3 Volume of Paddy Production by Region in 2007

(unit: metric ton)

Rank	Region	Irrigated Paddy		Rain fed Paddy		Total	
		Production Volume	Share	Production Volume	Share	Production Volume	Share
1	**Region III**	**2,710,433**	**21.6%**	**303,914**	**7.1%**	**3,014,347**	**17.9%**
2	Region VI	1,240,210	9.9%	877,388	20.6%	2,117,598	12.6%
3	Region II	1,872,024	14.9%	208,216	4.9%	2,080,240	12.4%
4	Region I	1,113,627	8.9%	578,002	13.6%	1,691,629	10.1%
5	Region XII	998,390	8.0%	236,367	5.5%	1,234,757	7.3%
6	Region VIII	631,886	5.0%	398,735	9.4%	1,030,621	6.1%
7	Region V	724,258	5.8%	273,323	6.4%	997,581	5.9%
8	Region IV-B	536,497	4.3%	326,718	7.7%	863,215	5.1%
9	ARMM	250,400	2.0%	381,291	9.0%	631,691	3.8%
10	Region IX	374,836	3.0%	176,474	4.1%	551,310	3.3%
11	Region X	507,939	4.0%	43,307	1.0%	551,246	3.3%
12	CARAGA	312,206	2.5%	135,111	3.2%	447,317	2.7%
13	CAR	372,282	3.0%	72,874	1.7%	445,156	2.6%
14	Region IV-A	340,836	2.7%	87,249	2.0%	428,085	2.5%
15	Region XI	378,087	3.0%	40,867	1.0%	418,954	2.5%
16	Region VII	192,239	1.5%	119,562	2.8%	311,801	1.9%
National Total		12,556,150	100.0%	4,259,398	100.0%	16,815,548	100.0%

Source: Country STAT by Bureau of Agricultural Statistics, Department of Agriculture



Source: Country STAT by Bureau of Agricultural Statistics, Department of Agriculture

Figure 3.2.3 Volume of Irrigated Paddy Production by Region

(2) Gross Value Added in Each Industrial Sector for Region III

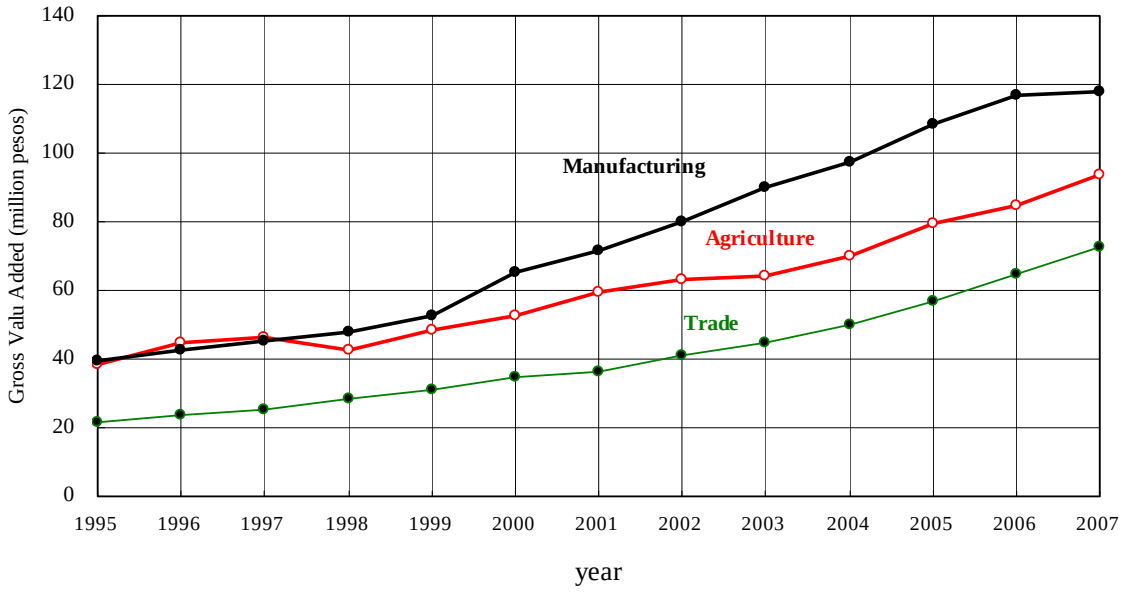
According to the statistics from NSCB, the highest GVA in Region III has been recorded in the Manufacturing Subsector of the Industrial Sector followed by the Agriculture/Fishery Subsector of the Agricultural Sector and the Trade Subsectors of the Service Sector throughout the recent 10 years from 1998 to 2007 (refer to Table 3.2.4 and Figure 3.2.4). The GVA in the Manufacturing Subsector makes up 24% of the GRDP of Region III in 2007, while the GVA in the Agriculture/Fishery Subsector was about 19%. Thus, there is currently a substantial difference between the GVAs in the Manufacturing and Agriculture Subsectors. During the years from 1995 to 1997, however, the GVA in the Manufacturing Subsector were almost the same as those in the Agriculture/Fishery; both of these subsectors produced about 24% of the GRDP in 1995, as shown in Table 3.2.5.

Table 3.2.4 Gross Value Added in Industrial Origin in Region III

(unit: million pesos)

Sector	Subsector	Amount	Share
Agricultural Sector	(1) Agriculture and Fishery	93,435	18.6%
	(2) Forestry	104	0.0%
Industrial Sector	(3) Mining and Quarrying	639	0.1%
	(4) Manufacturing	118,107	23.6%
	(5) Construction	33,774	6.7%
	(6) Electricity and Water	23,338	4.7%
Service Sector	(7) Transport, Comm., Storage	39,306	7.8%
	(8) Trade	72,669	14.5%
	(9) Finance	9,112	1.8%
	(10) O. Dwellings & Real Estate	33,627	6.7%
	(11) Private Services	48,504	9.7%
	(12) Government Services	28,742	5.7%
Regional Total (GRDP)		501,356	100.0%

Note: The current price as of 2008
Source : "Gross Regional Domestic Product" by National Statistical Coordination Board



Source: "Gross Regional Domestic Product" by National Statistical Coordination Board

Figure 3.2.4 Long-Term Variation of Gross Value Added in Manufacturing and Agriculture Subsector

The annual average growth rate of the GRDP in Region III from 1995 to 2007 was about 10%. The highest growth rate of GVA was recorded in "Transport, Communication &

Storage" (14.3%) followed by "Electricity/Water Subsector" (13.8%). The Manufacturing Subsector, which currently takes the largest share of GRDP in Region III, also recorded the annual growth rate of 9.6%. In contrast, the Agriculture/Fishery Subsector confines its growth rate below 8%. The degradation of the annual growth rate of the GVA in the Agriculture/Fishery Subsector is the nationwide tendency, which could be attributed to the lower productivity per head of worker as compared with the Industry and Service Sectors. Nevertheless, the Agriculture/Fishery is still one of the key industries and currently takes in the largest number of employees in Region III. Moreover, as described in the foregoing item (1), promotion of the sector is indispensable to accord to one of the national policies for the increase of food self-sufficiency rate.

Table 3.2.5 Annual Average Growth Rate of Gross Value Added in Industrial Sectors of Region III from 1995 to 2007

Sector	Subsector	Gross Value Added (in million pesos)		Annual Ave. Growth Rate 1995-2007
		In 1995	In 2007	
Agricultural Sector	(1) Agriculture and Fishery	38,532	93,435	7.7%
	(2) Forestry	0	104	-
Industrial Sector	(3) Mining and Quarrying	1,248	639	-5.4%
	(4) Manufacturing	39,226	118,107	9.6%
	(5) Construction	14,002	33,774	7.6%
	(6) Electricity and Water	4,922	23,338	13.8%
Service Sector	(7) Transport, Comm., Storage	7,904	39,306	14.3%
	(8) Trade	21,339	72,669	10.8%
	(9) Finance	2,354	9,112	11.9%
	(10) O. Dwellings & Real Estate	11,749	33,627	9.2%
	(11) Private Services	10,939	48,504	13.2%
	(12) Government Services	7,724	28,742	11.6%
Regional Total (GRDP)		159,939	501,356	10.0%

Note: The current price as of 2008
Source : "Gross Regional Domestic Product" by National Statistical Coordination Board

3.2.2 Number of Employees and Gross Regional Product per Head of Employee

The number of the employees in Region III is about 3.4 million, which corresponds to about 35% of the total population in the region. The largest number of employees in the region belongs to agriculture/forestry and the wholesale/retail; both of the occupations receive about 22% of the total employees in the region as shown in Table 3.2.6.

Table 3.2.6 Number of Employees in Each Occupation

Occupation	Number of Employees(thousand)	Share to Total(%)
Agriculture and Forestry	745	21.9%
Wholesale and Retail*	743	21.9%
Manufacturing	416	12.2%
Social Service Activities**	382	11.2%
Transport, Communication and Storage	375	11.0%
Construction	252	7.4%
Private Household with Employed Persons	151	4.4%
Hotel and Restaurants	124	3.7%
Real Estate, Renting and Business Activities	82	2.4%
Fishing	59	1.7%
Financial Intermediation	45	1.3%
Electricity, Gas and Water	17	0.5%
Mining and Quarrying	5	0.1%
Total	3,396	100.0%

Note: * Including repair of motor vehicles, motorcycles and personal household goods
** Including public administration, and other community, social & personal service activities
Source: "2008 Philippines Statistical Yearbook" by National Statistical Coordination Board

The GVA per head of employee was estimated based on the above GVA and the number of employees in each industrial sector. The highest GVA per head of employee is 255 thousand pesos/employee in the Industrial Sector followed by 122 thousand pesos/employee in the Service Sector and 116 thousand pesos/employee in the Agricultural Sector.

Table 3.2.7 Gross Value Added per Head of Employee

Sector	Gross Value Added (million pesos)	Number of Employees in Each Industrial Sector (thousand)	Gross Value Added per Head of Employee (pesos/person)
Agricultural Sector	93,539	804	116,342
Industrial Sector	175,858	690	254,867
Service Sector	231,960	1,902	121,956
Total	501,357	3,396	147,632

Note: The current price as of 2008
The current number of Employees as 2007
Source: "2008 Philippines Statistical Yearbook" by National Statistical Coordination Board

3.2.3 Income and Poverty Statistics

The annual incomes in Region III for the recent decade from 1997 to 2006 are in the range of 1.05 to 1.14 times of the national average, as shown in Table 3.2.8. At the same time, the annual income in Region III is the third highest value next to NCR and Region VI-A among the 17 regions in the Philippines. Thus, Region III is rather wealthy as compared with the other regions. There are, however, large differences in income in the Philippines, and particular attention should be paid to the families whose income is below the poverty threshold.

Table 3.2.8 Annual Average Family Income in Region III

Region	1997	2000	2003	2006
Average Annual Income (pesos/year/family)	133,130	151,449	160,000	197,640
Ratio to the National Average	108%	105%	108%	114%

Source: "2008 Philippines Statistical Yearbook" by National Statistical Coordination Board

NSCB has estimated the "Per Capita Poverty Threshold" (hereinafter referred to as "PCPT"), which is the minimum income necessary to enhance an adequate standard of living by province in the Philippines. The national average PCPT is 15,057 pesos/head/year, and about 33% of the population in the country is regarded as indigent whose annual income is below the average PCPT. The indigents in the major four provinces of Bulacan, Nueva Ecija, Pampanga and Tarlac in the study area form about 20% of the total population.

Table 3.2.9 Annual Per Capita Poverty Threshold and Incidences of Population for Whole Country and Four Provinces Overlapped with Study Area

Objective Area	2003			2006		
	Per Capita Poverty Threshold (pesos/head/year)	Poor Population	Poverty Incidence (%)	Per Capita Poverty Threshold (pesos/head/year)	Poor Population	Poverty Incidence (%)
1 National Total	12,309	23,836,104	30.0	15,057	27,616,888	32.9
2. Provinces in Region III	14,378	1,535,784	17.5	17,298	1,914,590	20.7
3. Major Provinces in Study Area	14,629	1,289,078	17.5	17,446	1,584,003	20.3
(1) Bulacan	15,027	307,762	12.3	17,768	358,012	13.4
(2) Nueva Ecija	14,394	484,106	27.1	17,830	662,742	37.7
(3) Pampanga	15,148	289,106	14.7	17,243	234,820	10.8
(4) Tarlac	13,866	208,104	18.4	16,463	328,428	27.6

* Annual Per Capita Poverty Threshold = The minimum annual income per person to meet the basic food and non-food requirement.
** Poor Population = The population whose annual income is less than the per capita poverty threshold.
*** Poverty Incidence = The proportion of poor population to total population.
Source: "2008 Philippines Statistical Yearbook" by National Statistical Coordination Board

As stated above, the average ratio of the poor population in the study area is far lower than the national average. However, particular attention should be given to the ratio in Nueva Ecija Province, which is far higher than those in the other three provinces and exceeds even the national average. According to the "Socio-Economic Profile of Nueva Ecija Province, Series of 2005," a majority of the employees are engaged in the Agricultural Sector (47% in the Agricultural Sector, 40% in the Service Sector, and 13% in the Industry Sector). Accordingly, one of the crucial measures for poverty alleviation in Nueva Ecija Province should be addressed to the increment of income of the employees engaged in the agricultural sector.

3.3 Land Cover

3.3.1 Preparation of Map of Existing Land Cover in the Study Area

There are two available data sources for the existing land cover condition in the study area, as follows:

- Land cover data prepared by DENR based on Landsat images taken in 2003 (available for the entire study area)
- Land cover data prepared by NAMRIA and JICA for the new NAMRIA topographic map (1:50,000) in 2008 (available only for the area covered by the new NAMRIA topographic map)

After the evaluation by the Study Team, it was found that the latter data source represents much more realistic conditions, especially for the built-up area. It was therefore decided that the latter data source would be utilized as much as possible in the study, although it does not cover the entire study area.

The existing land cover map was prepared by integrating the data from the above two data sources. The latter data source was utilized for the main part of the study area as long as they were available; whereas; the former was applied for the portions where the latter was not available. The categories of land cover in the two data sources are different from each other. To combine the two data sources into one integrated map, re-categorization was conducted. Annex-T 3.3.1 shows the categories applied in the Study and their relationship with the categories in the two original data sources. The combined data have been stored as GIS data for further utilization.

3.3.2 Existing Land Cover Condition

Annex-F 3.3.1 demonstrates the existing land cover condition in the study area based on the newly prepared map, as described in Subsection 3.3.1. As shown in the figure, the agricultural area widely spreads over the central part of the study area. The mountain area is characterized by forest land and/or brush land. The built-up area is in general scattered. However, around the San Fernando and Angeles areas is a continuous built-up area. The share of each category of land cover in the study area is summarized in Table 3.3.1. It can be understood that more than 40% of the total study area is cultivated area. Most of the population is concentrated on the populated area of about 3% of the total study area.

Table 3.3.1 Land Cover Category in the Study Area

Land Cover Category		Area (km^2)	Percentage of Total Area (%)
Forest		1,875.4	18.0
Brush Land		2,533.9	24.3
Cultivated Area	Paddy Field	3,972.5	38.1
	Other Cultivated Area	706.7	6.8
Populated Area	Built-up Area	268.0	2.6
	Settlement	70.1	0.7
Wetland	Swamp	57.1	0.5
	Fishpond	490.5	4.7
Water Body		149.3	1.4
Others	Others (Natural)	293.5	2.8
	Others (Artificial)	17.5	0.2
Total		10,434.4	100.0

Source: JICA Study Team

3.4 Water Use

3.4.1 Present Water Use

The Water Code of the Philippines[1] together with its IRR[2] defines the type of water use as listed in the following Table 3.4.1.

Table 3.4.1 Definition of Water Use by the Water Code

Type	Definition
Domestic	Utilization of water directly drawn from a source by a household for drinking, washing, bathing, cooking, watering of gardens or animals and other domestic uses
Municipal	Utilization of water for supplying the water requirements of a community, whether by piped or bulk distribution for domestic and other uses, direct consumption, the drawer or abstractor of which being the national government, its subsidiary agencies, local government units, private persons, cooperatives or corporations.
Irrigation	Utilization of water for producing agricultural crops
Power Generation	Utilization of water for producing electrical or mechanical power.
Fisheries	Utilization of water for the propagation and culture of fish as a commercial enterprise or any other aqua-culture ventures
Livestock Raising	Utilization of water for large herds or flocks of animals raised as a commercial enterprise
Industrial	Utilization of water in factories, industrial plants and mines including the use of water as an ingredient of a finished product.
Recreation	Utilization of water for swimming pools, bath houses, boating, water skiing, golf courses and other similar facilities in resorts and other places of recreation.
Other Purposes	Utilization of water other than above

Source: Water Code, 1976[1] and the Amended Implementing Rules and Regulations, 2005[2]

Permits for the above water uses in the Philippines have been granted by the NWRB. The granted water quantity had been just one value for the entire year before 2004, while it can be now either one value for the entire year or two different values in wet and dry seasons[3]. The granted water quantities in the study area are summarized by type of water use and sources, as shown in Table.3.4.2. The data shown in the table includes the trans-basin water, which is abstracted outside Pampanga river basin and conveyed to the basin. The location of water use permits for surface water and groundwater are as shown in Annex-F 3.4.1 and 3.4.2, respectively.

Table 3.4.2 Summary of Granted Water Use Permits in the Study Area

(unit: m^3/s)

Type of Water Use	Volume of Granted Water Use Permit by Water Source			
	Surface Water	Surface Water (Trans-basin)	Groundwater	Total
Domestic/Municipal	5.398	0.000	3.806	9.204
Municipal by MWSS	28.660	17.576	0.000	46.236
Irrigation by Users other than NIA	30.299	0.000	1.122	31.421
Irrigation by NIA	228.285	55.397	1.426	285.108
Power Generation	103.000	0.000	0.000	103.000
Fisheries	0.010	0.000	0.018	0.028
Livestock	0.000	0.000	0.019	0.019
Industrial	0.116	0.000	1.149	1.265
Recreation	0.000	0.000	0.073	0.073
Other Purposes	0.000	0.000	0.229	0.229
Total excl. Power Generation	292.768	72.973	7.842	373.583
Total	395.768	72.973	7.842	476.583

Source: NWRB

The following could be understood from the above Table 3.4.2:

(1) The granted water quantity for all water uses is estimated at about $477m^3/s$. Of the total granted water quantity, that for power generation is $103m^3/s$, which could be re-used for other purposes at further downstream portions and not actually consumed. The consumable permitted water

quantity in the study area could therefore be 374m^3/s.

(2) Of the above consumable permitted water quantity, about 20% (73m^3/s) is to be supplied from the water sources out of the study area through the trans-basin transmission system. Such external water sources for the study area includes: (a) Umiray River for Angat dam reservoir; (b) Aurola area and Casecnan River for Pantabangan dam reservoir; and Tarlac River for NIS in the province of Tarlac.

(3) On the other hand, about 46m^3/s is granted for MWSS, one of biggest water users which is responsible for water supply to Metro Manila. Considering the current water supply system by MWSS, almost all of the granted 46m^3/s would be consumed outside the study area, which means exported water. It could therefore be said that the study area is in import excess state in terms of the granted consumable water quantity.

(4) Among the consumable permitted water quantity, only 2% (7.8m^3/s) is granted for groundwater sources. The groundwater is currently the main source for domestic/municipal and industrial water use in the study area.

(5) According to the granted water quantity, there are two big water users related to the study area; one is NIA for irrigation water use and the other is MWSS for municipal water of Metro Manila. About 90% of the consumable permitted water quantity is granted to NIA and MWSS.

The volume of actual water use depends on the availability of water, and therefore, the actual water demand would not necessarily coincide with the above granted water quantity. From this point of view, the present water demand for some categories of water use has been estimated, as shown in Table 3.4.3, based on the available information collected in the study.

It should be noted that the category of municipal water demand includes the following types of water use: domestic, municipal, recreational and other purposes. The commercial and light industrial water demand, which may be provided by public water providers and may not be granted as industrial purpose in the water permit issued by NWRB, is also included in the category of the municipal water demand.

Table 3.4.3 Summary of Estimated Present Water Demand in the Study Area

(unit: m^3/s)

Category of Water Demand Estimation	Type of Water Use defined by Water Code	Estimated Present Water Demand (Annual Average)	Granted Water Quantity
Municipal	Domestic Municipal Recreation Other purposes	7.429	9.506
Municipal by MWSS	Municipal	46.236*	46.236
Industrial	Industrial	1.265*	1.265
Irrigation	Irrigation	Maximum 241.028 Average 113.356 Minimum 22.508	316.529
Power Generation	Power Generation	103.000*	103.000
Fisheries (Brackish water)	Fisheries	17.900	0.000
Fisheries (Fresh water)	Fisheries	6.400	0.028
Livestock	Livestock	0.290	0.019
Total excl. power generation and fisheries (brackish water)		174.976	373.583
Total		295.876	476.583

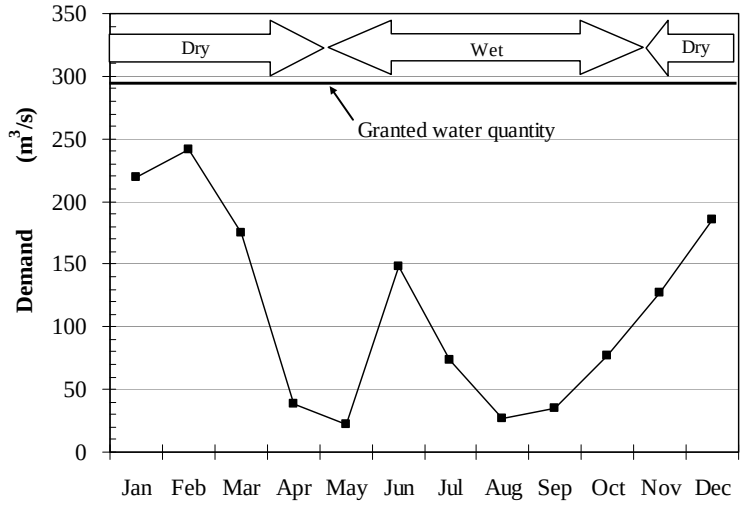
Note: * It is assumed that the present demand is the same as the granted water quantity.
Source: JICA Study Team

The following items could be noted from the above Table 3.4.3:

(1) The actual water demand for irrigation monthly vary, as shown in Figure 3.4.1, taking the maximum of about 241m^3/s, the minimum of about 23m^3/s and theese average of about 113m^3/s. Thus, the granted water quantity is larger than the present peak water demand in a year. This

excess ("granted water quantity" – "present peak water demand") may have been reserved for future development of irrigation area with existing water resources development facilities.

(2) The estimated water demand for fisheries supplied from freshwater is much larger than the currently granted water quantity.



Source: JICA Study Team

Figure 3.4.1 Monthly Variation of Present Total Irrigation Water Demand for Entire Study Area

3.4.2 Water Tariff

The water charge is broadly classified into two categories, namely; (1) the water tariff, which the water public and/or private service provider (hereinafter referred to as WSP) collects from the end users as their service fees; and (2) the water levy, which the national government imposed to the WSPs for their usage and/or consumption of surface water and/or groundwater. The water tariff is further divided into the "Irrigation Service Fee" (herein referred to as "ISF") and the "Water Tariff for Municipal Use."

Of the above water charges, the water levy is described in detail as one of the issues on the legal arrangement for water management in Chapter 4, while the water tariff is discussed as a matter of water use in this subsection.

(1) Rate of Irrigation Service Fee

The National Irrigation Authority (NIA) provides the irrigation water supply services as the WSP including construction, operation and management of the irrigation facilities for the farmers. NIA sets up the ISF based on a concept such that NIA delivers the right volume of water at the right time to every farm at least twice a year, and the farmers shall pay ISF for NIA's services in the delivery of water to the farms.

The rate of ISF is expressed in terms of production volume of the irrigated paddy but not in terms of monetary value. Accordingly, the rate varies year by year depending on the price of rice. Due to this background, the rates of ISF for the principal national irrigation systems (NISs) in and around the study area are estimated in terms of the monetary value. As listed in Table 3.4.4, the rates of ISF for NISs except NEPIS and UPRIIS are estimated at 1,500 pesos/ha as of 2008, while those for NEPIS and UPRIIS are 1,000 pesos/ha and 1,750 pesos/ha, respectively.

Table 3.4.4 Historical Trend of Irrigation Water Charges of NISs in and around the Study Area

(unit: pesos/ha)

National Irrigation Systems	2002	2003	2004	2005	2006	2007	2008
AMRIS	1,222	1,240	1,276	1,286	1,294	1,300	1,500
Porac-Gumain RIS	1,274	1,294	1,288	1,282	1,307	1,236	1,500
NEPIS	900	900	900	1,000	1,000	1,000	1,000
TASMORIS	1,113	1,095	1,098	1,152	1,195	1,190	1,500
Pampanga RIS	-	1,500	1,349	1,400	1,381	1,377	1,500
TGIS	-	-	-	-	-	-	1,500
UPRIIS-District I	-	-	-	-	1,716	-	-
UPRIIS-District II	-	-	-	-	1,750	-	-
UPRIIS-District III	-	-	-	-	1,257	-	-
UPRIIS-District IV	-	-	-	-	1,750	-	-

Note -: Lack of data.
Source: NIA

(2) Rate of Water Tariff for Municipal Water Supply Services

There are a variety of the public and private WSPs for municipal water services such as: (a) Water Districts, (b) Local Government Units, (c) Rural Water Supply Associations, (d) Barangay Water Service Associations, (e) Subdivisions, (f) Cooperatives, and (g) Private Water Service Providers.

Of the above WSPs, the Water Districts currently set their water tariff based on the regulation prepared by the Local Water Utilities Administration (LWUA). Others except LGUs and MWSS are under the jurisdiction of NWRB and apply the water tariff system prepared by NWRB. LGUs have their own rate setting guidelines for water supply service called "Voluntary Regulation", while MWSS as one of cooperatives undertakes the municipal water supply services for the whole of Metro Manila setting its own water tariff based on its particular regulation.

The Water Districts under the jurisdiction of LWUA are the majority of WSPs in the study area, and their water tariff are summarized in Table 3.4.5 (refer to Annex-T 3.4.1). The LWUA undertakes the governmental financing to the Water Districts by loan, and the Water Districts are obligated to pay back the loan with some interest using the source of their water tariff collected from the end users.

Table 3.4.5 Water Tariff for Municipal Water Service of Water Districts under the Jurisdiction of LWUA

Province	Number of Samples	Service Conn'n Fee (pesos)	Basic Water Charge* (pesos)	Specific Charge (pesos/m^3)				
				11~ 20m^3	21~ 30m^3	31~ 40m^3	41~ 50m^3	>51m^3
I. Rate in and around Study Area								
Bulacan	22	10,090	173	19	21	24	26	29
N. Ecija	18	3,207	192	20	22	23	25	27
Pampanga	12	9,526	148	16	18	19	21	23
Tarlac	2	11,208	174	19	21	23	25	27
Total	54	7,729	174	19	20	22	25	27
II The National Average Rate as of 2008								
	-	-	167	19	21	23	25	26

Note: *: The minimum rate for water use of less than 10m^3.
- : Data is not available.
Source: "Philippine Water Districts Directory", LWUA

LWUA has reported semi-annual average unit price of water distributed as shown in Table 3.4.6 (refer to Annex-T 3.4.2). Each WD has been approved by LWUA to decide their

own prices to the end users with their margins of 10% at maximum in addition to each unit cost. Therefore, the portion of these margins has already been included in the price.

Table 3.4.6 Average Unit Water Tariff for Municipal Water Supply in Last 10 Years

(Unit: Pesos/m^3)

Province		Number of Sample	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bulacan	Others	20	12.2	11.7	12.5	13.2	13.4	14.1	15.2	15.9	16.8	16.8
	Meycauayan and Obando	2	n/a	n/a	24.7	24.7	24.7	36.9	42.2	42.2	42.2	42.2
Nueva Ecija		19	13.9	13.9	13.9	15.5	16.4	17.4	18.2	19.4	20.2	20.3
Pampanga		13	11.2	11.2	12.0	12.0	12.4	13.4	15.6	16.2	16.2	16.7
Tarlac		9	16.3	14.2	13.5	14.5	15.1	16.1	18.0	18.3	18.8	20.7

Remarks: 1) Unit water tariff in the table is for first half of the year.
2) Treated bulk water is provided by MWSI to Meycauayan and Obando WDs.
Source: LWUA Official Web Site Home Page.

In addition to the Water Districts, there also currently exist 38 private WSPs in and around the study area, which are under jurisdiction of NWRB. Each of these WSPs is given by NWRB a certification called "Certificate of Public Convenience" (CPC) for being qualified to pursue the business of water supply services. The WSPs supply water to different areas, and their water tariff is to be lower than those of the above Water Districts, as listed Table 3.4.7 (refer to Annex-T 3.4.3).

Table 3.4.7 Water Tariff for Municipal Water Service by Private WSPs under the Jurisdiction of NWRB

Province	Number of Samples	Service Conn'n Fee (pesos)	Basic Water Charge (pesos)	Specific Charge (pesos/m^3)				
				11~ 20m^3	21~ 30m^3	31~ 40m^3	41~ 50m^3	>51m^3
Blacan	4	1,279	183	12	18	19	20	21
Pampanga	7	10,041	120	15	13	14	14	15
Tarlac	1	-	85	-	11	12	13	14
Total	12	5,660	144	13	15	16	16	17

Note: *: The minimum rate for the water use of less than 10m^3.
- : Data is not available
Source: Annual Report of WSPs submitted to NWRB

(3) Collection Ratio of Water Tariff

Some of the water tariff has a low collection ratio, and a major concern is given to the ISF in particular. The past trend of collection ratios of ISFs for NIS is as listed below.

Table 3.4.8 Annual Collection Ratio of Irrigation Service Fees for National Irrigation System

National Irrigation Systems	2002	2003	2004	2005	2006	2007	2008
AMRIS	60.2%	51.7%	45.3%	45.4%	47.9%	49.2%	27.3%
Porac-Gumain RIS	38.3%	50.6%	49.3%	71.4%	63.2%	65.3%	71.8%
NEPIS	37.5%	38.1%	21.9%	30.4%	15.5%	19.5%	10.2%
TASMORIS	28.4%	38.1%	35.4%	40.6%	44.3%	37.9%	67.1%
Pampanga RIS	-	94.2%	65.4%	72.2%	85.4%	74.8%	59.1%
TGIS	-	-	-	-	-	-	-
UPRIIS-District I	-	-	-	-	58.5%	-	-
UPRIIS-District II	-	-	-	-	66.9%	-	-
UPRIIS-District III	-	-	-	-	52.1%	-	-
UPRIIS-District IV	-	-	-	-	44.6%	-	-

Note: - Lack of data.
Source: NIA.

As listed above, the collection ratio of ISFs varies depending on the irrigation system and the year. The collection rates as of 2008 are in the range of 10.2% to 67.1%. According to officials of NIA, the current rate regulation was set in 1975 (35 years ago), and since then, it has never been revised. The rate systems are generally set to recover operation and maintenance cost including salaries and wages of staff and laborers. However, even the salaries and wages are hardly recovered by the water tariff at present.

As compared with the above collection ratios of ISF, those of the water tariff for municipal water supply service are deemed to be better. The collection ratios by the WSPs for municipal/industrial water supply service under the jurisdiction of NWRB are in the range of 50% to 90%, and several WSPs could achieve the highest ratio of 90%, as listed in Table 3.4.9.

Table 3.4.9 Annual Collection Ratio of Water Tariff for Municipal Water Supply Service

As of December 2007

Province	CPS WSP	City/Municipality	Collection Efficiencies
Bulacan	San Gabriel	Santa Maria	60%
	Brgy 1, Bulihan	Malolos	-
	Brgy Tabe	Guiguinto	90%
	Zigzag Hills, Malhacan	Meycauayan	-
	-	Marilao	61%
Pampanga	Balibago	Angeles City	90%
	-	Mexico	70%
	Santo Domingo	Angeles City	90%
	Clarkview/Plaridel	Angeles City	90%
	Woofland Drive Camenville	Angeles City	-
	Timog Park	Angeles City	52%
	Santa Lucia Resettlement	Magalang	50%
Tarlac	Teresa Homes, Brgy Tibag	Tarlac City	65%

Note: - Lack of data.
Source: NWRB

The customers for the municipal water supply services are required to pay their water charges at the beginning of the month for their consumption in the last month, and disconnection of the water supply service is enforced on customers whose payments are delayed for more than two months. This penalty is likely to boost the collection ratio of water tariff.

3.5 Water-Related Diseases

The pollution of the surface water as well as the groundwater could cause a variety of contagious diseases. Those diseases could outbreak through several routes such as (a) drink of and/or contact with the polluted water, (b) infection by mosquito and other vectors, which breed in and around the water and (c) infection by parasites (such as schistosome), which inhabit in the water. From these points of view, the water-related diseases are categorized into the following four (4) groups.

Table 3.5.1 Typical Cases of Water-Related Diseases

Cause of Disease	Typical Case of Disease
Drinking of Polluted Water	Cholera, Typhoid, Paratyphoid, Hepatitis (Type A and E), Dysentery, Diarrhea*
Contact with Polluted Water	Scabies, conjunctivitis, typhus, trachoma
Infection by Vector	Malaria, Dengue, Yellow Fever, Filariasis
Infection by Parasite	Schistosomiasis

Note *: The diarrhea caused by drinking of polluted water which contains the parasite.
Source: JICA Study Team

According to the statistics of NSCB, the whole country and Region III recorded water-related diseases as all-year average from 1995 to 2002, as shown in Table 3.5.2. Among the diseases, Malaria is the most prevalent in the whole country taking the disease ratio of 83.6 to 100,000 in population, and Dengue Fever and Typhoid/Paratyphoid follow. On the other hand, the highest disease ratio in Region III is from Dengue Fever (disease ratio of 12.3 to 100,000) followed by Typhoid/Paratyphoid

and Malaria. Particular attention is given to Schistosomiasis, which has still rather high disease ratio in the whole country (12.5 to 100,000) but almost expelled in Region III.

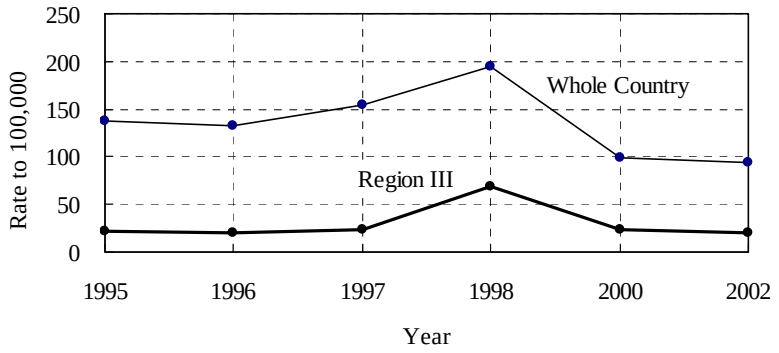
It is herein noted that Diarrhea is more prevalent than Malaria and Dengue Fever in Region III as well as in the whole country. However, Diarrhea is caused not only by drinking of polluted water but also by other non-water-related factors such as eating/drinking of too much food, spoiled food, and poisonous materials. Due to this background, it is virtually difficult to know the diseases rate of Diarrhea caused by polluted water, and Diarrhea is not counted as part of water-related diseases.

Table 3.5.2 Number of Water-Related Diseases in the Philippines and Region III
(Five-Year Average for 1995 to 1998 and 2002)

Area	Disease	Number of Cases	Rate to Total Number of Water-Related Diseases	Rate per 100,000 Persons
Whole Country	Malaria	59,218	57.6%	83.6
	Dengue Fever	19,408	18.9%	26.3
	Typhoid/Paratyphoid Fever	14,744	14.3%	20.8
	Schistosomiasis	8,845	8.6%	12.5
	Cholera	565	0.5%	0.8
	Total	102,780	100.0%	143.9
Region III	Dengue Fever	1,346	52.6%	18.4
	Typhoid/Paratyphoid Fever	633	24.8%	9.1
	Malaria	542	21.2%	8.2
	Cholera	34	1.3%	0.5
	Schistosomiasis	2	0.1%	0.0
	Total	2,557	100.0%	36.2

Source: 2006 Compendium of Philippines Environmental Statistics, NSCB

As listed above, the disease ratio of all cases in Region III is far lower than that in the whole country. Most of the present drinking water in Region III is from the groundwater, and judging from the lower disease ratio of Typhoid/Paratyphoid Fever in the region than the country average, the groundwater in the region is currently controlled under the rather good hygienic conditions. Likewise, the lower disease ratio of Malaria, Dengue Fever and Schistosomiasis in the region reveals that the surface water has not been seriously deteriorated.



Source: 2006 Compendium of Philippines Environmental Statistics

Figure 3.5.1 Temporal Variation of Annual Water-related Disease Ratio

The temporal variation of the annual total number of water-related diseases is as shown in Figure 3.5.1. The ratio reached to the peak in 1998 and then tends to reduce year by year in the whole country as well as in Region III. The ratios in 1998 were about 195 to 100,000 in population in the whole country and 69 to 100,000 in Region III, while they reduced to 94 to 100,000 and 21 to 100,000, respectively in 2002. Thus, water related hygiene is likely to improve in Region III as well as in the whole country.

3.6 Indigenous People

In the study area, there are 133,312 Indigenous People (IP) which is composed of five groups of tribes, as summarized below. The Aeta tribe accounts for 34.2% of the total population of IPs in the study area, followed by the Ibaloi, Kalanguya and Kankanaey tribes.

Table 3.6.1 Population of Indigenous People in and around the Study Area as of 2006

(unit: person)

Province / Tribe	Aurora		Bulacan		Nueva Ecija		Pampanga		Tarlac		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Aeta	112	0.8	0	0.0	1,032	1.9	18,920	100.0	25,503	66.2	45,567	34.2
Abelling	0	0.0	0	0.0	0	0.0	0	0.0	13,032	33.8	13,032	9.8
Dumagat/ Remontado	5,049	34.4	6,861	100.0	10,701	19.7	0	0.0	0	0.0	22,611	17.0
Ibaoloi/ Kalanguya/ Kankanaey	0	0.0	0	0.0	42,585	78.4	0	0.0	0	0.0	42,585	31.9
Ilongot/ Bugkalot	9,517	64.8	0	0.0	0	0.0	0	0.0	0	0.0	9,517	7.1
Total	14,678	100.0	6,861	100.0	54,318	100.0	18,920	100.0	38,535	100.0	133,312	100.0

Note:

Relevant municipalities in Aurora Province:	Baler, Casiguran, Dilasag, Dinalungan, Dinagalan, Dipaculao, Maria Aurora, San Luis
Relevant municipalities in Bulacan Province:	Doña Remedios de Trinidad, Norzarway and San Jose del Monte
Relevant municipalities in Nueva Ecija Province:	Carranglan, Lupao, Pantabangan, Rizal, San Jose City, Science City of Muñoz, Bongabon, Cabanatuan City, Gabaldon, Laur, Licab, Palayan City, Gen. Tino
Relevant municipalities in Pampanga Province:	Angeles, Floridablanca, Mabalacat, Porac, City of San Fernando
Relevant municipalities in Tarlac Province:	Bamban, Camiling, Capas, Mayantoc, San Clemente, San Jose, Tarlac City

Source: NCIP Regional Office III

Republic Act No.8371, known as the Indigenous Peoples Rights Act, prescribes the fundamental rights of indigenous people in the country and describes that the ownership and possession of IPs to their ancestral domains shall be recognized and protected. Also, the act institutionalized the National Commission of Indigenous People (NCIP), which is responsible for the formulation and implementation of policies as well as issuance of Certification of Ancestral Domain/Land Titles (CADT/CALT). CADT refers to a title recognizing the rights of possession and ownership of IPs over the identified area, while CALT refers to a title recognizing to the right of utilization of the identified lands by the members of IPs. There are four (4) CADT/CALTs in and around the study area, as shown in the following table and in Annex-F 3.6.1.

Table 3.6.2 Status of AD/AL (Ancestral Land) Delineation and Titling in and around the Study Area as of March 9, 2010

Location	Claimant Tribe	Area (ha)
A. CADTs/CALTs		
A1. Sitio Karahume, Barangay San Isidro, Municipality of San Jose del Monte, Province of Bulacan	Dumagat	1,817.15
A2. Sitios Maugat, Kambubuyugan, Alulod/Calumpit and Tubigan, portion of Barangay Kalawakan, Municipality of DRT, Bulacan	Dumagat	19,537.68
A3. Barangays Capintalan, Minuli, Salazar and Putlan, Municipality of Carranglan, Province of Nueva Ecija	Kalanguya	25,373.10
A4. Barangays Nabuklod and Mawakat, Municipality of Floridablanca, Province of Pampanga; portion of Municipality of San Marcelino and portion of Barrangay Batiawan, Municipality of Subic, all in the Province of Zambales	Aeta	5,457.71
A5. Barangays Camias, Diaz, Inararo, Villamaria, Sapang Uwak, Porac, Pampanga and portion of So. Target, Sapang Bato, Angeles City	Aeta	18,659.73
A6. Barangays San Nicolas, San Vicente, Anupul (portion) and Calumpang, Municipality of Bamban, Province of Tarlac; portion of Barangay Marcos Village, Municipality of Mabalacat, Province of Pampanga	Aeta	10,323.308
A7. Barangays Belbel, Burgos, Moraza and Villar, Municipality of Botolan, Zambales	Aeta	20,657.89
A8. Barangays Atbu, Bacneng, Balete, Baliling, Bantinan, Baracbac, Canabuan, Imugan, Malico, Poblacion, Sta. Rosa, Sinapaoan, Tarlac, Villaflores and Unib, Municipality of Sta. Fe; Barangays Anayo, Balete, Calitlitan (portion), Canabuan, Canarem, Ocao-Capiniaan and Yaway, Municipality of Aritao; Sitio Kamaring, Barangay Cabalatan-Alang, Muncipality of Kayapa; all in the Province of Nueva Vizcaya	Kalanguya-Ikalahan	30,758.58
A9. Barangays Umiray, Lumutan, Canaway, Sablang, Magsikap, Pagsanghan, Maligaya, San Marcelino and portions of Catablingan, Minahan Norte, Mahabang Lalim, and Minahan Sur, all in the Municipality of General Nakar, Province of Quezon and portion of Brgy. Umiray, Municipality of Dingalan, Province of Aurora; portion of Municipality of Montalban, Province of Rizal; and portions of Municipalities of San Jose del Monte, Norzagaray and San Rafael, all in the Province of Bulacan	Dumagat	144,880.70
Sub-Total		277,465.85
B. ADs/ALs with the survey* completed		
B1. Sitio Mapidya, Rio Chico, Gen. Tino, Nueva Ecija	Dumagat	13,883.20
Sub-Total		13,883.20
C. ADs/ALs with the on-going survey		
C1. Sos. Baguingan, Kawayan, Flora, Yanca, Bilad, Maragulo, and Tarucan, Capas, Tarlac	Aeta	13,723.00
C2. Alfonso Castañeda & Dupax Sur, Nueva Vizcaya	Bugkalot	52,995.0
Sub-Total		66,718.00
D. Areas undergoing social preparation		
D1. Barangay Kabayunan, DRT, Bulacan	Dumagat	60,000.00
D2. Sitio Mabaldog, Barangay Ligaya, Gabaldon, Nueva Ecija	Dumagat	7,283.00
Sub-Total		67,283.00
Total		425,350.05

Note*: NCIP is in charge of implementation of the profile survey for the area.
Source: NCIP

3.7 Historical and Religious Sites

In the study area, there is no archeological and/or historical sites designated as World Heritage-listed area by UNESCO. However, there exist other significant historical sites and landmarks in the study area as summarized below.

Table 3.7.1 Historical sites and Landmarks in the Study Area

Province	Municipality/City	Historical Site/Landmark
Bulacan	Malolos	Barasoain Church
	Baliuag	Baliuag Church
	Paombong	Paombong Church
	Plaridel	Quingua Church
	San Rafael	San Rafael Church
	Calumpit	St.John the Baptist Church
	Sub-Total	6 sites
Nueva Ecija	Carranglan	Dalton Pass
	Cabanatuan	McArthur Statue
	Cabanatuan	Pangatian Shrine
	Guimba	Triala House
	Penaranda	Church of Peneranda
	Gapan	Tabacalero of San Isidro
	Sub-Total	6 sites
Pampanga	Angeles city	Church of Sto. Rosario
	Bacolor	Church of Bacolor
	San Fernando	Church of San Fernando
	Mabalacal	Marcos Village
	Sub-Total	4 sites
Tarlac	Capas	Capas National Shrine
	Capas	Death March Monument
	Tarlac	Tarlac Cathedral
	Sub-Total	3 sites
Total		19 sites

Source: Manila Bay Area Environmental Atlas, PAWB-DENR, 2007

References in Chapter 3

1) NWRB, Water Code of the Philippines, 1976.
2) NWRB, Water Code of the Philippines and the Amended Implementing Rules and Regulations, 2005.
3) NWRB: Resolution No. 008-0604, June 15, 2004.

Chapter 4. Present Practices for Water-Related Development and Conservation in the Study Area

4.1 Water Resource Development Facilities

4.1.1 Existing Large Storage Dams

There exist the two large storage dams in the study area, namely; Angat storage dam and Pantabangan storage dam. Both of them are accompanied with trans-basin water transfer schemes. The fundamental features of the existing storage dams are summarized in the following table. The location maps for Angat storage dam and Pantabangan storage dam with their dimensions are presented in Annex-F 4.1.1 and 4.1.2, respectively.

Table 4.1.1 Fundamental Features of Existing Storage Dams

Storage Dam	Item	Description
Angat	Completion year*1	September, 1967 (construction started in 1961)
	Purpose*1	Municipal, Irrigation water supply, Hydropower, Flood control
	Dam type*1	Earth and rock fill dam
	Dam height*1	131m
	Effective storage*1,*4	894MCM (696MCM for Municipal/Irrigation water supply, Hydropower generation)
	Drainage area*2	546km^2
	Re-regulation dam*1	Ipo Dam, Bustos Dam
	Trans-basin*1,*2,*3	Umiray-Angat trans-basin (operation started on June, 2000) (A=130km^2) (Two intakes with catchment area of 31km^2 have not yet been completed.)
	Inflow*4	Self catchment: 1,869MCM/year (observed average in 1968-2007) Umiray-Angat trans-basin: 370MCM/year (observed average in 2001-2003, 2006-2007)
Pantabangan	Completion year*5	November, 1973 (release started on February, 1974)
	Purpose*5	Irrigation water supply, Hydropower generation, Flood control
	Dam type*5	Zoned earth fill dam
	Dam height*5	107m
	Effective storage*5	2,775MCM (Total volume:3,000MCM, Dead volume: 225MCM) (1,757MCM for Irrigation water supply, Hydropower generation)
	Drainage area*2	937km^2 (incl. catchment of Aurola trans-basin and Masiway Dam)
	Re-regulation dam*5	Masiway Dam
	Trans-basin*2,*5	1) Aurora trans-basin (A=68km^2) 2) Casecnan trans-basin (operation started in December, 2001.) (A=570km^2)
	Inflow*6	Self-catchment & Aurora trans-basin: 1,195MCM/year (observed average in 1980-2008) Casecnan trans-basin: 751MCM/year (observed average in 2002-2008)

Source: *1:NWRB/JICA, Dams in the Philippines[1)]
*2:GIS data prepared by JICA Study Team
*3:ADB, MWSS: Umiray-Angat Trans-basin study[2)]
*4:Data provided by NPC; analyzed by JICA Study Team
*5:NIA, Pantabangan Dam, Briefing Kit[3)]
*6:Data provided by NIA; analyzed by JICA Study Team

4.1.2 Proposed Large Storage Dams

In the previous water resources study[4), 5), 6)], twenty eight (28) possible large storage dam sites have been identified in the study area and in the surroundings with possible trans-basin water transfer to the study area. Among them, the five large storage sites have been further studied in the past and at least pre-F/S level studies have been completed (Locations are shown in Annex-F 4.1.3). Their fundamental features are summarized in Table 4.1.2.

Table 4.1.2 Summary of Features of Proposed Storage Dams

Storage Dam	Item	Description
Bayabas[*1]	Purpose	Municipal and Irrigation water supply
	Dam type	Zoned earth and rock-fill dam
	Dam height	110m
	Effective storage	144MCM[*8] (Total volume: 154MCM, Dead volume: 10MCM)[*8]
	Drainage area*[6]	52km^2
	Inflow*[7]	98MCM/year (average in 1958-2007 using simulated runoff)
	Remarks	Water use permit of 3.5m^3/s at the proposed dam site was granted to the Provincial Government of Bulacan in November, 2004.
Maasim[*1]	Purpose	Municipal and Irrigation water supply
	Dam type	Zoned earth-fill dam
	Dam height	47m
	Effective storage	95MCM (Total volume: 100MCM, Dead volume: 5MCM)
	Drainage area*[6]	53km^2
	Inflow*[7]	79MCM/year (average in 1958-2007 using simulated runoff)
	Remarks	
Balintingon[*2,*3]	Purpose	Irrigation water supply and hydropower generation
	Dam type	Rock-fill dam
	Dam height	138m
	Effective storage	488MCM (Total volume:572MCM, Dead volume: 84MCM)
	Drainage area*[6]	224 km^2
	Inflow*[7]	567MCM/year (average in 1958-2007 using simulated runoff)
	Remarks	The originally planned use for new Balintingon irrigation service area[*2]. Recently, the possibility of conveyance to AMRIS was re-evaluated[*3].
Gumain[*4]	Purpose	Irrigation water supply
	Dam type	Zoned rock-fill dam
	Dam height	108m
	Effective storage	99MCM (Total volume:110MCM, Dead volume: 11MCM)
	Drainage area*[6]	118km^2
	Inflow*[7]	255MCM/year (average in 1958-2007 using simulated runoff)
	Remarks	The study was conducted before Mt. Pinatubo eruption. Re-evaluation may be needed.
Balog-Balog[*5]	Purpose	Irrigation and fisheries water supply, Hydropower generation, Flood control
	Dam type	Rock fill dam
	Dam height	114m
	Effective storage	575MCM (Total volume: 625MCM, Dead volume: 50MCM)
	Drainage area*[6]	289km^2
	Inflow*[7]	633MCM/year (average in 1958-2007 using simulated runoff)
	Remarks	-

Source: *1: NIA/NWRB/World Bank: Water Resources Development Project, Draft Final Report, Task 5; Pre-Feasibility Study for Additional Water Supply to AMRIS, Main Report, 1994[7)]
*2: NIA, Balintingon Reservoir Multipurpose Project, Feasibility Study, Vol. I, Main Report, 1983[8)]
*3: CALENERGY: Balintingon Multipurpose Project, Prefeasibility Study Report, 2006[9)]
*4: NIA/JICA, Feasibility Study Report on the Gumain River Irrigation Project, 1985[10)]
*5: NIA, Balog-Balog Multipurpose Project, Feasibility Study, Main Report, 1980[11)]
*6: GIS data prepared by JICA Study Team
*7: Simulated runoff by JICA Study Team
*8: The original H-V-A curve does not seem to be correct. JICA Study Team prepared H-V-A curve based on 1/50,000 scale topographic map.

4.1.3 Possible Storage Dam Sites for Municipal Water Supply

Clark Development Cooperation (CDC) recently conducted a water resources study[12)] to look for future possible water sources. Several sites around the Clark Special Economic Zone were explored in the study. Among them, the two sites shown in Table 4.1.3 have the possibility for development as storage dam sites for municipal water supply. According to CDC, feasibility study for these sites will be conducted soon under the assistance of the World Bank. If development of these dam sites is judged to be feasible, they could be utilized not only for supplying water to the Clark area but also for supplying municipal water to Angeles City and/or other adjacent areas.

Table 4.1.3 Summary of Possible Storage Dam Sites for Municipal Water Supply

Site	Item	Description
Marimla2	Possible dam height*1	60m
	Total storage volume*1	16MCM
	Drainage area*2	40km^2
	Inflow*3	70MCM/year (average in 1958-2007 using simulated runoff)
	Remarks	
Bangat3	Possible dam height*1	60m
	Total storage volume*1	50MCM
	Drainage area*2	33km^2
	Inflow*3	63MCM/year (average in 1958-2007 using simulated runoff)
	Remarks	

Source: *1: H-V-A curves prepared by CDC, Clark Special Economic Zone Water Resources Study, Final Report, 2000.
*2: GIS data prepared by JICA Study Team
*3: Simulated runoff by JICA Study Team

4.2 Agriculture/Irrigation and Fishery Development

4.2.1 Irrigation

The development strategies for the agriculture sector in the Medium-Term Philippine Development Plan (MTPDP) 2004-2010[13)] are anchored on two primary goals: (i) expansion of agricultural production base; and (ii) increase of productivity. Self-sufficiency in rice production is considered, in particular, as a key component of the agriculture productivity goal. Succeeding the MTPDP 2004-2010 is the Updated Central Luzon Regional Physical Framework Plan (RPFP) 2005-2030[14)], which was formulated in 2006. The RPFP 2005-2030 gives priority to the development of new irrigation systems and rehabilitation of existing systems in order to expand the coverage of the agricultural production area and to increase efficiency.

In accordance with the above policies, the irrigation systems of about 250,000 ha have been developed in the study area, as listed below.

Table 4.2.1 Type of Irrigation System in the Study Area

	Administrative Agency	Service Area	(Share)
National Irrigation System (NIS)	Constructed and operated by NIA	177,616 ha*1	(72 %)
- River Irrigation System (RIS)			
- Pump Irrigation System (PIS)			
- Groundwater Irrigation System (GIS)			
- Small Reservoir Irrigation Project (SRIP)			
Communal Irrigation System (CIS)	Constructed by NIA and turned over to IA	53,884 ha*1	(22 %)
- Communal Irrigation System (CIS)			
- Pump Irrigation System (PIS)			
Small Scale Irrigation and Water Harvesting	BSWM	1,826 ha*2	(1%)
- Diversion Dam (DD)			
- Small Water Impounding Project (SWIP)			
- Small Farm Reservoir (SFR)			
- Shallow Tubewell (STW)			
Private Irrigation System		12,770 ha*3	(5 %)
Total		246,096 ha	(100 %)

Source : *1; NIA, *2; BSWM, *3; RPFP, 2005-2030 (including out of Study area)

The National Irrigation System (NIS), which has the service area of more than 1,000 ha in general, is constructed, operated and maintained by NIA. There are eight (8) NISs in the Study area with a total service area of 178,000 ha including groundwater systems, as shown in Table 4.2.2. Locations and schematic flow diagrams of the NISs are as shown in Annex-F 4.2.1 and 4.2.2, respectively. Of these NISs, the Upper Pampanga River Integrated Irrigation System (UPRIIS) is the largest in the study area and also in the entire country. It has a total service area of 119,000 ha covering the province of Nueva Ecija and some areas in Bulacan and Tarlac.

Table 4.2.2 Summary of National Irrigation Systems (NISs) in the Study Area

Name of System	Service Area (ha)	Water Source
Angat-Maasim RIS (AMRIS)	31,485	Angat R., Massim R.
Porac-Gumain RIS	4,004	Porac R., Gumain R.
Tarlac-San Miguel-O'donel RIS (TASMORIS)	5,301	Tarlac R., San Miguel R., O'donnel R.
Pampanga Delta RIS (PDRIS)	11,920	Pampanga R.
Upper Pampanga River Integrated Irrigation System (UPRIIS)	119,411	Pampanga R., Talavera R.
Aulo SRIP	810	Aulo R.
Nueva Ecija Pump IS	1,313	Groundwater
Tarlac Groundwater Irrigation System (TGIS)	3,372	Groundwater
Total	177,616	

Source: NIA

Communal irrigation systems (CISs), most of which have the service area of less than 1,000 ha, are constructed and turned over by NIA to organized groups of farmer-beneficiaries called "Irrigators' Association (IA)." The locations of CISs are shown in Annex-F 4.2.3. The construction costs of CISs are borne by NIA and later amortized by the beneficiaries after turnover. Some CISs are privately owned and operated. There are one hundred eighty-six (186) functional CISs with 37,100 ha of service area. However, ninety-five (95) systems with the total service area of 16,830 ha are non-functional.

There are also various small-scale irrigation systems under the Bureau of Soils and Water Management (BSWM) of the Department of Agriculture (DA). Locations of small-scale irrigations are shown in Annex-F 4.2.4. These systems are developed to increase cropping intensity and production by providing small-scale irrigation and rainwater harvesting infrastructure utilizing small local catchments or shallow groundwater.

The ongoing and proposed national irrigation projects to be implemented until 2018 are listed in the NIA-COPLAN, 2009-2018[15]; the Indicative Irrigation Development Program, 2010-2019[16]; and BSWM as shown in Tables 4.2.3 and 4.2.4, respectively. In addition to the proposed projects in the NIA COPLAN, the updated Central Luzon Regional Physical Framework Plan (RPFP) further envisioned development of the Balintingon Multipurpose Project, for which the feasibility study was made in 1983 and reviewed and updated at the pre-feasibility level in 2006. This project was proposed to irrigate an additional service area of 14,900 ha and to divert water to the AMRIS area.

Table 4.2.3 Summary of On-going National Irrigation Projects

Name of Project	Province Covered	Schedule	
		Start	End
Balog-Balog Multipurpose Project Phase I	Tarlac	1999	2011
Rehabilitation of AMRIS	Bulacan	2009	2010
Along-along Creek Irrigation Project (In UPRIIS Div-3)	Nueva Ecija	2010	2019
Comprehensive Agrarian Reform Program, Irrigation Component, Project-II	Nationwide	1993	-
Repair, rehabilitation of existing Groundwater Irrigation Systems, Establishment of Groundwater Pump Project	Nationwide	-	-
Repair, Rehabilitation, Restoration & Preventive Maintenance of existing National & Communal Irrigation Facilities	Nationwide	-	-
Balikatan Sagip Patubig Program (BSPP)	Nationwide	2010 -	2019
Repair, Rehabilitation, Restoration & Preventive Maintenance of Existing National & Communal Irrigation Facilities (RRENIS/CIS)	Nationwide	2010 -	2019
Restoration/Rehabilitation of Existing NIA Assisted Irrigation System (PRE-NIA-AIS)	Nationwide	2010 -	2019
Participatory Irrigation Development Project (PIDP)	Nationwide	2010 -	2019
Rehabilitation of Small Water Impounding Projects / Diversion Dam	Nationwide	2009-	2011
Upper Tabuating SRIP	Nueva Ecija	2010-	2010-

Source : NIA COPLAN, 2009-2018, NIA: Indicative Irrigation Development Program, 2010-2019 and BSWM

Table 4.2.4 Summary of Proposed National Irrigation Projects

Name of Projects	Province Covered	Service Area (ha)	Expected Funding
Participatory Irrigation Development Project	Nationwide	26,791	GAA / IBRD
Procurement of Pumps, Drilling Rigs & Related Equipment	Nationwide	3,900	GAA / Spanish Loan
Balog-balog Multipurpose Project Phase 2	Tarlac	34,410	GAA / ODA
Sector Loan on Rehabilitation of Irrigation Facilities	Nationwide		GAA / JICA
Casecnan Multipurpose Power & Irrigation Project Irrigation Component - Phase II	Nueva Ecija / Bulacan	61,000	GAA / ODA
Irrigation Water Resources Augmentation Pump Establishment Project	Nationwide	2,361	-
Appropriate Irrigation Technologies for Enhanced Agricultural Production	Include. Regions III	4,000	GAA / ODA
Central Luzon Groundwater Irrigation Systems Reactivation Project	Nueva Ecija	5,000	-
Gumain Reservoir Project	Pampanga	16,750	-

Source : NIA COPLAN, 2009-2018 and Indicative Irrigation Development Program, 2010-2019
Note : GAA : General Appropriations Act, BRD : International Bank for Reconstruction and Development

The location map of the projected national irrigation projects including the Balintingon project is shown in Annex-F 4.2.5, and their schematic flow diagrams are shown in Annex-F 4.2.6.

In addition to the above NISs, construction of new or rehabilitation of existing CISs will be implemented under the nationwide programs, but no concrete development plan for individual CISs is available at present. The proposed projects to be implemented by BSWM are shown in Table 4.2.5.

Table 4.2.5 Summary of Proposed Small-Scale Irrigations under BSWM

	Number	Service Area (ha)
Diversion Dam (DD)	18	1959
Small Water Impounding Project (SWIP)	24	1,635
Small Farmers Reservoir (SFR)	4	112
Total	46	2,706

Note: Estimated by the Study Team based on the BSWM database.

4.2.2 Fishery

Fishery activities in the study area consist mainly of inland municipal and commercial fishing and aquaculture, while marine fishery also prevails in a part of Bulacan and Pampanga as well as Zambales and Bataan in Central Luzon. Aquaculture has the largest share (92%) of the region's fish production, as shown in Table 4.2.6.

Table 4.2.6 Fish Production in 2008 by Province

(unit: ton)

Provinces	Commercial Fishery	Municipal Fishery		Aquaculture	Total
		Inland	Marine		
Bulacan	978	1,261	2,722	46,808	51,769
Nueva Ecija	0	1,783	0	7,022	8,805
Pampanga	0	9,327	2,237	143,917	155,481
Tarlac	0	398	0	6,141	6,538
4 Provinces - Total	978	12,768	4,959	203,889	222,593
(Share)	(0.4%)	(5.8%)	(2.2%)	(91.6%)	(100%)
Region III Total	8,980	13,243	29,222	223,481	274,926
Country Total	1,226,205	181,678	1,151,309	2,407,698	4,966,889

Source: Bureau of Fisheries & Aquatic Resources

Fishes caught in Pampanga river basin especially in the Pampanga delta are a mixture of freshwater species and those tolerant of saltwater. Major species such as tilapia and tiger shrimp can tolerate varying concentrations of saltwater up to the strength of sea water. Major fish culture is aquaculture

in fishponds, in which the major fishes are Tilapia and Milkfish. Region III, mostly in the Pampanga delta, is ranked as the highest producer in the country in terms of aquaculture of Tilapia and Milkfish both in brackish and freshwater in fishponds.

In 1992 after the Mt. Pinatubo eruption, fishery production drastically declined especially in the province of Pampanga due to the loss and damage of flow channels and fishponds. However, aquaculture production has remarkably increased especially in the Pampanga delta, while fish harvest was stable in the other provinces for the last five years.

Most of the fish ponds lie in the Pampanga delta, taking fresh or brackish water directly from the rivers or creeks. In addition, a certain number of fish ponds are also operated within the service area of the NIA irrigation systems. NIA does not permit fishery in the canals while fishponds are allowed. Reportedly, fishpond owners pay double or more for the Irrigation Service Fee (ISF) compared to paddy farming, through an agreement between NIA and the fishpond owners/farmers. Fishery operation is about 4 to 8 months and its water requirement is around five times of that for paddy.

4.3 Municipal Water Supply, Sanitation and Sewerage

4.3.1 Municipal Water Supply

Immediately after the Millennium Development Goals (MDGs)[17] was released through the UNDP Millennium Summit held in September 2000, the Government of the Philippines had resolved to adopt the MDGs and tightly integrated them into the Medium-Term Philippine Development Plan (MTPDP) 2004-2010[13] thus allowing government strategies, policies and action plans to simultaneously address national and MDG targets.

The MDGs focused on the eight targets, and one of them emphasized the access to safe drinking water in any water supply service level. In line with this policy, the MDGs for Central Luzon targeted to increase the population rate which could access safe water drinking and sanitary toilet facilities from about 79% in 1990 to 90% in 2015.

Recently, the Philippine Water Supply Sector Roadmap[18] was been issued by NEDA. The roadmap describes the framework, vision, goals, strategies and programs needed to achieve the desired outcomes for the development of the water supply sector. The vision in the Philippine Water Supply Sector Roadmap is “Access to safe, adequate and sustainable water supply for all,” which targets the objectively verifiable indicators with 100% access coverage and sustaining utility operation by 2025. There are four outcomes: (i) Strengthened Institutions in 2025; (ii) Developed Capacities in 2025; (iii) Strategic Alliances Built in 2025; and (iv) Adequate Infrastructure Provision.

There are three water service levels called Level 3, Level 2 and Level 1 systems in the study area. The Level 3 system is the piped household connection provided by the Water Districts (WDs), LGUs and other private water providers. Level 2 and Level 1 are the piped communal faucets and point source systems, respectively.

The provincial health offices and other relevant agencies have undertaken sample surveys on the population who could access the water supply service level. The existing water service level ratio for each city and municipality in the study area was estimated based on the information from the aforesaid relevant agencies. The estimated ratio of water supply service level by province is summarized in the following table. The data for each municipality/city are shown in Annex-T 4.3.1, as well as in Annex-F 4.3.1 and 4.3.2.

Table 4.3.1 Present Coverage Ratio of the Water Supply Service System in the Study Area

Province	Water Supply Service Level			Safe Water Access	
	Level 3	Level 2	Level 1	Safe	Unsafe
Bulacan	57%	0%	43%	89%	11%
Nueva Ecija	34%	6%	60%	85%	15%
Pampanga	45%	5%	50%	76%	24%
Tarlac	32%	0%	68%	80%	20%
Total	45%	3%	52%	83%	17%

Note: Inside the study area only
Source: PHO for Bulacan, Nueva Ecija, Pampanga and Tarlac (arranged by JICA Study Team)

About 45% of the population in the basin has the Level 3 water system while 3% have the Level 2 water system and 52% have the Level 1 water system. The basin average ratio with access to safe water is 83%. This means that 17% have water supply of any water service level that are not within the permissible water quality under the Philippine National Standards for drinking water which is also patterned after the World Health Organization (WHO) standards. The groundwater is the major water source in the study area. Based on the NSO 2000 census of population and housing[19)], about 98% are using groundwater as their water source in the basin. About 2% in the study area have access to surface water such as small springs and rivers as the point sources for domestic water supply and also for drinking by boiling the water and/or with the aid of simple household sand filtration systems.

4.3.2 Water Supply Service from the Study Area to MWSS Service Areas

MWSS is providing the municipal water supply for Metro Manila and a part of the provinces of Rizal and Cavite through its water service providers: Manila Water Company, Inc. (MWCI) and Maynilad Water Services Inc. (MWSI). MWSS's service areas are located out of Pampanga river basin, while their present major water source is the Angat-Umiray system located in the river basin, which stores the runoff discharge of Angat River and Umiray River.

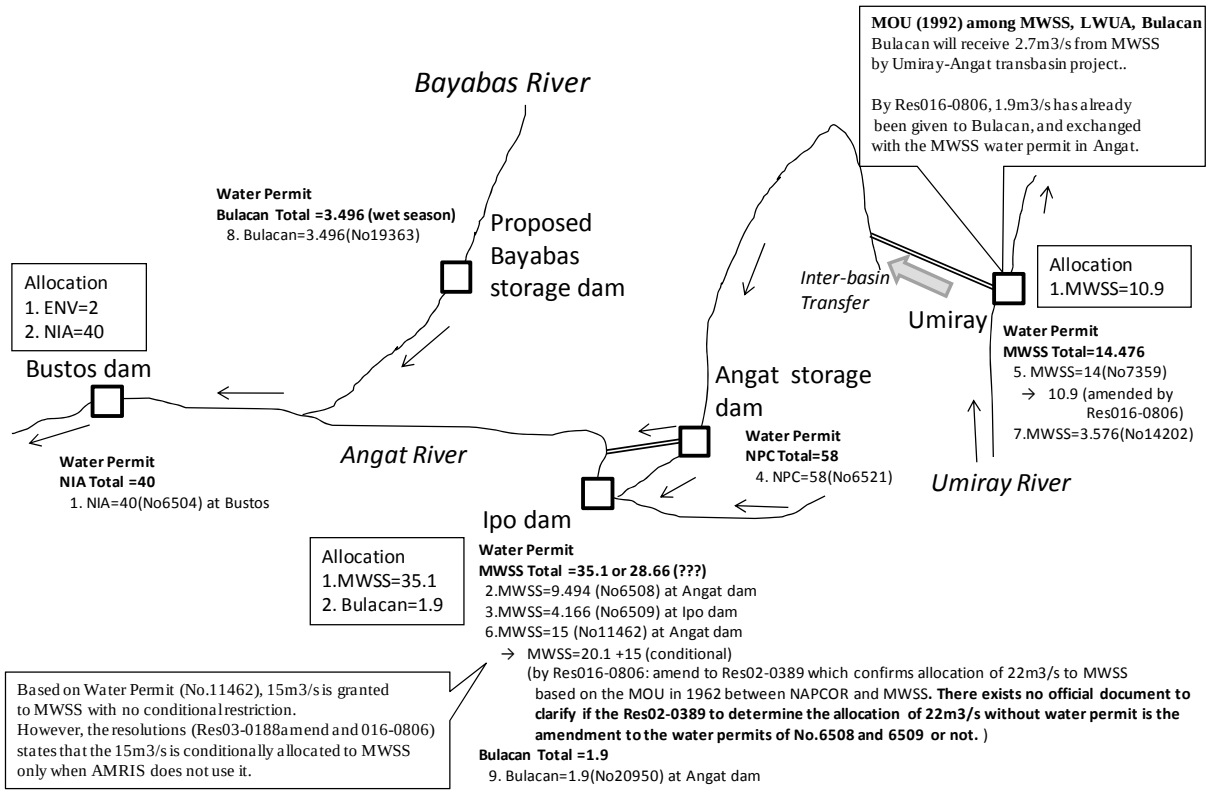
The allocation of water in the Angat-Umiray system is complicated. The water use permits have been historically granted to several water users. However, the actual allocation at present is based on the resolutions issued from time to time. The latest water allocation at upstream of Bustos Dam, which is the major abstraction point for AMRIS, is as shown in the table below.

Table 4.3.2 Updated Water Allocation in Angat-Umiray System

Water User/ Purpose of Use	Volume of Allocated Water	Remarks
NIA	40 m^3/s	The volume is reduced to 25m^3/s when the conditionally allocated 15m^3/s to MWSS is subtracted.
MWSS	46 m^3/s	The volume includes 20.1 m^3/s from Angat storage dam, 10.9m^3/s from Umiray and 15m^3/s from unutilized irrigation water (conditional allocation).
Bulacan Province	5.396 m^3/s	The volume includes 1.9 m^3/s from Angat storage dam (will be abstracted soon) and 3.496m^3/s at proposed Bayabas storage dam site (not yet abstracted).
NPC	58 m^3/s	The volume is non-consumable.
Environmental Flow	1.9 m^3/s	The volume is in equivalent to 10% of dependable flow for quasi-natural condition
Total	151.296 m^3/s	The consumable volume is limited to 93.296 m^3/s

Source: JICA Study Team based on related Water Use Permits, Resolutions, MOUs and MOAs

Figure 4.3.1 shows the granted water use permits and the latest water allocation in Angat-Umiray system. The relationship between the granted water use permits and the resolutions issued are sometimes unclear as indicated in the figure.



Source: JICA Study Team based on related Water Use Permits, Resolutions, MOUs and MOAs

Figure 4.3.1 Water Use Permits and Water Allocation in Angat-Umiray System

The supply of 46m^3/s from Angat-Umiray system has been frequently unstable. There is water use conflict between the MWSS and NIA in Angat-Umiray system due to limited supply. Both MWSS and NIA have agreed to seek the additional water sources to stabilize the water supply from Angat-Umiray system. According to MWSS[20)], the following water sources are under investigation.

- Proposed Balintingon storage dam in Balintingon multi-purpose project and conveyance to AMRIS area: Pre-F/S completed in 2006
- Direct abstraction of surface water of Pampanga River at around Apalit and conveyance by pumps to AMRIS area: Under investigation
- Candaba River: (Details unknown)

In addition to the above potential water sources, NIA, NWRB and the World Bank had proposed Bayabas and Maasim storage dams, which are located near the Angat dam site to supplement the water supply capacity of Angat-Umiray system in 1994. The additional water source for the Angat-Umiray system could be conceived further through the ongoing rehabilitation works of the existing damaged diversion tunnel for the Umiray-Angat trans-basin system and the construction of two additional diversion intakes, which could result in about 20% increase from the current inflow.

The above supplementary water supply sources are the utmost efforts to guarantee the present water supply of 46m^3/s allocated to the Angat-Umiray system, and it would be virtually difficult to secure further water allocation of more than 46m^3/s for the existing MWSS service area. From this viewpoint, MWSS had projected several new water sources, almost all of which are located out of the study area except the Sumag diversion project, to utilize the remaining intakes on Umiray River to meet the incremental domestic water demand in Metro Manila and other MWSS's service areas. Considering the current unstable water supply condition in the Angat-Umiray system, the water requirement of MWSS from the system should not exceed 46m^3/s even after the completion of the Sumag project.

In addition to the above water resource development plan, MWSS projects to expand its services area to the province of Bulacan. A part of the coastal area of Bulacan currently suffers from saline water intrusion to the groundwater and lowering of the groundwater level, which causes difficulties in using the groundwater as the source of drinking water. To cope with this problem, MWSS has agreed with the Provincial Government of Bulacan to supply bulk water to the existing water districts. The project would deliver the treated bulk water of 2.7m^3/s to the priority cities and municipalities of Bulacan. Based on the data provided by MWSS[19], the objective cities/municipalities for the bulk water supply project are as shown in the table below.

Table 4.3.3 Objective Service Area of Bulacan Bulk Water Supply Project

Classification	Objective Area
Out of the Study Area	• San Jose Del Monte (Raw water of 50MLD is currently supplied from MWSS.) • Meycauayan, Marilao and Obando (Areas supplied with treated water under MWSI) • Balagtas and Bocaue (Other areas to be served)
Within the Study Area	• Sta.Maria, Guiguito, Malolos, Bulacan, Calumpit (Other areas to be served)

Source: MWSS

The water source of the treated 2.7m^3/s bulk water is not yet known. However, according to NWRB Resolution No. 015-0816 issued on August 18, 2006, 1.9m^3/s out of the 2.7m^3/s allocated to Bulacan Province is to be sourced from the Angat-Umiray system. The newly developed water source at the Sumag Intake could be utilized for the remaining 0.8m^3/s, based on the Memorandum of Understanding (MOU) among MWSS, LWUA and the Bulacan Provincial Government in 1992.

4.3.3 Sanitation

There are two types of toilet, namely; (i) the sanitary toilets in the form of flush toilet with septic tank; and (ii) the unsanitary toilet without septic tanks which dispose human waste without passing through the septic tank so that leachate percolates directly into the ground or water bodies. The existing sanitary condition for each city and municipality in the study area were evaluated based on the environmental report from the PHO.

The estimated ratio of population with sanitary toilet is presented in Table 4.3.4 (refer to Annex-T 4.3.2 and Annex-F 4.3.3 for details). Unsanitary toilets have a significant impact on the water quality issue. As shown in Table 4.3.4, a part of the ratio component of unsafe water is complemented by the ratio of unsanitary toilet.

Table 4.3.4 Safe Water Ratio Relative to Sanitation Facilities

Province	2008 Safe Water Ratio		2008 Sanitation Facilities	
	Safe	Unsafe	Sanitary	Unsanitary
Bulacan	89%	11%	91%	9%
Nueva Ecija	85%	15%	86%	14%
Pampanga	76%	24%	88%	12%
Tarlac	80%	20%	85%	15%
Total	83%	17%	88%	12%

Note: Inside the study area only
Source: PHOs, JICA Study Team

4.3.4 Sewerage

In addition to the above MDGs, the Clean Water Act was enacted in 2004[21], and its Section 8 titled "Domestic Sewage Collection, Treatment and Disposal" prescribed the following requirements:

- Within five (5) years following the affectivity of this Act, the agencies, which vests in the entities to provide water supply and sewerage facilities and/or concessionaires in Metro Manila and other highly urbanized cities, shall connect the existing sewage lines in all subdivisions, condominiums, commercial centers, hotels, sports and recreational facilities, hospitals, market places, public buildings, industrial complexes and other similar establishments including households to available sewerage system. This connection works shall be made through coordination with the LGUs.

- The said connection shall be subject to sewerage services charge/fee in accordance with existing rules or regulations unless the sources had already utilized their own sewerage system.
- All sources of sewage and wastewater shall comply with the requirements herein. In the areas not considered as highly urbanized centers (HUCs), the DPWH in coordination with the Department of Health (DOH) and other concerned agencies shall employ the septic tank or the combined sewerage-septic management system.

The sewerage system located in the Clark Special Economic Zone (CSEZ) in Mabalacat Municipality, Province of Pampanga, is the sole existing complete system in the study area. The sewerage system has two separate subsystems for storm drainage and sewage. Presently, sewage effluent is treated at the biological wastewater treatment plant (WWTP) with the capacity of 8,023m^3/day catering to the effluent of about 16,280 population and receiving the effluent from a number of industrial, commercial and institutional houses/buildings within the CSEZ. The Clark Water Corporation (CWC) is the main service provider for both water supply and sewerage systems. CWC is charging sewerage tariff at 40% of the domestic water bill. The present WWTP is proposed to be expanded by year 2010 to cater the effluent of 13,500 m^3/d and by 2012 to 33,000 m^3/d.

In the province of Nueva Ecija, Cabanatuan City had carried out a complete feasibility study and engineering design for the construction of the urban sewerage, sanitation and drainage system to serve about 33,200 people. The designed combination of drainage-sewerage system is composed of drainage/sewer lines, lift stations, and wastewater treatment plant with a capacity of 6,630 m^3/d dry weather flows for STP 1 and 1,541 m^3/d dry weather flows for STP 2. The proposed biological treatment plant includes anaerobic lagoon and chemical disinfection. At present, the combined drainage and sewer lines are already constructed but the WWTP has not been done yet due to lack of funds.

The rest of the municipalities and cities in the study area have no sewerage system and the effluent is discharge directly into the nearest stream. It has been reported that the present sludge disposal system was unmonitored and most of the desludgers are disposing untreated sludge anywhere such as open dumpsites and rivers.

4.4 Hydropower Generation

4.4.1 Overview

The total peak power demand in the Philippines had reached 8,993MW in 2007, while the present total installed capacity is 15,937MW. Thus, the present installed capacity is apparently adequate for the peak power demand. However, about 50% of the installed capacity rely on oil and coal energy, most of which is supplied through importation. Accordingly, the energy self-sufficiency for power generation is hardly achieved. In order to improve the power supply states in the Philippines, Department of Energy (DOE) set the following two targets: (i) to reach the energy self-sufficiency level of 60% by 2010; and (ii) to introduce competitive and reasonable processes for power generation.

The Luzon Grid, where the study area is located, has the installed capacity of 12,172MW, which corresponds to about 73% of the country total. Of the said installed capacity, about 2,210MW or 18% is by the hydropower plant. To achieve the target of energy self-sufficiency, DOE presumes the necessity to increase the cumulative installed capacity by hydropower in the Luzon Grid from 2,210MW in 2005 to 2,510MW by the year 2014.

4.4.2 Existing Hydropower Plants

There currently exits three hydropower plants in the study area (refer to Annex-F 4.4.1), namely; (i) Angat hydropower plant with an installed capacity of 246MW, which is placed at Angat storage dam; (ii) Pantabangan-Massiway hydropower plant with an installed capacity of 112MW placed at the downstreams of Pantabangan Dam and Massiway Dam; and (iii) Casecnan with an installed capacity of 160MW placed at the outlet of the Casecnan trans-basin tunnel connecting with Pantabangan dam reservoir. The total installed capacity of these three hydropower plants is 458MW, which is about 20% of the total installed capacity by hydropower plants in the Luzon Grid.

Of the said existing three hydropower plants, the Angat hydropower plant is the most important to contribute to the peak power demand in Metro Manila, in particular, because the plant is located near the demand area and possesses the largest installed capacity. In the Luzon Grid, peak demand usually occurs during day time, and the Angat hydropower plant tends to release a large volume of the discharge during daytime and little during night time in the summer season, in particular, to cover the peak power demand. Such peak power generation requires a large fluctuation of discharges released from the dam reservoir throughout the day. Bustos Dam is located downstream of Angat storage dam, functioning as the after-bay to re-regulate the discharge released from Angat storage dam and supply a constant discharge to the irrigation area of AMRIS. Due to the large fluctuation of the discharge released from Angat storage dam, however, difficulties in re-regulating the discharge often occur, which leads to the difficulties in supplying the water to AMRIS from Bustos Dam.

4.4.3 Proposed Hydropower Plants

There are proposed installations of hydropower plant in the following proposed multipurpose water resources development projects:

- Balintingon Reservoir Multipurpose Project: Installed Capacity = 30MW; Expected Generated Power = 119.6GWh/year
- Balog-Balog Multipurpose Project: Installed Capacity = 43.5MW; Expected Generated Power = 103.12GWh/year

After completion of the projects, it is expected that the installed capacity of 73.5MW will be added to the Luzon Grid.

4.5 Mitigation for Flood and Sediment Disasters

4.5.1 Existing Works

The major structures for flood and sediment disaster prevention in the study area are as listed in Table 4.5.1 (refer to Annex-F 4.5.1).

Table 4.5.1 Completed Major Structural Flood Mitigation Projects

River System	Principal Project Contents	Purpose*	Implementation Period	Project Cost (billion pesos)
Pampanga	Arnedo Dike	FC	1940s	Unknown
	Arayat-Aparit-Masantol Setback Levee on Right Bank	FC	1970s	Unknown
	Arayat–Cabiao Ring Levee	FC	1970s	Unknown
	Candaba Floodway	FC	1970s	Unknown
	Cabiao-San Isidro–Gapan Levee	FC	1970s	Unknown
	Bebe-San Esteban Diversion Channel	FC	1970s	Unknown
	Pampanga Delta Development Project (PDDP), Phase I	FC	1990s-2000s	2.90
Rio Chico	Rio Chico River Control	FC	1970s	Unknown
	PHUMP-Phase I (for Sacobia-Bamban River)	FC/SB	1990s	3.50
Angat	Hagonoy-Calumpit-Plaridel-Bustos Levee on Left Bank	FC	1970s	Unknown
	Labangan Floodway	FC	1970s to 1980s	Unknown
	Abacan River Improvement	FC	1970s to 1980s	Unknown
Porac	Mega-Dike and Transverse Dike on Pasig-Potrero River	FC/SB	1990s	0.90
	PHUMP-Phase II (for Pasig-Potrero River and San Fernando River)	FC/SB	2000s	4.55

Note: * FC = Flood Control; SB = Sabo Works
** Aside from the projects listed above, a variety of channel maintenance and rehabilitation projects have been undertaken in Pampanga River Basin.
Source: F/S and Project Implementation Phase I of PPDP[22)], and Data furnished from DPWH Region III

Most of the existing flood mitigation structures were founded in the 1970's. The Pantabangan storage dam was constructed in the upper reaches of Pampanga river basin in 1973 with the flood control capacity of 330MCM. Immediately after the dam construction, several levees/river dikes were constructed along the Pampanga mainstream. Of these levees/dikes, the Arayat-Apalit-Masantol Setback Levee has the longest length of 40km. However, the levees protect only the right bank of Pampanga River against flood, and more serious flood overflow tends to rush into the left bank area

where Candaba Municipality covering the Candaba Swamp and the other two municipalities of San Luis and San Simon are located. Moreover, the other river dikes/levees aim mainly at preventing river bank erosion and/or fixing the river alignment and hardly contribute to the increment of river channel flow capacity. As a result, most of the downstream and midstream sections of Pampanga River have small channel flow capacities, which could not cope with even the probable flood runoff discharge of 5-year return period.

In order to increase such small channel flow capacity, the Pampanga Delta Development Project (PDDP) was launched in 1982 and the PDDP Phase I was implemented in 1992 to 2002. The Project was completed at a reduced scale due to the budgetary constraints and difficulty of land acquisition of the Philippine government. The target river channel improvement length was 14.2km while the completed length was only 13.9km. Further work on the PDDP is being held as a plan examined.

Sediment prevention works had been also installed in the eastern area of Mt. Pinatubo in the 1990's and 2000's to cope with the large volume of sediment runoff caused by the eruption of Mt. Pinatubo. Among others, the major projects for sediment prevention and management are: (i) the Pinatubo Hazard Urgent Mitigation Project (PHUMP), Phase I for Sacobia-Bamban River (a tributary of Pampanga River); (ii) the Construction of Mega Dike and Transverse Dike for Pasig-Potrero River (a tributary of Pasac River); and (iii) the PHUMP Phase II for Pasig-Potrero River and San Fernando River.

In addition to the above structural approaches, the non-structural approaches by flood forecasting and warning system had been also adopted in the study area. Among others, the existing flood forecasting and warning systems are: (1) the basin-wide flood forecasting and warning system for Pampanga completed in 1981 (refer to Annex-F 4.5.2); (2) the flood forecasting and warning system for effective reservoir operation of Pantabangan and Angat storage dams established in 1994; and (3) the community-based flood forecasting and warning system for Bulacan Province established in 2005.

4.5.2 Ongoing and Proposed Works

The ongoing and proposed structural works for flood and sediment disaster prevention and management are as listed below (refer to Annex-F 4.5.3).

Table 4.5.2 Ongoing and Proposed Major Structural Flood Mitigation Projects

Name and Status of Project	Target River Basin	Status	Principal Purpose of Project	Families to be Relocated	Project Cost (billion pesos)
PHUMP Phase III *1	Pasac	Ongoing (2005-2010)	Flood mitigation for Pasac Delta	40 to 80	4.70
PHUMP Phase IV *2	Pasac	Proposed	Flood mitigation for San Fernando River and its connecting channels	100	3.30
PDDP FC Phase II *3	Pampanga	Proposed	Flood mitigation for Pampanga Delta	6,700	8.80
PDDP FC Phase III *3	Pampanga	Proposed	Flood Mitigation for South Candaba Swamp area	Unknown	Unknown
Maintenance/ Rehabilitation Works *4	Pampanga	Proposed (2008-2014)	River channel maintenance and rehabilitation	Nil	0.20

Source: *1: Pinatubo Hazard Urgent Mitigation Project, Phase II: Monitoring and Planning of Flood Control Works on the Pasac Delta (including Porac-Gumain River) and Third River Channel, 2002
*2: Pampanga Delta Development Project (Flood Control Component, Review Study for Phase 2, 2003
*3: Feasibility Report on the Pampanga Delta Development Project, 1982
*4: DPWH Region III

The above structural works are broadly classified into the following three groups: (i) Pinatubo Hazard Urgent Mitigation Project (PHUMP), Phase III and Phase IV, which aim at coping with the flood and sediment disasters in the eastern area of Mt. Pinatubo; (ii) Pampanga Delta Development Project (PDDP), Phase II and Phase III, which aim at coping with the frequent flood overflow of

Pampanga River; and (iii) the maintenance and rehabilitation works for the existing flood and sediment prevention and management structures. It should be noted herein that the proposed PDDP Phases II and III have been indefinitely differed as mentioned above.

In addition to the above structural works, there are two principal non-structural works for flood and sediment disaster prevention and management, which are now in progress or proposed in the study area. One is the ongoing project for upgrading of the aforesaid flood forecasting and warning system in Pampanga river basin and for dam reservoir operation of the Angat and Pantabangan storage dams (refer to Annex-F 4.5.2). The other one is the PHUMP Phase III, Part 2, which is proposed as a continuation of the said PHUMP Phase III to mitigate flood and sediment runoff in Porac river basin. This project includes several sub-project components such as those for watershed management, land use management, flood management by FFW, and institutional management.

4.6 Watershed Management

The community-based forest management (CBFM) was formulated in 1995 by virtue of Executive Order (EO) 263, and eventually adopted as the national strategy to ensure the sustainable development of the country's forest resources pursuant to EO 318 of 2004. The CBFM takes the principles of social equity, sustainability and community participation in forest management and biodiversity conservation. CBFM now integrates and unifies all people-oriented forestry programs. It is currently envisioned that 9 million ha of forestland, i.e., 30% of the country's total land area, will be placed under the CBFM by 2020.

The CBFM strategy led to the streamlining of the Revised Philippine Master Plan for Forestry Development (PMPFD) in 2003 and the formulation of the Green Philippines Program (GPP) in 2006. The PMPFD aims to reconcile forestry objectives with those for land, water resources, indigenous peoples and local environmental governance. The GPP, on the other hand, focuses on collaborative partnerships with the private sector in order to generate sufficient funding and support towards rapid reforestation and reversal of further loss of forest cover. The GPP targets the greening of four (4) thematic areas, namely; (i) protected areas; (ii) mangrove and coastal areas; (iii) agro-forestry; and (iv) urban parks, green campuses and subdivisions.

Consistent with the framework of PMPFD and GPP, DENR Region III and its field offices, namely; the Forest Management Service (FMS), the Protected Area, Wildlife and Coastal Management Division (PAWCZMD), the provincial ENR offices and their respective community ENR offices, implement the watershed management projects in the basin. The DENR works closely with other government agencies such as NIA, NPC and LGUs and coordinates private sector participation in forestry development and conservation initiatives.

The ongoing watershed management programs and projects by the above agencies are as described in Table 4.6.1.

Table 4.6.1 (1/3) Ongoing Watershed Management Programs and Projects

Programs/Projects	Contents
Forest Protection and Law Enforcement Program (FPLEP)	The program is a regular undertaking of DENR Region III through the respective provincial/community ENR offices. It involves protection of about 1,984km^2 of untenured forestlands through surveillance, apprehension, and initiation of legal proceedings against perpetrators of illegal forest activities. Other activities in coordination with other agencies such as NIA, NPC and concerned LGUs are fire management through multi-sector forest protection councils, vulnerability assessment/geo-hazard mapping, capacity building, and IEC.

… Continue to next page

Table 4.6.1 (2/3) Ongoing Watershed Management Programs and Projects

Programs/Projects	Contents
Community-Based Forest Management (CBFM) Program	The CBFM program grants tenurial authority to organized communities to manage, develop, protect and utilize forest resources, subject to the issuance of CBFM Agreement for 25 years, renewable for another 25 years. The Program is being implemented by the DENR-FMS-Regional CBFM Office. The activities under the program include forest plantation development, agro-forestry, forest protection and maintenance and livelihood development. The livelihood component is anchored on agro-forestry, which provides additional income sources from fruit-bearing trees, seedling production, cash crops (such as vegetables, ginger, coffee, pineapple and cassava), livestock, poultry, freshwater fish culture, etc. - Area under CBFM tenure (1999-2008): 18,150 ha of production forests in Pampanga, Bulacan and Nueva Ecija - Area planted: 418 ha (2.3%) timber plantations and 892 ha (4.9%) agro-forestry. - Beneficiaries: 40 people's organizations (POs); 3,020 households - Annual budget (2008): Php 6.55M for Region III.
Integrated Agro-forestry Development Program (IAFDP)	The IAFD program is a special CBFM program for upland agrarian reform beneficiaries under the Comprehensive Agrarian Reform Program (CARP). It is being undertaken by the DENR through a Memorandum of Understanding with the Department of Agrarian Reform (DAR). The component activities include agro-forestry, forest protection and maintenance, livelihood development, organizational development and stakeholder capability building. - Tenured area (2007-2008): 1,297 ha in Nueva Ecija and Bulacan. - Actual area planted (2008): 520 ha - Beneficiaries: 2 POs; 79 households
Coastal Resources Management Program (CRMP)	The DENR's Protected Area, Wildlife and Coastal Zone Management Services-Coastal and Marine Management Division (PAWCZMS-CMMD) reforests logged over mangrove areas and protects old-growth mangrove forests within the coasts of Bulacan and Pampanga. The program supports the initiative of the Manila Bay Coastal Strategy to conserve critical marine habitats and biodiversity. Other activities involve coastal resource assessment, mapping, and database development; formulation of Coastal Zone and Sea Use plans; establishment of coastal and marine sanctuaries; monitoring, law enforcement and policy support; capacity development and IEC. - Actual accomplishment (2004-2008): 85 ha of new mangrove forests established; 170 ha of old-growth mangrove forests maintained and protected
Protected Area Community-based Forest Management Program (PACBRMP)	The program is being undertaken by the RCBFMO. It covers the protected areas and ancestral domains of indigenous communities. The main strategy is CBFM with timber establishment and agro-forestry, which is expected to provide alternative sources of income to upland communities, especially the IP communities. - Tenured area (2008): 50 ha of ancestral domain claims in Mt. Arayat, Pampanga - Beneficiaries: One PO; 107 household-members.
Private Forest Plantation Development Program (PFPDP)	Private forest plantation development is covered by various forms of forest lease contracts and management agreements with private companies or individuals, such as IFMA, SIFMA, AFFLA, PFDA, TFLA and FLGMA. The concessionaires plant commercial species of timber and derive their income from harvested tree stands. The DENR-Forest Resource Development Division (FRDD) regulates the volume of timber extraction in accordance with the annual allowable cut (ACC) specified in the lease agreement. - Tenured area (1982-2008): 15,539 ha of production forests in Nueva Ecija, Pampanga, Bulacan and Tarlac - Area Planted (as of 2008): 2,917 ha (19%)
NIA-UPRIIS's Watershed Management Program	The NIA-UPRIIS co-manages with the DENR and organized POs and cooperatives the 10,356 ha of Pantabangan-Carranglan Watershed forest Reserve (WFR). The activities include maintenance of established timber plantations and agro-forests as well as protection (patrolling, surveillance, monitoring, fire management), road grading, infra support, stakeholder capability building, and sustenance of livelihood projects. The Inter-agency Task Force composed of NIA, NPC, DENR, concerned LGUs and representatives of the Protected Area Management Board (PAMB) was created in 2008 to craft a comprehensive Forest Land Use Plan (FLUP) with technical assistance from EcoGov, a national environmental NGO. In 2009, the NIA-UPRIIS started to rehabilitate and reforest an initial 100 ha of Pantabangan-Masiway watersheds jointly with the Energy Development Corporation, a private power company that now operates Masiway Dam for hydroelectric power generation. Under this joint management arrangement, EDC provides funds and technical assistance in the propagation and use of indigenous species to reforest the denuded areas surrounding the dam. The NIA helps create additional income sources by hiring locals for nursery seedling production, contract reforestation and agro-forestry establishment.

… Continue to next page

Table 4.6.1 (3/3) Ongoing Watershed Management Programs and Projects

Programs/Projects	Contents
NPC'S Watershed Management Program	The NPC manages the watersheds that support two hydro-electric dams in the basin, namely; Pantabangan and Angat WFRs. This is undertaken through the respective Watershed Action Teams (WAT). The activities are financed out of the environmental charges collected from power consumers. NPC's programs are anchored primarily on forest protection involving patrolling, surveillance and apprehension of violations in partnership with organized community volunteers. In Angat WFR, the NPC maintains the strong support of the Armed Forces of the Philippines military contingent. To strengthen protection, the AWAT plans include resettlement and livelihood development such as rattan production, inland fishery and honey bee culture. The AWAT also conducts research and development for the conservation of biodiversity, specifically under the Philippine Eagle Conservation Project in partnership with the UPLB and the Philippine Eagle Foundation. In the Pantabangan-Carranglan area, the PWAT is an active member of the Inter-Agency Task Force together with NIA, DENR, LGUs and the Protected Area Management Board (PAMB). The major challenges for PWAT include the management of forest fires, which are rampant in the Pantabangan-Carranglan area, and protection against illegal activities such as timber poaching, charcoal making and "kaingin" farming. PWAT partners with universities and colleges to implement livelihood programs for forest occupants, such as handicraft making, mushroom growing, honey bee culture and charcoal briquette production. - Area Planted (as of 2008): 90 ha of Pantabangan-Carranglan WFR; 130 ha of Angat WFR
Integrated Social Forestry (ISF) Projects	The implementation of ISF projects has been devolved to LGUs by virtue of RA 9160 or the Local Government Code of 1991. Through the program, the province of Nueva Ecjia plans to rehabilitate 200 ha of ISF areas within the Carranglan watershed. Tarlac plans to rehabilitate 500 ha of ISF areas in O'Donnell watershed, which is expected to be funded out of the country-wide development fund. - Tenured Area under ISF (as of 2008): 12,942 ha - Actual Area Planted (as of 2008): 100 ha in Talavera and Aulo-Cabo Watersheds - Number of Beneficiaries: 5,590 households
Private Sector Watershed Management Initiatives	As part of their corporate social responsibility commitment, the private sector partners with the DENR in reforestation activities through the "Adopt-a-Watershed Program." Among active partners in the basin are: (1) Water Districts in watersheds supporting domestic water supply sources; (2) Clark Development Corporation (CDC) and Subic-Clark Alliance for Development (SCAD) in Tarlac-O'Donnell Watershed in line with the future domestic water supply projects for Clark SEZ; (3) Holcim Cement in Angat-Maasim watersheds; (4) Manila Water Corp. and Maynilad Water Services in the Angat watershed areas in order to sustain the domestic water supply of Metro Manila; and (5) various NGOs in support of the "Trees for Life" program in the basin.
Pampanga River Basin Rehabilitation Project (PRBRP)	The PRBRP is a special project undertaken in Pampanga, N. Ecija, Bulacan and Tarlac by the DENR-Forest Resource Conservation Division (FRCD) III from 2004 to 2008 in response to flood events in the basin. The objective of the Plan is to double the forest cover of Pampanga river basin from 24% to 48%. The PRBP utilized the CBFM beneficiaries who were contracted to undertake the reforestation and maintenance activities. It was temporarily shelved in 2009 due to budget constraints. In 2010-2012, the project will resume completing the maintenance and protection works involving a backlog of 500 ha newly established tree plantations. - Target area: 67,700 ha - Actual area planted (as of 2008): 10,075 ha newly planted; 5,766 ha maintained and protected - Beneficiaries: 62 POs
Forestland Management Project (FMP)	The FMP is a 10-year JICA-assisted project in the pipeline and targeted for implementation in 2011. It covers three critical river basins in the country, namely; Upper Magat-Cagayan River Basin in Region II, Jalaur River Basin in Iloilo and Upper Pampanga River Basin. The project components include: (i) physical survey and mapping and socioeconomic baseline profiling; (ii) PO formation and CBFMA acquisition; (iii) PO capacity building; (iv) forest tree plantation, silvi-pasture and agro-forestry with bio-fuel and soil conservation measures; (v) infrastructure support such as farm-to-market roads, bridges, and pipeline irrigation system for agro-forestry; (vi) policy initiative (including establishment of cost-sharing mechanism and payment for environmental services); and (vii) monitoring and evaluation. - Target area (Upper PRB): 44,600 ha - Target reforestation/agro-forestry area: 14,133 ha - Estimated project cost: Php 998 million as of 2009

4.7 Water-Related Environment Management

The protection of water-related environment is laid down in the following national and regional imperatives:

- Maintaining good public health, ecological integrity and economic viability as embodied in the Philippine Agenda 21, the country's blueprint for sustainable development.
- Enhancing water quality management, environmental compliance, solid waste management and pollution control, according to the DENR-EMB's priority thrusts and consistent with the mandates of the Clean Water Act (RA 9275), the Philippine EIS System (PD 1586), and the Ecological Solid Waste Management Act (RA 9003).
- Restoring the ecological integrity of Manila Bay in accordance with the Operational Plan for the Manila Bay Coastal Strategy (OPMBCS).

The Supreme Court in 2008 issued a continuing *mandamus* for the urgent cleanup of Manila Bay based on the OPMBCS. Specifically, the *mandamus* calls for a concerted effort among government agencies to: (i) reduce by 50% the water pollution discharges from all sources by 2015; (ii) implement integrated solid waste management programs in all LGUs by 2007; (iii) achieve ecologically sound and sustainable aquaculture fisheries production by 2015; and (iv) protect aquifers from contamination and saltwater intrusion by increasing the coverage of water supply distribution by 50% by 2015.

The DENR-Environment Management Bureau (EMB) III spearheads the initiatives and programs meant to improve and safeguard water quality in the region. These programs are implemented in partnership with other public agencies, private businesses, academe, civil society groups, the LGUs and international development institutions.

The ongoing Capacity Development Project on Water Quality Management funded by JICA is meant to strengthen the capabilities of the DENR-EMB national and regional offices to implement priority actions mandated under the Clean Water Act. It also aims to strengthen capacity of the WQMA governing boards, industries, commercial entities, LGUs, and other stakeholders for achieving the water quality goals identified in the WQMA action plans. The Project began in 2007 and is now in its second phase. Under this project, the Marilao-Meycauayan-Obando river system in Bulacan was selected as the pilot area for designating WQMA and formulating the WQMA Action Plan for Region III. This pilot WQMA will serve as a model for designating WQMAs and formulating and implementing corresponding action plans in Pampanga river basin and in other river systems within the region.

The ongoing programs and projects on water-related environmental management in the basin are described in Table 4.7.1.

Table 4.7.1 Ongoing Water-Related Environment Management Programs and Projects

Name of Programs/Projects	Contents
Ecological Solid Waste Management Program (ESWMP)	The LGUs implement respective 10-year ESWM plans pursuant to RA 9003. Activities, however, are limited in scale due to budgetary constraints. Most LGUs undertake only the soft components of the ESWM plans such as segregation at source, reduction, composting and IEC. Only a few LGUs have established MRFs at the barangay and municipal level. Most LGUs in Pampanga and Nueva Ecija still resort to open dumping. Eleven LGUs in Bulacan have upgraded into controlled dumpsites. The sanitary landfill in Norzagaray needs to be improved. The industrial locators of Clark SEZ together with the 8 LGUs of Tarlac, 5 LGUs of Pampanga and 2 LGUs of Bulacan dispose of their residual wastes in the 100-ha Sanitary Landfill in Sitio Kalangitan, Capas, Tarlac. This facility also receives hospital wastes and other hazardous wastes from such generators throughout the region.
Industrial Pollution Control Program	The DENR-EMB regulates industrial pollution by monitoring compliance with the ECC, Discharge Permits and Self-Monitoring Reports (SMRs). It undertakes pollution adjudication for non-compliant industries. The agency also promotes industrial self-regulation under the Revised Industrial Eco-watch System (RIES) and the Philippine Environmental Partnership Program (PEPP). The former is a public disclosure system where industries are rated in color codes (Gold, Silver, Green or Blue and Red or Black) to indicate compliance or non-compliance, respectively. The latter is an incentive and reward system for industries that voluntarily adopt pollution prevention and cleaner production processes. A number of big industries in the basin such as BASECOM Corporation and Far East Alcohol Corporation (FEACO) are signatory to the Environmental Consent Agreement (ECONA) as a commitment to self-regulation. Likewise, Clark Development Corporation (CDC) was deputized by the DENR-EMB to police industrial and commercial locators in the Clark Special Economic Zone.
Sagip-Ilog Projects	The LGU of San Fernando City rehabilitates San Fernando River through periodic cleanup activities. Future plans also include dredging, slope protection works, resettlement of informal settlers and creation of a river park to boost local tourism. Similarly, the LGU of San Rafael, Bulacan aims to restore Angat River by engaging the participation of the industries and local communities in periodic cleanup and pollution monitoring, starting with the profiling of potentially pollutive industries and business establishments.

Source: DENR-EMB, CDC, PPDOs (2008-2009).

References in Chapter 4

1) NWRB/JICA:Dams in the Philippines, 2000.
2) ADB, MWSS: Umiray-Angat Transbasin Study, Feasibility Study, Main Report Vol.1, 1992.
3) NIA-UPRIIS: Pantabangan Dam, Briefing Kit.
4) NWRB/JICA: Master Plan Study on Water Resources Management in the Republic of the Philippines, Final Report, Vol III-1, Supporting Report, Part-D, 1998.
5) NWRB: Survey/Inventory on Water Impounding Reservoirs, 1978.
6) Prov. Gov. Nueva Ecija: Pre-Feasibility Study Report of Water Impounding Projects in the Province of Nueva Ecija, 1994.
7) NIA/NWRB/World Bank: Water Resources Development Project, Draft Final Report, Task5, Pre-Feasibilitystudy for additional water supply to AMRIS main report, 1994.
8) NIA: Balintingon Reservoir Multipurpose Project, Feasibility Study, Vol. I, Main Report, 1983.
9) CALENERGY: Balintingon Multipurpose Project, Prefeasibility Study Report, 2006.
10) NIA/JICA: Feasibility Study Report on the Gumain River Irrigation Project, 1985.
11) NIA:Balog-Balog Multipurpose Project, Feasibility Study, Main Report, 1980.
12) CDC: Clark Special Economic Zone Water Resources Study, Final Report, 2000.
13) NEDA: Medium-Term Philippine Development Plan, 2004-2010, 2004.
14) NEDA Region III: Updated Central Luzon Regional Physical Framework Plan (RPFP), 2005-2030, 2006.
15) NIA: COPLAN, 2009-2018.
16) NIA: Indicative Irrigation Development Program, 2010-2019.
17) UNDP: Central Luzon MDG Rate of Progress (Region III), www.undp.org.ph
18) NEDA, Philippine Water Supply Sector Roadmap, 2009.
19) NSCB: 2000 Census of Population and Housing, 2000.
20) MWSS: Reply to the request of data and information to JICA Study Team, 2009.
21) GOP: Republic Act No. 8749, Clean Water Act, 1999.
22) JICA: Feasibility Study on Pampanga Delta Development Project, February 1982.

Chapter 5. Present Institutional-Setup for IWRM

5.1 Present Legal Framework

5.1.1 Background of National and Regional Administration

For the purpose of administration and development planning, the Philippines is divided into three tiers of governance, namely; the national, regional and local governments. The national government is divided into 17 administrative regions based on their geographical location, namely; Regions I to XII, National Capital Region (NCR), Cordillera Administrative Region (CAR), CARAGA Region, and Autonomous Region of Muslim Mindanao (ARMM). NCR covers Metro Manila.

The local governments are classified into three hierarchies, namely; Province, City/Municipality and Barangay. Province is composed of city(s), municipalities and barangays. Provinces, cities, municipalities and barangays have their respective councils (Sanggunian) for legislation purposes. Region is the national administrative division for regional administration and coordination among multiple provinces.

The Local Government Code (LGC) enacted in 1991 essentially re-defined the role, relationship and linkages of national, provincial, city/municipal and barangay institutions in the provision of basic services, infrastructure and utilities. The new direction mandated the Local Government Units (LGUs) to play a larger role in planning and implementing local infrastructures and utilities, particularly, water supply and sanitation. This mandate raised significant institutional capacity and resource allocation issues.

The LGUs have been subdivided into 81 provinces, 136 cities, 1,495 municipalities and 42,008 barangays as of December 31, 2008. The LGUs are grouped into the seventeen (17) regions. The Department of Interia and Local Government (DILG) exercises general supervision for the provinces and cities of 16 regions. The ARMM is not part of the general supervision function of DILG..

The main national government agencies have established their respective regional and provincial offices for regulating their own responsible sectors in the provinces and municipalities, allocation of funds from the national budget, implementation of national projects, etc.

5.1.2 Hierarchy of Law

The hierarchy of laws enacted by the National Government of the Philippines is shown in Table 5.1.1. The Constitution and the Republic Acts (RAs) are enacted by the Congress while the Executive Orders (EOs) are promulgated by the President. Presidential Decrees (PDs) were promulgated by the President during the martial law period, 1972-1986. Administrative Orders (AOs) and Memorandum Circulars (MCs) are issued by the secretary of a department and the head of agencies or offices respectively.

Provincial ordinances are enacted by the provincial council, while provincial governors, municipal and city mayors have the authority to issue local administrative orders.

Executive orders, administrative orders, memorandum circulars and local administrative orders could be cancelled if the national or local administration changes. Legislative actions of Congress predominate over the executive actions or decisions of the Office of the President. The government administrators and managers in the Philippines tend to consider that the institution and organizations established by laws (Republic Act, Presidential Decree) are sustainable, but those established by Executive Orders and Administrative Orders are tentative and tend to be abolished or not functioning after the change of administration.

Table 5.1.1 Hierarchy of Laws and Regulations in Philippines

Hierarchy	Enactment	Example
I. National Laws and Regulations		
(1) Constitution	Congress	- The Philippine Constitution of 1987 (new)
(2) Republic Acts (1946-1972, 1987-present)	Congress	- The Water Code of the Philippines of 1776 (Commonwealth Act No. 146) - The Civil Code of the Philippines (RA No. 386-1949)
(3) Presidential Decrees (1972-1986)	President	- Water Code (PD No. 1067-1976) as amended
(4) Executive Orders (1987-present)	President	EO 123-2002
(5) Administrative Orders	Department Secretary	- DENR Administrative Order No. 2005-10, Implementation Rules and Regulations of the Clean Water Act
(6) Memorandum Circulars	Head of Agency/Office	- NWRB Resolution No. 010-0305-2005 - NIA: MC17S78
(7) Others, Guidelines	Head of Agency	- Implementing Rules and Regulations, Water Code of 1979 as amended (March 2005), Guidelines by NWRB
II Laws and Regulations for Local Governments		
(1) Provincial Ordinances	Provincial Council (Sanggunian Panlalawigan)	Provincial Revenue Code of Bulacan (Bulacan PO No. C-003-2004)
(2) City/Municipal/ Barangay Resolutions/Regulations	City/Municipal/Barangay Council (Sanggunian Panlungsod/Sanggunian Bayan/ Sanggunian Barangay)	
(3) Local Administrative Orders	Governor (Province), Mayor (City/Municipality), Punong Barangay	

Note: Refer to the legislative body of Barangay/Municipal/City/Province in SEC. 390, 445, 457, 467 of LGC; Philippine Commonwealth 1935-1946; Modified Parliamentary Republic 1978-1985; Republic under martial law 1972-1986; Republic 1987-present

Source: JICA Study Team

5.1.3 National Policies and Laws

The transformation of national policies for water supply, water resources management, decentralization, privatization, environmental protection and rationalization, and the corresponding main laws and orders for the water resources sector from the 1970s are summarized in Annex-T 5.1.1.

(1) Water Supply and Water Resources Management Policy

The three main legislations defining the institutional setup of the water supply sector were enacted in the 1970s. These are Republic Act No. 6234 of 1971 which created the Metropolitan Waterworks and Sewerage System (MWSS) for water supply in Metro Manila, the Provincial Water Utilities Act of 1973 which authorized the formation of local water districts in provincial centers outside Metro Manila, and the Water Code of the Philippines of 1976 which established the framework of water resources management. The Public Service Law, Presidential Decree No. 1206 of 1977 mandated the National Water Resources Board (NWRB) to supervise water utilities including the regulation of water tariff except those under the MWSS and the Local Water Utility Administration (LWUA).

(2) Decentralization Policy

The Local Government Code of 1991 transferred the responsibility to local governments for public services in their respective administrative areas. Local governments at all levels (provinces, cities/municipalities and barangays) were made responsible for basic service delivery. Pursuant to this Code the LGUs shall endeavor to be self-reliant and shall continue exercising the power and discharging the duties and functions currently vested upon them.

(3) Privatization Policy of Infrastructures

The privatization of infrastructures was initiated for electric power projects by the first legal framework, Executive Order No. 215 of 1987. The former BOT Law or RA No. 6959 of 1990, sought to enable the framework for private sector participation in infrastructure development including water supply. RA No. 7718 of 1994 (present BOT Law) amended RA No. 6959 of 1990, making it more flexible in the implementation of projects concerning roads, airports, water, information technology and so on, allowing nine types of schemes.

The National Water Crisis Act of 1995 provided the government with special powers to recognize sector agencies and pursue private sector participation. This act facilitated the privatization of water supply and sanitation in Metro Manila.

(4) Environmental Policy

Presidential Decree No. 1152 of 1977, the Philippine Environmental Code, established the standards for air and water quality, and the guidelines for land use management, natural resources, groundwater, and waste management. The Philippines Environmental Impact Statement (EIS) System was established by Presidential Decree No. 1586 of 1979. The Philippine Clean Water Act of 2004 defines the policies for pursuing economic growth within the framework of sustainable development in the aspect of water quality management of all water bodies. The Department of Environment and Natural Resource (DENR) is responsible for the execution of these laws.

(5) Rationalization Policy of Governments

The rationalization of government agencies stem from the Public Service Law, PD No. 1206 of 1977. The Administrative Code of 1987 vested the President with residual powers to reorganize the executive branches of the respective government agencies. NWRB has been restructured through Executive Order No. 123 of 2002, and has been entrusted with the responsibility for regulation of water service providers in water districts. Executive Order No. 366 of 2004 directed all department secretaries to conduct strategic review of the operations of the executive branches. Executive Order No. 123 has not yet been implemented. Executive Order No. 279 of 2004 outlined substantial reforms in the financing of the water supply sector, particularly, with regard to the role of LWUA on providing finance to water districts by pursuing more actively the water districts and other water providers to the private capital market.

The Department of Budget and Management (DBM) has approved the Rationalization Plan of seven government agencies. The seven agencies include the Office of the President, the Office of the Vice President, the Department and Labor and Employment, the DBM, the Department of Science and Technology, the Department of Tourism, and the Civil Service Commission. The applications of the remaining agencies are still pending approval at DBM as of June 2009.

Since 1995, successive government administrations have pursued their policy objectives through executive orders issued by the President rather than laws passed by the Congress.

5.1.4 Legal Framework for Policy, Planning, Approval, Implementation, and Monitoring of Water-related Projects

(1) Background

In the Philippines, mandates and responsibilities of the national government and sector agencies are governed by laws and regulations. However, the authority and responsibility for sector policymaking, planning, regulating, implementing and monitoring of projects are severely fragmented, spreading across different government tiers and various national government agencies[1)]. The fragmentation might be partly induced by the three policies of privatization, decentralization and rationalization.

(2) NEDA as the Highest Social and Development Planning and Policy Coordination Body

The National Economic Development Authority (NEDA) is the country's highest social and development planning and policy coordination body. In the performance of its function, the NEDA Board is assisted by five cabinet-level agency committees, namely; the Development Budget Coordination Committee (DBCC); the Infrastructure Committee (INFRACOM); the Investment Coordination Committee (ICC), the Social Development Committee (SDC); and the Committee on Tariff and Related Matters (CTRM). The NEDA Secretariat serves as the technical secretariat to all these committees, except for the DBCC, which is served by the DBM.

NEDA defines the institutional roles and responsibilities of sector agencies, sets broad coverage targets for the country, and defines broad policies, particularly, regarding access of low-income groups to services, cost recovery to sustainability, incentive to improve operational efficiency, and mechanism for private sector improvement. Allocation of the national funds is determined by the Department of Budget and Management (DBM). The Department of Finance (DOF), for its part, sets and implements policies on the use of grants and guarantees from the national government and official development assistance (ODA). Projects of which budget exceeds 500 million pesos are subject to review and approval by NEDA.

(3) National Sector Policies, Planning and Implementation, and Local Government

Key national government agencies are responsible for sector policy, planning, implementing and monitoring of national projects, and regulatory function specific to their jurisdiction. Each department issues department orders for authorities of officials of respective departments for planning, approval, implementation and monitoring of projects under its responsible sector.

The local government at all administrative levels retain de facto responsibilities for public utilities, including water supply and sanitation, for policy, planning, and regulatory functions specific to their jurisdictions, through the respective local government units (LGUs). This includes choosing financing and management options, deciding on tariffs, providing investment and funding support, and setting performance standards.

The Regional Development Council (RDC) regulates and approves inter-provincial and government loan projects. NEDA requires endorsement for implementation from all concerned provinces for the RDC's approval. The Secretariat of RDC is NEDA.

(4) Allocation of Sector Roles between National Government and Local Governments

The present Implementing Rules and Regulations (IRR) of the national and local governments were prepared reflecting the new sector role of the LGUs based on the Local Government Code of 1991 (LGC-1991). The basic services and facilities vested in the LGUs are listed for Barangay, Municipality, Province and City respectively in SEC. 17, CHAPTER I of LGC-1991.

(a) Basic Services and Facilities Vested in LGUs

The basic services and facilities in water-related sectors include, but not limited to, the following:

For a Barangay - Services and facilities related to general hygiene and sanitation, and maintenance of water supply systems.

For a Municipality - Extension and on-site research and facilities related to agriculture and fishery activities; inter-barangay irrigation systems; water and soil resources utilization and conservation projects; and enforcement of fishery laws in municipal waters including conservation of mangroves; implementation of community-based forestry projects including integrated social forestry programs subject to supervision, control and review of DENR, and management and control of communal forests; services and facilities related to general hygiene and sanitation; and communal irrigation,

small water impounding projects, artesian wells, spring development, rainwater collection and water supply systems, sea walls, dikes, drainage and sewerage, and flood control.

For a Province - Assistance in organization of farmers and fisherman's cooperatives and other collective organizations, and transfer of appropriate technology; and inter-municipal waterworks, drainage and sewerage, flood control, irrigation systems and reclamation projects.

For a City - All services and facilities of the municipalities and provinces.

(b) Public Works and Infrastructures Vested in National Government

National agencies or offices concerned should have devolved to LGUs the responsibility for the provision of basic services and facilities enumerated in SEC. 17 of LGC-1991. Regional offices of national agencies or offices whose functions were devolved to LGUs also should have been phased out. However, sector projects are still being led generally by national agencies in coordination with LGUs due to limitation of funds and resources of the LGUs.

Notwithstanding the provision of Subsection (b) of SEC. 17 of LGC-1991, public works and infrastructure projects and other facilities, programs and services funded by the National Government Appropriation Act, other special laws, pertinent executive orders, and those wholly or partially funded from foreign sources, are not covered under SEC. 17, except in cases where the LGU concerned is duly designated as the implementing agency for such projects, facilities, programs, and services.

5.2 Present Institutional-Setup

5.2.1 National Government Agencies

The key national government agencies involved in water resources management are the Office of the President (OP), the National Economic Development Authority (NEDA), the National Water Resources Board (NWRB), the Department of Public Works and Highways (DPWH), the Department of Agriculture (DA), the Department of Energy (DE), the Department of Environment and Natural Resources (DENR), the Department of Finance (DOF), the Department of Interior and Local Government (DILG), and the Department of Health (DOH). The mandates of the key government agencies in water resources management are summarized in Annex-T 5.2.1.

The National Water Resources Board (NWRB), the National Commission on Indigenous People (NCIP), the Metropolitan Water Works and Sewerage System (MWSS), the National Irrigation Administration (NIA), the National Power Corporation (NPCOR/NPC), the Environmental Management Bureau (EMB), and the Local Water Utilities Administration (LWUA) are the regulatory and/or implementation agencies under OP, DPWH, DA, DE, DENR and DOH respectively.

The mandates of these national agencies and line and staff bureaus are mutually correlated. The functional chart of the over 30 water-related national agencies in the Philippines is illustrated in Annex-F 5.2.1. The functional relationship with the local governments is presented in Subsection 5.2.2 of this report. Detailed functions of these agencies with respective responsible sector are presented in Subsection 5.2.3. The mandate and organizational structure of NWRB are presented in Subsection 5.3.2 (1) and Subsection 5.3.5(1) respectively.

5.2.2 Functional Relationship among National and Local Governments

Part of the roles and authorities of the national government agencies were transferred to the local governments based on LGC-1991 [refer to Subsection 5.1.4(4)]. Under the decentralization and rationalization policies, the present institutional arrangements for the functional relationships among the national government agencies and the local governments are still in the transition period. The roles of the national and local governments have not yet been unified, and those vary depending on the sector policy and prevailing conditions. Annex-F 5.2.2 illustrates the present functional relationships among the water-related national government agencies and the local governments. The illustrated

relation is still progressive as of June 2009, and it is subject to clarification among the agencies concerned.

5.2.3 Institutional Structure by Sector

This section deals with further allocation of the responsibility and authority of the national government agencies and the local governments focusing on the key water-related sectors and subjects (refer to Annex-F 5.2.2).

(1) Water Supply and Sanitation

The delineated roles and responsibilities of the key agencies of water supply sector are summarized in Annex-T 5.2.2. Annex-T 5.2.3 illustrates the institutional structure of domestic and municipal water supply and sanitation among national government agencies and the local governments.

The NWRB, the Metropolitan Waterworks and Sewerage System (MWSS), the Local Water Utilities Administration (LWUA) and the LGUs are the regulatory agencies for water supply. The NWRB regulates water service providers including some LGU-managed water utilities in terms of water supply tariff and coverage and services. The water supply and sanitation services to cities and municipalities of Metro Manila are regulated by MWSS. The services are currently provided by two private concessionaires, Manila Water Company, Inc. (MWCI) and Maynilad Water Services, Inc. (MWSI).

NEDA Resolution No. 4 (series of 1994) allows LGUs to implement all levels of water supply projects and redefines the role of other sector agencies.

LWUA regulates urban water supply except in Metro Manila. The Department of Interior and Local Government (DILG) regulates and implements rural water supply. The LWUA and the Water Supply and Sanitation Project Management Office (WSSPMO) of DILG, through their respective funding activities define and enforce specific quality and performance standards of service for water districts and LGU-managed systems, respectively. They also assist water and sanitation service providers through capacity building and technical assistance.

Services by LWUA initially implemented the Level III water supply projects which were financially viable. LWUA's support, in particular, extends beyond technical assistance to actual improvement in execution of individual water district projects and governance of water districts.

WSSPMO plays a critical role in the rural water supply sector due to its area management role in local territories. It participates in general administration and institutional building, such as assistance to LGUs in the formation of rural and/or barangay waterworks and sanitation associations and identification of water supply systems.

DPWH, together with DILG and DOH provided, initially, technical assistance to LGUs in planning, implementation and operation and maintenance of water supply facilities limiting to the period of two years.

Under the 2004-2010 Medium Term Philippine Development Plan (MTPDP), the National Anti-Poverty Commission Water Supply Coordination Office (NAPC-WASCO) was created as the national coordinating unit for the implementation of the President's Priority Program of Water (P3W). This program gives special attention to "waterless" LGUs nationwide.

NEDA Resolution No. 5 reaffirms the principle of provision of sewerage and sanitation services on the basis of willingness-to-pay. The resolution mandates the establishment of a Central Project Support Office (CPSO) at LWUA to assist LGUs in the formulation, preparation and implementation of sewerage and sanitation projects.

EO 279 (February 2004) instituted reforms in the financing policies for the water supply and sewage sector and water service providers, rationalizing the LWUA's organizational structure and transferring it to the office of the President. EO 387 (November 2004) transferred LWUA from the office of the President to DPWH. EO 421 (April 2005) refocused LWUA's functions

and organizational structures as envisaged in EO 279. EO 738 (July 2008) transferred LWUA from DPWH to DOH.

(2) Irrigation

There are three types of irrigation systems in the Philippines: national, communal and private. Under the jurisdiction of the Department of Agriculture (DA), the functions of the National Irrigation Administration (NIA), created initially by RA 3601 of 1963, were broadened under Presidential Decree Nos. 552 of 1974 and 1702 of 1980, both amending RA 3601. NIA undertakes program-oriented and comprehensive water resources projects for irrigation purposes as well as concomitant activities such as flood control, drainage, land reclamation, hydropower development, watershed management, etc., except private irrigation systems. Communal irrigation systems were devolved to LGUs based on Irrigation Management Transfer (IMT) started in 2009 and LGC-1991. Private irrigation systems are composed of plantations operated by companies and small private irrigation systems.

In the irrigation sector, NIA plays the main role of implementation, operation and maintenance of the nation's irrigation systems in collaboration with local governments except private irrigation systems. The IMT is planned to be completed in five years under the NIA's rationalization plan approved in 2008. The national irrigation system offices (NISOs) and the provincial irrigation offices (PIOs) have been merged within a province or a cluster of 2 to 4 provinces as the irrigation management offices (IMOs) in order to strengthen financial viability of the national irrigation systems (NISs). IMOs are managed by the regional irrigation offices (RIOs) of NIA.

NIA issued several manuals for design, operation and maintenance; for example, Design Manual for Diversion Dams (1987 under process), Design Manual for Canals and Canal Structures (under process), General Operation & Maintenance Manual (Final Report, January 1991).

(3) Flood Control

Flood control requires a river basin approach participated by multiple government agencies. Annex-T 5.2.4 illustrates the institutional structure of national government agencies in flood control. The DPWH has played a main role in flood control and oversees its national and regional projects.

The projects under DPWH are presently being executed based on Department Order No. 24, Series of 2007 known as the Amended Omnibus Level of Authorities of Officials of DPWH. The levels of authority delegated are 11 groups based on the DPWH project cycle and functions and services of other offices. Those levels are planning, environment and social aspects, design, land acquisition and infrastructure right-of-way, procurement, contract management, infrastructure maintenance, quality control, human resources, financial resources, and equipment and property (other than real estate).

The DPWH PMO-Major Flood Control Projects (PMO-MFCP) manages the planning, design, construction, and operation and maintenance of major flood control projects of the nation. After construction, the PMO-MFCP transfers the role of operation and maintenance of river and flood control facilities of selected river basins to the regional offices of DPWH such as the Agno-PMO Flood Control Office. Some provincial governments contribute to a part of operation and maintenance based on a memorandum of agreement (MOA) between DPWH and the LGU concerned by arrangement of NEDA depending on the prevailing local conditions. The Flood Control and Sabo Engineering Center (FCSEC) under DPWH is in charge of planning of flood control and Sabo works.

DPWH had issued a series of technical guidelines and standards; for example, Design Guidelines, Criteria and Standards for Public Works and Highways in 4 volumes (1987 called "Red Book"), DPWH Standard Specifications for Public Works Structures (1995), Technical Standards and Guidelines for Planning and Design (draft March 2002), Manual on Construction Supervision of Flood Control Projects (December 2004), Manual on

Maintenance of Flood Control and Drainage Structures (April 2005). Upgrading of the Red Book is in progress.

(4) Watershed Management

Pursuant to Executive Order No. 192 (10 June 2007), the DENR is the primary government agency responsible for the conservation, management, development and proper use of the environment and natural resources, including forests and watershed areas. The Forest Management Bureau (FMB) under DENR formulates and recommends policies and/or programs for the effective protection, development, occupancy, management and conservation of forest lands and the watershed.

NIA, NPC, PNOC (Philippine National Oil Company) MWSS and the WDs are guided by DENR policies and collaborate with the latter to protect and preserve the watershed areas in their respective areas of responsibility. There are inter-agency agreements by and among them to combine their efforts and resources in maintaining and promoting environmentally sound watershed areas. Community involvement is also encouraged by enlisting people's participation in undertakings and development projects on watershed areas, and safeguarding them.

On the other hand, the Bureau of Soils and Water Management (BSWM) under the Department of Agriculture (DA) remain responsible for the assessment, development and preservation of existing and potential soil and water resources for agriculture.

The LGUs also can perform watershed management functions but are subject to supervision and control of DENR based on the Local Government Code. Provinces and municipalities implement community-based forest management, social forestry, and watershed projects, with the discretion of LGU executives.

(5) Water Quality

The Clean Water Act (CWA), RA No. 9275-2004, enacts comprehensive water quality management in all water bodies and in the control and abatement of pollution from the land-based sources. The water quality standards and regulations are being enforced irrespective of sources of pollution. The act provides, among others, that DENR in coordination with NWRB shall designate certain areas as water quality management areas using appropriate physiographic units such as watersheds, river basins or water resources regions. The implementing rules and regulations (IRR) of CWA-2004 was promulgated pursuant to Section 32 of CWA-2004 and EO 192-1987, DENR Charter.

(6) Large Dam

Most of the large dams were planned and constructed by NPC and NIA. However, no unified nationwide planning and design standard for dams and appurtenant structures was established. NPC customarily apply the USBR standards and manuals to dams.

5.2.4 Institutional Framework for the Study Area

There are no specific institutional and legal arrangements in the study area with respect to water-related sector planning and implementation, and IWRM. The legal framework for policy, planning, approval, implementation of water-related projects, and the regulatory framework of water resources management are basically the same as those applied nationwide except those transferred to the provincial, city, municipal and barangay governments based on the LGC-1991. The power and attributes of local government, inter-government relationship, local legislation, organizational structure and staffing, local taxation and fiscal matters, local fiscal administration including budgeting, and share of local government units in the national wealth are enumerated in the LGC. The local governments have not initiated yet further specific and/or own arrangements for management of the water-related sector.

Annex-F 5.2.3 shows the organizational chart of the Government of the Province of Pampanga as a typical organizational chart in the study area. The organization under the Provincial Governor is

composed of the Provincial Treasurer's Office, the Provincial Engineer's Office, the Provincial Planning and Development Office (PPDO), the Provincial Budget Office, the Provincial Agriculturist Office, the Provincial Assessor's Office, the integrated Provincial Health Office, the Provincial Library and Information Office, and the Provincial Jail. This organizational structure is basically the same for the other provinces.

The PPDO takes charge of formulation of the provincial strategic development plan.

5.3 Present Framework of Water Resources Management

5.3.1 The Constitution and Water Code

(1) The Constitution

The national policy on water, as a natural resource, is enshrined in Section 2, Article XII of the 1987 Philippine Constitution, as follows:

> "All lands of the public domain, waters, minerals, coal, petroleum and other mineral oils, all forces of potential energy, fisheries, forests or timber, wildlife, flora and fauna, and other natural resources are owned by the State. The exploration, development, and utilization of natural resources shall be under the full control and supervision of the State. In cases of water rights for irrigation, water supply, fisheries, or industrial uses other than the development of water power, beneficial use may be the measure and limit of the grant."

(2) The Water Code

(a) Objective

The Water Code of the Philippines (Presidential Decree No. 1067-1976) is the basic water law of the Philippines. It is anchored on the principle that all waters belong to the State. Proceeding from this premise, these waters are not subject to acquisitive prescription. The State may allow the use or development of water by administrative concession, but the utilization, development, conservation and protection of water resources shall remain within the control of and regulation by government.

In synthesis, the objectives of the Water Code are to:

- Establish the basic principles and structural framework relating to the appropriation, control, conservation and protection of water resources to achieve their optimum development and efficient use, to meet present and future needs;
- Define the scope of the rights and obligations of water users and provide for the protection and regulation of such rights;
- Institute a basic law to govern the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources and rights to land related thereto; and
- Identify the administrative agencies which will enforce the Code.

(b) Definition and state ownership of water

"Water" is expansively defined by the Code. Thus, Article 4 thereof declares that "Waters, as used in this Code, refers to water under the ground, water above the ground, water in the atmosphere and the waters of the sea within the territorial jurisdiction of the Philippines." This definition practically captures the entire segment and categories of water resources in their natural state or from the perspective of their source. This fundamental policy was enunciated in the Philippine Constitution, incorporated in the Civil Code (see succeeding section), and now reiterated in the Water Code. Other provisions of the Water Code categorically reinforce this stand as can be seen from the provisions of Articles 5 and 6.

Article 5. The following belong to the State:

- Rivers and their natural beds;
- Continuous or intermittent waters of springs and brooks running in their natural beds and the beds themselves;
- Natural lakes and lagoons;
- All other categories of surface waters such as water flowing over lands, water from rainfall whether natural or artificial and water from agricultural runoff, seepage and drainage;
- Atmospheric water;
- Subterranean or ground water; and
- Seawater.

Article 6. The following waters found on private lands also belong to the State:

- Continuous or intermittent waters rising on such (private) lands;
- Lakes and lagoons naturally occurring on such lands;
- Rain water falling on such lands;
- Subterranean or ground waters; and
- Waters in swamps and marshes.

The owner of the land where the water is found may use the same for domestic purposes without securing a permit, provided that such use shall be registered, when required by NWRB. NWRB, however, may regulate such use when there is wastage or in times of emergency.

(c) Separation of water from land

The provisions of Article 6 of the Water Code are a departure from the stipulations of the Civil Code on water. Before their repeal by the Water Code, certain provisions of the Civil Code, particularly those on ownership of waters (Section 503) recognized private ownership of certain categories of water (i.e., continuous or intermittent waters rising on lands of private ownership; lakes and lagoons, and their beds, formed by Nature on such lands; subterranean waters found on the same; etc.). These laws on the ownership of waters found in private lands are now expressly abrogated by Article 6 of the Water Code. Other instances of repeal of Civil Code provisions by the Water Code are treated, in passing, in succeeding sections.

(d) Appropriation

The appropriation of water which is the acquisition of rights over the use of water or the taking or diverting of waters from a natural source, is governed by the Water Code. Provided such use or taking or diversion is accomplished in a legal manner and for a lawful purpose, the Code allows appropriation of water for any of the following purposes:

- Domestic - the utilization of water for drinking, washing, bathing, cooking or other household needs, home gardens, and watering of lawns or domestic animals;
- Municipal - the utilization of water for supplying the water requirements of the community;
- Irrigation - the utilization of water for producing agricultural crops;
- Power generation - the utilization of water for producing electrical or mechanical

power;

- Fisheries - the utilization of water for the propagation and culture of fish as a commercial enterprise;
- Livestock raising - the utilization of water for large herds or locks of animals raised as a commercial enterprise;
- Industrial - the utilization of water in factories, industrial plants and mines, including the use of water as an ingredient of a finished product;
- Recreational - the utilization of water for swimming pools, bath house, boating, water skiing, golf courses and other similar facilities in resorts and other places of recreation. (Art. 10, Water Code)

(e) Water rights and permit

Under the Water Code, no person shall appropriate water without a water right. A water right is acquired with the issuance of a water permit which is the evidence of the water right granted. The following may apply for a water permit:

- Citizens of the Philippines who are of legal age;
- Associations, duly registered cooperatives or corporations organized under the laws of the Philippines, at least 60% of the capital of which is owned by citizens of the Philippines; and
- Government entities and instrumentalities including government-owned or controlled corporations.
- The measure and limit of appropriation of water is its beneficial use. Beneficial use as defined in the Code is the utilization of water in the right amount during the period that water is needed for producing the benefits for which the water is appropriated. Standards of beneficial use are prescribed by NWRB to the appropriators of water for different purposes and conditions.

(f) Revision

The National Water Resources Board (NWRB; former NWRC) promulgated the Implementing Rules and Regulations (IRR-1979) of the Water Codes (PD No. 1067-1976) as a guideline. Revision of the IRR-1979 in accordance with EO 123-2002 was approved and implemented in 2005.

The revision of the Water Code of 1976 has been initiated for the meetings with the head of offices and stakeholders. The progress and the content of the draft have not been disclosed yet to the public.

5.3.2 Regulation of Water Resources Allocation

(1) NWRB as Apex Regulatory Body

The overall responsibility for coordination of water resources development and management is vested in the National Water Resources Board (NWRB) which was initially created as National Water Resources Council (NWRC) by Presidential Decree No. 424-1974. Its basic mandate is to administer and enforce the Water Code. NWRC was converted to NWRB by Executive Order No. 124-A of 1987.

The jurisdictional powers, functions and duties of NWRB include: (a) to formulate policies and guidelines on water resources development and management; (b) to effect cross-sectoral and inter-departmental coordination of water resources development activities; (c) to grant or issue water permits and certificates of public convenience/and necessity; (d) to advise NEDA on matters relating to water resources development plans, programs and projects, and (e) to exercise jurisdiction over disputes concerning water allocation and utilization.

The NWRB is manifestly a collegial and quasi-judicial body. Its governing board is composed of five cabinet departments (DENR, NEDA, DOF, DOJ, DOH) and a water agency, NHRC. Three cabinet departments, DPWH, DA and DTI involved in water users and four water agencies, LWUA, MWSS, NIA, NPC were excluded from the board members after Executive Order No. 123-2002. The Chairman of the Board is the Secretary of DENR at present.

(2) Water Permit Procedure

NWRB's procedure for processing and approval of water permit application is illustrated in Annex-F 5.3.1. Procedure Item No. 9, Technical Appraisal and Clearance from other agencies, are done by deputized agencies in practice; for example, NIA for agriculture and fisheries, NPC for hydropower, LGUs and MWSS for municipal water. Issue of permit to drill for groundwater (Procedure Items No. 11-13) requires much manpower in urban and rural areas. Procedure No. 6, Hearing Adjudication/Decision, and Procedure No. 14 Technical Evaluation, also require much manpower of the Board.

NWRB has a plan to empower deputizing any official or agency of the government to perform any of its specific functions or activities in order to resolve its chronic shortage of manpower. In particular it was sought to achieve the regular submission of an accomplishment report to monitor performance related to water permits in remote areas from the office of NWRB in Manila. Memorandums of Agreement were signed in 2004 between NWRB and the three municipalities based on Resolution No. 008-1003, Deputizing the Three Municipalities of Sta. Fe, Bantayan and Madridejos in Batanyan Island, Cebu, October 23, 2003. The task of the deputy stipulated in the agreement covers:

- Receive water permit application (WPA);
- Verify details on application and compliance with requirements;
- Receive filing fees;
- Ensure the postings of WPAs at designated posting areas;
- Conduct field investigations/site inspections;
- Submit recommendations on the WPA to the Board;
- Deliver Permit to Drill (PTD) to applicant issued by the Board;
- Receive well data after the well has been drilled;
- Verify that water permittees comply with the conditions imposed in the water permit;
- Monitor drilling of wells and other water resources development activities in the area consistent with the positions of the Water Code of the Philippines;
- Collect well data;
- Perform such other similar functions relative to the processing of WPAs.

(3) Levy Related to Water Permits

(a) Fees and Charges

The NWRB is responsible to collect the levy (water fees and charges) related to the water permit as stipulated in the Water Code.

Pursuant to Executive Order No. 1973, series of 2000, and to NWRB Resolution No. 010-0305 dated 21 March 2005, NWRB on its 29th Meeting approved the application/filing fees and annual water charges, as shown in Annex-T 5.3.1.

(b) Responsibility of Concessionaires

The National Power Corporation (NPC) was exempted from the annual water charge (Item B) due to its non-profit character based on Presidential Decree No. 938 (May

1976)[2)]. However, after the issuance of NWRB Resolution-1998, all the parties granted water permits (concession) must pay the annual water charges regardless of whether or not they are private or public entities. The NPC still does not pay in spite of the opinion of the Department of Justice (DOJ) that NPC must pay. The National Irrigation Authority (NIA) also had not paid the annual water charges without legal exemption though the charge to irrigation use is less than a half of other uses. The filing fee can be exempted.

Irrigators' associations who rely on the irrigation system of NIA are responsible to pay the irrigation service fee (ISF) to NIA. NIA is responsible to pay the annual water charges for the system's granted with a water permit (concession).

Irrigators who operate their own irrigation systems are also responsible to pay the annual water charges for their granted water permits.

(c) Collection Rate of Annual Water Charges

The water utility division of NWRB sends the annual water charge bills to the concessionaries. The charges paid to NWRB are remitted to the Bureau of Treasury under the Department of Finance (DOF), and those are treated as national funds. Manila Water Company Inc. and Manilad Water Service Inc. of MWSS paid the annual water charges in 2007.

Many water users do not pay the annual water charge after the respective water permits have been granted. The Water Utility Division of NWRB has the capacity to bill only 30 to 40% of the concessions due to limited staff capacity. Out of the entities billed, about 80 to 85% pay the charges at present.

Out of the number of entities not billed (60–70% of the concessionaries), 20% is NIA, 10% is NPC and 70% is Water Districts. There are four types of irrigation water users: individual farmers using shallow wells, irrigators' associations for communal irrigation, NIA for government irrigation systems, and corporations mainly plantations. It is technically difficult to go after the individual farmers because many of them had abandoned their farms due to dry-out of shallow wells. Majority of the irrigators' associations paid the charges, but the exact number of irrigators' associations at present was not obtained because the collapsed associations have not been caught. NIA intentionally does not pay the charges. Some of the large corporations do not pay too. The entities which do not pay shall be subject to review and inspection because many irrigated lands have been converted to subdivision lots (household residential areas) in Bulacan and Dampang in particular. Review and inspection surveys have not been conducted yet due to shortage of manpower in NWRB.

5.3.3 Water Use Regulation during Draught

(1) Technical Working Group

The NWRB executes the appropriate water use regulation during draught on a case to case basis. For example the technical working group (TWG) established in 1960s for the water allocation of the Angat dam currently holds monthly regular meetings under the secretariat of NWRB. The Angat multipurpose dam (hydropower, irrigation, municipal water supply to Manila, etc.) is located at Angat River, the tributary of Pampanga River in the province of Bulacan. The TWG for Angat Dam is functioning as a kind of draught regulation committee.

(2) A Case of Litigation for Water Right Allocation

During the severe draught in September 1997 caused by El. Niño, most of the water of Angat Dam allocated under the water permit to NIA, of which water users are irrigators' associations, was transferred to MWSS based on the first priority to domestic and municipal use as stipulated in Article 95 of the Water Code. Farmers (irrigators' association) did not claim compensation for the water rights following the regulation by the Administrator of NIA. Majority of the farmers had not fully paid the irrigation service fees for a long time. Farmers

had to pay the irrigation service fees if they claim compensation. On the other hand, the Provincial Government of Bulacan litigated against MWSS. The Regional Trial Court determined that the Manila Water Supply System (MWSS) shall pay the royalty (1% of the gross sales) to the Province of Bulacan based on Section 13 of the Local Government Code of 1991. The resolution has not been finalized yet. MWSS plans to appeal to the Court of Appeals if the resolution is finalized.

This case suggests that the position of the irrigators' association in terms of water rights is weak and unstable under the present Water Code. The purpose of the annual water charges based on water permit and the purpose of the royalty of water based on the Local Government Code of 1991 are different; hence, they should be subject to review.

5.3.4 Water Resources Planning and Assessment

(1) Water Resources Planning and IWRM

The NWRB is tasked with collating, coordinating and updating the framework plans for water resources and for NEDA to integrate the plans for water resources development and management into the national strategies and policies. In 1994, NWRB produced an updated National Framework Plan on Water Resources Management that incorporated regional framework studies. The NWRB also recommends to NEDA suitable action plans to address emerging issues in the water resources sector as they evolve.

On the other hand, the NEDA Board, which is chaired by the President of the Philippines, formulates national policies and strategies including those on the water resources sector. NEDA has been the leading agency in preparing the Medium-Term Philippine Development Plan (MTPDP) and the Medium Term Public Investment Plan (MTPIP). Both planning documents incorporate water resources sector plans at the national and regional levels. There are also coordinating committees established to align development of water resources with the national strategies and fiscal direction of the government. The role of NWRB in this segment of water resources management is confined to updating policies on water resources and integrating various sub-sector policies, strategies and plans on water resources.

The NWRB does not have the authority to determine the priority of projects for implementation of a specific river basin water resources master plan. Neither a national government agency nor a local government has the authority to determine and implement such an IWRM Master Plan which shall involve multiple provinces and multiple water sectors in the river basin.

For the planning and implementation of the IWRM Basin Master Plan, closer coordination of the Regional Development Council (RDC) and the Infrastructure Committee (INFRACOM) would be necessary for provincial governments and national agencies respectively.

The RDC regulates and approves inter-provincial projects and government loan projects under the NEDA Secretariat. The function of INFRACOM, chaired by the Director-General of NEDA, is to advise the President and the NEDA Board on matters concerning infrastructure development, including highways, airports, seaports and shore protection, railways, power generation, transmission and distribution, telecommunication, irrigation, flood control and drainage, water supply and sanitation, national buildings for government offices, hospitals and related buildings, state colleges and universities, elementary and secondary school buildings, and other public works.

(2) Water Resources Assessment and Data

Assessment of water resources is a collaborative effort by several agencies of government. The Bureau of Research and Standards (BRS), the National Irrigation Administration (NIA) and the National Power Corporation (NPC) are the three agencies that are primarily responsible for the collection of stream flow data.

In 1974, NWRB assumed the responsibility of accumulating and processing data on river stages and discharges. In 1987, the functions of NWRB were realigned and maintenance of

the national network of stream flow data was transferred to BRS. The actual collection and processing of the stream flow data in the field are under the direct control and supervision of the regional offices of DPWH. There are about 274 monitoring stations nationwide which daily register river stages. The information and data collected from these stations are submitted to the DPWH regional offices where they are fed and processed through the BRS-developed computerized data processing system. However, in September 2010, it was noted that BRS does not have sufficient capacity to continue recording and processing of stream flow data. It was also noted that the DPWH regional offices are primarily project-oriented and are the implementing arms of the department. Water data collection is not an inherent mandate of the office.

NIA and NPC are also involved in generating stream flow data mainly for the purpose required by their respective projects. Data collection activities by these agencies are normally confined to monitoring stations surrounding their project sites. Information gathered by these agencies are processed but are hardly published. Collectively, these agencies maintain about 168 stream flow stations which monitor river stages and discharges. It is necessary that the data gathered by these agencies are included in the information network for stream flow data to be useful.

5.3.5 Strengthening of NWRB and Water Code by EO 123

(1) Progress of EO 123

The NWRB is composed of five divisions with 126 positions under the Office of the Executive Director (OED), namely; the Policy and Program Division, the Water Right Division, the Water Utilities Division, the Monitoring and Enforcement Division, and the Administrative and Financial Division. NWRB's organizational chart is shown in Annex-F 5.3.2. The total number of personnel is only 103 including 8 of the OED as of June 2009 for the 126 positions. It has been reported that the shortage of manpower at present is serious to enable execution of NWRB's mandate.

The NWRB was attached to the Office of the President in January 2010. EO 123 was later issued aiming to strengthen NWRB by attaching it to DENR and transferring the review and approval of the tariff of Water Districts to NWRB from the Local Water Utilities Administration (LWUA). Under EO 123, the NWRB is required to execute the following three tasks:

(a) Review of the Implementing Rules and Regulations (IRR) of the Water Code and amend the same;

(b) Formulate a new or revised organizational structure for its Secretariat to effectively and efficiently carry out its mandate under PD 424 (1974) and PD 1067 (1976); and

(c) After approval by the President of the new or revised organizational and manpower structure of the NWRB Secretariat, NWRB shall become a bureau under DENR for the purpose of administrative control and supervision.

The first task was approved and implemented in 2005. For the second task, NWRB proposed to DBM for approval in 2008, a new organization which will provide three services with 182 positions, namely; policy, coordination and integration service; economic regulatory service; and resource regulation service. The new organizational structure is as shown in Annex-F 5.3.3. It was prepared based on the logical framework for NWRB[3)]. The mandate of NWRB stipulated in the Organizational Performance Indicator Framework (2008) shall be as follows: "NWRB coordinates and regulates all water resources development and management of the country. It is responsible for achieving a scientific and orderly development of all water resources consistent with the principles of optimum utilization, conservation, and protection to meet present and future needs."

After NWRB was transferred from the President's Office to DENR based on Executive Order No. 860 on 8 February 2010, it reviewed the organizational structure proposed in 2008 and

drafted the amendment as shown in Annex-F.5.3.4, where the legal and adjudication office is upgraded into a Service and the number of positions is increased from 182 to 196.

(2) Past Legislative Reform Initiatives

(a) Initiative by DENR with UNDP Assistance

In 1996 President Ramos created the Presidential Task force on Water Resources Management and Development (PTFWRDM) under DENR, with assistance from the United Nations Development Programme (UNDP), to develop a comprehensive water resources management strategy and to prepare the draft of a bill on water resources in order to respond to the Water Crisis Act of 1995. In August 1997, the PTFWRDM drew up a legislative proposal to create a new apex body to take charge of water resources management and economic regulation of all utilities within the country. The proposal sought to create the Water Resources Authority of the Philippines (WRAP) as a new entity to take over the functions, powers and responsibilities of NWRB in addition to new and broad powers and functions. However, the bill never led to the Committee hearing stage, and the task force was disbanded in 2002. The new WRAP bill, i.e., Senate Bill No. 799, was filed with the Public Service Committee of the Senate during the 14th Congress (2007-2010).

(b) Initiative by NEDA with IBRD Assistance

A policy report prepared by NEDA for the International Bank for Reconstruction and Development (IBRD) in 1996 recommended that economic regulations (regulation of water service providers) should be separated from resource management (regulation of water utilization including the issuance of water permits and enforcement of laws) and proposed the creation of the Water Regulatory Commission (WRC) as an independent economic regulatory body. The farmers envisaged that water resources regulation would still remain with NWRB while the WRC would devote itself to purely economic regulation. However, the WRC draft bill never reached the Committee hearing stage. In the 14th Congress (2007-2010) Senate Bill No. 519, which proposed to create the WRC was referred to two Senate committees where it remained pending.

(c) Conflict of Two Bills (WRAP and WRC)

Both bills, the WRAP (by DENR) and the WRC (by NEDA), intended to strengthen the country's economic regulatory framework but the underlying principles are divergent. While the WRC separates the resources regulatory functions from economic regulation, the WRAP is an apex body incorporating both functions. Both bills drafted at almost the same period by two different executive departments were funded by two different donor agencies.

However, there was not enough consultation done with the different stakeholders regarding the two bills. Many stakeholders were very worried about the powers vested in the WRAP and raised their objections with some resorting to lobbying against the bill with their Congress allies. Without enough consultation, the WRC bill filed later also failed to get active support from the stakeholders including the main sector players such as NWRB, LWUA, DILG, Philippine Association of Water Districts (PAWD) and LGUs.

For these bills to move forward, the major stakeholders in the sector must agree on the end result.

(3) Recommendation by NEDA

NEDA, NWRB and GTZ jointly recommended a regulatory reform of the water supply sector in the Philippines in November 2008[4)]. The theme of the recommendation is as summarized below.

(a) NWRB shall continue to exist purely as a resource management regulatory agency after the WRC has been formed. During the interim period or prior to the creation of WRC, it

shall continue to function as a resource and economic regulator and shall be strengthened to be able to improve both functions. NWRB shall also start discussions with the other economic regulators to harmonize functions and start the deputizing process.

(b) LWUA should continue to function as a specialized funding agency and a provider of technical and management assistance to all types of water utilities. All WDs issued with the Conditional Certificate of Conformance (CCC) should be automatically granted an operating license by WRC.

(c) A special law creating WRC should be enacted by the government purely for economic regulation of the sector. All types of water utilities should be under the ambit of WRC except those created under special laws.

5.3.6 Present Status of IWRM and River Basin Organization

(1) IWRM as National Policy

The Medium-Term Philippine Development Plan (MTPDP) for 2004-2010 adopted the Integrated Water Resources Management (IWRM) through the river basin approach as the general strategy for water resources management. In this regard, the creation of river basin organizations or any appropriate authority was identified as a specific strategy to manage water resources. MTPDP 2004-2010 envisages that water resources management is a society's responsibility, sharing transparent and fully integrated planning of the whole stretch of the river system considering all upstream and downstream users.

(2) Current Situation of RBO

In the Philippines River Basin Organizations (RBO) were established as authority, council, commission or board in the past for four river basins, namely; Laguna Lake Development Authority (LLDA) in 1969; the Bicol River Basin Council in 1973; the Agno River Basin Development Commission; and the Bohol Integrated Water Resources Management Board (BIWRMB) in 2007. A non-government multi-sector body, PCEEM Davao Foundation Inc., has been also functioning to assist protection and/or rehabilitation of watersheds and water quality management of the Talomo-Lipadas Watersheds (TLWs) since 2002. There is a move to establish the Agusan River Basin Authority, the Cagayan River Basin Authority, and several river basin development authorities drafted as House Bills in 2009.

There is no official river basin organization for Pampanga river basin at present. The Upper Pampanga River Basin (UPRB) Coordination Council was established by the Province of Nueva Ecija collaborated with the Central Luzon State University, NIA and others in 2002, but there is no official report of activities in NEDA Region III. The present status of activities of the RBOs is summarized in Table 5.3.1.

Table 5.3.1 Existing and Planned River Basin Management Organizations

River Basin	Presence of River Basin Authority/Council/Commission/RBO
Pasig-Laguna Lake River Basin (2,520 km^2)	• Laguna Lake Development Authority (RA No. 4850-1969), Presidential Decree No. 813, 1975, LLDA under DENR
Bicol River Basin (3,771 km^2)	• Bicol River Basin Council (EO No. 412-1973) • Bicol River Basin PMO (EO No. 359-2004) • Bicol River Basin and Watershed Management Project, Phase II, World Bank, planned
Agno River Basin (5,952 km^2)	• The then existing Agno River Basin Development Commission was abolished, but movement to reactivate to create Agno River Basin Development Authority, draft House Bill Nos. 2379 and 2498
Bohol Province (Island of 4,177 km^2)	• Bohol IWRM Board (Executive Order No. 10, 2007, Province), to materialize Bohol Environment Code of 1998
Agusan River Basin (10,921 km^2)	• Agusan River Basin Authority, proposed with a draft bill in the Master Plan for the Agusan River Basin Project, Final Report, 2007
Cagayan River Basin (25,469 km^2)	• Cagayan River Basin PMO (EO No.474-2008) • Draft House Bill No. 5090 creating Cagayan River Basin Authority
Pampanga River Basin (10,434 km^2)	• UPRB Coordination Council established in 2002 but no activities • PRCS-PMO (Project Flood Control Cluster 2) of DPWH Region III for flood control exists • Integrated Water and Soil Resources Management (IWSRM) proposed by NEDA-Region III

Source: JICA Study Team

(3) Types of RBO

The RBOs are classified into five types in terms of dimension of functions or authority as shown in Table 5.3.2. Type-1 has the broadest and strongest functions while Type-5 has narrow functions.

Table 5.3.2 Types of RBO

Functions/Authority in the River Basin	Type				
	1	2	3	4	5
To make policy, plan, coordinate, implement all projects concerned	○				
To make policy, plan, coordinate, implement river-related projects together with River Basin Management Office		○			
To regulate and monitor water rights	○	○	○	○	
To prepare water resources development plan for the basin's water rights				○	
To advocate IWRM and monitor water and watershed environment	○	○	○	○	○
To operate and maintain river and hydraulic structures	○			○	○

Note ○: Function included.

Source: JICA Study Team

The existing as well as the planned and studied RBOs in the Philippines and two practices in Australia and Japan are classified in Table 5.3.3 based on the corresponding functions.

Table 5.3.3 Types of River Basin Organization in the Philippines and Other Countries

Type	Philippines		Other Counties
	Existing	Studied/Planned	
1. Statutory body for integrated area development and management of all infrastructures	LLDA (1966, amended in 1975)	Ifugao-Isabela River Basin Development Authority(House Bill)	
2. Statutory body for policy making, planning, coordinating all inter-agency activities	Bicol River Basin Council (1973), Implementation by Bicol River Basin Management Office EO No. 359 (2004)	Agusan River Basin Authority, etc.	
3. Statutory coordination body for advocating IWRM and monitoring watershed environment	Bohol IWRM Board (2008), PCEEM-Davao Inc. (2002)	Agusan River Basin Authority	
4. National agency for water resources management of the specified basin			Murray-Darling Basin Authority, Australia (2008)
5. National agency for construction and O&M of facilities in the specified basin			Japan Water Agency (2003)

Source: JICA Study Team

The Laguna Lake Development Authority (LLDA) is classified as Type-1 RBO, but it is a body for integrated area development. LLDA has an extremely broad and powerful functions particularly in planning and regulating all kinds of infrastructure and not limited to advocating water resources and environmental management. The functions of Type-2 RBO are broad and similar to Type-1 although its services are focused on water-related projects in a river basin or a tributary of a river basin. The Bohol IWRM Board classified as Type-3 is a statutory coordination body for advocating IWRM and monitoring watershed environment and its functions are limited to mainly management of watershed environment and water quality. The PCEEM-Davao Foundation Inc. classified as Type-3 is an NGO for multi-sector collaboration through networking and collaboration of local stakeholders. The Agusan River Basin Authority (ARBA) aims to integrate comprehensive land use and water use plan and also to integrate the ARB Master Plan to the Local Government Code, but its functions are limited to coordination.

(4) Functions of RBOs in the Philippines and Other Countries

Type-1 and Type-2 RBOs in the Philippines are basically different from those operating in the advanced countries such as Australia and Japan, in particular. Type-1 and Type-2 will create a new layer of authority due to their broad functions which overlaps with the functions of RDCs or NEDA Regional offices or other line agencies. Type-3, Type-4 and Type-5 will not create any overlapping authority with the line agencies, in principle.

The water rights administration has been linked with the River Basin Water Resources Development Plan (the Basin Plan) in Type-4 and Type-5, and there is no such legal arrangement in the Philippines. For example, the Basin Plan, which is linked with water rights of a river basin, is under the mandate of the National River Administrator, Ministry of Land, Infrastructure, Transport and Tourism, Japan. The NWRB explains that the micro and macro framework of water rights is not delineated well by a river basin unit in the Philippines. The micro framework of water rights is a management framework to issue respective water permits (water rights), while the macro framework is a management framework to regulate water rights allocation and conflicts in a region from a part of the basin to the whole basin between more than two water rights based on the water resources policy. Allocation of functions of operation and management of a river and the hydraulic structures is not well defined between the national government and the local governments in the Philippines, and this underlines the basic difference of functions of the RBOs.

(5) Recommendation by NWRB and Apprehension by NEDA Region III

The National Water Resources Board (NWRB) recommended that a river basin organization (RBO) should be organized in line with the preparation of the Study. Both the NWRB and JICA agreed that the creation of an RBO will be to the best interest of the Study[6]. The NWRB envisages that the creation of the RBO would materialize the IWRM by a river basin unit, and a positive effect to reinforce water resources management including water rights would be gained.

On the other hand, the IWRM Plan concept was accepted as a part of the Medium-Term Philippine Development Plan (2004-2010) during the Central Luzon Water Summit, but the creation of an RBO or another organizational structure is not part of NEDA Region III's plan because the existing Regional Development Council (RDC) is functioning well at present.

NEDA Region III respects the present mandates of the national and regional line agencies and local governments keeping them basically unchanged. Strengthening of the existing institution and organizations is recommended without creating a new layer of authority. NEDA Region III is apprehensive that the creation of an RBO would create a new layer of authority whose functions will overlap with the authority of the RDC to coordinate the implementation of projects concerned with the multiple provinces and sectors.

(6) RBCO

DENR envisaged to be the primary government agency responsible for the conservation, management, development and proper use of the country's environment and natural resources, including those in reservations, watershed areas and lands of the public domain, as well as the licensing and regulation of all natural resources utilization as may be provided by law. The River Basin Control Office (RBCO) under DENR orchestrates and provides the overall direction and technical assistance in the implementation of policies, plans and programs for the protection, conservation, management and wise use of the country's river basins. It shall ensure effective and efficient improvement of all mandates and provision of EO 510.

The RBCO proposed to establish the National River Basin Commission (NRBC) chaired by the DENR secretary which is to be supported by RBCO, Water Resources Management Bureau (a line bureau), River Basin Organization (RBO), DENR-RENRO (Regional Environmental and Natural Resources Office), etc., in March 2007[5]. This proposal, however, was cancelled in 2009.

Since February 2010 the NWRB has been attached to DENR and RBCO is scheduled to be merged with the River Basin Development Division of NWRB as proposed in the organizational structure (refer to Section 5.3.5(1), Annex-F 5.3.3 and Annex-F 5.3.4) based on the Rationalization Plan submitted to DBM for approval.

(7) Proposed House Bills Creating River Basin Authority

Five (5) House bills were drafted for creating the river basin authorities infringing the concept of managing the whole stretch of a river system. House Bill No. 927 (An Act creating the Ifugao-Isabela River Basin Authority), No. 1299 (the Zamboanga River Development Authority), No. 1338 (the Iloilo and Muelle Loney Development Authority), No. 1810 (Each City or Municipality to create a River Basin Development Authority), No. 3199 (Each City or Municipality to create a River Basin Development Authority) cover only cities and tributaries of the major river basins. House Bill No. 5090 creating the Cagayan River Basin Authority is consistent with the MTPDP.

References in Chapter 5

1) Chapter 7, Water Supply and Sanitation, Policy and Institutional Framework, Philippines Meeting Infrastructure Challenges, the World Bank Group in the Philippines, Public-Private infrastructure Advisory Facility, December 2005, P110.

2) Further Amending Certain Sections of Republic Act No. 6395 entitled "An Act Revising the Charter of the National Power Corporation" as amended by Presidential Decree Nos. 380, 395 and 758, Section 13, Non-profit character of the Corporation; Exemption from All Taxes, Duties Fees, Imports and Other Charges by the Government and Government Instrumentalities.

3) Organizational Performance Indicator Framework, FY 2008 Performance Budget of Department/Agencies, Sustaining Philippine Expenditure Management Reform, Department of Budget and Management, December 2007

4) The Philippine Water Supply Sector Road Map, November 2008, pp 179-181

5) DENR, RBCO, The Integrated River Basin Management and Development Master Plan (IRBMDMP), March 2007, pp 65-79

6) Item 10(3) River basin organization of Minute of Meetings on Implementation Arrangement of the Study (March 14, 2008)

Chapter 6. Problems and Issues on IWRM in Pampanga River Basin

6.1 General

A variety of approaches are being made for water resources development and management in Pampanga river basin to address the issues/problems in the various water-related sectors such as water allocation/distribution, flood/sediment disaster management, watershed management and water-related environmental management. It has been confirmed that some of the issues/problems are not latent in a single sector but they extend over several sectors, through the field reconnaissance and discussions in the official meetings including the steering committee meetings, the TWG meetings and the stakeholder meetings. The details of the problems and issues are as described hereinafter.

6.2 Agriculture/Irrigation and Fishery Development

The principal issues in this sector are as described below.

6.2.1 Water Shortage

The most serious problem in the existing irrigation system involves the AMRIS, which relies on the Angat multipurpose dam reservoir as the water source. The priority of water distribution from the dam reservoir is given to municipal water supply for Metro Manila, and the AMRIS has been hardly supplied with adequate irrigation water from the reservoir. Moreover, since the storage capacity of the existing Bustos Dam which functions as the afterbay for Angat Dam is not enough to regulate the daily fluctuation caused by hydropower generation at Angat Dam, the AMRIS could not effectively utilize the full water from the Angat Dam.

Water shortage is also observed in many paddy fields served by the existing national and communal irrigation systems. The main reasons of water shortage are: (a) the recent climate change causing unstable rainfall pattern; (b) the limited water resource development; (c) the deterioration of irrigation facilities due to insufficient maintenance; and (d) the lack of small small-scale irrigation systems including water impounding facilities, etc. In addition, the degradation of the watershed due to illegal logging and slash/burn agriculture is deemed to be also one of the reasons of unstable water resource for irrigated cultivation.

6.2.2 Delay of Large-Scale Irrigation Development Projects

In Pampanga river basin, there are various plans of irrigation development including the national irrigation systems, the communal irrigation systems and the small-scale irrigation developments. The major large-scale projects are: (a) the Casecnan Multipurpose Irrigation and Power Project-Irrigation Component (CMIPP-IC), Phase 2; (b) the Balintingon Reservoir Multipurpose Project (BRMP); and (c) the Balog-Balog Multipurpose Project (BBMP), Phase II. However, the implementation of these projects has been either suspended or delayed mainly due to budgetary constraints accelerated by the rapid escalation of cost of construction materials and/or the unstable security condition at the project sites.

6.2.3 Low Irrigation Efficiency

The current low irrigation efficiency is caused by various reasons such as: (a) deterioration of canals and related facilities due to lack of maintenance; (b) insufficient water control facilities including discharge measuring devises; and (c) high water conveyance loss in the unlined canals. The low irrigation efficiency leads to the low collection efficiency on irrigation service fees.

The lack of proper water management activities both by the farmers and the related agencies is also identified as one of the reasons of the low irrigation efficiency. In order to enhance such low irrigation efficiency, capacity development and the introduction of new water-saving technologies is required. It has been pointed out in the stakeholder meetings that the role of the LGUs is weak, especially in the implementation and operation of communal irrigation systems.

6.2.4 Deterioration of Water Quality in Fishponds

The Pampanga delta is the biggest aquaculture area in the nation, and hence aquaculture in the fishponds is one of the most important industries in Region III. The major issue on the management of fishponds involves two aspects of water quality, namely; (1) the water pollution load generated by the effluent and garbage from the factories, settlement areas, livestock industry and the various point pollutant sources in the upper reaches of the fishponds; and (2) the pollution load generated by the fishponds themselves, which leads to the pollution of the Manila Bay. In addition, it has been also pointed out in the stakeholder meeting that sulfate in the groundwater has increased due to the eruption of Mt. Pinatubo.

6.2.5 Depletion of Groundwater

Depletion of the groundwater has been reported in the Bulacan, Pampanga and Nueva Ecija provinces due to the increasing pump installations for irrigation, fishpond operation and domestic water supply. Such depletion of the groundwater is further accelerated because of the inadequate groundwater use regulation. Depletion of groundwater has caused saltwater intrusion into the pump irrigation systems in some areas in the Pampanga and Bulacan provinces.

6.2.6 Flood Damage to Irrigation System and Fishpond

Frequent flood damage and poor drainage condition due to the degradation of drains and the related facilities in the existing agricultural land are the reasons of low and unstable production, especially in lower Pampanga and its tributaries. The flood damages in the fishpond area have been also reported in the stakeholder meeting.

6.3 Municipal Water Supply, Sanitation and Sewerage

The principal issues in this sector are as described below.

6.3.1 Inadequate Water Supply Source

The present municipal water supply in the study area is inadequate against the incremental water requirements accelerated by the growing population. Likewise, the wells tend to diminish their impounding water and some of them have already dried up due to the unregulated groundwater extraction. Some water wells in the coastal areas of Bulacan and Pampanga are left unused because of saltwater intrusion. The high percentage of unaccounted water was also identified as one problem in the water shortage caused by the pipe leakages and the excessive water use of unmetered and illegal connections.

6.3.2 Unsafe Water Supply

As described in the Subsection 4.3.1, about 17% of the households in the study area is unable to access to safe drinking water (refer to Table 4.3.1 and Annex-F. 4.3.1). The difficulties in accessing safe drinking water could be attributed to the following four (4) principal factors:

(1) The unsanitary toilets where the leachate from human waste directly penetrate into the ground, contaminating the groundwater sources;

(2) The poor operation and maintenance of the water sources and distribution system, which lead to the pipe leaks, the uncared periodic flushing of the pipelines, and the elapsed schedule for well disinfection specifically for the Level 1 system;

(3) Improper well development, which causes the improper placing of blank and screen casings during construction, producing water containing sand and other solids; and

(4) Saltwater intrusion on groundwater due to over-extraction.

6.3.3 Increasing Pollution Load in Water Bodies

The problem on the increase of pollution load in the water bodies has been identified as the result of insufficient water pollution load reduction facilities in the study area. The present sewage from the household septic tanks flows directly to the water bodies. There exists no municipal wastewater treatment plant in the study area except for the area of Clark where 80% is covered by the sewerage

system. The system served 100% of the domestic users while the other industrial and commercial users are not yet fully served. The present septage disposal system is not properly monitored and most of the de-sludgers are disposing the untreated sludge at any place, including open dumpsites and rivers. The water pollution load analysis for the study area has been carried out and the potential sources of high pollution load have been identified in ten (10) cities/municipalities, including the cites of Angeles, San Fernando, Malolos, Tarlac and Cabanatuan and the municipalities of Hagonoy, Baliuag, Calumpit, Mabalacat and Guagua.

6.4 Mitigation for Flood and Sediment Disasters

The principal issues in this sector are as described below.

6.4.1 Occurrence of Chronic and Aggravating Flood Damages

The Regional Disaster Coordinating Committee (RDCC) for Region III recorded the recent flood damages from 2003 to 2006 in the three provinces of Bulacan, Pampanga and Nueva Ecija, which are centered in the study area, as shown in Table 6.4.1. According to the flood damage records, these provinces have suffered from extensive flood damages, which include 30 to 750 thousand of population affected by flood every year. In 2004, in particular, large flood damages successfully occurred three times a year.

Table 6.4.1 Recently Recorded Major Flood Damage in Pampanga Bulacan and Nueva Ecija Provinces

Typhoon	Time of Flood	Affected Population	Number of Casualties	
			Dead	Injured
Haurot	Jul. 2003	163,309	5	
Marce	Aug. 2004	757,070	14	1
Violeta	Nov. 2004	9,562	2	
Winnie	Nov. 2004	537,058	16	2
Toyong	Nov. 2004	324,498	8	2
Labuyo	Sep. 2005	43,631		
Glenda	Jul. 2006	30,831		
Mienyo	Oct. 2006	34,045	1	0

Source: RDCC-Region III

The recent largest flood damage was caused by Typhoon Marce in August 2004. The remote sensing analysis by Dartmouth Flood Observatory shows that the flood area by Typhoon Marce spreads to about 1,151km^2, which corresponds to about 11% of the whole study area and encompasses a substantial part of the deltas of Pampanga River and Pasac River. The population, who resides within the flood area, is estimated at about 920 thousand corresponding to about 15.6% of the whole population in the study area: Of this total population, about 493 thousand are in Pampanga Province corresponding to about 53.5% of the whole population in the flooded area. After Pampanga Province, Bulacan Province has the second largest population of about 361 thousand or 39.2% of the whole population in the flooded area. Thus, a substantial part of the potential flood inundation areas in Pampanga river basin are in the Pampanga and Bulacan provinces.

Table 6.4.2 Estimated Extent of Flood Area and Population in the Flood Area for the Typhoon Marce, Aug. 2004

Province	Flooded Area (km^2)			Population in the Flooded Areas (2)			
	Populated area (1)	Other areas	Total	Populated area	Other areas	Total	
Pampanga	27.7	595.2	623.0	439,665	53,024	492,689	(53.5%)
Bulacan	16.1	212.8	228.8	335,195	25,744	360,938	(39.2%)
Nueva Ecija	2.7	228.8	231.5	33,716	16,439	50,155	(5.5%)
Tarlac	0.7	60.6	61.3	10,206	4,699	14,905	(1.6%)
Others	0.1	6.3	6.3	866	555	1,420	(0.2%)
Total	47.3	1,103.7	1,151.0	819,647	100,461	920,108	(100.0%)

Note: (1) The "populated area" in the above table is the area defined as the "built-up area" or "settlement area" shown in the topographic map (1:50,000) prepared by NAMRIA and JICA in 2008.
(2) Population in the flood area = (Flooded area) x (Population density)
Source: Flooded Area: Dartmouth Flood Observatory (http://www.dartmouth.edu/~floods/)
Population Density for the populated area and other areas: Population Census by NSCB

6.4.2 Insufficient Structural Capacity for Flood Mitigation

As stated above, serious flood damage occurs almost every year in the study area, and it is unevenly distributed to Pampanga and Bulacan Province. One of the principal causes of such frequent and large-scale flood damage could be attributed to the extremely small river flow capacity and the large siltation of river channels as described below.

(1) Small River Channel Flow Capacity

The channel flow capacities of the downstream and midstream sections of Pampanga River were preliminarily estimated, as listed in Table 6.4.3, in the previous relevant study on PDDP FC in 1982. According to the results of estimation, the flow capacities of whole sections of Pampanga River from Masantol to Cabiao (the stretches of about 14km to 54km upstream from the river mouth) are evaluated to hardly cope with even the 5-year return period flood.

Table 6.4.3 River Channel Flow Capacity and Probable Peak Runoff Discharge

(unit: m^3/s)

River	Stretch	Channel Flow Capacity	Probable Peak Flood Runoff Discharge	
			5-year return period	10-year return period
Pampanga	River Mouth – Masantol	4,300 (500)*	2,654	3,517
	Masantol – Sulipan	2,200	2,654	3,517
	Sulipan – Arayat	1,800	2,349	2,731
	Arayat – Cabiao	2,000	2,424	3,071
	Cabiao - San Isidro	2,500	2,408	3,051
Angat	Calumpit - Expressway Bridge	900	737	854
San Fernando	Sexmoan - San Fernando	200	272	363

Note: *: The channel flow capacity for this stretch of about 15km was increased from 500 to 4,300 m^3/s through PPDP-Phase I in 2003

Source: Feasibility Report on the Pampanga Delta Development Project, 1982, JICA)

(2) Prolonged Large Sediment Runoff

Mt. Pinatubo, which is located in the southwestern part of the study area, erupted in 1991 and produced an extremely large volume of lahar runoff. Of the lahar produced by the eruption, there still remains a volume of about 900MCM in the upper reaches of the river basin, from which the sediment continues to flow to the downstream river stretches.

The current sediment runoff volume into the river channel is estimated at about four times of those before eruption of Mt. Pinatubo. A substantial part of these present larger sediment runoff would accumulate in the river channel causing reduction of the channel flow capacity, unless certain countermeasures are taken such as the river dredging to remove the sediment and reforestation to reduce the sediment runoff.

6.4.3 Increment of Flood Damage Potential

The aforesaid flood damages in Pampanga river basin were evaluated, in the stakeholder meetings, to be further aggravated in the future due to the complex factors such as:

(1) Increase of surface runoff-discharge due to the expansion of the built-up area and poor watershed management;

(2) Increase of the assets/properties in the flood hazard area caused by the unplanned and/or rapid urban expansion;

(3) Encroachment of illegal settlers into the waterways;

(4) Unregulated quarrying in the river channels; and

(5) Climate change.

6.4.4 Inadequate Information and Knowledge on Flood Mitigation

The following issues were pointed out in the stakeholder meetings:

(1) Inadequate real-time information on flood: The necessary information on flood forecasting and warning is hardly disseminated to the residents on the real-time base during flood time.

(2) Inadequate information on flood hazard area: Information on the flood hazard areas is seldom provided to the residents.

(3) Untimely release of dam water: There is a risk when the existing dams release excessive discharge leading to man-made floods.

(4) Garbage disposal into the waterways: A large volume of garbage is being dumped into the rivers and drainage channels hampering the safe flood flow.

6.4.5 Weakness in Institutional Set-up

The weakness in the institutional setup of flood and sediment disaster management was pointed out as one of the principal issues in the stakeholder meetings, including: (1) the lack of proper coordination among the relevant government agencies; and (2) the political intervention on the planning and implementation of the flood/sediment management project.

6.5 Watershed Management

The principal issues in this sector are as described below.

6.5.1 Watershed Degradation

The extent classified as forestland[1] in the study area is about 359,550 ha or 34.5% of the entire catchment area. On the other hand, the actual forest cover in the study area is limited to 187,540 ha or 17.9% of the entire catchment area based on the satellite images in 2005 (refer to Annex-F 6.5.1). Thus, the actual forest cover is far smaller than the classified forest land. The following items could be enumerated as the principal reasons for such limited forest cover in the study area.

(1) Poverty and Lack of Livelihood Opportunities

The continuing degradation of the watersheds can be traced to the cycle of poverty and resource misuse and abuse. This stems from the lack of income-earning opportunities in the lowlands, which continues to drive migrants into the uplands in search of livelihood. While exerting pressure on already dwindling and fragile resources, this spawns a rise in destructive activities in forestlands, such as timber poaching and unsustainable harvesting of forest resources, encroachment and illegal land use, and destructive cultivation practices, e.g., “kaingin” (slash-and-burn) farming. These, in turn, exacerbate the problems of soil erosion, forest fires, lowland flooding, prolonged droughts and unproductive lands, with dire consequences in terms of social and economic costs to both upland and lowland dwellers. This perpetuates the endless cycle of resource abuse and further impoverishment among the poor occupants of the basin.

(2) Absence of Harmonized Protected Area Plans

The absence of harmonized plans leads to illegal and conflicting land uses, along with the consequent habitat destruction and bio-diversity loss in these sensitive areas. Of the eight (8) initial components of the NIPAS, comprising an aggregate area of more than 200,000ha, only two (2) PAs, namely; Pantabangan-Carranglan WFR and Talavera WFR, have Initial Protected Area Management Plans but these are neither comprehensive nor updated.

Conduct of thorough resource inventory, cadastral survey, ground delineation and mapping, and socio-economic censuses in these areas is of urgency. The end in view is to properly zone, assign appropriate land/resource uses and craft management strategies to adequately protect the critical habitats. Only then could the PA plans be harmonized with existing forest land use plans, ancestral domain plans and comprehensive land use plans, as the case may be.

[1] The classified forestlands are placed in upland areas with the ground slope of more than 18%, which remains as the untitled public domains and in the hands of the State

Among indigenous communities, the single most important issue concerns the violation of the condition of free prior and informed consent (FPIC), which is required before any project or undertaking within their ancestral domains. This basic right of the IPs has been guaranteed under the Indigenous People's Rights Act (IPRA). However, this is not properly recognized by most project proponents.

(3) Inadequate Information and Decision Support System

Poor monitoring and evaluation of projects as well as lack of updated data on prevailing conditions in the watersheds is a major constraint to sound watershed management. There is no single office that takes responsibility over regular collection and updating of information about the state of the forest and its resources. A thorough census of the forest occupants has not been undertaken. Even a basic comprehensive resource inventory has not been undertaken, particularly, of the ecologically sensitive areas within the basin and the conservation status of the biological resources. Thus, appropriate management plans have not also been prepared.

Moreover, there is low appreciation for watershed conservation and protection and the implications on environmental, social and economic costs. This is due to low awareness by the general public of the true state of the watershed and its resources, which translates into low participation in the efforts to conserve and protect them.

6.5.2 Weak Reforestation

Critical watersheds in the basin are rapidly being denuded; yet this is not matched with an aggressive campaign to reforest and rehabilitate them. Stakeholders identify three (3) reasons for this, namely:

(1) Inadequate Tenure Security

Inadequate tenure security leaves substantial parts of the forestlands as "open access" areas and therefore susceptible to encroachment and further degradation. Moreover, the constant shift in forest policies often leads to cancellation of some CBFM agreements, thus undermining efforts to improve tenurial security. In some cases, inaccurate surveys and overlapping claims have resulted in resource use conflicts among tenure holders.

(2) Poor Performance of Reforestation Projects

The performance of past and on-going reforestation projects in the basin is below targets. According to stakeholders, this is due to the following:

- Inappropriate management scheme such as one-time contract growing
- Inadequate technology, e.g., to improve adaptation to prevailing agro-climatic conditions and to increase the survival rate of planted species
- Inadequate maintenance and protection after planting
- Inadequate seedling nurseries

(3) Inadequate Institutional Capability

The DENR grapples with funding, manpower and logistics constraints such that field extension work is limited in scale. As a result, organized communities end up not adequately equipped with technical and management skills to undertake forest protection and development in their tenured areas. Funding and manpower resource constraints also affect the effectiveness and competence of the LGUs to undertake devolved watershed functions.

(4) Lack of Incentive for Private Participation and Investment in Forestry Development

The policy of total log ban and the slowdown of wood-based industries is said to be responsible for poor accomplishment among private forest concessionaires and the lack of interest by private investors to actively participate in forestry development.

6.5.3 Poor Institutional Coordination Mechanisms

The poor institutional coordination mechanism is enumerated as one of the principal issues on watershed management. The major causes of this issue are as explained below.

(1) Conflicting/Overlapping Mandates

Conflict arises due to unclear and overlapping mandate over watershed areas and hinders cooperation between the DENR and the LGUs. There is a need to strengthen coordination mechanisms as well as clear delineation of authority at the lowest planning level.

(2) Inadequate Devolution

On one hand, LGUs want full devolution of forest management functions over integrated social forestry (ISF) and small watershed areas devolved to them under the Local Government Code. On the other hand, DENR cites that LGUs do not have sufficient means and technical capability, much less the willingness to undertake the devolved functions.

(3) Political Interference

Stakeholders observe that watershed activities in the basin often take a backseat in favor of pet political projects such as big infrastructure development. Thus resources for forestry and environmental conservation projects only come in trickles.

6.6 Water-Related Environment Management

The principal issues in this sector are as described below.

6.6.1 Inadequate Water Quality Data Management

The inadequate water quality data management is enumerated as one of the principal problems on water-related environment management. The major causes of this problem are as described below.

(1) Poor Water Quality Monitoring

There is a pressing need to rationalize the DENR's water quality monitoring system in order to generate sufficient reliable data that would reflect the true status of water quality in the basin. At the moment, the DENR-Environmental Management Bureau (EMB) in Region III monitors only a few surface water bodies. However, frequency of sampling is rather irregular and sampling locations were not adequate. While at times sampling was conducted on a quarterly basis, the timing of sampling events at various locations was neither consistent nor synchronized across the different monitoring points of the river system. Sampling is also done with the least consideration of natural hydrologic boundaries or seasonal variations in rainfall intensity and river flows.

The water bodies presently being monitored regularly are the main Pampanga River, San Fernando River and others, though with lesser regularity, including Minalin River, Porac River and Angat River. Sampling stations are located mostly in the downstream reaches. There is no station in the upstream and midstream reaches, or where potential pollution sources are suspected to enter these river systems.

The parameters monitored with more or less regularity include only the conventional physico-chemical parameters such as pH, temperature, color, turbidity, DO, BOD, TSS, TDS. Occasionally fecal and total coliform levels were analyzed.

The DENR-EMB III also monitors drinking water quality in selected urban areas through its Tap Watch Program. Sampling however is done randomly from taps and distribution lines but not production wells.

In addition to conventional physico-chemical parameters, stakeholders identified the need to monitor other important parameters in surface and ground waters, if there is reason to suspect possible contamination such as heavy metals, oil and grease and nitrates and phosphates, pesticides, PCBs and other persistent organic pollutants (POPs).

(2) Inadequate Inventory of Pollution Sources

A complete inventory of the pollution generators in the basin has not been made. The particular concern is oriented to the identification and assessment of pollution loads from potentially pollutive industries and commercial establishments. Stakeholders identify gasoline stations/depots, fast food restaurants, food processing plants and commercial livestock farms among the most problematic industries in the basin. The DENR-EMB III estimates that less than 10% all the industries and commercial establishments operating in the basin are compliant with the ECC requirements and regularly submits the required self-monitoring reports.

All hazardous waste generators also need to be inventoried, including hospitals and electronic manufacturing industries. There is no toxic chemical manufacturer in the basin. Stakeholders pointed out the need to regulate the final disposal systems used by service companies that treat hazardous commercial and industrial wastes or conduct periodic de-sludging of residential septic tanks.

(3) Poor Data Storage and Management

There is a need to upgrade the DENR-EMB III's office facility, manpower capability and data storage system. This would facilitate systematic data retrieval and use to inform management decisions regarding water quality.

At the moment, the task of generating field monitoring data and storing these properly along with SMRs that are regularly submitted by industries is overwhelming enough for an office that is severely under-staffed and under-resourced.

6.6.2 Contamination of Surface Water, Groundwater and Coastal Water

In the basin, there are the potential sources of point- and non-point pollutions including domestic, industrial, livestock and aquaculture (fishpond) wastes.

In the present study, BOD pollution loads were estimated in order to assess the present and future conditions of water quality of the basin in terms of organic pollutants that enter surface water bodies. Initial estimates indicate that in 2008, about 50% of BOD pollution loads came from domestic sources, 26% from fishponds, 14% from industries and 9% from livestock. Agriculture contributed only 1% of the total BOD load. The basin contributes an estimated BOD pollution load of 103,000 tons/year entering Manila Bay.

Contamination of groundwater due to saline intrusion is of particular concern in the coastal areas of Bulacan and Pampanga. Studies have confirmed that the extent of saline intrusion has extended inland up to 20 to 30km from Manila Bay, even as far as the municipality of Sto. Tomas, Pampanga.

Stakeholders agree that contamination of water resources in the basin could be due to the causes described below.

(1) Inadequate Sewerage Treatment and Sanitation Facilities

As described in Subsection 4.3.4, only one complete sewage treatment plant (STP), namely; the one owned by Clark Water Corporation, operates in the study area. It caters to 80% of the residential and business locators in the Clark Special Economic Zone (CSEZ). On the other hand, a piped sewerage system in Cabanatuan City is now in place. It will eventually be connected to a treatment facility, which is designed to serve 12% of the urban population by the year 2015. Other than these developments, most residential and business establishments lack these basic pollution control facilities required by regulations pursuant to the National Sanitation Code and the Clean Water Act.

Residential and commercial septic tanks are emptied every five years or so by a handful of private de-sludging companies that operate in the basin. However, stakeholders point out that the wastes end up, not in sanitary landfills, but in unsanitary disposal facilities of the de-sludgers or worse, dumped in water bodies without the benefit of any treatment.

Moreover, at least 12% more of the basin's population do not have access to basic toilet facilities.

(2) Pollution from Industrial, Agricultural and Aquaculture Wastes

Besides organic pollution from wastewater and sludge, industries may also be contributing non-organic pollutants, possibly heavy metals, grease, oil, phenols, and others. A complete inventory of pollutive industries and their production processes would help identify the nature and impact of potential contaminants. The stakeholders identified San Fernando River, Abacan River, Angat River, Quitangil River and Sapang Balen among the most problematic receiving water bodies of industrial and livestock pollution.

Along with industries, agricultural (especially rice and vegetable) cultivation in the basin may be dispersing persistent organic pollutants (POPs) owing to massive use of agri-chemical inputs in the basin. However, a preliminary research conducted by Philrice failed to show any detectable level of agro-chemical pollutants in water samples from selected paddies and farm wells in Nueva Ecija.

In terms of organic pollution from agriculture, commercial fishponds appear to be contributing the most BOD load. However, the DA-BFAR regional representatives point out during stakeholder consultations that in recent years, the use of probiotics as feeds has gained wide acceptance among fishpond owners and operators. Probiotics are said to be more environment friendly than conventional feeds, which are responsible for high nutrient loading and attendant eutrophication of nearby water bodies and fishpond areas.

Livestock waste is extremely problematic in terms of BOD load, considering that Region III is considered the biggest livestock producer in the country. Presently, a number of commercial livestock farms are already equipped with small-scale bio-digesters. These farm-level facilities are able to convert animal manure and other farm wastes into methane for domestic or communal use as an environment friendly alternative to fossil fuels.

(3) Poor Solid Waste Management

Solid wastes dumped in rivers and creeks pollute as well as clog these waterways. At the same time, leachate from unsanitary landfills or dumpsites can contaminate surface and ground waters. Solid waste contributes to the total domestic and industrial pollution loads. Stakeholders identify the following waterways as hotspots of waste dumping incidents, namely; San Fernando River, Abacan River, Angat River and Quitangil River.

At present, most LGUs in the basin are still non-compliant with the requirements of the ESWM Act (RA 9003) pertaining to segregation, establishment of materials recovery facilities (MRFs), conversion of open dumpsites to controlled dumpsites and much less the provision of sanitary landfills.

The Clark Waste Management Corp operates the biggest and most ecologically safe sanitary landfill in the basin, i.e., a 100-ha facility in Sitio Kalangitan, Capas, Tarlac. The SLF is not operating at full capacity yet but can accommodate the residual as well as hazardous wastes, including treated sewage of all the LGUs in the basin. However, it now serves only the cities and municipalities of Tarlac and five others in Pampanga and Bulacan. The rest of the LGUs could hardly afford the tipping fee charges and are considering to cluster so as to save on related transport costs, if not put up a SLF of their own.

(4) Over-Extraction of Groundwater

Saline intrusion is believed to be caused by the over-extraction of groundwater in the coastal zone. The unregulated use of groundwater for irrigation and aquaculture production is said to have aggravated the situation.

(5) Siltation of Rivers

Rapid denudation of the uplands is responsible for sedimentation and siltation of water bodies. Monitoring results confirm the high TSS values in Pampanga, San Fernando and Angat Rivers.

(6) Illegal Settlements along River Easements

Waste dumping is exacerbated due to heavy encroachment of informal settlers, especially along the banks of San Fernando and Angat Rivers. More often than not, the unsanitary toilet conditions in urban poor settlements further aggravate the pollution problem and the resulting spread of water-related diseases.

6.6.3 Institutional Constraints

There exist the institutional constraints in this sector including the factors mentioned below.

(1) Inadequate Institutional Capability

With the passage of the Clean Water Act, the Ecological Solid Waste Management Act and the strengthened Philippine EIS system, the DENR-EMB has taken on an ever expanding role as a water quality and pollution regulatory body. Sadly, this has not been matched with corresponding budgetary and manpower allocation for the agency. As a result, the effectiveness of programs for environmental management, pollution control and pollution adjudication is often undermined. Since the DENR-EMB is ill-resourced, understaffed and under-equipped, the agency's capability for water sampling and laboratory analysis, let alone policing of pollution offenders, continues to be a huge and daunting challenge.

(2) Weak Regulatory Enforcement

The real problem in terms of regulations is not the absence or inadequacy of policies and laws. As discussed above, it is the institutional capability and the insufficiency of mechanisms to fully enforce them. Reluctantly, even the EMB admits that the "polluters pay" principle can only be enforced where police power is backed up by full logistics support. At best, the EMB could only rely on private and community volunteers deputized as pollution control officers to go after violators.

Thus, in spite of the Supreme Court Mandamus which compels all agencies to get their act together to clean up Manila Bay of pollution, most agencies in the basin admit the lack of technical, manpower and financial capacity to comply with their full mandates.

(3) Weak Institutional Coordination

Stakeholders also identified the lack of concrete coordination mechanisms between the DENR-EMB, the LGUs and other relevant agencies in relation to business regulation among industries and commercial establishments. The problem arises when industries and commercial establishments are issued business permits by the Municipal Mayors even in the absence of ECC, discharge and other pertinent permits from the DENR, sanitation clearance from the DOH or building permit from the DPWH.

(4) Inadequate Public Awareness

The unabated increase in pollution cases shows that violations of and utter disregard for anti-pollution and environmental laws continues to persist in most parts of the basin. This could only indicate a lack of public appreciation, awareness and personal or corporate commitment to work towards maintaining clean and safe water environment on a sustained basis. Some agencies have on-going IEC programs that bear on ecological sustainability though these tend to be limited and piecemeal. Stakeholders agree that there is a need for intensive and coordinated environmental awareness drive targeting the young generation.

6.7 Water Resources Development, Allocation and Distribution

The main problems and issues have been identified as described below.

6.7.1 Sustainable Water Source for Municipal Water Supply

The water source of municipal water supply in Pampanga river basin currently relies on the groundwater. The results of water balance between groundwater potential and demand show that the expected water demand is more than groundwater potential in some cities and municipalities, especially in the lower Pampanga river basin. This is mainly because of rapid increase of population and may be associated with saltwater intrusion and land subsidence.

The main concern on groundwater source is: if the present and future level 2 and 3 municipal and industrial water supply, which could abstract a large volume of groundwater, will affect sustainability of groundwater sources. The sustainably usable groundwater (referred to as $\boldsymbol{GWP_{DG1}}$) against the demand of level 2 and 3 municipal and industrial water use (referred to as ***DG1***) is determined considering both the usage of groundwater except for level 2 and 3 municipal and industrial water supply and the possible saltwater intrusion. The present and future risk on groundwater usage is then evaluated as shown in the following table, considering the possible range of groundwater recharge.

Table 6.7.1 Evaluation of Present and Future Risk for Groundwater Usage

Condition	Evaluation
$DG1 < GWP\text{-}L_{DG1}$	No risk
$GWP\text{-}L_{DG1} < DG1 < GWP\text{-}H_{DG1}$	At risk
$GWP\text{-}H_{DG1} < DG1$	At high risk

Note: GWP-L: GWP for which groundwater recharge rate is assumed to be 5% of average annual precipitation.
GWP-H: GWP for which groundwater recharge rate is assumed to be 12% of average annual precipitation.
Source: JICA Study Team

The following are noted from the evaluation:

- It is evaluated that, at present, among seventy-six (76) municipalities/cities inside the study area, nine (9) municipalities/cities are at high risk and eleven (11) are at risk. Many municipalities/cities located at lowland areas in Bulacan, as well as Angeles and San Fernando in Pampanga are at high risk (refer to Annex-T6.7.1 and Annex-F6.7.1).
- In future (2025), it is expected that eighteen (18) municipalities/cities in the provinces of Bulacan and Pampanga would be at high risk and twelve (12) including Tarlac and Cabanatuan would be at risk (refer to Annex-T6.7.1 and Annex-F6.7.2).

In some WDs in Bulacan Province, the deterioration of water quality has already exceeded the tolerable level for drinking purpose due to saltwater intrusion. In these WDs, it is necessary to convert groundwater source to either residual groundwater source at adjacent municipality/city or surface water source as soon as possible. In fact, the bulk water supply project in Bulacan was proposed more than 10 years ago, but has not yet been implemented.

For other areas, no clear tendency which shows deterioration of water quality has been observed in general. Therefore, for the time being, groundwater could be abstracted by utilizing mining yield even if the demand exceeds the potential. However, this should be minimized considering the sustainability of aquifer and groundwater resources. At least, it is necessary to consider the possibility of conversion of groundwater source to another source, such as residual groundwater source at adjacent municipality/city and surface water, in the place where the groundwater usage is at high risk.

Periodical intensive groundwater monitoring is also required. If it will be judged that there is continuous lowering of the groundwater level in a place where the groundwater usage is at risk, then conversion of source from groundwater to residual groundwater or surface water of the adjacent municipality/city is also possible.

The deficit of sustainable groundwater source in 2025 for municipal water supply in the place where the groundwater usage is currently at high risk or is expected to be at high risk in future (only in the study area) is estimated as follows (refer to Annex T 6.7.2).

- Bulacan: 49.8MCM/year
- Nueva Ecija: No deficit
- Pampanga: 67.1MCM/year
- Tarlac: 1.5MCM/year

The development of either residual groundwater source at adjacent municipality/city or surface water source should be considered for these volumes of water.

6.7.2 Securing Necessary Water Sources for Expansion of Large Irrigation System

In order to support regional economic growth and job opportunities, the expansion of irrigation area in Pampanga river basin is one of the fundamental strategies in the agricultural sector. The expansion of irrigation system requires additional water source. There are three (3) proposed water resources development projects including the construction of large storage dam as follows:

- Balintingon Reservoir Multipurpose Project (BRMP): Irrigation area = 14,900ha
- Balog-Balog Multipurpose Project Phase 2: Irrigation area = 39,150ha
- Gumain Reservoir Project: Irrigation area = 16,750ha

Based on the water balance study in the present study, these storage dams could supply enough water with 1/5years safety level (80% reliability) for the planned cropping pattern in the target irrigation areas. However, the existing F/S for Gumain storage dam should be re-studied, considering the possibility of supplying water for a part of future municipal water use in Pampanga as well as the effect of the Mt. Pinatubo eruption on the proposed dam site.

6.7.3 Inadequate Reliability of Water Supply in Angat-Umiray System

The Angat-Umiray System currently supplies water for municipal use in Metro Manila, irrigation use in AMRIS and hydropower generation. However, according to the reservoir operation record of Angat Dam for the 40-year period from 1968 to 2007, the reservoir water levels dropped below the lower rule curve in 31 years out of 40 years leading to difficulties in fully supplying the relevant irrigation and municipal water demand.. The most severe water shortage occurred in 1998, which caused no irrigation water supply to AMRIS from February to October.

The following main causes of the above inadequate reliability of water supply by Angat-Umiray System were identified through the analysis of related documents and discussions with the concerned agencies as well as the water balance study.

(1) Rapid Increase of Water Allocation to Municipal Water Use without Support of Adequate Water Resources Development

When Angat storage dam was constructed in 1967, the water supply of 9.5m^3/s by the dam reservoir was allocated to the municipal water use for Metro Manila. Since then, however, the municipal use in Metro Manila has rapidly increased and reached 46m^3/s[2] in 2001.

In spite of such rapid increment of the municipal water use, the new major water resources development for Angat dam reservoir was limited to Umiray-Angat trans-basin project, which was completed in 2000 but hardly covered the full requirement of municipal water use for Metro Manila.

Due to the rapid increase in municipal water use and the late and limited implementation of new water resources development, the chronic water shortage in the Angat-Umiray System

[2] The water use permit of 46m^3/s includes 15m^3/s, which is basically a part of the water use permit of irrigation use for AMRIS but conditionally reallocated to municipal water use for Metro Manila. The said conditional reallocation of 15m^3/s is allowed only when the irrigation water use in AMRIS is not affected by it.

occurs as described above, and a part or the whole of the water allocated to the irrigation use in AMRIS under Angat-Umiray System has been often reallocated to the municipal water use for Metro Manila.

(2) Improper Amendment and/or Modification of Water Use Permits

The original water use permit granted for the source of Angat dam reservoir was limited to 49.5m^3/s in total, which covered 40m^3/s for irrigation water use in AMRIS, and 9.5m^3/s for municipal water use in Metro Manila. However, the original water use permits have been amended and/or modified several times through a series of resolutions. As the result, the updated water use permit for Angat-Umiray System has increased to about 76.4m^3/s[3] due to increment of the municipal water use for Metro Manila by 21.5m^3/s, and for Bulacan Province by 5.4m^3/s.

When the environmental river flow of 2m^3/s for the downstream of the Angat dam reservoir is added to the updated water use permit, Angat-Umiray System is required to supply the water volume of 78.4m^3/s. This required water supply volume is slightly lower than the mean annual inflow discharge to the Angat-Umiray System (about 85m^3/s), but much larger than the probable annual inflow discharge of 5-year return period (about 64m^3/s). Thus, Angat-Umiray System could not promise to supply the water for its relevant water use permit at the safety level of 5-year return period. The past amendments and/or modifications of the water use permit were likely made with less consideration on the supply capacity of the System, and, they should be one of the principal causes to lower the reliability of water supply in Angat-Umiray System.

(3) Water Use Permit not Representing Actual Water Demand for Irrigation Water Use

The current practice in granting the water use permit for irrigation use is based on the annual maximum diversion requirement. However, the actual water demand for irrigation varies monthly or even weekly depending on farming activities. From this viewpoint, the reallocation of irrigation water may need to be practiced taking the right volume of water required for farming activities into account.

(4) Unregulated Peak Hydropower Generation

The peak discharges released by Angat hydropower plant is not coordinated well with NIA-AMRIS though reservoir operation is always a part of discussion during TWG meetings. If the capacity of the existing afterbay dams for Angat dam reservoir (i.e., Bustos Dam and Ipo Dam) is not enough to re-regulate the fluctuating release, the released water could not be effectively utilized for other purposes such as irrigation and municipal water uses.

According to NWRB, there is no regulation on the peak release from Angat hydropower plant, although it has been sometimes discussed during TWG meetings on the operation of Angat storage dam. The proper regulation should be considered to maximize the utilization of the limited water resources potential in Angat-Umiray System.

(5) Unofficial and Irresponsible Flood Operation Rule of Dam Reservoir

To discuss the available storage volume for municipal and irrigation water uses in Angat storage dam, it is necessary to fix the necessary storage volume for preventing over-topping of extreme flood as well as flood control volume. These volumes are usually examined during the planning stage of the dam reservoir and should be authorized by relevant agencies as a flood operation rule. In case of Angat storage dam, the Flood Operation Rule prepared in 1984 has not yet been approved but has been used as a practical guide. Because of this, the study for improving water supply sometimes assumed the different flood control volume so that more water use could be available. This may lead to misunderstanding among the stakeholders.

[3] The water use permit of 76.4m^3/s excludes the volume of 15m^3/s, which is conditionally reallocated from irrigation use in AMRIS to municipal water use in Metro Manila.

6.7.4 Expected Increase of Conflict among Water Users, especially between Municipal and Irrigation Water Users

Increase of conflict among water users, especially between municipal and irrigation water users are easily expected. Necessity of more surface water for both municipal and irrigation water supply in future is expected. In Pampanga river basin, a large amount of water use permits for irrigation water use has already been granted to NIA. If one needs to develop new water resources with storage dams, the existing water use permits should be adjusted considering the actual water use for irrigation. Otherwise, there will be no available water for additional water permits in the future. Uncertainty on water resources due to possible climate change in future may also cause the increase of the conflict.

The bitter experience on conflict between municipal and irrigation water use in Angat-Umiray System should not be repeated in other areas in Pampanga river basin. The improvement of water governance based on the problems and issues in Angat-Umiray System should be seriously considered to cope with the expected conflict.

6.8 Institution and Organization

The principal issues in this sector are as described below.

6.8.1 Issue-1: Strengthening of Regulation Capacity for Water Use Permits

In order to attain a more rational and equitable water use permit system, it is required to specify the seasonal variations of allowable maximum limits of water uses, and the minimum water supply security level for water uses. At the same time, monitoring on the actual water uses and enforcement for the proper water uses shall be strengthened.

6.8.2 Issue-2: Enhancement of Efficient Water Use and Re-allocation of Water Use Permits

A detailed implementation rule and regulation (IRR) shall be prepared to clarify the rules, processes, compensation and all other necessary conditions for lease and transfer of the water use permit so as to enhance the more efficient water uses.

6.8.3 Issue-3: Modification of Overlapping Water Charge Systems

The Water Code prescribes that NWRB is entitled to collect the water fees and charges for the water use permit, while the Local Government Code prescribes that the LGU is entitled to collect a share from the proceeds of water resources within its jurisdiction area. It is required to unify the overlapping provisions on the water charges in the Water Code and the Local Government Code.

6.8.4 Issue-4: Achievement of Sustainability of Groundwater

In order to enhance the effective groundwater management, it is required to establish the extensive groundwater monitoring system and to arrange the institutional setup, which is effective to prevent the excessive groundwater abstraction.

6.8.5 Issue-5: Introduction of Specific Law to Enhance Multipurpose Dam Projects

It is required to establish the legal basis on the allocation rule of cost and reservoir volume for the multipurpose dam. Such allocation rule would be useful to achieve the rational and equitable water allocation for irrigation/municipal water use and hydropower generation during a drought.

6.8.6 Issue-6: Enforcement to Maintain Environmental Flow

The environmental river flow is a major determinant of the ecosystem health, while the significance of the environmental river flow is hardly comprehended and complied with among water users. In order to retrieve such unfavorable conditions, a legal arrangement would be required to preserve the minimum environmental river flow.

6.8.7 Issue-7: Strengthening of Water Quality Monitoring and Management

The quality of surface water and groundwater is being deteriorated, while the present management to monitor and enforce water quality control is not effective. In order to cope with this issue, institutional

arrangement shall be made to specify the responsibilities of the water users and to empower execution capacity of the NGAs and LGUs for water quality management including the monitoring system.

6.8.8 Issue-8: Management and Mitigation of Risk from Water-Related Disasters

There is no legal basis to define the responsibility to mitigate risks from floods of each of the water users concerned. Establishment of the flood control basin plan for the whole river basin or the concerned river stretch would provide a clue to resolve the issue.

6.8.9 Issue-9: Improvement of Watershed and Forest Management

The functions and territories of watershed management are not well defined among DENR and other related national/local government agencies. Funds for implementation, maintenance and monitoring are also limited. Necessity of institutional strengthening has been reported but detailed and concrete problems and causes about the weak capacity have not been clarified well.

6.8.10 Issue-10: Setup of Authority to Implement the Pampanga River Basin IWRM

It is required to clarify the institutional and legal arrangements in Pampanga river basin to implement the IWRM Plan in practice.

6.8.11 Issue-11: Strengthening of Execution and Financial Capacity for Sustainability

It is necessary to clarify the responsibilities for the operation and maintenance of the river facilities in the basin. It is also indispensable to strengthen the financial capacity of both LGUs and the national government agencies to achieve sustainable IWRM from the regional interests.

Chapter 7. Guideline for Formulation of IWRM Plan

7.1 General

7.1.1 Objectives of the Guideline

The Guideline aims at attaining the following objectives:

(1) To furnish definite procedures and methodologies for the formulation of the IWRM Plan for Pampanga river basin;

(2) To serve as a tool for consensus building with the stakeholders on the proposed IWRM Plan through presenting and obtaining their consent on the outputs in the course of the study; and

(3) To be used as reference and/or standards since a substantial part of the outputs will be useful for the formulation of IWRM plans for other river basins although the Guideline is particularly prepared for Pampanga river basin.

7.1.2 Basic Concept of the IWRM Plan

The IWRM would be a flexible tool for optimizing the sustainable development of water resources as quoted from "Catalyzing Change," a handbook issued by the Global Water Partnership. The IWRM is also assumed not to be a goal in itself, but should be an approach to promote the coordinated development and management of water resources and maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

The process of IWRM shall move forward like a spiral with several and different stages starting from the initial primitive stage toward the mature stages, as shown in Figure 7.1.1. Each of the stages in the process of IWRM shall cover the sequence of the four (4) steps, namely; (i) assessment of existing conditions; (ii) planning (i.e., formulation of the IWRM Plan); (iii) implementation of projects for IWRM; and (iv) monitoring of results of project implementation. Moreover, the accountability to and synergy with the stakeholders has to be assured through involvement of multi-stakeholders at every step of the IWRM.

The present stage of the IWRM in Pampanga river basin is the initial spiral stage, and, of the above four (4) steps, the present study supports those of items (i) and (ii) above. Follow-up activities after the present study are indispensable to the completion of the initial spiral stage of the IWRM.

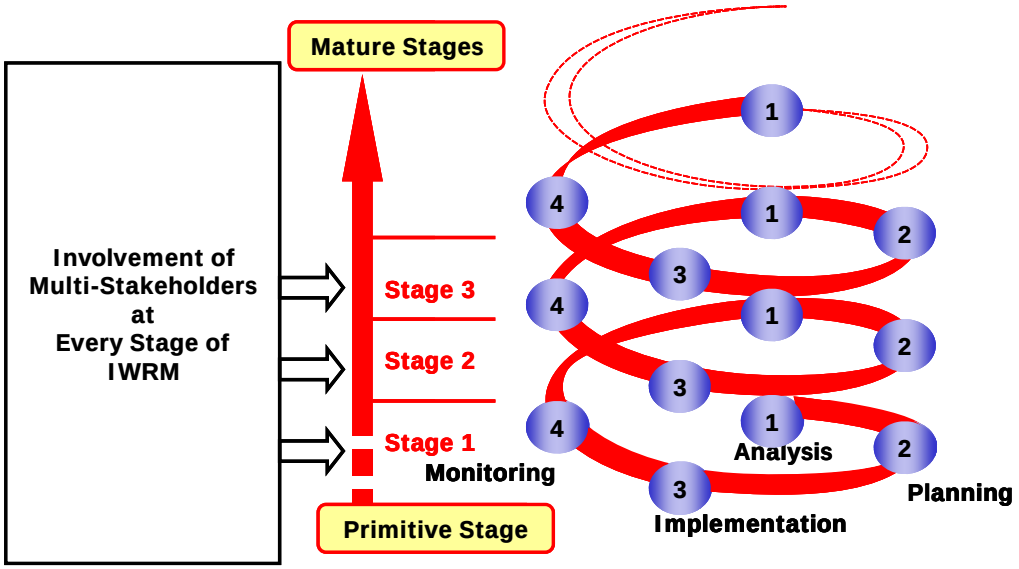


Figure 7.1.1 Process of IWRM

7.2 Planning Procedures

As stated above, the Guideline is to furnish definite procedures and methodologies for the formulation of the IWRM Plan for Pampanga river basin. The procedures, together with the methodologies of plan formulation, are as explained below.

7.2.1 Step 1: Assessment (Identification of Problems and Issues on IWRM)

Assessment of the principal problems and issues on the IWRM for Pampanga river basin shall be made as the basic approach for the formulation of the IWRM Plan. The problems and issues are latent in various aspects, such as: (i) water resources development, allocation and distribution for irrigation, municipal water and other various water demands; (ii) flood and sediment disaster management; (iii) watershed management; and (iv) other water-related environmental management. Moreover, some of the problems and issues are not limited into a single sector, but they extend across several sectors causing inter-sector conflicts.

7.2.2 Step 2: Setting of Planning Framework

The planning frameworks shall be set as preconditions for the formulation of the IWRM Plan. The principal items of the planning framework are, as follows:

- Target completion year of the entire plan;
- Socioeconomic frames by the target year;
- Visions, objectives and sector goals of IWRM Plan for Pampanga river basin; and
- Ceilings of Project Investment Cost.

Details of the planning framework setup are as described in the following Section 7.3.

7.2.3 Step 3: Selection of Potential Projects for IWRM of Pampanga River Basin

Various government agencies and non-government entities currently implement and/or propose projects that could cope with the aforesaid issues and/or problems on IWRM and contribute to the visions, objectives and sector goals of the IWRM Plan. These ongoing and proposed projects shall be identified as the components of the IWRM Plan.

In addition, conceptual projects, which are essentially required to solve the issues and/or problems but currently neither implemented nor proposed, shall also be further proposed as components of the IWRM Plan. Details of the selection of projects for IWRM are as described in Section 7.4.

7.2.4 Step 4: Preliminary Study on Alternative Approaches to Specific Issues

Some of the projects selected as potential components of the IWRM Plan in the above Step3 may contain several alternative approaches to cope with their own specific issues. The optimum plan among the alternative approaches should be ideally determined before finalizing of the IWRM Plan.

However, a feasibility study shall be required to determine such optimum plan. On the other hand, the IWRM Plan would involve numerous projects to attain a variety of water-related development scenarios; therefore, a feasibility study could be hardly carried out in detail for each of the individual projects. From this point of view, the IWRM Plan shall take the following fundamental rules into consideration:

- The feasibility study shall be included as a part of the project and undertaken before the commencement of physical project works;
- The outline of the project features together with the project investment cost required shall be provisionally assumed taking the conceptual alternative approaches into account; and
- The preliminary study on the project(s) may be carried out to estimate the most-likely optimum plan when the project is judged to prominently influence the entire IWRM Plan and, at the same time, to provide the basic information for the preliminary study are available.

Details of the preliminary study on alternative approaches are as described in Section 7.5.

7.2.5 Step 5: Grouping of Projects

The projects selected for the IWRM Plan in the above Step3 shall be divided into Group-A and Group-B to facilitate programming of the project development scenarios mentioned below and the project implementation schedule and/or the project investment program. The projects in Group-A have to be implemented in accordance with the basic social and natural requirements regardless of the amount of project cost. All projects not included in Group-A are classified into Group-B. The typical projects classified in Group-B are the regional economic development projects and the projects for mitigation of water-related disasters, which shall be implemented through a special budget during the specific term(s). Details of the grouping of projects are as described in Section 7.6.

7.2.6 Step 6: Setting of Development Scenarios for Projects in Group-A and their Phased Implementation Schedule

The target development scenario for projects in Group-A shall be set as prerequisite for the phased project implementation schedule[1]. That is, the development scenario shall be firstly delineated and then, the phased implementation schedule shall be programmed in order to attain the development scenario. Details of the development scenario for projects in Group-A and their phased implementation schedules are as described in Section 7.7.

7.2.7 Step 7: Evaluating and Prioritizing of Projects in Group-B

The projects classified into Group-B in the above Step5 shall be evaluated to prioritize them. The evaluation is to be made for the inter-sector projects which extend over the various water-related sectors such as (i) agriculture/irrigation and fishery development; (ii) municipal water supply, sewerage and sanitation; (iii) flood and sediment disaster management; (iv) watershed management; and (v) water-related environmental management. Details of the evaluation and prioritization of projects in Group-B are as described in Section 7.8.

7.2.8 Step 8: Development Schedules for Projects in Group-B and their Phased Implementation Schedule

The phased implementation schedule for projects in Group-B shall be programmed in accordance with the priority order of projects as evaluated in the above Step7 and the ceiling of project investment cost for the short-term, medium-term and long-term scenarios. Then, the phased development scenario shall be delineated as the result of the phased implementation schedule. However, when the development scenario proposed by the priority order of projects are hardly acceptable by the stakeholders, the priority order shall be reexamined and certain modifications of the phased implementation schedule as well as the development scenario shall be made. Details of the development schedule for projects in Group-B and the phased implementation schedules are as described in Section 7.9.

7.2.9 Step 9: Formulation of the IWRM Plan for Pampanga River Basin

The implementation schedules, investment programs and development scenarios of the proposed projects shall be finalized by integrating the outputs given from the above Step6 and Step8, and by clarifying the following items:

- The phased programs in the short-term (2011-2015), the medium-term (2016-2020) and the long-term (2021-2025);
- The expected eligible financial sources for the projects;
- The implementation bodies for the projects; and
- The sectors to which the projects would belong, such as (i) agriculture/irrigation and fishery development; (ii) municipal water supply, sanitation and sewerage; (iii) flood and

[1] The phased implementation schedule of a project is herein defined as the project implementation period divided into the short-term (2011-2015), the medium-term (2016-2020) and the long-term (2021-2025).

sediment-disaster management; (iv) watershed management; and (v) water-related environmental management.

Details of formulation of the IWRM Plan for Pampanga river basin are as described in Section 7.10.

7.2.10 Step 10: Formulation of Institutional Setup Plan

The optimum institutional setup plan required to execute the aforesaid spiral processes of IWRM for the assessment, formulation, implementation and monitoring of the projects shall be also proposed.

7.3 Setting of Planning Framework

As described above, the planning framework shall be set as the precondition for formulation of the IWRM Plan. The principal items to be included in the planning framework are as described below.

7.3.1 Target Year

The target year is the completion year for all of the proposed projects in the IWRM Plan. In this study, the target year is set at 2025, and the project implementation period is divided into the following three terms: (i) Short-term for the period from 2011 to 2015, (ii) Medium-term for the period from 2016 to 2020; and (iii) Long-term for the period from 2021 to 2025.

7.3.2 Socioeconomic Frame

The socioeconomic frame is to present the trend of socioeconomic conditions such as population growth and growth of GRDP in the study area. These socioeconomic conditions by the above target year are indispensable to estimate the future municipal water demand, flood damage potential and other basic information for the formulation of the IWRM Plan.

7.3.3 Visions, Objectives and Sector Goals of the IWRM Plan for Pampanga River Basin

The IWRM Plan shall involve the various multi-water-sector-projects/programs. Hence, inter-sector visions are proposed as the principal targets common to all proposed projects for the IWRM of Pampanga river basin. The objectives in the several categories are further assumed to embody the visions. Moreover, each of the water-related sectors in the IWRM Plan is to be provided with concrete sector goals, which could enhance the objectives and/or visions.

The principal policies in the existing national and/or regional development programs such as the MTPDP 2004-2010 and the RPFP 2005-2030 are to be referred in setting the above visions, objectives and sector goals of the IWRM Plan for Pampanga river basin.

7.3.4 Ceiling for Project Investment Cost

When implementation of the projects excessively concentrates upon any of the short-term, medium-term and/or long-term, the total project investment cost may exceed the affordable limit of the national and/or regional budgetary capacity. From this point of view, the approximate ceiling of the project investment cost is to be provisionally estimated for each of the short-term, medium-term and long-term projects, referring to the previous actual disbursement for each project.

7.4 Selection of Eligible Projects for IWRM of Pampanga River Basin

There are a large number of water-related projects being currently undertaken and/or proposed by the various government agencies and private entities in the study area. Of these projects, those which are judged to be effective to attain the aforesaid visions, objectives and sector goals are selected as the components of the IWRM Plan. Moreover, the JICA Study Team, in corroboration with the members of the Steering Committee (SC) and the Technical Working Group (TWG), as well as the other stakeholders, further worked out the conceptual projects which would be essentially required to cope with the water-related problems and issues such as water shortage, flood/sediment disaster and the deterioration of water-related environment. It should be noted that the conceptual projects would require either further study such as feasibility study or the determination of basic project components before their implementation. The eligible projects for the IWRM of Pampanga river basin are as summarized in the table below.

Table 7.4.1 Projects Eligible for the IWRM of Pampanga River Basin

Sector	Ongoing Projects	Proposed Projects	Conceptual Plans*	Total
Agriculture/Irrigation and Fishery	14	11	3	28
Municipal Water Supply, Sanitation and Sewerage	3	4	11	18
Flood and Sediment Disaster Management	4	2	4	10
Watershed Management	12	-	4	16
Water-related Environment Management	3	1	4	8
Inter-sector for Water Resources Management	-	-	4	4
Total	36	18	30	84

Note *: Proposed by JICA Study Team
Source: JICA Study Team

7.5 Preliminary Study on Alternative Approaches to Specific Issues

As described in Step4 in the foregoing Section 7.2, the IWRM Plan deals with a large number of projects; therefore, a comparative study on alternative approaches for each of the projects shall be hardly carried out, in detail, at the stage of formulation of the IWRM Plan. From the above point of view, the IWRM Plan shall take the three principal rules described in Step4 in Section 7.2 into consideration.

In the formulation of the IWRM Plan for Pampanga river basin, it is preliminarily assumed that nine (9) projects among 84 projects would possibly contain alternative approaches. The following two (2) were further examined as the objectives of the preliminary study (refer to Chapter 10).

- Project for Recovery of Reliability of Water Supply in Angat-Umiray System (Code: IS-C-02)
- Flood Mitigation for Pampanga Delta (Code: FL-C-01)

The above alternative approaches would be compared and the optimum approach shall be selected from various points of view such as: (i) economic viability as expressed by EIRR and/or the project least cost; (ii) financial affordability against the project investment cost; (iii) technical viability; (iv) environmental impacts including those to the natural environment (such as geographic conditions, vegetation and water quality) and the social environment (such as house resettlement, lapse of right of land ownership and loss of opportunity); and (v) adaptability to future possible climate changes. The optimum approach would consist of several projects as components, and these components would be merged into one project.

7.6 Grouping of Projects

As described in Step5 of the planning procedures in Section 7.2, the potential projects for the IWRM Plan of Pampanga river basin as selected in Section 7.4 shall be classified into Group-A and Group-B according to their purposes and/or contents. The details of this classification are as described below.

7.6.1 Group-A

The following projects shall be classified into Group-A:

- The projects for basic human needs like the municipal water supply projects, which are indispensable to secure the living condition of people;
- The projects, which are indispensable for preservation of the irreversible natural environments and/or resources; and
- The projects for rehabilitation and/or maintenance of the existing water resources management facilities, which are indispensable for sustainment of the inherent design capacity of the facilities.

The projects under the above items have to be implemented in accordance with the social, natural and/or physical fundamental requirements regardless of the amount of project cost. For instance, the expansion of a safe municipal water supply system has to be unconditionally required to cope with the growth of population as the basic human need.

Moreover, the target development scenarios for the projects in Group-A shall be set as the prerequisite for implementation of the projects. That is, the development scenarios shall be firstly set, and then the implementation schedule of the projects shall be programmed to attain the development scenarios.

7.6.2 Group-B

The following projects shall be classified into Group-B:

- The projects for economic development, which could enhance the growth of the regional economy and/or improvement of the livelihood in the region;
- The projects for mitigation of flood and sediment disasters, which could contribute to better public welfare and growth of the regional economy; and
- The ad hoc projects, which could support and/or strengthen the annual regular projects classified into Group-A.

The commencement of the projects for the above items could be optionally selected depending on the availability of budget for project implementation. The phased implementation schedule of the projects in Group-B shall be firstly determined taking the following two (2) factors into account:

- The priority order of projects, which could be determined taking the results of inter-sector project evaluation into consideration; and
- The ceiling of project investment cost for each of the short-term, medium-term and long-term projects.

After the phased implementation schedule of the projects has been determined, the development scenarios shall be delineated as the results of the project implementation schedule. However, when the development scenarios delineated as the results of the project implementation schedule are deemed to be unjustifiable and/or they are hardly acceptable by the stakeholders, the prioritization of projects shall be reexamined and a certain modification of the project implementation schedule as well as the development scenarios shall be made.

7.7 Development Scenarios for Projects in Group-A and their Implementation Schedule

As stated above, the projects classified into Group-A have to be implemented in accordance with the development scenarios, which shall be determined by the essential social, natural and physical needs regardless of the amount of project cost. The typical development scenarios and their corresponding phased implementation schedules for Pampanga river basin are as set forth in Table 7.7.1.

Table 7.7.1 Typical Development Scenarios by the Projects in Group-A

Sector	Development Scenario
Agriculture/ Irrigation and Fishery Development	The on-going six (6) annual regular projects for rehabilitation of the existing irrigation facilities shall be sustained until 2025 so as to improve the agricultural productivities.
	The on-going four (4) annual regular projects for fishery development shall be sustained until 2025 so as to improve the fishery productivities.
Municipal Water Supply, Sanitation and Sewerage	The water supply capacity of the existing Angat-Umiray System shall be strengthened to promise the full supply level for municipal water demand in Metro Manila and irrigation water demand in AMRIS by 2020.
	The new bulk water supply system with the capacity of 2.7m^3/s for Bulacan Province shall be developed to cope with the incremental population and preserve the safe water quality for drinking by 2015. The new bulk water supply system with the capacity of additional 3.8m^3/s for Bulacan Province shall be developed to cope with the incremental population and preserve the safe water quality for drinking by 2025.
	The new bulk water supply system with the capacity of 0.8m^3/s for Metro Clark (Pampanga and Tarlac Provinces) and 1.3m^3/s for Pampanga Province shall be developed to cope with the incremental population and preserve the safe water quality for drinking by 2025.
	Safe drinking water access with Level 3,2,1 water supply system shall reach to 100% by 2025 The service area of Level 3 water supply system in the urban area shall cover 80% of the households in the study area by 2025. At the same time, the present coverage ratio of Level 3 water supply system in the rural area shall be maintained by 2025, notwithstanding the future increment of population.
	The whole households in the study areas shall be provided with the sanitary toilets by 2025.
Management of Flood and Sediment Disasters	The on-going annual regular program for rehabilitation and maintenance of river dyke and slope by DPWH shall be sustained by 2025 so as to preserve the inherent design capacities of the facilities.
	The annual regular program for rehabilitation and maintenance of drainage and flood cool facilities by LGUs shall be sustained by 2025.
	Public awareness on IWRM shall be improved through integration of the salient points of IWRM into school curricula.
Watershed Management	The on-going nine (9) regular programs for watershed management in Pampanga river basin shall be sustained by 2025, which could expand the new forest cover at the rate of 660 ha per annum.
Water-related Environment Management	The non-structural projects by DENR and LGUs, which are intended to protect water quality, shall be sustained by 2025 so as to reduce the pollution load from various sources.
	The structural programs for reduction of the risk for contamination in water body shall be sustained by 2025.

7.8 Evaluation and Prioritization of Inter-Sector Projects in Group-B

The evaluation of projects classified into Group-B shall be made to prioritize the projects and to formulate the phased implementation program for them. The evaluation shall be made from six (6) categories, namely; (i) Viability of the Project; (ii) Enhanced Livelihood; (iii) Improved Quality of Life; (iv) Decentralized Development; (v) Sustained Ecosystem; and (vi) Empowered People. Of these categories, item (i) is the fundamental factor to judge the viability of project implementation. On the other hand, items (ii) to (vi) are the indexes to evaluate how the project could make a contribution to the aforesaid strategic objectives.

Each of the above categories for evaluation would have further four to five criterions for evaluation, as listed in Table 7.8.1. The total number of criterions for evaluation would reach 25 items, and such a rather large number of criterions would be advantageous for a well-balanced evaluation of a wide range of projects in various water-related sectors.

Table 7.8.1 Categories and Criterions for the Evaluation of Projects

Category	Criterion for Evaluation
1. Viability of the Project	1.1 Economic viability
	1.2 Technical viability
	1.3 Financial affordability
	1.4 Impacts to natural and social environment
	1.5 Adaptability to climate change
2. Enhanced Livelihood	2.1 Creation of new job opportunities in the Region
	2.2 Increase of income level in the Region
	2.3 Improvement of livelihood for vulnerable groups*
	2.4 Reduction of income gaps in urban and rural areas
3. Improved Quality of Life	3.1 Increase of access to safe drinking water
	3.2 Increase of per capita municipal water supply volume
	3.3 Improvement of sanitary and health conditions
	3.4 Mitigation of flood risks
4. Decentralized Development	4.1 Development of regional economic development centers
	4.2 Increase of regional productivity in agriculture, fishery, forestry, industry and service sectors
	4.3 Creation of favorable circumstances for private investment in the Region
	4.4 Enhancement of social equity in the Region
5. Sustained Ecosystem	5.1 Enhancement of sustainable monitoring on ecosystem
	5.2 Protection of ecologically vulnerable areas
	5.3 Promotion of vegetation in watersheds
	5.4 Reduction of potential pollution loads
6. Empowered People	6.1 Promotion of stakeholder participation in project planning and execution
	6.2 Improvement/transfer of knowledge and skills
	6.3 Promotion of community-based activities
	6.4 Empowerment of vulnerable groups*

Note*: Vulnerable groups include the poor, indigenous people, women-headed households, out-of-school youths, handicapped and the elderly.

Each of the above criterions for evaluation would have three ranks of scores. Projects which may be expected to attain a high performance in the criterion would take the score of 3, while those which would attain a lower performance would take the score of 2 or 1. Details of the criterions for scoring are as shown in Annex-T 7.8.1.

(1) Score 3: Achievement of the criterion for evaluation has been already verified and/or programmed as one of the primary purposes of the project.

(2) Score 2: The project is judged to make a certain indirect contribution to the criterion for evaluation, although achievement of the criterion is not the primary purpose of the project and/or it has not been clearly verified yet.

(3) Score 1: The project is judged to hardly satisfy the criterion and/or make any contribution to the criterion.

7.9 Development Scenarios for Projects in Group-B and their Phased Implementation Schedule

The IWRM Plan for Pampanga river basin would include 41 projects classified into Group-B. Of these projects, 12 ongoing projects are to be implemented in accordance with their existing schedules, which had been already fixed by the project proponents. On the other hand, the other 29 proposed and/or conceptual projects are to be implemented, taking the following prerequisites into account:

- The projects shall be implemented in order, based on the scores made in the aforesaid inter-sector project evaluation.
- The investment cost of projects shall be accumulated in accordance with the above priority order of projects. However, the accumulated investment cost over the sum of the investment cost for the ongoing infra-development projects[2] shall not exceed the ceiling cost (i.e.,

[2] The ongoing infra-development projects include 12 projects in Group-B and 11 projects, which are being undertaken by NIA, DA and DPWH as the yearly regular program for maintenance and rehabilitation of the existing water related infrastructures and classified into Group-A.

31.6 billion pesos for the short-term, 33.7 billion pesos for the medium-term and long-term, as estimated in Section 8.4).

- When the accumulated investment cost exceeds the ceiling of either the short-term or the medium-term, project implementation shall shift to the next term (i.e., from the short-term to the medium-term or from the medium-term to the long-term) and the accumulation of investment cost shall be reset and the evaluation restarted.
- Judging from the scope of projects, several projects would need the implementation period of more than 5 years extending over each of the short-term, the medium-term or the long-term. When a project has the implementation period of more than 5 years, its costs for the first and second 5-year terms are estimated assuming the yearly equal disbursement of the project cost.

7.10 Formulation of IWRM Plan

The following items shall be the components of the IWRM Plan and formulated with reference to the results of examination described in the preceding Sections 7.7 to 7.9 (refer to Figure 7.10.1).

7.10.1 Project List

The ongoing, proposed and conceptual projects, which could be effective to attain the visions, objectives and sector goals of the IWRM Plan by 2025, shall be proposed and put into the Project List. The necessary information in the Project List shall include the title of the project, the implementing body of the project, the necessary project investment cost and the project's classification under the aforesaid Group-A and Group-B.

7.10.2 Project Implementation Program

The implementation schedule for each of the above projects shall be proposed as the phased programs for the short-term (2011-2015), the medium-term (2016-2020) and the long-term (2021-2025). Some of the projects would be completed within one (1) single term, while some would extend across more than two (2) terms.

7.10.3 Project Investment Program

The project investment schedule shall be proposed as the phased program for investment of project cost in each of the short-term (2011-2015), the medium-term (2016-2020) and the long-term (2021-2025). The budgetary source for investment and/or the method for procurement of the budget shall be also proposed as a part of the program taking the ownership of the project, the budgetary capacity of the project implementing body and the possibility of external financial assistance into account.

7.10.4 Development Scenarios

The phased development scenarios for each of the short-term, the medium-term and the long-term shall be proposed in accordance with the above phased implementation schedule of the projects. The development scenarios shall be also proposed by each of the sectors of IWRM such as (i) agriculture/irrigation and fishery development; (ii) municipal water supply, sanitation and sewerage; (iii) flood and sediment disaster management; (iv) watershed management; and (v) water-related environmental management.

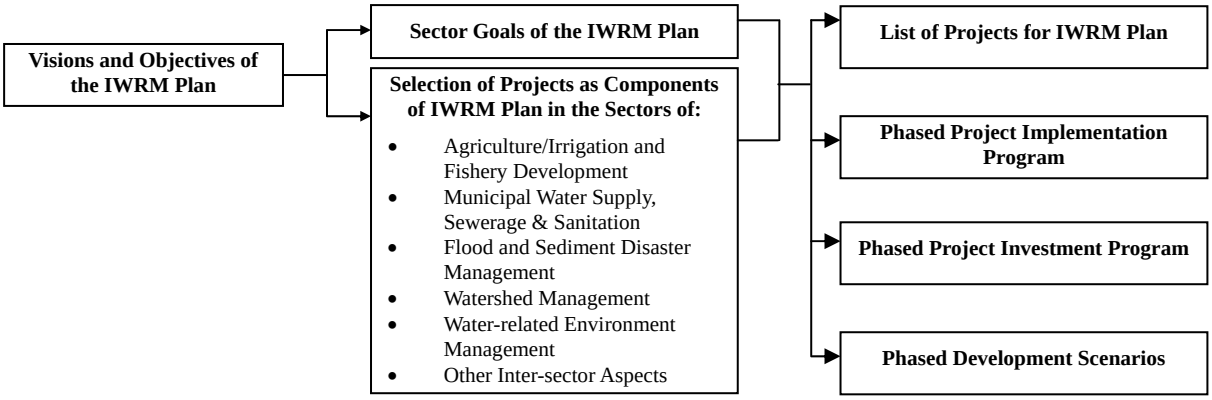


Figure 7.10.1 Image of Output of the IWRM Plan for Pampanga River Basin

7.11 Institutional Setup Plan for the IWRM of Pampanga River Basin

Institutional and organizational strengthening will be sought out from the following two (2) aspects:

(1) To manage and/or to coordinate key issues in water resources in the river basin such as reasonable allocation and regulation of water rights, upstream and downstream issues in flood control, watershed management, water quality management, sustainable groundwater management, etc.; and

(2) To establish the River Basin Organization (RBO) for Pampanga river basin as the implementing body for the proposed IWRM Plan in terms of equitable and sustainable development, environmental conservation, and operation and maintenance of river facilities and the monitoring system in the river basin.

The former would be related to the improvement of the Water Code and capacity strengthening of NWRB as an apex body for water rights and water resources management. The latter would be related to capacity strengthening of sector agencies such as DENR (watershed, forest management, water-quality management), DPWH (flood control and water-related natural disasters), NIA (irrigation water management) and LGUs (watershed, forest management, water quality management, flood control and water-related natural disasters, communal irrigation, groundwater management). The purpose, function, role and responsibility of the stakeholders as well as financial sustainability and the regional policy would be clarified to validate the RBO.

7.12 Stakeholders related to the IWRM Plan for Pampanga River Basin

7.12.1 Hierarchy of Stakeholders and Preparation of Opportunities for Consensus Building and Hearing of Opinions

The participation of and consensus building with the stakeholders is essentially required for the IWRM. It is, however, virtually difficult to make a consensus with all of the stakeholders, since the number of the potential stakeholders in Pampanga river basin would be more than 20 million people including the related organizations and residents living in Pampanga river basin, Metropolitan Manila and the region from which water is transmitted. Accordingly, the priority stakeholders shall be selected and divided into three (3) groups with different degrees of participation in the planning process, as shown in Table 7.12.1

Table 7.12.1 Hierarchies and Functions of Stakeholders

Hierarchy/Expected Members	Function
1. Core stakeholders • Steering Committee members • Technical Working Group members	• To make the final decisions on consensus. • To bring forward the problems and needs of IWRM. • To propose the draft plan on IWRM.
2. Stakeholders (representatives at entire basin level) • Related governmental organizations • Related organizations (water users association, fishermen's association, water supply company, power supply company, etc.) • Representatives of local level stakeholders • Representatives of association of indigenous people, women's association, religious association, etc. • Representatives of LGUs in Metro Manila • Representatives of LGUs related to water transmission to reservoirs in the basin • NGO and Academes • Others, if necessary	• To bring forward the problems and needs of IWRM. • To propose the draft plan on IWRM.
3 Other stakeholders • Other stakeholders not included in the other stakeholders of the above items 1 and 2	• To disclose the information through the internet, etc.

Three (3) kinds of meetings, consisting of the Steering Committee Meeting, the Technical Working Group Meeting and the Stakeholder Meeting, are held for the hearing of opinions and consensus building on the proposed IWRM Plan for Pampanga river basin. Decision-making on consensus in the present study is basically under the responsibility of the core stakeholders which consists of the members of the Steering Committee and the Technical Working Group. On the other hand, the Stakeholder Meeting aims at the hearing of opinions. The members of the Steering Committee and the Technical Working Group had been determined at the early stage of the study.

7.12.2 Timing and Topics of Meetings

The Steering Committee and Stakeholder meetings are held as one set at each juncture in the course of the study. The Technical Working Group meetings had been also originally scheduled at each juncture in the course of the study, but rescheduled, on the way of the study, to be held once a month as far as the activities of the JICA Study Team continues in the Philippines.

The main activities in the Steering Committee and Technical Working Group meetings include discussion on pending issues in the previous meetings, decision-making and confirmation of agenda for the succeeding stakeholder meeting. On the other hand, in the Stakeholder Meeting, explanation of the results of the study and hearing of opinions from the stakeholders are carried out according to the agenda approved by the Steering Committee and the Technical Working Group. The options brought forward by the stakeholders are to be incorporated into the work in the next step, and the results of the work are discussed in the next meeting of the Steering Committee and the Technical Working Group.

7.13 Schedule for Planning Procedures

As described in Subsection 7.1.2, the process of IWRM should move forward like a spiral with several different stages, and each of the stages covers the four sequences of: (i) Assessment of existing conditions; (ii) Planning (i.e., formulation of the IWRM Plan); (iii) Implementation of the projects for IWRM; and (iv) Monitoring of the results of project implementation.

The present stage of the IWRM for Pampanga river basin is the initial spiral stage, and of the above four sequences at this stage, item (i), Assessment of existing conditions, and item (ii), Planning, are being undertaken for a 2-year period of from February 2009 to January 2011, as shown in Figure 7.13.1.

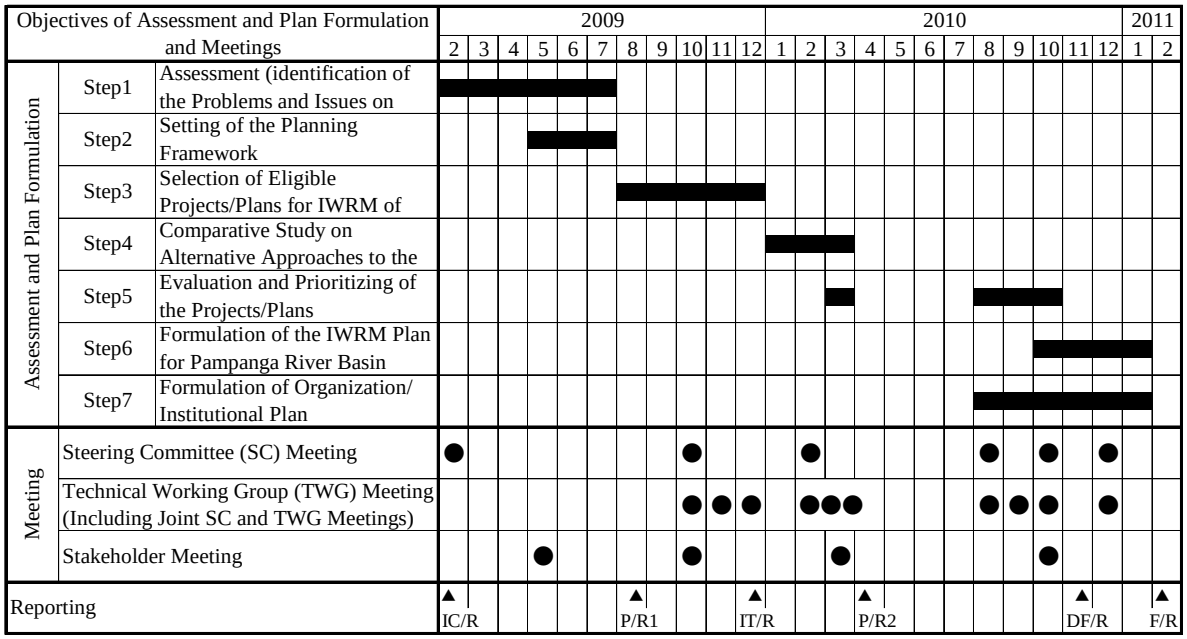


Figure 7.13.1 Schedule of Planning Procedures

Chapter 8. Setting of Planning Framework

8.1 Target Year

The target year of the IWRM Plan under this planning stage had been set at 2025 as agreed in the "Minutes of Meeting on Implementation Agreement for the Study." On the premise of the target year 2025, the project implementation period is divided into the following three 5-year terms. The phased implementation schedule as well as the phased investment program for the IWRM Plan is formulated on the premise of the said three terms.

(1) Short-Term for the period from 2011 to 2015;

(2) Medium-Term for the period from 2016 to 2020; and

(3) Long-Term for the period from 2021 to 2025.

8.2 Socioeconomic Framework

The following socioeconomic frameworks are adopted as the bases for the formulation of the IWRM Plan.

8.2.1 Projected Population in the Study Area

Since about 99% of the whole extent of the study area belongs to the four provinces of Bulacan, Nueva Ecija, Pampanga and Tarlac, the population projection for the study area is made based on the Census for the said provinces. The specific population growth rates for the provinces are assumed based on the projection by the National Statistic Coordination Board (NSCB), as listed below:

Table 8.2.1 Projected Population Growth Rates for the Study Area

Province	2006-2010	2011-2015	2016-2020	2021-2025
Bulacan	2.70%	2.41%	2.18%	1.94%
Nueva Ecija	1.62%	1.50%	1.31%	1.10%
Pampanga	1.81%	1.62%	1.42%	1.23%
Tarlac	1.70%	1.55%	1.35%	1.16%
The Study Area	**2.06%**	**1.86%**	**1.66%**	**1.46%**

Source: NSCB

8.2.2 Projected Gross Regional Domestic Product (GRDP)

The projected growth of GRDP is estimated from the past annual average growth rate of Gross Value Added (GVA) in the industrial sectors recorded for Region III. Region III had an increase in GVA from 1995 to 2007, as listed below.

Table 8.2.2 Annual Average Growth Rate of Gross Value Added in Region III from 1995 to 2007

Sector	Gross Value Added (in million pesos)			Annual Ave. Growth Rate of GVA (1995-2007)	Annual Ave. Growth Rate of GVA (2003-2007)
	In 1995	In 2003	In 2007		
Agriculture, Fishery & Forest	38,532	64,012	93,539	7.7%	8.2%
Industry	59,398	127,901	175,857	9.5%	9.0%
Service	62,009	155,377	231,959	11.6%	10.2%
Total	159,939	347,426	501,356	10.0%	9.4%

Source: NSCB

8.2.3 Price Level of Project Cost

The project cost discussed in this project formulation is converted to the price level as of 2009 using the "Wholesale Price Index (WPI) for Construction Material" shown below.

Table 8.2.3 Average Annual Increase Rate of Wholesale Price Index against Previous Year

Year in Interval	1960–1969	1970–1979	1980–1989	1990–1999	2000–2008	1960–2009
WPI - Construction Materials	5.58%	5.65%	5.68%	5.52%	7.39%	5.97%

8.3 Visions, Objectives and Sector Goals of IWRM for the Study Area

8.3.1 Purpose for Setting of Visions, Objectives and Sector Goal

The IWRM Plan would involve multi-water-sector projects such as those in the sectors of: (i) agriculture/irrigation and fishery development; (ii) municipal water supply, sanitation and sewerage; (iii) management of flood and sediment disasters; (iv) watershed management, (v) water-related environmental management; and (vi) water resources development, allocation and distribution. Taking these multi-sector projects into account, the visions for the IWRM Plan are proposed as the principal targets common to all proposed projects for the IWRM of Pampanga river basin. The objectives in the several categories are further assumed to embody the visions. Moreover, each of the water-related sectors in the IWRM Plan is provided with concrete sector goals, which could enhance the objectives and/or visions.

8.3.2 National and Regional Development Policies

The visions, objectives and sector goals shall be in line with the national and regional development policies. The policies on the nationwide and/or region-wide socioeconomic development and political improvement in the Philippines have been delineated through the "Medium-Term Philippine Development Plan (MTPDP) 2004-2010"[1)] and the "Regional Physical Framework Plan (RPFP) 2005-2030, Central Luzon"[2)]. The IWRM Plan Framework in the Philippines[3)] had been also formulated through the leadership of NWRB in 2006 as the nationwide roadmap to enhance the adequate supply of clean water at a reasonable price, while at the same time effectively safeguarding biodiversity and healthy environment. The details of these national and regional development policies are as described hereinafter.

(1) Medium-Term Philippine Development Plan 2004-2010

The Philippines recorded the national average poverty incidence of 34% in 2000, which worsened from 33% in 1997. In the light of such extremely high and aggravating poverty incidence, the MTPDP 2004-2010 addressed "Poverty Alleviation" as the priority task of the government. The MTPDP further emphasizes the necessity to accelerate the country's economic development, particularly through decentralized development for the small and medium enterprises (SMEs) and agribusiness, which could lead to the reduction of unemployment and rural poverty. Taking these conditions into account, the MTPDP set ten (10) objectives to contribute toward poverty alleviation and national economic development,

Table 8.3.1 Objectives Delineated in MTPDP 2004-2010

Category	Objectives	
Livelihood	(1)	Increase of job opportunities and income
Education	(2)	Increase of enrollment rate of schools
Fiscal Status	(3)	Creation of fiscal status balanced with right revenues and expenditures
Decentralized Development	(4)	Spread of transport and digital infrastructure network over the country
	(5)	Sustainable supply of power and water over the country
	(6)	Spread of new centers of government, business and community in Luzon, Visayas and Mindanao
	(7)	Development of Subic-Clark corridor as the competitive international service and logistics center in Southeast Asia Region
National Harmony	(8)	Execution of elections of high integrity
	(9)	Peace in Mindanao and to all insurgencies
	(10)	Closure of divisive issues generated by the EDSA Revolution

Of the above objectives, those under the categories of livelihood and decentralized development in particular are closely related to the water management for the study area, and they are further elaborated as below.

(a) The Objectives under the Category of Livelihood

The MTPDP stated that poverty in the Philippines is basically the problem in rural areas, because a majority of the poor are the small and/or landless farmers, the farm workers,

the fisher-folks and the indigenous people, and most of them are engaged in agriculture. Moreover, they tend to reside in the environmentally vulnerable areas and be handicapped by the less public service such as power/water supply.

From the above points of view, the MTPDP highlighted agriculture and agro-forestry development as the principal driving force for job creation, which could lead to poverty alleviation as well as economic development in rural areas, in particular.

The MTPDP worked out the nationwide vision to create two million jobs in the agricultural sector, which should have been achieved through development of two million hectares of new agricultural land. At the same time, the MTPDP stressed the necessity for increase of agricultural productivity at competitive prices, which could lead to the incremental income of farmers. Hence, the strengthening of irrigation water supply and/or expansion of agro-forestry as a part of watershed management would be highlighted to increase job opportunities in the agricultural sector and the income of farmers.

(b) The Objectives under the Category of Decentralized Development

The MTPDP addressed the necessity for spreading the new urban centers in Luzon, Visayas and Mindanao to decongest the overconcentration of economic activities in Metro Manila and to spur economic growth in the Philippines. The Subic-Clark corridor, which is partially located in the study area, in particular, is highlighted as the potential competitive international service and logistics center in Southeast Asia. Angeles, San Fernando and other major cities located in the study area would also be the strong candidates as the new government, business and community centers, because of the existing infrastructures and the easy access to Metro Manila through the North Luzon Expressway. The development of new bulk water supply systems, sewerage systems, flood mitigation systems and other water development/management programs would be the critical factors to create such new urban centers.

(2) Regional Physical Framework Plan (RPFP) 2005-2030, Central Luzon

The RPFP 2005-2030 set forth the following four (4) primary targets of regional development:

- Increase of agricultural productivity, which could lead to the increase of farmer's income in particular;
- Reduction of business cost through upgrading of the existing road infrastructure and strengthening of the linkages between the existing economic zones and their host municipalities;
- Reduction of the risk on natural calamities such as floods, landslides and earthquakes/tsunamis; and
- Increase of growth potential through agrarian reform, increase of enrollment rate of schools and improvement of residents' physical condition.

All of the above targets are likely to be oriented to the achievement of socioeconomic development, which could lead to improvement of living conditions and livelihood of residents finally contributing to poverty alleviation and economic development in the region. To achieve the visions, the RPFP set the following policies, strategies and/or action plans in each of the water-related sectors.

(a) Agriculture/Irrigation and Fishery

- The primary agriculture and aquaculture lands shall be preserved without being converted to other uses.
- The government shall continue to support agriculture and aquaculture development, especially in the construction of irrigation and drainage facilities.

- Science and technologies shall be harnessed to increase agriculture and aquaculture productivity with competitive costs for production.
- Priority shall be given to the development of new irrigation systems in order to expand the agricultural production areas. Existing irrigation systems shall be also rehabilitated and improved to increase their efficiencies.

(b) Municipal Water Supply, Sanitation and Sewerage

- The region's groundwater and surface water resources shall be properly developed and managed to satisfy the demand and reduced cost for municipal water supply.
- Existing municipal water supply and sanitation facilities shall be rehabilitated, improved and properly maintained. New facilities shall be also developed to increase their efficiency and service coverage.

(c) Management of Floods and Sediment Disasters

- Extensive and efficient flood control systems shall be provided to protect the settlement and production areas, in particular.
- Utmost effort shall be made to retain floodwater in the upper and middle reaches by suitable reservoir or flood retarding pond/swamp. This would ensure better control over floods and at the same time, create possible water resources development for multi-purpose project functions like power generation, irrigation and recreational facilities.
- Expansion of settlements in areas prone to disasters shall be restrained.

(d) Watershed Management

- The region shall focus on reforestation in open areas.
- Building of settlements and/or livestock production shall be discouraged in the upland areas with steep ground slopes of more than 18% and 30%, respectively. Production activities in NIPAS areas shall be also strictly prohibited.
- Massive reforestation of degraded mangrove ecosystems shall be pursued.

(3) Integrated Water Resources Management (IWRM) Plan Framework in the Philippines

The ever-increasing water demand is becoming a critical factor to the socioeconomic development and global competitiveness in the Philippines. Moreover, there is a critical linkage between better water management in various sectors and the country's socioeconomic development. From these points of view, the MTPDP underscored a need to adopt the IWRM approach as a more integrated and holistic management of water resources in the Philippines. This approach involves the coordinated development and management of water, land and related resources within the hydrological boundaries, to optimize economic and social welfare without compromising the sustainability of vital ecosystems.

The IWRM Plan Framework delineated four (4) Sustainable Outcomes, which are the medium to long-term goals for the water resources management in the Philippines. To achieve the Sustainable Outcomes, nine (9) Strategic Themes, which are either sector or inter-sector imperatives, are further set forth in the IWRM Plan Framework. The contents of the sustainable outcomes and strategic themes are as shown below.

Table 8.3.2 Sustainable Outcomes and Strategic Themes in the IWRM Plan Framework

Sustainable Outcomes	Strategic Themes
Effective Protection and Regulation for Water Security and Ecosystem Health	• To ensure the rational, efficient and ecologically sustainable allocation of water. • To enhance the effectiveness in groundwater management and aquifer protection. • To achieve the clean and healthy water. • To mitigate the risks of climate change events and water-related disasters.
Sustainable Water Resources and Responsive Services for Present and Future Needs	• To promote water conservation/stewardship and improve the water use efficiency. • To expand the access and ensure availability of affordable and responsive water supply and sanitation services.
Improved Effectiveness, Accountability, and Synergy among Water-Related Institutions and Stakeholders	• To promote the participatory water governance and supportive enabling environment. • To strengthen the knowledge management and the building capacity for IWRM.
Adaptive and Proactive Response to Emerging/ Future Challenges	• To explore the new pathways to water resource management - water sensitive design and water rights trading.

8.3.3 Visions, Objectives and Sector Goals adopted for the Study

With reference to the above nationwide and/or region-wide development plan and IWRM Plan Framework, the following visions, objectives and sector goals are adopted for the IWRM Plan of the study area.

(1) Visions

"Poverty Alleviation" and ***"Economic Development"*** are raised as the priority tasks in the MTPDP. All of the socioeconomic and infrastructure development programs proposed in the RPFP for Central Luzon are also directed to the said two principal tasks. With reference to the MTPDP and the RPFP, "Poverty Alleviation" and "Economic Development" are adopted as the principal visions of the IWRM plan for Pampanga river basin.

It is herein noted that "Poverty Alleviation" is oriented to not only the betterment of livelihood/increase of income for poverty thresholds but also securing the basic human needs such as safe drinking water and safe living conditions against flood and other water-related disasters. At the same time, the approaches to "Poverty Alleviation" shall not be made to sacrifice the vital ecosystem. Likewise, "Economic Development" shall be oriented to not only development of the regional economy but also preserving and/or recovery of the ecosystem in Pampanga river basin.

The related vision statement proposed by a member of TWG is as shown in Table 8.3.3.

Table 8.3.3 Vision Statement

The Pampanga river basin (PRB) shall become the most economically advanced river basin in the country that shall attain the lowest incidence of poverty, fully restored watershed and ecosystems, properly utilized and managed water resources, adequately provided modern infrastructure facilities, and an empowered citizens in partnership with transparent, accountable, and development-oriented leaders.

As described in the preceding Section 3.2, the average ratio of poverty thresholds in the study area as of 2006 is about 20%, which is lower than the national average of about 33%. Nevertheless, particular attention shall be given to the ratio of poverty thresholds in Nueva Ecija Province in the study area. The ratio in this province is about 38%, which exceeds the national average. A majority of the employees in the province are engaged in the agriculture/forestry sector and one of the crucial issues on poverty alleviation for the province should be addressed to increment the income of employees in the sector.

It is further noted that manufacturing, agriculture/forestry and trade are the three (3) major industries in Region III, which produce the Gross Value Added of more than 50% in the region. Accordingly, these three industrial sectors shall take the principal role for the "Economic Development" in the study area, so that enhancement of the bulk water supply system for manufacturing and the irrigation system for agriculture would be the important water-related works to ensure the economic development in the study area. Enhancement of the irrigation system in particular would be the crucial issue, since Region III is the largest irrigated paddy-producing district in the country taking the share of about 22% of the national total.

(2) Objectives

To achieve the said principal visions, the following five (5) items are further proposed as the objectives of the IWRM plan for Pampanga river basin with reference to the MTPDP, RPFP and IWRM Plan Framework in Philippines:

(a) Objective 1: Enhanced Livelihood

Objective 1 is oriented to the enhancement of the minimum requirement for livelihood, which shall contribute to poverty alleviation. The importance of this objective is emphasized in the MTPDP for the Philippines as well as the RPFP for Central Luzon. To achieve this objective, both the MTPDP and RPFP emphasized the necessity to increase job opportunities in the agricultural sector, and agricultural productivity with competitive production costs.

(b) Objective 2: Improved Quality of Life

Objective 2 is oriented to the improvement of the quality of life, which shall be one of the essential factors for poverty alleviation similar to the above Objective 1. Both the MTPDP and RPFP highlighted the importance of the following two water management systems for improvement of the quality of life, namely; (i) the substantial municipal water supply system, which could promise access to safe drinking water; and (ii) substantial mitigation system against flood, sediment disasters and other water-related damages.

(c) Objective 3: Decentralized Development

Objective 3 is the main driving force for the decentralized socioeconomic development of the existing urban centers in the study area such as Clark Field, Angeles City and San Fernando City, and the agricultural development in the rural areas. Both the MTPDP and RPFP highlighted two principal water-related issues to give a strong incentive of such decentralized development, namely; (i) availability of adequate municipal water supply for the urban centers and adequate irrigation water supply for the principal irrigation areas in the study area; and (ii) minimization of damage by floods, sediment disasters and other water-related disasters in the study area.

(d) Objective 4: Sustained Ecosystem

The above Objectives 1, 2 and 3 would contain active interventions to reform the existing natural environment, which could result in spoiling the rich biodiversity and the healthy ecosystem. To avoid such adverse effects to the ecosystem, Objective 4 is to be launched. The major approaches to attain this objective would include reforestation of mangroves and other degraded ecosystems and inducement of sanitary facilities and efforts to improve the quality of surface water.

(e) Objective 5: Empowered People

As described above, water resource development and management shall involve various sectors such as those for water allocation/distribution, mitigation of water-related disasters and conservation of ecosystems. To achieve a well-balanced water resources development and management, it is indispensable to involve all of the stakeholders in the IWRM Plan and pursue capacity building for them at all stages and key processes.

From this point of view, this objective is proposed as a part of the MTPDP and the IWRM-RFP and applied in the study.

(3) Goals of Each of Water related Sectors

To achieve the aforesaid five (5) objectives, the goals for each of the water-related sectors are assumed, with reference to the MTPDP, RPFP and the IWRM Plan Framework, as listed below.

Table 8.3.4 Goals in Each of the Sectors of Water Development and Management

Sector	Goal
Agriculture and Hydropower	• Rehabilitate and develop irrigation system • Enhance new agricultural technology on water management • Sustainable fishery under integrated water resource management
Municipal Water Supply, Sanitation and Sewerage	• Improve water supply quality • Ensure necessary water supply capacity • Reduce pollution load
Flood and Sediment Disaster Mitigation	• Mitigate chronic damage by flood and sediment disasters
Watershed Management	• Intensify management, protection and maintenance of vulnerable and ecologically sensitive area • Increase forest cover of critically denuded uplands, and mangrove areas and urban corridors
Water-related Environment Management	• Strengthen water quality monitoring, data management, regulatory and decision support system • Reduce pollution load from various sources in key areas of Pampanga river basin in order to render quality of waters fit for specified uses

8.4 Ceiling of Investment Cost for Projects in Group B

8.4.1 Overview

The ceiling of project investment cost shall be one of the important factors to determine the implementation schedule for the projects in Group B. When the implementation of projects excessively concentrates upon any of the aforesaid short-term, medium-term and/or long-term, the total project investment cost may exceed the affordable limit of the national and/or regional budgetary capacity. From this point of view, the approximate ceilings of investment cost for the projects in Group B are provisionally estimated for each of the short-term, medium-term and long-term, as listed in Table 8.4.1. The detailed estimation bases for these ceilings of investment cost are as described in Subsection 8.4.2.

Table 8.4.1 Ceilings of Investment Cost for Projects in Group B

Term	Period	Ceiling Amount
Short-term	2011–2015	31.7 billion pesos
Medium-term	2016–2020	33.7 billion pesos
Long-term	2021–2025	33.7 billion pesos
Total	2011–2025	99.1 billion pesos

8.4.2 Estimation Basis for the Ceiling of Investment Cost

The national budget of the Philippines had increased from 0.948 trillion pesos in 2005 to 1.426 trillion pesos in 2009, with the annual average incremental rate of about 11% as listed below.

Table 8.4.2 Summary of National Government Budget

(Unit: Billion Pesos)

Year	Allocated to Departments and Agencies	Allocated as Special Purpose Funds	Total
2005	442	506	948
2006	401	652	1,053
2007	458	669	1,126
2008	722	592	1,315
2009	710	716	1,426

Of the above national budget, 15 to 20 billion pesos (about 1.0 to 1.4% of the national budget) are allotted to infrastructure development of the water source/distribution for irrigation implemented by NIA and flood mitigation by DPWH, as listed in Table 8.4.3.

Table 8.4.3 National Budget Allocated to the Projects for Water-Related Infrastructure Development

(Unit: Billion Pesos)

Year	Description	Water Use*	Flood Mitigation**	Total
2007	(1) Whole Nation	7.31	7.93	15.25
	(2) Study Area	1.52	0.27	1.79
	(3) Share {(2)/(1)}	20.80%	3.30%	11.70%
2008	(1) Whole Nation	8.04	6.73	13.67
	(2) Study Area	2.08	0.56	2.64
	(3) Share {(2)/(1)}	25.90%	8.30%	19.30%
2009	(1) Whole Nation	12.55	6.93	19.48
	(2) Study Area	0.36	1.54	1.9
	(3) Share {(2)/(1)}	2.90%	22.30%	9.80%

Note: *: Budget allocated to projects of NIA under the "Agriculture and Fisheries Modernization Program" in "Special Purpose Funds"
**: Budget allocated to projects of DPWH under the "Department Fund"
Source: Budget Expenditures/Sources by the Department of Budget and Management

In addition to the above national budget, the LGUs also have a certain budget for the implementation of water-related projects. Nevertheless, the annual total budgets of the provincial governments in the study area are in the range of about 1 to 2.4 billion pesos only and such amounts would make it virtually difficult to shoulder the necessary costs for the major water-related development projects.

Accordingly, the national budget could be regarded substantially as the sole eligible source for the implementation of major water-related projects. At the same time, the budget could be unevenly concentrated to a particular project, which would be implemented during a particular period, provided that the project implementation is judged to be strategically important for the nation. Moreover, the national budget has increased in the recent five (5) years with an annual incremental rate of about 11%, and this incremental tendency is expected to continue for the time being. From these viewpoints, the ceilings of investment cost for the projects are estimated on the following assumptions:

- The national budget for water-related infrastructure development projects would be able to continue to increase by 11% per year until the end of the short-term plan (i.e., 2015); and
- Taking into account the maximum percentage of the above national budget allocated to the study area in the previous years, about 20% of the national budget could be expended, as the ceiling, for project development in the study area.

Based on the above assumptions, the ceiling of investment by the target year 2025 is estimated at about 99 billion pesos, and those for short-term, medium-term and long-term plans are as listed in Table 8.4.1.

References in Chapter 8

1) NEDA: Medium-Term Philippine Development Plan 2004-2010, 2004.
2) NEDA Region III: Updated Central Luzon Regional Physical Framework Plan (RPFP) 2005-2030, 2006.
3) NWRB: IWRM Plan Framework in the Philippines, 2006.

Chapter 9. Selection of Eligible Projects as Components of the Proposed IWRM Plan

9.1 General

Various government agencies and non-government entities are proposing and/or executing numerous projects related to IWRM in Pampanga river basin. Some of these on-going and proposed projects are selected in order to cope with the problems/issues on IWRM Plan for Pampanga river basin and at the same time to attain the aforesaid visions, objectives and sector goals in the IWRM Plan. In addition, the Study Team in corroboration with the relevant government agencies as well as other stakeholders worked out the conceptual projects, which would be essentially required as a part of IWRM Plan. It should be noted that the conceptual projects would require either further study such as feasibility study, or determination of the basic project components, before their implementation.

The on-going, proposed and conceptual projects were further modified through the several consultation meetings with the relevant government agencies and other stakeholders. As the result, the following projects were finally determined as the components of the proposed IWRM Plan for Pampanga river basin. Details of these projects are as described in Section 9.2 to 9.7 below.

Table 9.1.1 Number of Programs and Projects as Components of the Proposed IWRM Plan

Sector	On-going Projects	Proposed Projects	Conceptual Projects*	Total
Agriculture/Irrigation and Fishery Development	14	11	3	28
Municipal Water Supply, Sanitation and Sewerage	3	4	11	18
Flood and Sediment Disaster Management	4	2	4	10
Watershed Management	12	0	4	16
Water-related Environment Management	3	1	4	8
Inter-sector for Water Resources Development, Allocation and Distribution	-	-	4	4
Total	36	18	30	84

Note (*): Proposed by JICA Study Team
Source: JICA Study Team

9.2 Projects in the Sector of Agriculture/Irrigation and Fishery Development

Self-sufficiency through sustainable rice production is a key component of agriculture in the national policy. In line with this policy, the national/regional development strategies for agriculture were oriented to development of new irrigation systems and rehabilitation of existing systems.

In addition, the upgrading of irrigation infrastructure and dissemination of improved agricultural technology are also emphasized as the principal strategies. In approaching these strategies, it is necessary that both structural and non-structural measures shall be well linked to maximize their multiple effects to increasing productivity and improving livelihood in rural areas. The projects should not limit to only large-scale national irrigation but also communal and small-scale irrigation, both for new development, rehabilitation and improvement.

The projects for agriculture and fishery development were selected to comply with the above national/regional strategies and to cope with the problems and issues identified in Section 6.2. The on-going, proposed and conceptual projects thus selected are as listed in Table 9.2.1, and their detailed profiles are as given in Annex-T 9.2.1.

Table 9.2.1 Projects for Agriculture/Irrigation and Fishery Development

Project					Problems and Issues to be complied by the Project		
Classification	Status	Code	Name of Project	Implementing Agency	Waters Shortage for Irrigation	Low Irrigation Efficiency	Water Pollution in Fish Pond
Irrigation	On-going	AI-G-01	Balog-Balog Multipurpose Project Phase 1	NIA	○		
		AI-G-02	Along-along Creek Irrigation Project (UPRIIS Div3)	NIA	○		
		AI-G-03	Repair, Rehabilitation of Existing Groundwater Irrigation Systems, Establishment of Groundwater Pump Project (REGIP)	NIA	○		
		AI-G-04	Balikatan Sagip Patubig Program (BSPP)	NIA	○		
		AI-G-05	Repair, Rehabilitation, Restoration & Preventive Maintenance of Existing National & Communal Irrigation Facilities	NIA	○		
		AI-G-06	Restoration/Rehabilitation of Existing NIA Assisted Irrigation System (RRE-NIAIS)	NIA	○		
		AI-G-07	Participatory Irrigation Development Project, APL1-Infrastructure Development	NIA	○		
		AI-G-08	Rehabilitation of Small Water Impounding Projects / Diversion Dams	DA-BSWM	○		
		AI-G-09	Comprehensive Agrarian Reform Program, Irrigation Component	NIA	○		
		AI-G-10	Upper Tabuating SRIP	NIA	○		
	Proposed	AI-P-01	Balintingon Reservoir Multipurpose Project (BRMP)	NIA/G. Tino	○		
		AI-P-02	Balog-Balog Multipurpose Project Phase 2	NIA	○		
		AI-P-03	Sector Loan on Rehabilitation of Irrigation Facilities	NIA	○		
		AI-P-04	Casecnan Multi-purpose Irrigation & Power Project Irrigation Component Phase 2	NIA	○		
		AI-P-05	Procurement of Pumps, Drilling Rigs & Related Equipment	NIA	○		
		AI-P-06	Irrigation Water Resources Augmentation Pump Establishment Project	NIA	○		
		AI-P-07	Appropriate Irrigation Technologies for Enhanced Agricultural Production	NIA		○	
		AI-P-08	Central Luzon Groundwater Irrigation Systems Reactivation Project	NIA	○		
		AI-P-09	Gumain Reservoir Project	NIA	○		
		AI-P-10	Rehabilitation of AMRIS	NIA	○		
		AI-P-11	Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects, Small Diversion Dam Projects	DA Region III/LGUs	○		
	Conceptual	AI-C-01	New Construction of Small Scale Irrigation Project under BSWM	BSWM/LGUs	○		
		AI-C-02	Introduction of Water Saving Irrigation Technology	NIA		○	
		AI-C-03	Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs	NIA		○	
Fishery	On-going	AF-G-01	Aquaculture Fisheries Development Programs	DA-BFAR			○
		AF-G-02	Comprehensive Regulatory Services	DA-BFAR			○
		AF-G-03	Support Projects and Activities	DA-BFAR			○
		AF-G-04	Fisheries Resources Management for Improved and Sustainable Harvest	DA-BFAR			○

As indicated in Table 9.2.1, there are 14 on-going projects and 11 proposed projects by NIA and other relevant agencies and judged to be eligible as components of the IWRM Plan. In addition to these on-going and proposed projects, the three (3) conceptual projects indicated above are judged to be essentially necessary for development of infrastructures and improvement of irrigation technologies in particular. The backgrounds for selection of these conceptual projects are as described below.

- AI-C-01: New Construction of Small-Scale Irrigation Project under BSWM

  The target areas of the on-going and proposed projects tend to be biased to the large-scale national irrigation systems (NIS) and development for the smaller communal irrigation systems (CIS) is left behind. Such uneven development would lead to difficulties in enhancing a well-balanced and equitable agricultural products and farmers' livelihoods. From these points of view, this conceptual project is proposed to develop the potential sites for CISs, which are identified by BSWM in the study area.

- AI-C-02: Introduction of Water Saving Irrigation Technology

  The objectives of the on-going development of irrigation technologies in the study area are confined to innovation of the irrigation facilities such as photovoltaic energy in power generation and drip tape for water dispersion. Improvement of more essential irrigation technologies is deemed to be necessary. Hence, this conceptual project is proposed to maximize the water-use efficiency for irrigation through introduction of the water saving technologies such as "Controlled Irrigation/Alternate Wet and Dry (AWD)" and "System of Rice Intensification (SRI)."

- AI-C-03: Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs

  The discharges in the existing irrigation networks both for NISs and CISs are not accurately and adequately monitored due to: (a) inadequate number and malfunction of discharge measuring devices; (b) inadequate calibration of conversion tables (H-Q curve) of water discharge against water level or gate opening height; and (c) inadequate communication system between the sites and the gate control offices. As a result, the monitoring data are not well utilized to effectively irrigate the water. To utilize the limited water sources more efficiently, this conceptual project is proposed.

9.3 Projects in the Sector of Municipal Water Supply, Sanitation and Sewerage System

The Government of the Philippines has targeted through the "Philippine Water Supply Sector Roadmap" that 100% of the households shall have access to safe, adequate and sustainable municipal water supply by 2025. At the same time, the Clean Water Act of 2004 requires that the DPWH in coordination with DOH and other agencies concerned shall employ the septic tank or the combined sewerage-septic management system.

The projects for this sector are selected taking the above national policies and the problems/issues identified in Section 6.3 into account. The on-going, proposed and conceptual projects thus selected is as listed in Table 9.3.1, and their detailed profiles are as listed in Annex-T 9.3.1.

Table 9.3.1 Projects for Municipal Water Supply, Sanitation and Sewerage

Project					Problems and Issues to be complied by the Project		
Classification	Status	Code	Name of Project	Implementing Agency	Inadequate Water Supply Source	Unsafe Water Supply	Increasing Pollution Load in Water Bodies
Municipal Water Supply	On-going	MW-G-01	Angat Water Utilization and Aquaduct Improvement Project (AWUAIP) Phase 2	MWSS	○		
	Proposed	MW-P-01	Rehabilitation of Umiray-Macua Facilities	MWSS	○		
		MW-P-02	Sumag River Diversion Project	MWSS	○		
		MW-P-03	Bulacan Treated Bulk Water Supply Project	MWSS/LGU		○	
		MW-P-04	Metro Clark Bulk Surface Water Project	CDC	○		
	Conceptual	MW-C-01	Additional Level 3,2, 1 Facilities towards 2025 in Bulacan	LWUA/WDs/LGUs /Private WSPs	○	○	
		MW-C-02	Additional Level 3,2, 1 Facilities towards 2025 in Pampanga	LWUA/WDs/LGUs /Private WSPs	○	○	
		MW-C-03	Additional Level 3,2, 1 Facilities towards 2025 in Nueva Ecija	LWUA/WDs/LGUs /Private WSPs	○	○	
		MW-C-04	Additional Level 3,2, 1 Facilities towards 2025 in Tarlac	LWUA/WDs/LGUs /Private WSPs	○	○	
		MW-C-05	Extended Bulacan Bulk Water Supply Project	LGU	○		
		MW-C-06	Pampanga Bulk Water Supply Project	LGU	○		
Sanitation	Conceptual	MS-C-01	Additional Sanitary Facilities towards 2025 in Bulacan	LGUs		○	
		MS-C-02	Additional Sanitary Facilities towards 2025 in Pampanga	LGUs		○	
		MS-C-03	Additional Sanitary Facilities towards 2025 in Nueva Ecija	LGUs		○	
		MS-C-04	Additional Sanitary Facilities towards 2025 in Tarlac	LGUs		○	
Sewerage	On-going	MP-G-01	Cabanatuan Sewerage System	LGU			○
		MP-G-02	Expansion of Clark Sewerage System	Clark Water			○
	Conceptual	MP-C-01	Septage Treatment and Disposal Facility	LWUA/WDs/LGUs /Private WSPs			○

The above on-going and proposed projects are judged to hardly fulfill even the present municipal water demand; therefore, it is virtually difficult to cope with the future incremental water demand caused by population growth in the study area. Moreover, the on-going and/or proposed projects for sanitation and sewerage are developed within the minimal extent of the study area.

Taking the above backgrounds into account, 11 conceptual projects are proposed for the sake of: (a) ensuring the necessary supply capacity for the future incremental municipal water demand; (b) improvement of the necessary level of water quality for safe drinking; and (c) reduction of basin pollution loads. The detailed backgrounds on the selection of these conceptual projects are as described hereinafter.

- MW-C-01, 02, 03, 04: Additional Level 3, 2, 1 Facilities towards 2025 in Bulacan, Pampanga, Nueva Ecija and Tarlac

  The on-going and proposed projects are judged to hardly promise securing access to safe water quality for drinking in the study area. From this point of view, the four (4) conceptual projects, of MW-C-1, MW-C-2, MW-C-3 and MW-C-4 are proposed to attain the following development scenarios:

  (a) The coverage of Level 3, 2 and 1 water supply systems with safe drinking water supply shall reach 100% by 2025.

  (b) The coverage ratio of Level 3 Water Supply System in urban areas shall increase to 1% per annum by 2015, and their average ratio shall reach 80% by 2025. At the same time, the lowest coverage ratio in urban areas shall not be below 46.5% in 2025.

  (c) The present average coverage ratio of Level 3 Water Supply System in rural areas shall be maintained until 2025, notwithstanding the future increment of population. The target coverage ratio to be maintained in rural areas is 18% in average for the whole study area.

- MW-C-05: Extended Bulacan Bulk Water Supply Project

  The Bulacan Treated Water Supply Project (MW-P-03) was proposed, in 2007, through the MOA agreed between MWSS and Bulacan Province. This proposed project aims at strengthening the municipal water supply capacity for Bulacan Province. However, the municipal water demand in 2025 is estimated to rise above the present supply capacity. Taking these conditions into account, this conceptual project is proposed to develop a new bulk municipal water supply system to meet the future population growth in Bulacan Province by 2025. The new system would take the surface water source as its principal source and its supply capacity could make up for the potential deficit of 3.8m^3/s for about 1.7 million people in 2025.

- MW-C-06: Pampanga Bulk Water Supply Project

  This conceptual project is proposed to develop the new bulk municipal water supply system to meet the future population in Pampanga Province. This project aims at promising the full supply level for the demand in 2025. The new system would take the surface water source and/or the groundwater in the vicinities as its principal source and make up for the potential deficit of about 2.1m^3/s in 2025. It is assumed that 0.8m^3/s will be provided through the Metro Clark Bulk Surface Water Project (Code: MW-P-04) and the remaining 1.3m^3/s for 0.6 million people will be supplied through the Pampanga Bulk Water Supply Project.

- MS-C-01, 02, 03, 04: Additional Sanitation Facilities toward 2025 in Bulacan, Pampanga Nueva Ecija and Tarlac

  About 88% of households in the study area are currently provided with sanitary toilets. This ratio of sanitary toilets is proposed to increase by 10% by 2015 and reach 100% by 2025 so as to achieve the sector goal of 100% safe water.

- MP-C-01: Septage Treatment and Disposal System

To enhance the proper treatment and disposal of septage from the aforesaid sanitary toilets, this conceptual project is proposed on the premise that the treatment and disposal of septage shall prevail over all households with level 3 water supply facilities in the urban areas (about 82% of the urban households of target cities in average) in the following ten (10) urban centers by 2025: (a) Angeles, San Fernando, Guagua and Mabalacat in Pampanga Province; (b) Baliuag, Calumpit, Hagonoy and Malolos in Bulacan Province; (c) Cabanatuan in Nueva Ecija Province; and (d) Tarlac City in Tarlac Province.

9.4 Projects in the Sector of Management for Flood and Sediment Disasters

To mitigate the flood problems in the country, the MTPDP 2004-2010 made a priority to the efficient maintenance and rehabilitation of existing flood mitigation facilities including the dredging of waterways, riverbank protection, and relocation of informal settlers along the river/drainage channels so as to fulfill the inherent flood control capacity of the existing facilities. The MTPDP also emphasizes the necessity of adequate investment to the twelve (12) nationwide priority flood mitigation projects, two (2) of which are addressed to the Mt. Pinatubo Hazard Urgent Management II and III in the study area.

In line with the above national policies, the RPFP raised two (2) regional strategies for flood management: The first is oriented to the adoption of a comprehensive flood mitigation project emphasizing the necessity of the nonstructural measures such as flood forecasting and warning and watershed management. The second is addressed to strengthening of the flood detention capacity by the river basin. The RPFP states that floodwaters shall be held back in the upper and middle reaches by a suitable reservoir or a low retention basin. This would insure better control over floods and, at the same time, create the possible water resources development for irrigation, municipal water supply and other various uses of water. The on-going, proposed and conceptual projects for this sector are selected to comply with the above national policies and the same time, to cope with the problems and issues identified in the Section 6.4. The results of the selection are as shown in the table below.

Table 9.4.1 Projects for Management of Flood and Sediment Disasters

Project				Problems and Issues to be complied by the Project		
Status	Code	Name of Project	Implementing Agency	Insufficient Structural Capacity for Flood Mitigation	Increment of Flood Damage Potential	Inadequate Information and Knowledge Relevant to Flood Mitigation
On-going	FL-G-01	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part I	DPWH	○		
	FL-G-02	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part II	DPWH		○	
	FL-G-03	Maintenance and Rehabilitation Works for River Dike and Slope	DPWH	○		
	FL-G-04	Flood Forecasting and Warning System Capacity Building Project upon Dam Release in the Philippines	PAGASA			○
Proposed	FL-P-01	Flood Control Measures in Mt. Pinatubo Devastated Area-Focus on Pasac Delta	DPWH	○		
	FL-P-02	Bacolor Comprehensive Rehabilitation Master Plan	LGU	○		
Conceptual	FL-C-01	Flood Mitigation for Pampanga Delta	DPWH	○		
	FL-C-02	Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and N. Ecija	LGUs			○
	FL-C-03	Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs	LGUs	○		
	FL-C-04	Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula	DE-Region III			○

As listed above, the four (4) on-going projects and two (2) proposed projects by the relevant agencies are identified as the eligible components of the IWRM Plan for the study area. In addition, the following four (4) conceptual projects, which take structural and nonstructural measures, respectively, into account, are judged to be essentially necessary for flood management in the study area

- FL-C-01: Flood Mitigation for Pampanga Delta

  Several projects with structural measures have been undertaken to cope with the flood problems associated with the large volume of sediment run-off in Pasac river basin (i.e., the eastern Pinatubo Area) since the eruption of Mt. Pinatubo in 1991. The projects for the management of flood and sediment disasters by structural measures are further being implemented and/or proposed in Pasac river basin including those of FL-G-01 and FL-P-01.

  As for Pampanga river basin, however, no prominent flood mitigation plan has been introduced since the "Pampanga Delta Development Project Flood Component (PDDP-FC) Phase I" was completed at a reduced scale due to budgetary constraints and difficulty of land acquisition of the Phillipine government in 2002. Under such conditions, flood damages occur along the down/midstream of Pampanga River almost every year in spite of a certain effect of flood mitigation by Phase I. Accordingly, the execution of flood mitigation works as the Post-PDDP Phase I for Pampanga Delta in particular would be one of the important issues in the IWRM for the Study Area and hence, this conceptual project is proposed.

- FL-C-02: Community-Based Flood Early Warning System for Provinces of Pampanga, Tarlac and Nueva Ecija

  In parallel with the projects using various structural measures for the management of flood and sediment disasters, projects with non-structural measures have been carried out and some of them such as those of FL-G-02 and FL-G-04 are still in progress. The major concern with such non-structural projects is given to the Community-Based Flood Early Warning System (CBFEWS).

  A CBFEWS has been established in Bulacan Province, proving the effectiveness of the participative approach of the communities to the flood warning and evacuation with less project cost as compared with the structural project. From the viewpoint of such advantages, this conceptual project is proposed to establish the CBFEWS for the provinces of Pampanga, Nueva Ecija and Tarlac.

- FL-C-03: Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs

  The cities/municipalities in the study area suffer from chronic flood inundation due to deterioration of the existing drainage/flood control facilities and/or inadequate urban drainage systems. To resolve such drainage problems, the LGUs (the governments of the cities/municipalities) have proposed the maintenance, rehabilitation and improvement of the drainage systems in their jurisdiction areas as a part of the "Medium-Term Development Plan for 2010-2013." However, the implementation period of the plan is limited to a three-year period from 2010-2013 while sustainable rehabilitation and improvement are deemed to be indispensable. From this point of view, a conceptual plan for the captioned project is worked out assuming that the project shall be implemented as the annual regular program toward 2025.

- FL-C-04: Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula

  One of the important issues on IWRM is addressed, in the stakeholder meeting, to improvement of the residents' awareness on the water-related management works. Moreover, the improvement of public morals is important to the avoidance of unfavorable activities against IWRM such as garbage dumping into the waterways and encroachment along the river areas. To attain such improvement of public awareness and public morals, this captioned project is worked out.

9.5 Projects in the Sector of Watershed Management

The 2003 Revised Master Plan for Forestry Development (MPFD) raised a policy to enhance the life-sustaining functions of vital forest ecosystems by pursuing the following objectives:

- To sustainably manage the watershed and forest by capable institutions with active participation of empowered stakeholders;
- To enhance protective and biodiversity values of forests;
- To improve the quality of life of upland communities actively participating in sustainable forest management through CBFM;
- To enhance and improve decision-making processes on forest management through the adoption of improved management and information systems as well as a fully relevant monitoring and evaluation system; and
- To enhance forestry institutions' effectiveness, efficiency and competence in forest administration, forest conservation/management and forest protection.

At the regional level, the parallel thrusts are laid out in the Operation Plan for the Manila Bay Coastal Strategy. Among the objectives of this Operation Plan in relation to habitat and resource degradation are: (a) to establish, restore and manage declared protected areas and critical habitats in the Manila Bay region; (b) to increase the forest cover of the watersheds; and (c) to rehabilitate and manage mangrove areas.

Consistent with the national and regional thrusts, the twin goals are set for the watershed management sector under the proposed IWRM Plan, namely; (a) to intensify management, protection and maintenance of vulnerable and ecologically sensitive areas; and (b) to increase forest cover of critically denuded uplands and mangrove areas and urban corridors. The on-going, proposed and conceptual projects for this sector are selected to comply with the above twin sector goals and at the same time, to cope with the problems and issues identified in Section 6.5. The results of the selection are as shown in the table below.

Table 9.5.1 Projects for Watershed Management

Project				Problems and Issues to be complied by the Project		
Status	Code	Name of Project	Implementing Agency	Watershed Degradation	Weak Reforestation	Poor Institutional Coordination
On-going	WS-G-01	Forest Protection and Law Enforcement Program (FPLEP)	DENR/PENRO/CENRO	○		
	WS-G-02	Community-based Forest Management Program	DENR/RCBFMO	○	○	
	WS-G-03	Integrated Agro-Forestry Development Program (CBFM-CARP)	DENR/RCBFMO/DAR	○		
	WS-G-04	Coastal Resource Management Program (CRMP)	DENR/PAWCZMS	○		
	WS-G-05	Protected Area Community-based Resource Management Program (CBFM-PACBRMA)	DENR/PAWCZMS	○		
	WS-G-06	Private Forest Plantation Development Program (PFPDP)	DENR-FRCD		○	
	WS-G-07	NIA-UPRIIS' Watershed Management Program	NIA-UPRIIS	○		
	WS-G-08	NPC's Watershed Management Program	NPC	○		
	WS-G-09	Integrated Social Forestry (ISF) Projects	LGUs/DENR/RCBFMO			○
	WS-G-10	Private-sector Watershed Management Initiatives	Private Firm/NGOs		○	
	WS-G-11	Forestlands Management Project (FMP)	DENR-FASPO	○		
	WS-G-12	Pampanga River Basin Rehabilitation Project (PRBRP)	DENR-FRCD		○	
Conceptual	WS-C-01	Upland Development Program	DA/DENR/LGUs		○	
	WS-C-02	Protected Area Management Program (PAMP)	DENR/PAWCZMS	○		
	WS-C-03	Urban Greening Program	DENR/LGUs/Pvt. Sector			○
	WS-C-04	Community-based Eco-tourism Program	DOT/DENR/LGUs	○		

As listed above, there are twelve (12) on-going projects for watershed management in the study area. These projects cover the various objectives such as (a) reforestation in the denuded erosion-prone areas; (b) improvement of livelihood of the residents based on the agro-forestry; (c) protection of classified forestland against illegal activities such as illegal logging, forest fires and encroachment into forest land; (d) capacity building of the relevant stakeholders on the proper watershed management; and (e) strengthening of the institutional setup for watershed management.

Upon review on these on-going projects, the major concerns are addressed to the four (4) conceptual projects described below. These projects are expected to cope with the issues/problems which could hardly be solved by the on-going projects:

- WS-C-01: Upland Development Program (UDP)

  There is no specific intervention in the basin that will effectively mitigate the trend of rapid soil erosion and restore biodiversity in the uplands. The only initiative in the basin that directly addressed this concern is the World Bank-Assisted Watershed Management and Erosion Control Project (WMECP) which ended in 1991. DENR records show that at present, about 18,000 ha of forestlands and 4,100 ha of A&D lands in the upland of the basin are severely eroded. Hence, this conceptual project is proposed to benefit 20% of these severely eroded areas by introducing appropriate diversified upland farming systems. In addition it will also benefit some 6,000 ha of the severely denuded uplands within the two (2) watersheds that support two national irrigation systems, namely; Porac-Gumain and O'Donnell.

- WS-C-02: Protected Area Management Program (PAMP)

  There are five (5) watershed forest reserves and three (3) national parks in the basin that comprise the initial components of the NIPAS as informally declared by Congress. However, none of these has been formally established as a NIPAS site. Under these conditions, this conceptual project is proposed in order to work towards the formal establishment of the priority sites as NIPAS through declaration by Congress and the Chief Executive. The priority sites are considered the most critical in the basin in terms of conservation of biodiversity, unique ecosystems and cultural heritage.

- WS-C-03: Urban Greening Program

  Very little attention has been paid to greening the urban areas and restoring some degree of ecological balance in the built-up areas. Urban greening is widely recognized as one of the effective strategies in the lowlands to mitigate downstream flooding, arrest urban air pollution, improve the scenery and restore the aesthetic value of urban sprawl. Hence, this conceptual project is proposed to restore vegetation corridors along highways, river/drainage channels, school campuses, public plazas and subdivisions. The project is deemed to be a more logical and strategic greening option for LGUs in lieu of upland reforestation in the sense that these urban corridors are definitely "closer to home" to most communities than the forest hinterlands.

- WS-C-04: Community-Based Eco-Tourism Program

  A number of protected areas or critical habitats in the basin present a high potential for eco-tourism development. Three (3) particular sites in the basin are already drawing tourist traffic, namely; Pantabangan Dam, Biak-na-Bato National Park, and Candaba Swamp. However, these sites lack adequate facilities and services for eco-tourism. Specifically, appropriate infrastructures are needed to support low-impact tour activities that could provide value-added in terms of gaining public awareness and support to conservation priorities and providing additional income to organized communities. Examples include access trails to scenic spots, transport facilities, guided tour transports, hostels/visitor hosting facilities, restaurants/kiosks, trekking and camping grounds, souvenir shops, extreme sports facilities, audio-visual rooms, wildlife sanctuaries and the like. In addition, eco-tourism could generate funds as environmental fees to sustain habitat conservation efforts in these areas. For these reasons, this conceptual project is proposed with the full participation of community stakeholders.

9.6 Projects in the Sector of Water-Related Environment Management

The national strategy on the water-related environmental management is oriented to the coordinated management of water-related environment for maintaining the life-sustaining functions of vital ecosystems. There is also a parallel inter-sector effort to restore the ecological integrity of Manila Bay and to improve the environmental quality of the river basins fronting the Bay including Pampanga

river basin. This is laid out in the Operational Plan for the Manila Bay Coastal Strategy (OPMBCS), which became the basis for the Supreme Court mandamus compelling relevant agencies to clean up Manila Bay. Taking these national/regional strategies and/or policies into account, the following two folds are assumed as the specific water-related environmental management goals under the IWRM Plan for Pampanga river basin:

- To strengthen water quality monitoring, data management, regulatory and decision support systems; and
- To reduce pollution load from various sources in key areas of Pampanga river basin in order to render quality of waters fit for specified uses.

The on-going, proposed and conceptual programs and projects for this sector are selected to comply with the above sector goals and, at the same time, to cope with the problems and issues identified in the Section 6.6. The results of the selection are as shown in the table below.

Table 9.6.1 Projects for Water-Related Environmental Management

Project				Problems and Issues to be complied by the Project	
Status	Code	Name of Project	Implementing Agency	Inadequate Water Quality Data Generation and Management	Contamination of Surface, Ground and Coastal Waters
On-going	WQ-G-01	Ecological Solid Waste Management Program (ESWMP)	DENR-EMB III		○
	WQ-G-02	Industrial Pollution Control Program (IPCP)	DENR-EMB III		○
	WQ-G-03	Sagip-Ilog Project	DENR-EMB/ LGUs/Pvt. Sector		○
Proposed	WQ-P-01	Clean Development Mechanism	Private Industries		○
Conceptual	WQ-C-01	Capacity Development to Upgrade WQ Monitoring and Data Management Program	DENR-EMB	○	○
	WQ-C-02	Capacity Development to Improve Water Quality and Aquaculture Fisheries Management	DA-BFAR		○
	WQ-C-03	Capacity Development Project to Improve Industry Adoption of Cleaner Production Options	DTI/DENR/ Private Industries		○
	WQ-C-04	Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan and Pampanga	LGUs		○

As listed in Table 9.6.1, there are three (3) on-going projects and one (1) proposed project which could be useful for the mitigation of contamination of surface water, groundwater and coastal water. In spite of the current efforts by the on-going/proposed projects, two (2) principal issues as listed in Table 9.6.1 are expected to still remain, and the following conceptual projects are proposed in order to cope with the issues.

- WQ-C-01: Capacity Development to Upgrade Water Quality Monitoring and Data Management Program

  Monitoring data on surface water quality in the study area is extremely inadequate and there is no inventory done on the potential pollution sources in the basin. These make it difficult to ascertain the actual status of pollution loading in the water bodies. Moreover, the EMB regional office lacks the manpower, laboratory capability and water quality data processing, storage and retrieval system necessary to cope with the enormous tasks required to implement the Clean Water Act. For these reasons, this conceptual project is proposed to be implemented in a step-wise manner, with particular attention to: (a) rationalizing the choice of monitoring stations, parameters, sampling frequency and timing in relation to potential pollution sources; (b) improving laboratory and data management capability in order to better inform management decision; and (c) improving public awareness and institutional coordination mechanisms among related water quality regulatory and permitting bodies.

- WQ-C-02: Capacity Development to Improve Water Quality and Aquaculture Fisheries Management

  The preliminary estimates in this study show that fisheries contribute 24% of the basin's potential pollution load. Current fisheries programs, however, are concerned only with increasing productivity without due regard for the potential impact of nutrient overloading and other unsustainable cultural practices involved in fishpond operations, which could lead to serious water pollution problems like eutrophication. This conceptual project is proposed in order to improve the capacity of fishpond operators to adopt proven and emerging aquaculture technologies and best management practices, including the use of the so-called "pro-biotic," that will improve water quality and ensure the sustainability of aquaculture operations.

- WQ-C-03: Capacity Development Project to Improve Industry Adoption of Cleaner Production Options

  Some of the major industries and commercial livestock farms in the basin already employ green industry options including waste-to-fuel or waste-to-energy facilities (e.g., bio-gas digesters), wastewater effluent recycling, composting for fertilizer production; alternative fuel or raw material from solid wastes, among others. However, most small- and medium-scale industries in the basin have neither the technological know-how nor resource capability to adopt these and other emerging cleaner production technologies and management practices. This conceptual project is meant to identify and improve adoption by non-compliant industries of the most appropriate among the available and emerging pollution reduction opportunities in order to improve their compliance with the Clean Water Act.

- WQ-C-04: Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan and Pampanga

  Owing to budgetary constraints, the LGUs in the basin are able to implement their 10-year ESWM Plans on a limited scale and only involving the soft measures (e.g., IEC, segregation, recycling, etc.). To improve compliance with RA 9003, N. Ecija proposes to construct 5 sanitary landfill and support facilities in Gen. Tinio and Sta. Rosa and the cities of Muñoz, San Jose and Palayan. On the other hand, most LGUs can hardly afford to construct sanitary landfills. As an alternative, the construction of transfer stations-cum-materials recovery facilities (MRFs) is proposed for highly urbanized LGUs in Bulacan and Pampanga in order to optimize the use of the existing but under-utilized sanitary landfills in Capas, Tarlac and San Jose Del Monte, Bulacan as final dumping area.

9.7 Inter-Sector Projects for Water Resources Development, Allocation and Distribution

The water resource development, allocation and distribution discussed in this section aims at supporting the achievement of goals especially for two (2) sectors, namely; (a) agriculture/irrigation and fishery; and (b) municipal water supply, sanitation and sewerage. Of development projects of water resources for these sectors, those for agriculture/irrigation and fishery development may make lower economic contributions as compared with those for municipal water supply. In the IWRM Plan for Pampanga river basin, however, preservation of the present agricultural productivities is given priority over the economic contribution considering the importance to secure the job opportunities in the agricultural sector and attain the poverty alleviation in the rural area. In line with this basic consideration, the policy of water resources development, allocation and distribution is oriented to the equal importance of both goals in the two (2) sectors.

The water resources development could also make a contribution of the hydropower generation. However, the increase of capacity of hydropower generation in Pampanga river basin is not considered as the primary issue, since many indicative hydropower plants are projected outside Pampanga river basin for further increase of installed capacity in the Luzon grid as described in National Energy Plan, 2006.

The conceptual projects are selected to comply with the above strategy and, at the same time, to cope with the problems and issues identified in the Section 6.7. The results of the selection are as listed in

the table below, and the backgrounds of selection of these conceptual projects are as described in the items (1) to (4).

Table 9.7.1 Inter-Sector Projects for Water Resources Development, Allocation and Distribution

Project				Problems and Issues to be complied by the Project			
Status	Code	Name of Project	Implementing Agency	Sustainable Water Source for Municipal Water Supply	Securing of Necessary Water Sources for Expansion of Large Irrigation System	Inadequate Reliability of Water Supply in Angat-Umiray System	Expected Increase of Conflict among Water Users, especially between Municipal and Irrigation Water Users
Conceptual	IS-C-01	Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin	NWRB/ Others	○			
	IS-C-02	Project for Recovery of Reliability of Water Supply in Angat-Umiray System	NWRB/NIA/ MWSS/NPC/ LGU			○	
	IS-C-03	Enhancement of Monitoring System for Surface Water in Pampanga River Basin	NWRB/ Others				○
	IS-C-04	Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution	NWRB/ Others			○	○

- IS-C-01: Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin

  This conceptual project is proposed to step-wisely develop the comprehensive monitoring system on the water level of the groundwater as well as the land subsidence in strategic locations based on geology within the river basin so as to execute the proper groundwater resources management.

- IS-C-02: Project for Recovery of Reliability of Water Supply in Angat-Umiray System

  As described in the foregoing Section 6.7(3), the present water supply capacity of Angat-Umiray System is currently below its relevant water demand due to the remarkable increment of the municipal water demand of Metro Manila. In spite of such critical shortage of the water supply capacity, no definite new water resources development scheme has been committed. In order to recover the reliability of the water supply in Angat-Umiray System, this conceptual project is proposed to increase the supply capacity by the development of new water resources and reduction of the present irrigation demand by more efficient irrigation water supply (refer to Section 10.2).

- IS-C-03: Enhancement of Monitoring System for Surface Water in Pampanga River

  The usage of surface water will increase and become more complicated because of diverse water movement by abstraction for irrigation and municipal use and their return flow. To utilize the limited water resources more efficiently and effectively, it is vital to monitor the actual condition of water movement by a natural and artificial drainage system. From this point of view, this conceptual project is proposed to realize the inter-sector surface monitoring system by enhancing the existing monitoring system of each sector and agency.

- IS-C-04: Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution

  In order to cope with the future incremental potential conflicts among water users, it is indispensable to improve the methodology of water allocation as well as water permitting system. From this point of view, this conceptual project is proposed to execute the capacity development of NWRB and relevant agencies on water allocation and distribution.

Chapter 10. Preliminary Study on Alternative Approaches to Specific Issues

10.1 General

Of the 84 projects selected as components of the IWRM Plan in Chapter 9, the nine (9) projects listed in Table 10.1.1 are preliminarily estimated to possibly contain several alternative approaches to cope with their own specific issues, and feasibility study would be required to select the optimum approach among the alternatives. However, it is virtually difficult to carry out the feasibility study for all of these projects in detail at the time of formulation of the IWRM Plan due to the constraints on the information for the projects and the time for the study. In line with the rules adopted to formulate the IWRM Plan as described in Section 7.5, the preliminary study is made, at this study stage, on the particular projects, which are judged to be prominently influential to the entire IWRM Plan and could provide the basic information for the preliminary study.

Table 10.1.1 Projects Estimated to contain Alternative Approaches to Specific Issues

Code	Project Title	Contents of Comparative Study on Alternative Approaches
AI-C-01	New Construction of Small Scale Irrigation Project under BSWM	The optimum plan shall be selected among the alternative combinations of development of the 46 potential sites for small-scale irrigation.
MW-C-05	Extended Bulacan Bulk Water Supply Project	The optimum plan shall be selected among the alternative combinations of those not selected by the project, e.g., IS-C-02 is selected among (a) development of Bayabas storage dam; (b) development of Balintingon storage dam; (c) upgrading of irrigation system of AMRIS; and (d) other water sources outside the Pampanga river basin such as Laiban dam.
MW-C-06	Pampanga Bulk Water Supply Project	The optimum plan shall be selected among the alternative combinations of (a) development of residual groundwater at surrounding cities/municipalities; (b) development of Gumain storage dam; (c) direct abstraction from Pampanga River.
MP-C-01	Septage Treatment and Disposal Facility	The optimum plan shall be determined among the alternative combination of project sites and basic project components as well as implementation scheme.
FL-C-01	Flood Mitigation for Pampanga Delta	The optimum plan shall be selected among the alternative combinations of (a) river channel improvement; and (b) construction of flood retarding basin at Candaba Swamp. The optimum design scale for flood mitigation plan shall also be selected among the alternative design scales of 5, 10 and 20-year return period.
WS-C-01	Upland Development Program (UDP)	The optimum plan shall be determined among the alternative combination of project sites and basic project components.
WS-C-04	Community-Based Eco-Tourism Program	The optimum plan shall be determined among the alternative combination of project sites and basic project components.
WQ-C-04	Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan and Pampanga	The optimum plan shall be determined among the alternative combination of project sites and basic project components as well as implementation scheme.
IS-C-02	Project for Recovery of Reliability of Water Supply in Angat-Umiray System	The optimum plan shall be selected among the alternative combinations of (a) development of Bayabas storage dam; (b) development of Balintingon storage dam; (c) upgrading of irrigation system of AMRIS; and (d) Other water source outside the Pampanga river basin such as Laiban dam

In this study, the preliminary study was provisionally made for two (2) projects, FL-C-01 and IS-C-02, among the nine (9) projects listed in Table 10.1.1. The principal features of these projects are as described in the following Subsections 10.1.1 and 10.1.2, and the detailed contents of the preliminary study are in Sections 10.2 and 10.3.

10.1.1 Project for Recovery of Reliability of Water Supply in Angat-Umiray System (IS-C-02)

This project aims at dealing with the inadequate reliability of water supply in the Angat-Umiray system. The system currently causes the serious and chronic water shortage in the downstream national irrigation system of AMRIS, and there could be several alternative combinations of the possible countermeasures to cope with the issue such as: (a) development of Bayabas Dam as a new supplementary source for water supply of the Angat-Umiray system; (b) canal lining for the AMRIS to curtail the water demand for irrigation; (c) development of Balintingon Dam with conveyance system to AMRIS as the supplementary source for water supply; and (d) reduction of municipal water demand from the Angat-Umiray system by developing new water sources outside the Pampanga river basin. In addition, the introduction of new water saving technologies for irrigation could be the potential measure for the reduction of irrigation water demand.

10.1.2 Flood Mitigation for Pampanga Delta (FL-C-01)

This project aims at coping with the chronic and serious flood damage along the downstream of Pampanga River (the mainstream), where no dynamic flood mitigation measure has been introduced since the Pampanga Delta Development Project - Flood Component (PDDP-FC), Phase I was completed in 2002. The major hindrances to implementation of the flood mitigation project for the downstream of Pampanga River are the houses densely packed along the river channel, which requires an extremely large number of resettlement for river channel improvement. Taking the necessary number of resettlement and other socio-economic and environmental impacts into account, integrative flood mitigation measures are preliminary examined at the concept level.

10.2 Water Resources Development, Allocation and Distribution

10.2.1 Principal Issue on Water Resources Development, Allocation and Distribution in Angat-Umiray System

Angat-Umiray river system possesses the water resource development facilities of Angat multipurpose dam reservoir together with the basin-transfer system from Umiray River to the dam reservoir, and it has been used as the water source for the irrigation of “AMRIS” and the municipal water use in Metro Manila since 1967. However, the municipal water demand in Metro Manila has continued to increase due to the dynamic increment of the urban population, while no fundamental water resources development for such incremental demand has been carried out. As the result, Angat-Umiray System has been causing the water shortage for almost every two years at present.

Moreover, the Province of Bulacan had acquired the water use permit of 1.9m^3/s from the source of Angat-Umiray System, based on the MOU among MWSS, LWUA and the Provincial Government of Bulacan in 1992. This water use permit has not been in force yet but it is expected as the water sources for the Bulacan Treated Bulk Water Supply Project which is proposed to cope with the deterioration of groundwater used as the present source for municipal water supply. Nevertheless, the water use permit is hardly promised due to the aforesaid current low reliability of water supply by Angat-Umiray System.

Under the above conditions, the reliability of water supply both for municipal and irrigation water use in Angat-Umiray System shall be one of the most crucial issues in Pampanga river basin, and various alternative approaches are identified to cope with the issue. Hence, this subsection discusses the comparison of alternatives to the recovery of reliability of water supply in Angat-Umiray System.

10.2.2 Possible Options for Recovery of Reliability of Water Supply in Angat-Umiray System

The IWRM Plan formulated in this study takes a strategy such that the primary irrigation area shall be preserved to keep the agricultural productivity and secure the job opportunities in the agricultural sector. With reference to the results of the previous/ongoing study and the programs proposed by the relevant agencies, the seven (7) potential options are firstly assumed as the measures to recover the reliability of water supply in Angat-Umiray System. However, taking the project economical and technical viabilities into account, three (3) of the said potential options are excluded from the objectives of the alternative study in this subsection: The potential and objective options for the alternative study are as listed in Table 10.2.1.

Table 10.2.1 Possible Options for Recovery of Water Supply in Angat-Umiray System

Category	Option	Selected for Alternative Study
A: Option to increase water resources potential of Angat-Umiray System	A-1: Development of Bayabas Storage Dam	Selected
B: Options to decrease the irrigation water demand to Angat-Umiray System	B-1: Development of Balintingon Storage Dam and Conveyance System to AMRIS	Selected
	B-2: Conveyance of Excess Water from UPRIIS to AMRIS	Excluded
	B-3: Upgrading and Improvement of Irrigation Facilities and Water Management of AMRIS	Selected
	B-4: Direct abstraction of surface water of Pampanga River at around Apalit and conveyance by pumps to AMRIS	Excluded
	B-5: Water saving technology	Excluded
C: Options to reduce the municipal water demand of Metro Manila to Angat-Umiray System	C-1: Development of Laiban Dam as the New Water Source outside Pampanga river basin	Selected

The above seven (7) options are as briefly described below.

(1) Option A-1: Development of Bayabas Storage Dam

Development of Bayabas storage dam with 144MCM in effective storage volume is proposed in the catchment area of Bayabas River, a tributary of Angat River. This storage dam could be utilized as the backup water supply source for irrigation of AMRIS, and it releases the water only when the water level of Angat Dam drops to around the critical level for reservoir operation (EL.180m above MSL). This would be the only possible option to increase water resources potential in Angat-Umiray System. It is however noted that the water use permit at this dam site was already granted to the Provincial Government of Bulacan in 2004; therefore, this Option is the subject of transfer of the water use permit from Bulacan Province to the present users of Angat-Umiray System (i.e., NIA or MWSS).

(2) Option B-1: Development of Balintingon Storage Dam and Conveyance to AMRIS

Development of Balintingon storage dam with 488MCM in effective storage volume is now being proposed in the catchment area of Peñaranda River, a tributary of Pampanga River, which is located north of Angat-Umiray System. The dam was originally proposed for developing the new Balintingon Irrigation Area of 14,900ha in the lower reaches of the dam reservoir. On the other hand, this Option is proposed in this study to transfer a part of the discharge from the dam to AMRIS by reducing the irrigation area from the proposed 14,900ha to 10,000ha. It is herein noted that the water permit for the river flow at the proposed dam site has been already granted but a substantial part of it needs to be transferred to the water users of dam reservoir.

(3) Option B-2: Conveyance of Excess Water from UPRIIS to AMRIS

This option is to convey the excess water in the existing irrigation area of UPRIIS to the lower Maasim diversion dam using the existing UPRIIS Division-4 CX-3 canal. However, the excess water could be available only when expansion of new irrigation area in UPRIIS Division-5 is canceled or reduced, while such cancelation/reduction is judged to be not realistic, because the diversion facilities have already been completed. Accordingly, this option is not adopted for further alternative study.

(4) Option B-3: Upgrading and Improvement of Irrigation Facilities and Water Management of AMRIS

This option is to upgrade the main canals in AMRIS by concrete lining so as to reduce the conveyance loss in the canals. By the concrete lining of the main canals, 5% of diversion water requirement is expected to be reduced by preventing leakage from canals. Soft component for improvement of water management is also included.

(5) Option B-4: Direct Abstraction of Surface Water of Pampanga River around Apalit and Conveyance by Pumps to AMRIS

This option was considered by MWSS as one of possible alternate sources of Angat-Umiray System. The water is abstracted at around Apalit in Pampanga River and conveyed to AMRIS by pumps. However, this Option requires huge amount of energy for pumping, causing extremely high operation and maintenance cost, so that it is not selected for further alternative study.

(6) Option B-5: Water Saving Technology (WST)

The Department of Agriculture wrestles with spreading of the water saving technology (WST), which would be useful to save the irrigation water and thus maintaining the productivity of rice. However, the WST is still experimental and it is difficult to assure the saving of water to keep the production at the moment. From this point of view, this Option is not selected for further alternative study.

(7) Option C-1: Development of Laiban Dam as the New Water Source outside Pampanga River Basin

This option is to develop new water resources outside Pampanga river basin, aiming at strengthening the supply capacity for the municipal water demand in Metro Manila. One of the prominent development projects for municipal water supply in Metro Manila had been addressed to the Laiban Dam Project, which would be implemented by the BOT scheme with MWSS and San Miguel Corporation. However, MWSS terminated the negotiations for the joint venture proposal of San Miguel Corporation on March 4, 2010.

10.2.3 Selection of Alternative Plans

The following two (2) items are identified as the updated requirements on the reliability of water supply in Angat-Umiray System:

(1) To sustain the municipal water demand of 48.7m^3/s (46m^3/s for Metro Manila and 2.7m^3/s for Bulacan Province) on the premise of the design draft safety level of 10-year return period; and

(2) To sustain the present irrigation diversion requirement for the AMRIS's irrigation area of 26,000 ha in dry season and 20,355 ha in wet season on the premise of the design drought level of 5-year return period.

In order to fulfill the above requirements, the following four (4) alternative plans with the different combinations of the aforesaid possible options are scrutinized as shown in Table 10.2.2.

Table 10.2.2 Components of the Alternative Plans

Alt. No.	Components of the Alternative Plan	Annual Ave. Supply
Alt.-1	Option A-1: Development of Bayabas Storage Dam	- *
	Option B-3: Upgrading and Improvement of Irrigation Facilities and Water Management of AMRIS	0.9 m^3/s
Alt.-2	Option B-1: Development of Balintingon Storage Dam and Conveyance to AMRIS	2.9 m^3/s
	Option B-3: Upgrading and Improvement of Irrigation Facilities and Water Management of AMRIS	1.0 m^3/s
	Option C-1: Development of Laiban Dam as the New Water Source out of Pampanga River Basin	0.5 m^3/s
Al.-3	Option B-3: Upgrading and Improvement of Irrigation Facilities and Water Management of AMRIS	1.0 m^3/s
	Option C-1: Development of Laiban Dam as the New Water Source out of Pampanga River Basin	3.1 m^3/s
Alt.-4	Option C-1: Development of Laiban Dam as the New Water Source out of Pampanga River Basin	4.0 m^3/s

*: Bayabas storage dam supplies water to AMRIS only in drought year when the water level of Angat dam reservoir drops below EL. 184m above MSL.

10.2.4 Evaluation of Alternative Plans

The above four (4) alternative plans are evaluated from the several different points of view as shown in Table 10.2.3.

Table 10.2.3 Comparison of Alternative Plans

Alt. No.	Project Annual Cost* (mil. PHP)	Hydropower Output (GWh/year)	Socio-Environment	Institutional Arrangement	Technical Viability
Alt.-1	843	548	Environmental flow shall be taken into account.	• It is necessary to review the water use permit granted to NIA, Bulacan and MWSS.	Geological condition in/around dam reservoir must be carefully investigated.
Alt.-2	1,085	563	Resettlement of around a thousand families is required	• It is necessary to review the present water use permit on Peñaranda River. • Conveyance of water to AMRIS requires agreement of the Prov. of Nueva Ecija and Bulacan. • The implementation body of Laiban Dam project has not been fixed yet.	Water conveyance method from Balintingon Dam to AMRIS should be carefully studied.
Alt.-3	1,002	569	Resettlement of about 4,300 families is required	• The implementation body of Laiban Dam project has not been fixed yet.	No significant problem
Alt.-4	1,077	573	- ditto -	- ditto -	No significant problem

Note*: Project cost includes the initial investment cost and the annual O&M cost and it is expressed as the annual cost assuming the annual discount rate of 10% and the project life of 50 years.

As listed above, Alternative 1 would require the least project cost and far less resettlement as compared with the other alternatives. On the other hand, the Alternative 1 would cause an institutional issue in such that the water use permit of the Province of Bulacan has to be transfer to NIA, but such institutional issue is judged not to be a fatal problem. The only major concern on Alternative 1 concerns the geological conditions in and around the extent of the proposed dam reservoir area because severe landslide and soil erosion are observed at just the upstream of the proposed dam site. According to the preliminary field survey, such landslide and soil erosion are also judged not to be fatal to the construction of Bayabas Dam, but further detailed boring test and other geological surveys are required to confirm the technical viability of the dam.

As compared with Alternative 1, the other alternatives contain prominent disadvantages in the aspect of resettlement. Moreover, difficulties are foreseeable in implementing the Laiban Dam Project, which is one of the components for all alternatives other than Alternative 1, because MWSS encountered difficulties in completing the joint venture proposal for the construction of Laiban Dam with San Miguel Corporation.

From the above points of view, Alternative 1, which contains development of Bayabas storage dam and upgrading/improvement of irrigation facilities and water management of AMRIS, is selected as the optimum plan. Alternative 1 is, however, subject to further detailed geological survey in and around the reservoir area of Bayabas Dam.

10.2.5 Required Follow-up Programs for Recovery of Reliability of Water Supply in Angat-Umiray System

In order to materialize the aforesaid optimum plan for recovery of reliability of water supply in Angat-Umiray System, it is provisionally proposed to carry out the following feasibility study and capacity development in the next stages:

(1) Feasibility Study on Recovery of Reliability of Water Supply in Angat-Umiray System: The Study aims at clarifying the viabilities of Bayabas Dam in technical as well as economical, financial, socio-environmental and institutional aspects.

(2) Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution: The captioned capacity development is proposed to improve the water governance in Angat-Umiray system.

10.3 Flood Management

10.3.1 Principal Issue on Flood Risk in the Lower Pampanga River Basin

Since the eruption of Mt. Pinatubo in 1991, several projects have been undertaken or being proposed to cope with the flood problems associated with the large volume of sediment run-off in Porac river basin. As for Pampanga river basin, however, no prominent flood mitigation plan has been introduced since the Pampanga Delta Development Project Flood Component (PDDP-FC), Phase I was completed at a reduced scale due to the budgetary constraints and difficulty of land acquisition of the Philippine government. Under such conditions, flood damages occur along the down/midstream of Pampanga River almost every year in spite of a certain effect of flood mitigation by Phase I.

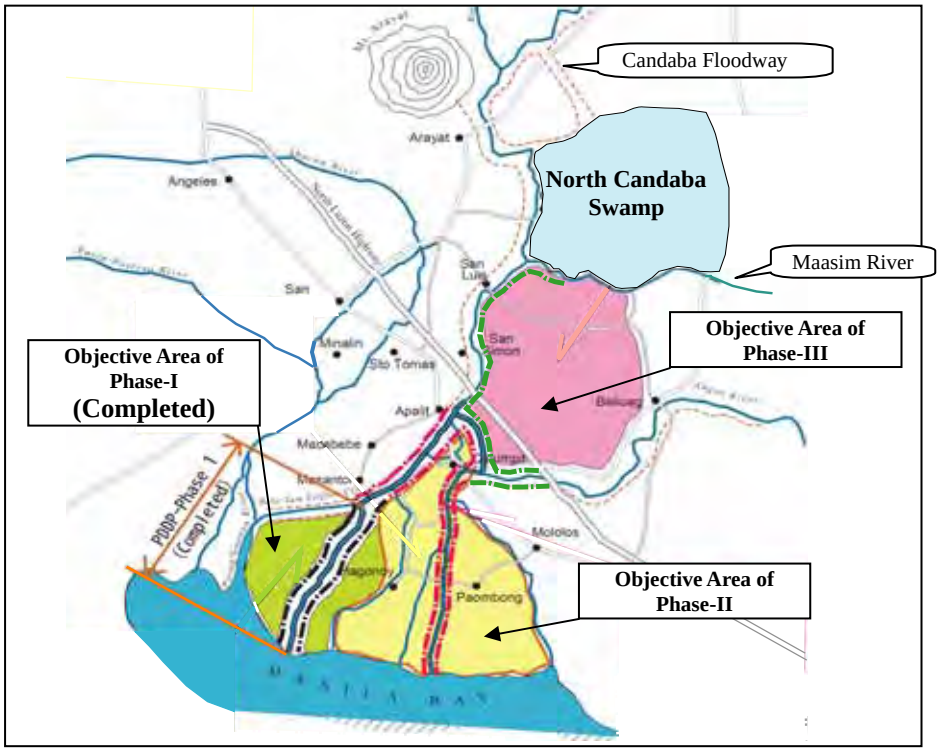
The principal hindrance in implementing the flood mitigation works for the downstream of Pampanga River concerns the houses densely packed along the river channel which requires a large number of resettlement for the widening of river channel. The previous PDDP FC Phase I had required the resettlement of 1,851 households, and the proposed PDDP FC Phase-II would further require the resettlement of about 6,709 households for its target river channel improvement of 30km in length.

Taking the occurrence of frequent disastrous flood damage and the difficulties in implementing the river channel improvement works into account, integrative flood mitigation measures for the PDDP Phase II river channel improvement are preliminarily examined at the concept level in this Section.

10.3.2 Objective Area

The PDDP FC is divided into three (3) phases, namely; Phase I, Phase II and Phase III. Among others, Phase I was completed with the projected channel improvement section of about 300m in length remaining in 2002. Following Phase I, Phase II is expected to start, covering the river channel improvement in the lower reaches from Apalit. Phase III is further proposed, as a part of the master plan for PDDP, to undertake the channel improvement of Pampanga River from Apalit to the confluence with the Maasim River[1)] (refer to Figure 10.3.1).

The extent of the objective flood mitigation areas is about 324km^2, and it administratively belongs to the municipalities of Calumpit, Hagonoy and Paombong in the Province of Bulacan and the municipalities of Macabebe and Apalit in the Province of Pampanga.



Source: Feasibility Report on the Pampanga Delta Development Project, 1982, JICA

Figure 10.3.1 Objective Flood Mitigation Area for PDDP-FC

10.3.3 Possible Options for Flood Mitigation of the Lower Pampanga River Basin

Taking the topographic and hydrological conditions in the objective area into account, the possible options for the flood mitigation are assumed to be: (a) river channel improvement along the downstream of Pampanga River; and (b) construction of flood retarding basin in the Candaba and San Antonio swamps.

In addition, the design flood scale for the flood mitigation measures could be also optional, and the PDDP adopted the 20-year return period as the design flood scale. However, Pampanga River experiences flood overflow in almost every year. Therefore, flood mitigation works with even the design flood scale of less than 20-year return period is expected to bring about a substantial flood mitigation effect. At the same time, a lower design scale of flood mitigation project would require a lesser number of house resettlement. From this point of view, the optimum design scale shall be also clarified.

10.3.4 Selection of Alternatives

The alternative flood mitigation plans have various combinations of the aforesaid two (2) optional flood mitigation measures (i.e., Option 1 for river channel improvement and Option 2 for flood retarding basin in North Candaba Swamp and/or San Antonio Swamp). The alternative flood mitigation plans would also possess various optional design scales within the limits of 20-year return period. Based on the assumption on the above combination of options, eight (8) alternatives for flood mitigation of the lower/middle Pampanga River are conceived, as shown in Table 10.3.1.

Table 10.3.1 Alternatives for Flood Mitigation of the Lower/Middle Reaches of Pampanga River

Design Scale / Optional Flood Mitigation Measures	5-year return period	10-year return period	20-year return period
Option 1 Only (= Sole river channel improvement without flood retarding basin)	Alternative – 1	Alternative – 2	Alternative -3
Option 2 Only (= Sole flood retarding basin without river channel improvement)	Alternative – 4	Alternative – 5	- *
Combination of Option 1 and Option 2	Alternative – 6	Alternative – 7	Alternative – 8

Note: *: The design flood scale of 20-year return period is hardly attained solely by the flood retarding basin in Candaba Swamp without the river channel improvement. (Refer to Section E.3.3.2 in Sector Report E). Accordingly, this alternative is ruled out from the potential alternatives.

10.3.5 Evaluation of Alternatives

The above eight (8) alternatives are evaluated from seven (7) points of evaluation as summarized in Table 10.3.2.

Table 10.3.2 Summary of Evaluation of Alternative Plans

Alt. No.	Points of Evaluation						
	(1) Technical Viability	(2) Economic Viability	(3) Impacts to Social Environment	(4) Impacts to Natural Environment	(5) Benefit to Water Use	(6) Regional Equity in the Flood Safety Level	(7) Adaptation to Climate Change
1	High	C	**A-**	B-		**A-**	
2	High	C	**A-**	B-		B-	
3	High	B+	**A-**	B-			
4	Fair	C	B-	**A-**	A+	**A-**	B+
5	Fair	C	B-	**A-**	A+	B-	B+
6	Fair	C	B-	**A-**	A+	**A-**	B+
7	Fair	C	B-	**A-**	A+	B-	B+
8	Fair	B+	**A-**	**A-**	A+		B+

Note:
Technical Viability: High = Technical viability has been already confirmed; Fair = Technical viability has not been confirmed yet but no particular technical difficulty in executing the project is foreseeable; Low = There remain uncertainties in the technical viability of the project
Other Evaluation: A+ stands for large positive impact, A- for large negative impact, B+ for medium positive impact, B- for medium positive impact, C for uncertain, and No Score for no or negligible impact

As listed above, Alternatives-1, 2, 3 and 8, which adopt the large scale river channel improvement along the downstream of Pampanga River, are evaluated to cause a serious negative impact to the "social" environment. This evaluation is attributed to the large number of resettlement of houses required for the river channel improvement.

On the other hand, the Alternatives 4 to 8, which will use the Candaba Swamp as the flood retarding basin, may require house resettlement though the large resettlement is not required, and they could cause serious impacts to the "natural" environment in the Swamp because of the impounding of floodwaters in the swamp. The Candaba Swamp is an important habitat for migratory birds during the rainy season and declared as a bird sanctuary by LGU. Moreover, the swamp is proposed as a candidate for the Ramsar Site and/or the East Asian-Australasian Flyway. Judging from these situations, difficulties in constructing a flood retarding basin in the swamp are foreseeable.

As for the alternative design scales for flood mitigation, it is evaluated that the alternatives which adopt the design scale of 20-year return period may lead to the dynamic increment of houses to be resettled, while the alternatives which have the design scale of 5-year return period is hardly verified from the viewpoint of regional equity in the flood safety level.

As stated above, any alternatives are still hardly selected as optimum plan at this preliminarily study stage due to the estimated serious negative impacts in the aspects of the resettlement required and the preservation of the natural environment. Under this condition, the non-structural flood mitigation measures such as usage of the flood forecasting and warning system and promotion of the watershed management (i.e. reforestation and hillside works on the steep slope area) are expected to take an important role for the chronic flood damages in Pampanga river basin, which occur almost every year. The existing and proposed non-structural measures for Pampanga river basin are as enumerated below:

- The flood forecasting and warning system for the entire Pampanga river basin had been established in 1981 through the financial and technical assistance of Government of Japan., and it is now being operated and managed by PAGASA. The real time information on the storm rainfall and river flow discharge could be gauged and used for early flood forecasting and evacuation.
- The flood forecasting and warning system for operation of Pantabangan and Angat dam reservoirs had been established in 1994 through the financial and technical assistance of Government of Japan., and it is now being operated and managed by PAGASA. Moreover, the capacity building for operation of the system is now being carried out through the technical assistance by JICA on the premises of the target completion of 2015. This system is expected to enhance the effective reservoir operation for flood control, which could lead to mitigation of the flood damage in the lower reaches of Pampanga River.
- The community-based flood warning system aims at establishing the methods and procedures for issuance of flood warning and evacuation and providing the necessary equipment for them in each of provinces. The system had been already completed in Bulacan Province in 2006, and establishment of the new systems is further proposed for Provinces of Pampanga, Tarlac and Nueva Ecija.
- The twelve (12) major watershed management projects are now being implemented expanding the forest coverage in Pampanga river basin, which could lead to increase the basin detention capacity of the storm rainfall and reduce the flood damages in the lower reaches of Pampanga river basin. Moreover, proposed is the Project of "WS-C-01: Upland Development Plan" in the study, which aims at reforestation as well as hillside works on the steep slope leading to reduction of the peak flood discharge and sediment runoff.

It is indispensable to carry out a further feasibility study in due consideration of: (a) the effectiveness of the above non-structural measures and (b) the results of the topographic/river channel surveys, the hydrological/hydraulic analysis and other basic surveys/analyses.

References in Chapter 10

1) JICA: Feasibility Study on Pampanga Delta Development Project, February 1982.

Chapter 11. Formulation of Project Implementation Schedule, Project Investment Plan and Development Scenario

11.1 Grouping of Projects

As described in Chapter 9, 84 projects have been selected as the eligible components of the IWRM for Pampanga river basin (refer to Table 9.1.1 and Annexes-T 9.2.1, to 9.7.1). These projects are classified into Group-A and Group-B in order to facilitate programming of the project implementation schedule and development scenarios mentioned below. The detailed criteria for classification into Group-A and Group-B are as described in Section 7.6.

As the result of classification, the projects are divided into Group-A and B as listed in Annex-T 1.1.1 and summarized Table 11.1.1. Group-A includes 43 projects and the investment cost of about 97 billion pesos in total. The Sector of "Municipal Water Supply, Sanitation and Sewerage" in Group-A, which corresponds to about 71% of the group total, requires the largest cost of about 69 billion pesos.

On the other hand, Group-B includes 41 projects requiring the investment cost of about 72 billion pesos. The Sector of "Agriculture/Irrigation and Fishery" takes 18 projects and the investment cost of 55 billion pesos (or about 76% of the total), which is the largest in Group-B. The second largest is in the Sector of Management of Flood and Sediment Disasters taking 7 projects and the project investment cost of about 12 billion pesos (about 17% of the total).

Table 11.1.1 Results on the Grouping of Projects

Group	Project	Number of Projects	Project Cost (million pesos)
A	Agriculture/Irrigation and Fishery Development	10	12,388
	Municipal Water Supply, Sanitation and Sewerage Development	15	68,571
	Management of Flood and Sediment Disasters	3	3,687
	Watershed Management	9	623
	Water-Related Environmental Management	5	3,417
	Inter-Sector Water Resources Development, Allocation and Distribution	1	7,966
	Sub-total	43	96,652
B	Agriculture/Irrigation and Fishery Development	18	55,400
	Municipal Water Supply, Sanitation and Sewerage Development	3	1,155
	Management of Flood and Sediment Disasters	7	12,071
	Watershed Management	7	2,951
	Water-Related Environmental Management	3	248
	Inter-Sector Water Resources Development, Allocation and Distribution	3	607
	Sub-total	41	72,432
Total		84	169,084

11.2 Project Implementation Schedule

11.2.1 Implementation Schedule for Group-A Projects

As described in Section 7.6 and 7.7, the development scenarios relevant to the Group-A projects are firstly conceived taking the basic social and natural needs into account, and then the implementation schedule for Group-A projects are set up to catch up with the development scenarios. The typical development scenarios are as enumerated below:

- *Development scenarios, which have to be timely implemented in accordance with the basic human need:* The typical scenario is the development of bulk municipal water supply system, which has to be completed in the right term to meet the municipal water demand increased with the urban population growth.

- *The development scenarios, which shall be gradually attained throughout the short, mid and long-term*: The scenarios are oriented to the gradual improvement of social and/or natural environment such as (a) increase of the access to the safe drinking water through expansion of the piped water supply system and the sanitary toilets; (b) expansion of the forest cover through yearly regular programs of reforestation; and (c) increase of agricultural activities through the yearly regular maintenance and rehabilitation of the existing irrigation facilities.

The JICA Study Team proposes the development scenarios for the Group-A projects in due consideration of: (a) the problems/issues on IWRM in Pampanga river basin (refer to Chapter 6) and (b) the visions, objectives and sector goals of the IWRM (refer to Section 8.3). The proposed development scenarios were further reviewed and revised through the TWG meetings on September 29, 2010, the TWG workshop on October 7, 2010 and the stakeholder meeting on October 13, 2010 (refer to Annex-T 11.2.1). As the result, the specific development scenarios for Pampanga river basin were finally determined and the implementation schedule for Group-A projects were further proposed in due consideration of the right time for completion of the projects to catch up the development scenarios. The proposed development scenarios and the relevant project implementation schedules are as shown in Annexes-T 11.2.2 and 11.2.3. The details of the development scenarios are further described in the Subsection 11.4.1.

11.2.2 Implementation Schedule for Group-B Projects

As described in Section 7.6, the Group-B projects are oriented to the following items:

- Development of the regional economy;
- Mitigation of flood and sediment disasters; and
- Support of yearly regular projects classified into Group-A.

Target completion year of the Group-B projects could be optional in general, and the priority order of the projects is assumed as the principal factor for the programming of implementation schedules for the Group-B projects. The detailed methodologies for the setting of priority of the projects and the implementation schedule are as described in Sections 7.8 and 7.9.

The priority order of Group-B projects is determined based on the results of scoring for each of the projects. The scoring for the Group-B projects were firstly made by the JICA Study Team and then the results of the scorings were reviewed and revised by the 13 members of the TWG, who represent the following agencies: NIA, NPC, BSWM, PHILVOLCS, DENR-RBCO, DPWH-FCSEC, PAGASA, DILG-Region III, Provincial Government of Tarlac (PPDO), Provincial Government of Bulacan (PGENRO), NEDA-Region III, MWSS, DENR-PAWB and NWRB.

The specific procedures taken for the scoring of projects are as listed below:

(1) The scoring for the 29 proposed and conceptual projects[1] were made firstly by the JICA Study Team as shown in Annex-T 11.2.4. The results of the scoring were presented to and discussed by the TWG members in the TWG Meeting on September 29, 2010.

(2) The TWG-Workshop was held on October 7, 2010. Each of the TWG members reviewed the results of the above scorings by the JICA Study Team, and revised the results of scorings through the Workshop. The scorings for each of the projects revised by the TWG members are averaged into the geometric mean as shown in Annex-T 11.2.5.

(3) Some of the TWG members proposed to make the second round scoring for the projects not referring to the results of scoring by the JICA Study Team. This second round scoring aimed at attaining more objective and precise results of scoring. In accordance with the proposal, the

[1] The Group-B includes 12 ongoing projects out of 41 projects in total. These ongoing projects are to be implemented in accordance with their existing implementing schedules, which had already been programmed by the project proponents. On the other hand, other 29 proposed and/or conceptual projects are to be implemented in due consideration of the priority order of the projects into account as described above.

second round scoring was individually made by each of the TWG members in the days following the Workshop. However, the second round scoring was prepared by three (3) members only.

(4) The limited number of second round scoring was judged to hardly represent the collective conclusion of the whole TWG members on scoring. From this point of view, the priority order of the projects is finally determined according to the first round scores made during the Workshop as stated in the above item (2).

In addition to the above priority order of the projects made by the scoring, the ceiling project investment cost for each of the short, mid and, long-tem is another important factor to determine the implementation schedule for the Group-B projects. The details of the ceiling project investment cost are as described in Section 8.4, and the projects to be implemented in the short, mid and long-term are proposed taking the ceiling project investment cost into account as shown in Annexes-T 11.2.6 and 11.2.7 The development scenarios to be attained by the proposed implementation schedule are assumed ,as shown in Annex-T 11.2.8and described in detail in the following Subsection 11.4.2.

11.2.3 Number of Projects to be implemented in 5-Year Terms

In accordance with the aforesaid implementation schedules for the Group-A and Group-B projects, the number of projects to be implemented in each of the short, mid and long-term is estimated as shown in Table 11.2.1.

Table 11.2.1 Number of Projects to be implemented in the Short, Mid and Long Terms

Classification of Projects		Short-term	Mid-term	Long-term	Total
Project to be Implemented within the Term	Group-A	41	36	36	113
	Group-B	33	17	6	56
	Total	**74 (44%)**	**53 (31%)**	**42 (25%)**	**169 (100%)**
Projects to be commenced in the Term	Group-A	41	0	2	43
	Group-B	33	7	1	41
	Total	**74 (88%)**	**7 (8%)**	**3 (4%)**	**84 (100%)**
Project to be Completed within the Term	Group-A	5	2	36	43
	Group-B	23	12	6	41
	Total	**28 (33%)**	**14 (17%)**	**42 (50%)**	**84 (100%)**

A total of 84 projects are to be implemented throughout the short, mid and long terms. Out of these projects, 74 projects are firstly commenced in the short-term, and 28 of them are to be completed within the same term as listed in Table 11.2.1. The remaining projects (i.e., 46 projects) continue to be implemented in the next mid-term. Likewise, 53 projects are implemented in the mid-term, including 7 projects to be newly commenced and 14 projects to be completed within the term. The number of projects to be finally implemented in the long-term is 42, which include 3 projects to be newly commenced.

11.3 Project Investment Plan

It is clarified that a total of about 169 billion pesos would need to be invested for implementation of the whole projects for the IWRM plan of Pampanga river basin (i.e., 84 projects). Of the total project investment cost, 61.5 billion pesos (36% of the total investment cost) is disbursed in the short-term, followed by 52.7 billion pesos (31%) in the mid-term and 55.0 billion pesos (33%) in the long-term as shown in Table 11.3.1.

Table 11.3.1 Project Cost to be disbursed in the Short, Mid and Long Terms

(Unit: million pesos)

Classification of Projects	Short-Term	Mid-Term	Long-Term	Total
Agriculture/Irrigation and Fishery Development	22,163	26,164	19,461	67,788
Municipal Water Supply, Sanitation and Sewerage Development	29,137	8,980	31,609	69,726
Management of Flood and Sediment Disasters	6,431	6,597	2,730	15,758
Watershed Management	1,721	1,588	265	3,574
Water-Related Environment Management	1,501	1,371	793	3,666
Inter-Sector Water Resources Development, Allocation and Distribution	509	7,965	99	8,573
Total	61,462	52,665	54,957	169,085

Of the total project investment cost of about 169.1 billion pesos, the ongoing and the proposed projects would require the investment cost of 21.5 and 77.5 billion pesos, respectively, as shown in Table 11.3.2. The necessary budgetary sources of a total of 99.0 billion pesos for the ongoing and proposed projects have been arranged and/or they are being sought by the project proponents. On the other hand, there is nothing to be done with the project investment cost of about 70.1 billion pesos for the conceptual projects. The conceptual projects for Municipal Water Supply, Sanitation and Sewerage Development in particular require large budgetary sources for their investment of 48.1 billion pesos.

Table 11.3.2 Project Investment Cost divided according to Classifications and Status of the Projects (Project Implementation Period: 2011–2025)

(Unit: million pesos)

Classification of Project	Ongoing Project	Proposed Projects	Conceptual Projects	Total
Agriculture/Irrigation and Fishery Development	12,766	54,208	814	67,788
Municipal Water Supply, Sanitation and Sewerage Development	5,213	16,456	48,057	69,726
Management of Flood and Sediment Disasters	1,454	5,820	8,484	15,758
Watershed Management	1,662		1,912	3,574
Water-Related Environment Management	356	1,036	2,273	3,665
Inter-Sector Water Resources Development, Allocation and Distribution			8,573	8,573
Total	21,452	77,520	70,113	169,085

As shown in Table 11.3.3, the public investment by the national government agencies and/or the local government units would be the major financial sources for all projects other than those for municipal water supply, sanitation and sewerage development. The public investment could include the private investment induced by BOT and/or foreign financial assistance.

In the sector for the municipal water supply, sanitation and sewerage development, the sewerage development could be implemented through public investment by the LGUs, while the municipal water supply development has to be implemented, in principle, through non-public investment by the public corporation/private firm.

Almost half of the investment cost (i.e., 34.2 billion pesos) is for municipal water supply development by public corporations and/or private firms. This investment cost is to be recovered through the fees collected for municipal water supply services.

Table 11.3.3 Project Investment Cost divided according to Classifications and Implementing Bodies of Projects (Project Implementation Period: 2011-2025)

(Unit million pesos)

Classification of Project	Project Implementing Bodies				
	NGAs	LGUs	NGAs & LGUs	Public Corporation/ Private Firm	Total
Agriculture/Irrigation and Fishery Development	53,514	-	14,274	-	67,788
Municipal Water Supply, Sanitation and Sewerage Development	-	35,521	-	34,205	69,726
Management of Flood and Sediment Disasters	11,242	3,008	1,508	-	15,758
Watershed Management	1,873	-	1,669	32	3,574
Water-related Environment Management	533	2,025	71	1,036	3,665
Inter-Sector Water Resources Development, Allocation and Distribution	-	-	8,573	-	8,573
Total	67,162	40,554	26,095	35,273	169,085

The project investment plan for each of the sectors is as described hereinafter.

11.3.1 Agriculture, Irrigation and Fishery Development

As shown in Table 11.3.4, the total project cost in this sector, which is to be disbursed by 2025, is estimated at about 67.8 billion pesos. Of this total project cost, about 98% or 665.5 billion pesos is to be used for development and operation/maintenance of the national irrigation system being financed from the “National Government Fund for Agriculture and Fisheries Modernization Program,” which is allocated to NIA. In addition to the Fund, the “Irrigation Service Fee” (ISF) is to be used as part of the

operation and maintenance for the existing irrigation facilities. However, the actual budget for Region III allotted from the ISF in the recent five (5) years from 2004 to 2008 is in the range of 51.3 to 64.2 million pesos only, which could hardly make a substantial contribution to the allotment for the necessary project cost.

Aside from the above budget of NIA, the following projects are to be financed from the national budget of the Department of Agriculture and/or the local government budget:

- Projects for the development of small scale irrigation system (the project codes of AI-G-08, AIP-11 and AI-C-01): The investment cost for these projects is estimated at about 811 million pesos, which is to be financed from the budget of DA-BSWM and the LGUs.
- Projects for inland fishery development (the project codes of AF-G-01 to 04): The investment cost for these projects is estimated at 450 million pesos in total which is to be financed from the budget of DA-BFAR.

Table 11.3.4 Project Investment Cost for Agriculture, Irrigation and Fishery Development

(Unit: million pesos)

Object*	Principal Entities for Financing	Short-Term		Mid-Term		Long-Term		Total	
1	NIA	21,545	97.2%	25,714	98.3%	19,268	99.0%	66,527	98.1%
2	DA and LGUs,	469	2.1%	300	1.1%	43	0.2%	811	1.2%
3	DA	150	0.7%	150	0.6%	150	0.8%	450	0.7%
Total		22,163	100.0%	26,164	100.0%	19,461	100.0%	67,788	100.0%

Note:
*: Object 1: Development and operation/maintenance for the large-scale irrigation systems and capacity development for agricultural development
Object 2: Development and operation/maintenance of small scale irrigation system
Object 3: Development of inland fishery

11.3.2 Development of Municipal Water Supply, Sanitation and Sewerage

The projects belonging to this sector would require the project investment cost of about 69.7 billion pesos in total as listed below:

Table 11.3.5 Project Investment Cost for Development of Municipal Water Supply, Sanitation and Sewerage

(Unit: million pesos)

Object*	Principal Entities for Financing	Short-term		Mid-term		Long-term		Total	
1	WD	3,793	13.0%	3,610	40.2%	3,722	11.8%	11,127	16.0%
2	Public Corporation/ Private Firm**	0	0.0%	255	2.8%	255	0.8%	510	0.7%
3		13,111	45.0%	1,176	13.1%	23,661	74.9%	37,948	54.4%
4		5,562	19.1%	0	0.0%	0	0.0%	5,562	8.0%
5	LGU	519	1.8%	304	3.4%	267	0.8%	1,090	1.6%
6		5,507	18.9%	3,635	40.5%	3,704	11.7%	12,846	18.4%
7		645	2.2%	0	0.0%	0	0.0%	645	0.9%
Total		22,163	29,137	100%	8,980	100%	31,609	100%	69,726

Note:
*: Object 1: Expansion of Level 3 and 2 municipal water supply systems
Object 2: Construction/provision of sewage treatment and disposal facilities
Object 3: Development of bulk water supply system
Object 4: Strengthening of Water Supply Capacity of Angat-Umiray System
Object 5: Expansion of Level 1 municipal water supply system
Object 6: Construction/provision of sanitary toilets
Object 7: Development of Sewerage System
**: MWSS and private firms such as Manila Water Company Inc. (MWCI) and Maynilad Water Service Incorporated (MWSI)

The project investment cost for Objects 4 and 7 shown in the above Table 11.3.5 have been secured by the public water service corporations such as MWSS and Clark Water as well the local government of Cabanatuan City. Moreover, the project investment cost for Objects 5 and 6 could be allotted by the budget of the LGUs. Thus, the available financial sources for the project investment of the Objects 4

to 7 could be foreseeable. On the other hand, the budgeting process of the project investment cost for Objects 1 to 3 has to be newly clarified.

The project investment for Objects 1 to 3 is subject to "full cost recovery" both for the initial construction cost and the annual O&M cost for the project facilities. That is, the WDs and/or the public water service corporations such as MWSS and CDC as the project implementing bodies should secure the necessary initial construction cost of the facilities and recover the initial cost as well as the annual O&M cost of the facilities by collecting fees for the use of facilities from the water users.

In order to clarify the availability of the above "full cost recovery," the project investment costs for the above Objects 1 to 3 are converted to unit costs per served water volume and compared with the current prevailing water tariff. The results of the conversion are as listed in Table 11.3.6 and the detailed clarification on the "full cost recovery "is as described in the following items (1) to (3).

Table 11.3.6 Conversion of Project Investment Cost to Unit Cost

Object*	Initial Investment Cost (million pesos)	Annualized Cost (million pesos/year)			Annual Water Consumption (mil. m^3/year)	Unit Cost (peso/m^3)
		Annualized Initial Investment Cost**	Annual O&M Cost	Total		
1	11,130	1,137.5	1,030.8	2,168.4	103.1	21.0
2	510	104.8	355.0	459.8	110.5***	4.2
3	37,948	3,880.4	379.7	4,260.1	225.9	18.9

Note:

*: Object 1: Expansion of Level 3 and 2 municipal water supply system
Object 2: Construction/provision of sewage treatment and disposal facilities
Object 3: Development of bulk water supply system

**: The initial investment cost is converted to the annualized cost based on the following assumptions:

- Project life is assumed at 50 years for Object 1 and 3, while it is assumed at 7 years for Object 2.
- The time interval for the replacement of facilities is assumed at 25 years for Object 1 and 3, while it is assumed at 7 years for Object 2.
- The annual discount rate is assumed at 10%.

***: The figure is estimated on the premises of volume of water consumption for Level 3 water supply system.

(1) Expansion of Level 3, 2 Municipal Water Supply System

As described in item (1) in Subsection 11.4.1, the "expansion of Level 3, 2 and 1 municipal water supply system toward 2025" is raised as one of the development scenarios for improving the water supply quality and securing the necessary water supply volume.

Expansion of the Level 1 water supply system is to be financed by the LGUs and it is not subject to full cost recovery as described above. On the other hand, the necessary investment cost for expansion of Level 3 and 2 water supply systems is to be secured and recovered by the WDs. That is, WDs should secure the initial investment cost from their own budget or loan from LWUA, and recover it by collecting of water service fees from the water users.

Out of 76 WDs in the study area, 13 WDs are expected to secure the necessary initial investment cost from their own budgets judging from the classification of WDs by LWUA (refer to Subsection D.6.3.1 in *Supporting Report D*). On the other hand, the remaining 63 WDs would need to have a loan from LWUA to secure the initial investment cost.

As shown in Table 11.3.6, the total initial investment cost is 11.1 billion pesos, and 6.1 billion pesos of it could be assumed as the necessary amount of loan from LWUA to the above 63 WDs. This amount of 6.1 billion pesos is disbursed for a 15-year period from 2011 to 2015, and therefore, the annual average disbursement is estimated at 0.41 billion pesos/year.

The future available annual loan by LWUA is estimated at about 4.8 billion pesos/year (refer to Subsection D.6.3.1 in *Supporting Report D*). Judging from the available loan amount by LWUA, the above annual average disbursement of 0.41 million pesos/year is judged to be secured.

As shown in Table 11.3.6, the unit cost for the initial investment and the O&M for expansion of Level 3 and 2 municipal water supply systems is estimated at about 21 pesos/m^3. On the other hand, the water tariff for service of Level 3 and 2 municipal water supply systems is in the range of 16 to 21 pesos/m^3. Judging from the unit cost for project investment and the current water tariff for service, the project investment could be fully recovered by the water tariff without a large increment in the water tariff.

(2) Construction/Provision of Sewage Treatment and Disposal Facilities

As described in item (2) in Subsection 11.4.2 mentioned below, one of the development scenarios is oriented to the construction/provision of e sewage treatment and disposal facilities, which shall cover about 80% of the households in the urban area of the principal ten (10) cities/municipalities by 2025. In this study, it is proposed that this project is to be implemented by WDs, and its investment cost is to be fully recovered in the following manners:

- As shown in Table 11.3.6, the necessary project investment cost is estimated at 4.2 pesos/m^3 based on the assumed water consumption volume of Level 3 water supply system. In order to recover the said project investment cost, it is proposed that the investment cost of 4.2 pesos/m^3 shall be surcharged to the above water tariff for the Level 3 and 2 water supply services.
- The above surcharge cost is called “Environmental Fee” as suggested in “the business model for development of sewage treatment and disposal facilities by WDs” which MWSS has been applying since 2008.

(3) Development of Bulk Water Supply System

As described in item (2) in Subsection 11.4.1 as mentioned below, development of the bulk water supply system is proposed for Bulacan Province, Pampanga Province and Metro Clark area in particular. The project investment cost for development of the bulk water supply system is to be recovered through the following manner:

- The public water service corporations such as MWSS as well as the relevant private firms would be the implementing body for development of the bulk water supply system. The initial investment cost for the development is estimated at 37.9 billion pesos in total as shown in Table 11.3.6. The budgetary capacity of these implementing bodies would be able to secure the said necessary initial investment cost judging from their previous business profiles.
- As shown in Table 11.3.6, the sum of the initial investment cost and the annual O&M cost for development of the bulk water supply system could be equivalent to about 19 pesos per unit m^3 of water consumption. In addition, the cost of about 21 pesos/m^3 for expansion of Level 3 and 2 water supply systems is required as a part of the bulk water supply service. Accordingly, the investment cost of about 40 pesos/m^3 in total is required for the service of the bulk water supply system.
- Bulk water services have been already introduced to Meycauayan WD and Obando WD in Bulacan Province. The present water tariff for those service areas of the bulk water supply is around 42 pesos/m^3, which is almost equal to the above necessary investment cost (i.e., 40 pesos/m^3).
- Compared to the necessary investment cost with the present water tariff for bulk water supply services, the investment cost could be fully recovered by the water tariff. The water tariff of the bulk water service is far higher than the water tariff of municipal water service without the bulk water supply. The water users may accept such high water tariff, because of the safe and stable water supply promised by the bulk water supply system.

11.3.3 Management of Flood and Sediment Disasters

The initial project investment cost in this sector is estimated at 15.8 billion pesos. Of this total initial investment cost, about 70% or 10.9 billion pesos is to be financed from the national government budget allocated to DPWH. The projects other than those by DPWH are: (a) operation, maintenance and improvement of the small scale flood control and drainage systems, which are to be financed by the LGUs; and (b) development of the flood forecasting and warning systems, which is to be financed by the budget of LGUs and PAGASA.

Table 11.3.7 Project Investment Cost for Management of Flood and Sediment Disasters

(unit: million pesos)

Object*	Principal Entities for Financing	Short-term		Mid-term		Long-term		Total	
1	DPWH	5,121	79.6%	5,594	84.8%	227	8.3%	10,942	69.4%
2	LGUs	1,008	15.7%	1,000	15.2%	2,500	91.6%	4,508	28.6%
3	Others	302	4.7%	3	0.0%	3	0.1%	308	2.0%
Total		6,431	100.0%	6,597	100.0%	2,730	100.0%	15,758	100.0%

Note:

*: Object 1: Development and O&M of the large-scale flood control facilities, maintenance of the major river channels/river facilities and capacity building on management of flood and sediment disasters.

Object 2: Establishment of community-based flood forecasting, warning and evacuation system, and operation, maintenance and improvement of the small-scale flood control and drainage facilities, which are under the jurisdiction of LGUs.

Object 3: Capacity development on dam reservoir operation to flood, etc.

DPWH undertakes the following five (5) projects for management of flood and sediment disasters for Pasac river system and Pampanga river system. Of these projects, the project of FL-G-02 is currently in progress, and a substantial part for its necessary budget has already been arranged. Moreover, the budgetary arrangement for the ongoing two (2) projects for Pasac river system (i.e., the projects of FL-G-01 and FlL-G-02) also have been made, and the proposed projects for Pasac river system (i.e., L-P-01) is now being made on the premises of foreign financial assistance. On the other hand, the project for Pampanga river system (i.e., FL-C-01) is left behind since Phase I of the project was completed at a reduced scale in 2002, and budgetary arrangement for the project is being required.

Table 11.3.8 Projects by DPWH for Management of Flood and Sediment Disasters

Project Code	Name of Project	Investment Cost (million pesos)
FL-G-03	Maintenance and Rehabilitation Works for River Dike and Slope	679
FL-G-01	Pinatubo Hazard Urgent Project (PHUMP) Phase III, Part I	470
FL-G-02	Pinatubo Hazard Urgent Project (PHUMP) Phase III, Part II	5
FL-P-01	Flood Control Measures in Mt. Pinatubo Devastated Area - Focus on Pasac Delta	4,320
FL-C-01	Flood Mitigation for Pampanga Delta	5,468
Total		10,942

The national government budget allotted to DPWH includes those for: (1) Programs (for line operations); (2) Projects (for implementation of the locally funded and foreign-assisted projects); and (3) others (for interest payment, etc). The operation and maintenance of flood control facilities and/or the river channels is basically financed from the budget for the above Programs for line operation. However, the national total budget financed from the Programs for O&M of flood control facilities/river channels was limited to 2.9 billion pesos in 2009. This budget is likely to be quite inadequate and thereby, a part of the budget for the above Projects has to be used for O&M just like the case of the project of FL-G-03.

11.3.4 Watershed Management

The project investment cost of 3.6 billion pesos in total is to be disbursed during the 15-year period from 2011 to 2025 as shown in Table 11.3.9. Of the total investment cost, about 91% or 3.3 billion pesos are financed from the national budget of DENR and used for reforestation, agro-forestry, and hillside works in the upland and preservation of the forest.

Table 11.3.9 Project Investment Cost for Watershed management

(unit: million pesos)

Object*	Principal Entities for Financing	Short-term		Mid-term		Long-term		Total	
1	DENR	1,559	90.6%	1,509	95.0%	187	70.6%	3,255	91.1%
2	Others	162	9.4%	79	5.0%	78	29.4%	319	8.9%
Total		162	9.4%	79	5.0%	78	29.4%	319	8.9%

Note:

*: Object 1: Reforestation, agro-forestry, hillside works in the upland and preservation of the forest in the classified forest land.

Object 2: .Preservation of forest in the watershed of the dam reservoir and urban greening

Out of the said total investment cost of 3.6 billion pesos, about 46.5% or 1.7 billion pesos is disbursed for the ongoing projects, and therefore, it could be secured provided that the present annual budget allotted to the projects are sustained until 2025. The remaining budget of 1.9 billion pesos (53% of the total investment cost) is for the conceptual project, and need to be secured from new financial sources which may require the foreign financial assistance and/or private investment through BOT.

11.3.5 Water-Related Environmental Management

The project investment cost of about 3.7 billion pesos in total is to be disbursed during the 15-year period from 2011 to 2025 as shown in Table 11.3.10. Out of the total investment cost about 53% or 2.0 billion pesos is for the construction and operation of solid waste management facilities for Nueva Ecija, Bulacan and Pampanga provinces, which are to be undertaken through the project of WQ-C-04. In order to attain the said solid waste management, Nueva Ecija Province has already arranged the necessary budget for the construction of five (5) sanitary landfills and their support facilities. As for Bulacan and Pampanga provinces, however, no definite budgetary arrangement for the solid waste management has been made and it remains as the future task. In order to minimize the budget for solid waste management for the two provinces, the proposed project works for the provinces are limited to construction and O&M of the transfer stations, assuming usage of the existing two (2) sanitary landfills located in Tarlac and Bulacan provinces.

The Clean Development Mechanism Program (CDM) projects would require the second largest investment cost of about 1.0 billion pesos next to the above solid waste management. This investment cost would be shouldered by the private firms and NGOs. Other project works, such as establishment of water quality monitoring system, capacity building and IEC relevant to the water-related environmental management would be financed by the national government budget allotted to DENR, the budget of the LGUs and the private investments.

Table 11.3.10 Project Investment Cost for Water-Related Environment Management

(unit: million pesos)

Object*	Principal Entities for Financing	Short-term		Mid-term		Long-term		Total	
1	LGUs	109	21.4%	99	1.2%	99	100.0%	307	3.6%
2	Private Firm	300	58.9%	0	0.0%	0	0.0%	300	3.5%
3	DENR and Others	100	19.6%	7,866	98.8%	0	0.0%	7,966	92.9%
Total		509	100.0%	7,965	100.0%	99	100.0%	8,573	100.0%

Note:

*: Object 1: Solid water management, Object 2: CDM programs, Object 3: Establishment of water quality monitoring system and capacity building/IEC on water-related environment management.

11.3.6 Inter-Sector Water Resources Development, Allocation and Distribution

The project investment cost of about 8.6 billion pesos in total is to be disbursed during the 15-year period from 2011 to 2025 as shown in Table 11.3.11. Out of the total investment cost about 93% or 8.0 billion pesos is for the project for recovery of reliability of water supply capacity of the existing Angat-Umiray System (Project of IS-C-02). The feasibility study for this project needs to be firstly undertaken by NWRB to clarify the necessary project components, which would include the new water resources development, and the organization setup for implementation of the project. Moreover, it would be necessary to clarify the possible financial sources and their shares for allotment.

The possible financial sources would include the national government fund by NWRB, NIA, NPC, the LGU's fund by Bulacan Province, the corporation/private fund by MWSS and its relevant MWCI and MWSI, and other private funds collected through BOT.

Table 11.3.11 Project Investment Cost for Inter-Sector Water Resources Development, Allocation and Distribution

(unit: million pesos)

Object*	Principal Entities for Financing	Short-term		Mid-term		Long-term		Total	
1	NWRB, Others**	100	19.6%	7,866	98.8%	0	0.0%	7,966	92.9%
2	NWRB	109	21.4%	99	1.2%	99	100.0%	307	3.6%
3	NWRB	300	58.9%	0	0.0%	0	0.0%	300	3.5%
Total		509	100.0%	7,965	100.0%	99	100.0%	8,573	100.0%

Note:
*: Object 1: Recovery of reliability of water supply of Angat-Umiray System
Object 2: Establishment of monitoring system for usage of surface water and groundwater
Object 3: Capacity building on water allocation and distribution

11.4 Development Scenarios

11.4.1 Development Scenarios for Group-A Projects

The target development scenarios for Group-A projects are proposed as described hereinafter.

(1) Development Scenarios for Agriculture/Irrigation and Fishery Development

In order to enhance the sector goals of "rehabilitation and development of the irrigation system" and "sustainable fishery under integrated water resources management," the following two (2) development scenarios are proposed:

(a) Rehabilitation of Existing Irrigation Facilities

The development scenario is oriented to the improvement of agricultural productivities by sustaining the following seven (7) ongoing programs for rehabilitation and/or maintenance of the existing irrigation facilities throughout the short, mid and long-term:

- AI-G-03: Repair, Rehabilitation of Existing Groundwater Irrigation Systems, Establishment of Groundwater Pump Project
- AI-G-04: Balikatan Sagip-Patubig Program
- AI-G-05: Repair, Rehabilitation, Restoration & Preventive Maintenance of Existing National & Communal Irrigation Facilities
- AI-G-06: Restoration/Rehabilitation of Existing NIA-Assisted Irrigation System
- AI-G-08: Rehabilitation of Small Water Impounding Projects/Diversion Dams
- AI-G-09: Comprehensive Agrarian Reform Program, Irrigation Component

(b) Sustainable Fishery Production

The development scenario is oriented to sustainable fishery productivities by continuity of the following four (4) ongoing projects, which are being undertaken by BFAR, DA or LGU, throughout the short, mid and long-term:

- AF-G-01: Aquaculture Fisheries Development Programs
- AF-G-02: Comprehensive Regulatory Services
- AF-G-03: Support Projects and Activities
- AF-G-04: Fisheries Resources Management for Improved and Sustainable Harvest

(2) Development Scenarios for Municipal Water Supply, Sanitation and Sewerage

In order to achieve the sector goal of "improvement of water quality," "ensuring of necessary water supply capacity," and "reduce of pollution load," seven (7) development scenarios are proposed in the study. Moreover, in order to embody these development scenarios, the implementation of 17 projects is proposed. The details of these development scenarios and the projects to embody the development scenarios are as described hereinafter.

(a) Short-Term Development of Bulk Water Supply System for Bulacan Province

The groundwater in Bulacan Province is currently used as the principal source for municipal water supply in the province. However, the supply capacity by the groundwater is judged to have reached the critical level causing the land subsidence as well as the serious sanitary intrusion to the groundwater. Hence, a development scenario on the "MW-P-03: Bulacan Treated Water Supply Project", which is most likely to use the surface water as the source, is proposed. This bulk water supply system shall be completed by 2015 to promise the water supply capacity of 2.7m^3/s, which can cover the municipal water demand of about one million residents.

(b) Strengthening of Water Supply Capacity of Angat-Umiray System

The Angat-Umiray System is the principal water supply source for the municipal water in Metro Manila and the irrigation water in AMRIS. However, the updated water demand for the municipal and irrigation use exceed far over the water supply capacity of Angat-Umiray System. As the result, a serious water shortage occurs in almost every two years.

Taking the potential water shortage into account, the development scenario is oriented to strengthening of the water supply capacity of Angat-Umiray System. In order to attain the development scenario, the following three (3) projects are scheduled to be urgently completed within the short-term:

- MW-G-01: Angat Water Utilization and Aquaduct Improvement Project (AWUAIP), Phase II;
- MW-P-01: Rehabilitation of Umiray-Macua Facilities; and
- MW-P-02: Sumag River Diversion Project.

The above urgent reinforcement of the existing Angat-Umiray System could still hardly attain the full supply level of the system for its present relevant water demand. Hence, The Project of "IS-C-02: Project for Recovery of Reliability of Water Supply System in Angat-Umiray System" is scheduled in the short-term and mid-term. The Project could drastically boost up the reliability of the Angat-Umiray System and promise the municipal water supply for Metro Manila with a design safety level of 10-year return period and the irrigation water supply for AMRIS with a design safety level of 5-year return period by 2020.

(c) Expansion of Level 3, 2 and 1 Municipal Water Supply

The following development scenarios on the step-wise expansion of the Level 3 , 2 and 1 municipal water supply systems in the study area is proposed in order to improve the water supply quality and at the same time to ensure the necessary water supply capacity:

- The coverage of Level 3, 2, 1 water supply systems with safe drinking water supply shall reach 100% by 2025.
- The coverage ratios of the Level 3 Water Supply System in the urban area shall increase by 1% per annum by 2015, and the average ratio in the whole urban areas of the study area shall reach 80% by 2025. At the same time, the lowest

coverage ratio of the Level 3 System in the urban areas shall not be below 46.5%[2] in 2025 so as to avoid the extremely uneven distribution of the System.

- The present average coverage ratio of Level 3 Water Supply System in the rural area shall be maintained until 2025, notwithstanding the future increment of population. The target coverage ratio of Level 3 in the rural area is 18% in average for the whole study area.

In order to attain the above development scenario, implementation of the following four (4) projects throughout the period from 2011 up to 2025 is proposed:

- MW-C-1: Additional Level 3, 2 and 1 Facilities towards 2025 in Bulacan
- MW-C-2: Additional Level 3, 2 and 1 Facilities towards 2025 in Pampanga
- MW-C-3: Additional Level 3, 2 and 1 Facilities towards 2025 in Nueva Ecija
- MW-C-4: Additional Level 3, 2 and 1 Facilities towards 2025 in Tarlac

(d) Construction/Provision of Sanitary Toilets

In order to reduce the pollution load in the study area, which could make an indirect contribution to secure the safe drinking water from the groundwater source, the following development scenario is proposed:

- The rate of construction/provision of sanitary toilets in all municipalities and cities shall increase at the rate of 10% per annum by 2015; and
- All households in the study area shall be provided with sanitary toilets by 2025[3].

In order to attain the development scenario, implementation of the following four (4) projects is proposed:

- MS-C-1: Additional Sanitary Facilities towards 2025 in Bulacan;
- MS-C-2: Additional Sanitary Facilities towards 2025 in Pampanga;
- MS-C-3: Additional Sanitary Facilities towards 2025 in Nueva Ecija; and
- MS-C-4: Additional Sanitary Facilities towards 2025 in Tarlac.

(e) Development of Bulk Water Supply System for Metro Clark

In order to cope with the increment of municipal water use in Metro Clark, the development scenario is oriented to gradual expansion of the bulk water supply system with the full supply capacity of $0.8m^3/s$ toward 2025. In order to attain the development scenario, "MW-P04; Metro Clark Bulk Surface Water Project" is proposed.

(f) Long Term Development of Bulk Water Supply System for Bulacan and Pampanga Provinces

In order to serve the incremental provincial population and cope with the deterioration of groundwater quality, proposed is the development scenario in which the bulk water supply system with the supply capacity of additional $3.8m^3/s$ for Bulacan and $1.3m^3/s$ for Pampanga Province shall be developed by 2025. The projects to embody the bulk water supply are as listed below:

- MW-C-05: Extended Bulacan Bulk Water Supply Project; and
- MW-C-06: Pampanga Bulk Water Supply Project.

---

[2] The boundary of 46.5% for the lowest coverage ratio is derived from the future expected incremental rates of 17% for a period of 17 years (from 2008 to 2025) added to half of the present average coverage ratio as of 2008 (= 29.5%).

[3] The target year is set at 2025, because the main purpose of construction/provision of sanitary toilets is to secure the access to safe drinking water for all by 2025, which is stated in the Philippine Water Sector Roadmap.

(3) Development Scenarios for Management of Flood and Sediment Disasters

In order to contribute to the mitigation of chronic flood damage and the improvement of knowledge on flood management, the following development scenarios are proposed:

(a) Sustainment of Regular Program of Maintenance and Rehabilitation of River Dike and Slope

Most of the existing river dikes, levees, river slope protection and other river structures in Pampanga and Pasac river basins are seriously deteriorated at present. In order to cope with such degradation of the river structures as well as river channels, the development scenario is oriented to sustainment of maintenance and rehabilitation of river dikes and slopes. The development scenario shall be embodied through the proposed project of "FL-G-03: Maintenance and Rehabilitation Works for River Dike and Slope." The project started in 2008 and it is proposed to continue as the yearly regular program toward 2025.

(b) Sustainment of Regular Program for Maintenance and Rehabilitation of Drainage and Flood Control facilities

In order to cope with the deterioration of urban drainage facilities under the jurisdiction of LGUs, the development scenario is proposed. In order to embody the development scenario, the project of "FL-C-03: Maintenance, Rehabilitation and Improvement for Drainage and Flood Control facilities under jurisdiction of LGUs" shall be sustained as the yearly regular program toward 2025.

(c) Improvement of Public Awareness

In order to improve public awareness on the management of flood and sediment disasters, proposed is the development scenario which is oriented to the inclusion of salient points of knowledge on the management of flood and other principal issues of IWRM into the curricula of primary and secondary schools. In order to attain the development scenario, the project of "FL-C-04; Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula" shall be implemented throughout the short, mid and long-term.

(4) Development Scenarios for Watershed Management

The following development scenarios are proposed to attain the sector goals of: "intensifying of management, protection and maintenance of vulnerable and ecologically sensitive area" and "increase of forest cover of critically denuded uplands, mangrove areas and urban corridors:"

(a) Sustainment of the On-going Regular Program of Watershed Management

The development scenario is oriented to sustaining the following ongoing nine (9) regular programs of watershed management in Pampanga river basin until 2025. Through execution of the projects, it is expected that the present forest cover of 187,500 ha would expand by about 10,000ha at the rate of 660 ha per annum by 2025.

- WS-G-01: Forest Protection and Law Enforcement Program (FPLEP)
- WS-G-02: Community-Based Forest Management Program
- WS-G-04: Coastal Resource Management Program (CRMP)
- WS-G-05: Protected Area Community-Based Resource Management Program (CBFM-PACBRMA)
- WS-G-06: Private Forest Plantation Development Program (PFPDP)
- WS-G-07: NIA-UPRIIS' Watershed Management Program
- WS-G-08: NPC's Watershed Management Program

- WS-G-09: Integrated Social Forestry (ISF) Projects

(5) Development Scenarios for Water-Related Environment Management

The following development scenarios are proposed to enhance the sector goals for the reduction of pollution load:

(a) Dealing with Contamination of Surface, Ground and Coastal Water

The pollution load from various sources shall be reduced by sustaining the following three (3) ongoing non-structural measures, which are the regular programs by DENR and LGUs:

- WQ-G-01: Ecological Solid Waste Management Program (ESWMP)
- WQ-G-02: Industrial Pollution Control Program (IPCP)
- WQ-G-03: Sagip-Ilog Project

(b) Reduction of Risk of Contamination in Water Body

By 2025, the following two (2) structural measures shall be implemented to reduce the risk of contamination from livestock, domestic and industrial wastes:

- WQ-P-01: Clean Development Mechanism Projects
- WQ-C-04: Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan and Pampanga

11.4.2 Development Scenarios for Group-B Projects

The phased implementation schedule for 41 Group-B projects is proposed as described in the Subsection 11.2.2. Hence, the development scenarios are conceived as the consequences of the proposed implementation schedule (refer to Annex-T 11.2.8). The detailed development scenarios are as described hereinafter.

(1) Development Scenarios for Agriculture, Irrigation and Fishery Development

The following four (4) development scenarios are expected through implementation of a total of 18 projects in the short-term, the mid-term and the long-term. The development scenarios would enhance the sector goals of: (a) Improvement of the irrigation system; and (b) enhancement of new agricultural technologies on water management, in particular.

(a) Improvement of Irrigation Technologies

As the consequence of implementation of the following three (3) projects, innovative irrigation technologies shall be developed and the capacity building on usage of the technologies shall be made so as to increase the irrigation efficiency and save irrigation water by 2015:

- AI-P-07: Appropriate Irrigation Technologies for Enhanced Agricultural Production
- AI-C-02: Introduction of Water Saving Irrigation Technology
- AI-C-03: Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs

(b) Short-Term Development of Infrastructures for Irrigation

Agricultural productivity shall be increased through the following seven (7) irrigation development projects, which contribute to the beneficial area (newly developed) of 5,880ha, the beneficial area (rehabilitated) of 37,046 ha and beneficiaries of 56,640 farm-families in total, by 2015.

- AI-G-01: Balog-Balog Multipurpose Project, Phase I

- AI-G-02: Along-along Creek Irrigation Project (UPRIIS Div 3)
- AI-G-10: Upper Tabuating SRIP
- AI-G-07: Participatory Irrigation Development Project
- AI-P-10: Rehabilitation of AMRIS
- AI-P-03: Sector Loan on Rehabilitation of Irrigation Facilities
- AI-P-11: Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects, Small Diversion Dam Projects

(c) Mid-Term Development of Infrastructures for Irrigation

The agricultural projects shall be increased through the following seven (7) irrigation development projects, which would contribute to the beneficial area (newly developed) of 58,443 ha, the beneficial area (rehabilitated) of 50,904 ha and beneficiaries of 101,893 farm-families in total by 2020:

- AI-P-02: Balog-Balog Multipurpose Project, Phase II
- AI-P-04: Casecnan Multipurpose Irrigation and Power Project Irrigation Component, Phase 2
- AI-C-01: Construction of New Small Scale Irrigation Project under BSWM
- AI-P-08: Central Luzon Groundwater Irrigation Systems Reactivation Project
- AI-P-06: Irrigation Water Resources Augmentation Pump Establishment Project
- AI-P-05: Procurement of Pumps, Drilling Rigs and Related Equipment

(d) Long-Term Development of Infrastructures for Irrigation

The agricultural projects shall be increased through the following two (2) projects, which contribute to beneficial area (newly developed) of 31,199 ha and beneficiaries of 9,152 farm-families by 2025:

- AI-P-01: Balintingon Reservoir Multipurpose Project (BRMP)
- AI-P-09: Gumain Reservoir Project

(2) Development Scenarios for Municipal Water Supply, Sanitation and Sewerage

The following two (2) development scenarios are expected as the consequence of implementation of three (3) projects. The development scenarios would enhance the sector goal of "reduce the pollution load", in particular.

(a) Development of Sewerage Systems

The following two (2) on-going projects for development of the sewerage systems shall be completed by 2015. Upon completion of the projects, about 12% of the population in Cabanatuan City and 100% in Clark would be served by the public sewerage system.

- MP-G-01: Cabanatuan Sewerage System
- MP-G-02: Expansion of Clark Sewerage System

(b) Construction/Provision of Septage Treatment and Disposal Facilities

The services of the septage treatment and disposal facilities shall be provided through the project of "MP-C-01: Septage Treatment and Disposal Facility" to about 80% of the urban area in the following ten cities/municipalities by 2025[4]: (1) Angeles,

[4] The target year has been set at 2025 referring the output from 4th stakeholder meetings, although the target water quality of Manila Bay by DENR is to be Class SB category by 2020.

(2) San Fernando, (3) Guagua, (4) Mabalacat, (5) Baliuag, (6) Calumpit, (7) Hagonoy, (8) Malolos, (9) Cabanatuan, and (10) Tarlac.

(3) Development Scenarios for Management of Flood and Sediment Disasters

The five (5) development scenarios in the sector are to be achieved through the implementation of seven (7) projects.

(a) Flood Mitigation for Pasac River Basin (Eastern Pinatubo Area)

The following on-going and proposed flood mitigation projects for Pasac river basin shall be completed by 2015. Upon completion of the projects, the chronic flood damage in the area of about 57,300 ha would be mitigated, and about 309,000 people would be benefitted.

- FL-G-01: Pinatubo Hazard Urgent Project (PHUMP), Phase III, Part I
- FL-G-02: Pinatubo Hazard Urgent Project (PHUMP), Phase III, Part II
- FL-P-01: Flood Control Measures in Mt. Pinatubo Devastated Area - Focus on Pasac Delta

(b) Flood Mitigation for Pampanga Delta

The chronic flood damage in Pampanga Delta shall be mitigated through implementation of the project of "FL-C-01: Flood Mitigation for Pampanga Delta" by 2020. Upon completion of the project, the potential flood inundation area of about 32,400 ha would be mitigated, and about 175,000 people would be benefitted.

(c) Capacity Building on the Appropriate Dam Reservoir Operation against Flood

The capacity building on the appropriate reservoir operation against flood for Pantabangan Dam and Angat Dam shall be completed through the technical cooperation with JICA by 2015. This technical cooperation is currently being undertaken under the on-going project of "FL-G-04 Flood Forecasting and Warning System Capacity Building Project upon Dam Release in the Philippines."

(d) Establishment of Community-Based Flood Forecasting and Warning System for the Provinces of Pampanga, Tarlac and Nueva Ecija

Bulacan Province had established a community-based flood forecasting and waning system in 2005. Succeeding Bulacan Province, the other three (3) provinces in the study area, Pampanga, Tarlac and Nueva Ecija, shall be provided with the community-based flood forecasting and waning system by 2015.

(e) Flood Mitigation for Bacolor Municipality

The Project of "FL-P-02: Bacolor Comprehensive Rehabilitation Master Plan" shall be implemented by 2025. Upon completion of the Project, the flood damage potential in the area of about 107,500 ha in Bacolor Municipality in Pampanga Province would be mitigated.

(4) Development Scenarios for Watershed Management

The following development scenario shall be achieved to attain the sector goals of: "intensifying of management, protection and maintenance of vulnerable and ecologically sensitive area" and "increase of forest cover of critically denuded uplands, mangrove areas and urban corridors:"

(a) Strengthening of the On-going Reforestation Efforts

The following seven (7) special projects shall be implemented in order to strengthen the on-going reforestation efforts. Upon completion of the projects, the forest cover shall expand by 39,900 ha.

- WS-G-03: Integrated Agro-Forestry Development Program (CBFM-CARP)
- WS-G-11: Forestlands Management Project (FMP)
- WS-G-12: Pampanga River Basin Rehabilitation Project (PRBRP)
- WS-C-01: Upland Development Program (UDP)
- WS-C-02: Protected Area Management Program (PAMP)
- WS-C-03: Urban Greening Program
- WS-C-04: Community-Based Eco-Tourism Program

(5) Development Scenarios for Water-Related Environment Management

The following development scenarios shall be achieved to attain the sector goals of "strengthening of the water quality monitoring" and "reduce of pollution loads:"

(a) Improvement of Monitoring and Processing System for Water Quality Data

By 2015, DENR shall improve the monitoring and processing system for the water quality data through implementation of the project of "WQ-C-01 Capacity Development to Upgrade WQ Monitoring and Data Management Program."

(b) Capacity Development to Reduce Pollution Load

By 2020, the capability of fishpond operators and non-compliant industries shall be improved through implementation of the following two (2) projects over the mid-term towards adopting cleaner production options in order to reduce their impacts on water quality:

- WQ-C-02: Capacity Development to Improve Water Quality and Aquaculture Fisheries Management
- WQ-C-03: Capacity Development Project to Improve Industry Adoption of Cleaner Production Options

(6) Development Scenarios for Inter-Sector Water Resources Development, Allocation and Distribution

The following two (2) development scenarios shall be achieved in order to strengthen the monitoring system on water resources and make capacity development on water allocation and distribution:

(a) Enhancement of Monitoring of Groundwater and Surface Water

By 2025, the monitoring of groundwater and surface water shall be enhanced through implementation of the following two (2) projects in order to comprehend the actual status of water resources in Pampanga river basin:

- IS-C-01: Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin
- IS-C-03: Enhancement of Monitoring System for Surface Water in Pampanga River

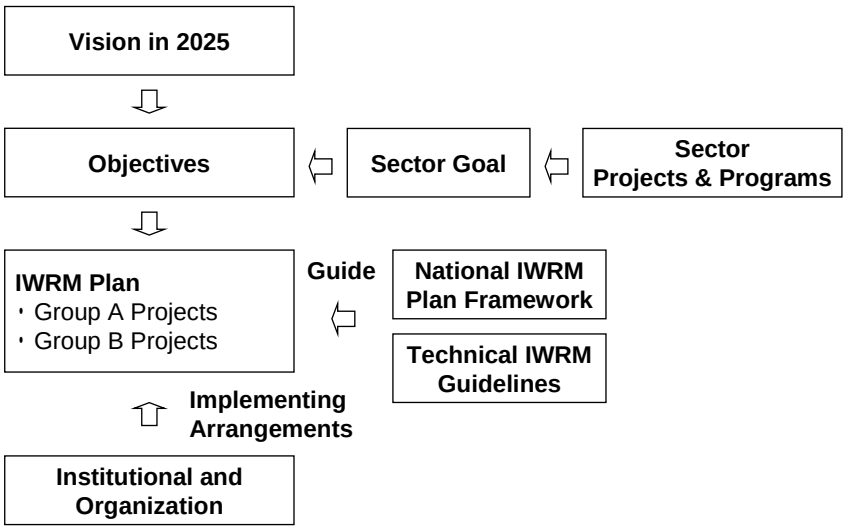
(b) Capacity Development on Water Allocation and Distribution

By 2015, the appropriate methodologies on water allocation and distribution for municipal water use, irrigation, hydropower generation and other various water uses shall be introduced to NWRB and other relevant agencies through implementation of the project of "IS-C-04: Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution."

Chapter 12. Proposed Institutional Setup for IWRM

12.1 Study Framework

The role of the institutional setup is at the position of implementing arrangements to localize and implement the IWRM Plan as illustrated in Figure 12.1.1.



Source: JICA Study Team

Figure 12.1.1 Role of Institutional Setup

The IWRM Plan would neither be implemented by amendment of the existing laws only nor capacity strengthening of the existing organizations only. The key actions are structurally reviewed from the three basic aspects, i.e., the legal aspect, the organizational aspect, and the financial aspect. Three aspects of actions are the basic elements to empower implementing functions, and thus those are to be executed simultaneously. Section 12.2 deals on alternative key actions for the respective strategic issues defined in Section 6.8 at first. Sections 12.3 to 12.5 integrate the key actions from the three aspects respectively.

12.2 Strategic Issues and Key Actions

12.2.1 Basic Aspects of Actions

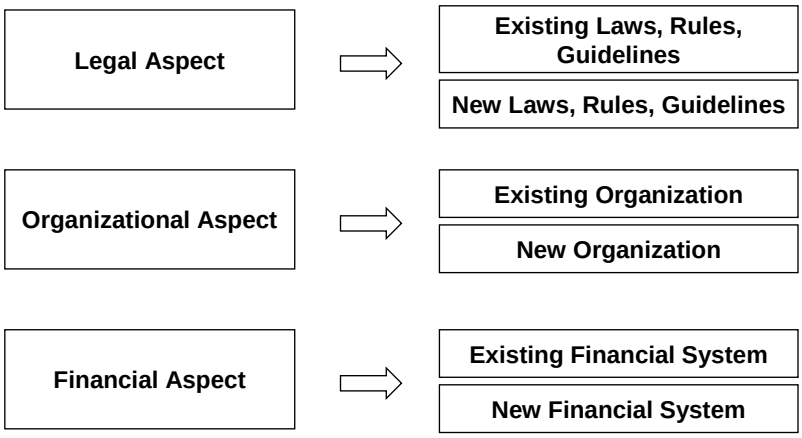
The three basic aspects of actions are defined as follows:

i. Legal Aspect: Amendment of related laws (the Water Code, the Local Government Code, etc.), regulation, rules, standards, guidelines;

ii. Organizational Aspect: Capacity strengthening of the existing organizations (NGAs/RLAs, LGUs, etc.) and supplementing of missing functions to the existing ones; and

iii. Financial Aspect: Strengthening of financial capacity necessary to achieve a sustainable IWRM.

Key alternative actions are studied as countermeasures to empower the existing and new institutions and/or organizations from the three aspects as shown in Figure 12.2.1.



Source JICA Study Team

Figure 12.2.1 Empowerment Elements for Basic Aspects

12.2.2 Proposed Key Actions

This subsection presents the key actions (solutions) from the three aspects, if applicable. Prospective outcomes by the respective key actions are presented in Subsection 12.3 for the amendment of the Water Code and other related laws, rules and guidelines, Subsection 12.4.2 for the capacity strengthening of the National Government Agencies (NGAs) and LGUs, Subsection 12.4.3 for the capacity building of the missing functions for IWRM, and Subsection 12.5.2 for the strengthening of financial capacity.

(1) Strategic Issue 1: Strengthen Water Rights Regulation Capacity

(a) Amend Articles of Water Code

The articles of the Water Code subject to amendment or modification to resolve the issue are as set out below.

- Establish an effective period of the water permit at 5 to 10 years to allow the NWRB to review and enforce rational and efficient use of water (Art. 26 & 28);
- Establish a rule to force the concessionaire to take concrete water saving measures (Art. 29 & 30, IRR Section 22);
- Establish a penal rule to revoke the water permit if its concessionary executes no measure of efficient use other than act of violation (Art. 29 & 30);
- Provide an Article to let the Water Code prevail over the other law (the Grid Law) specifically for water rights regulation;
- Provide clear compensation rule for the loss of the priority concessionaire in time of emergency (Art. 22 & 23); and
- Modify the condition of water permit to specify concrete seasonal water use schedule including non-consumptive use instead of only the maximum rate of diversion or withdrawal (seasonal quantity and rate), (Art. 18).

(b) Key Actions

Issue 1 could not be resolved by the amendment of the Water Code alone. Appropriate combination of legal, organizational and financial strengthening of water resources management will be required as done in the advanced countries. The actions cover:

(i) Legal Aspect

- Amend the relevant article of the Water Code and its IRR;

- Establish a legal basis to make a water resources basin development plan (the Basin Plan) to execute quantitative management of daily and/or seasonal variation of regional water budget (balance) for Pampanga river basin and the strategic river;
- Link legally water rights and the Basin Plan; and
- Establish planning technical standards for the Basin Plan.

(ii) Organizational Aspect

- Establish NWRB owned reliable and accurate monitoring stations for discharge, ecological flow and water quality at key water conflict areas; and
- Strengthen the capacity of NWRB for monitoring and enforcing water rights.

(iii) Financial Aspect

- Strengthen the financial capacity of NWRB including annual water charge collection.

(2) Strategic Issue 2: Enhance Efficient Water Use and Reallocation of Water Rights

(a) Amend Article of Water Code

The articles of the Water Code subject to amendment to resolve the issue are as set out below.

- Provide articles to link the water permit and the basin water resources development plan (the Basin Plan) to enable short and long term quantitative water rights management with securing water supply reliability;
- Provide an article to establish relevant monitoring stations for transparent and equitable water rights regulation including daily discharge;
- Establish planning standards for the Basin Plan to secure safe bulk water supply to various water uses with a reliable risk; and
- Provide an article to enable reallocation of the present water rights title granted to the public entities such as NIA, MWSS and Bulacan Province to the water users such as irrigators and/or water supply companies.

(b) Key Actions

Issue 2 could not be resolved by the revision of the Water Code alone. Appropriate combination legal authority to strengthen water resources management will be required in line with Issue 1. The actions cover:

(i) Legal Aspect

- Amend relevant articles of the Water Code and its Implementing Rules and Regulations (IRR);
- The key actions for Issue 1 are to be implemented simultaneously;
- Clarify risk of water supply failure of the conflicting water rights to enhance water rights transfer and trading;
- Change the present constant annual water charge system for water permits into different water charges for different supply reliability and seasonal variation; i.e., high charge for high reliability, high season, and longer concession like in Australia;
- Establish reliable assurance and compensation rule for water transfer and trading; and

- Establish IRR and technical guidelines for water transfer and trading.

(3) Strategic Issue 3: Modify Overlapping Water Charge Systems

(a) Key Actions

Issue 3 might not be resolved by the revision of the related article of the Water Code or the Local Government Code alone. At present the public entities (NIA, MWSS, Bulacan Province) still hold the water rights granted before the privatization of NIA and water companies. MWSS re-granted the water permit to two company water users. Bulacan Province also has a plan to re-grant its water right to the water supply providers in the province in the future. NWRB and Bulacan Province are both government entities in spite of being national and local respectively. The water permit annual charge and the charge based on the share of the national wealth seem to be overlapping to the water users. However, the purpose of these charges is basically different. The former is a national charge on water rights while the latter is a kind of royalty to the natural resources. The LGUs are entitled to charge royalty from the beneficiary as a part of local revenue if necessary based on the LGC. The duplication issue originate partly from such a condition that the holder of water rights is still the government entity. If the water right of public entities is transferred totally to the water users, the charge by NWRB and the charge by LGUs as royalty would not be duplicated. The actions cover:

(i) Legal Aspect

- Review the overlapping provisions of the Local Government Code against those of the Water Code (Art. 3 and 6, IRR Section 8), etc;
- Provide an Article in the Water Code that will not allow duplicated layers of granting water permits to public entities; and
- The public entities that have water rights at present shall independently transfer their rights to the water users.

(4) Strategic Issue 4: Achieve Sustainability of Groundwater

(a) Key Actions

Issue 4 could not be resolved by the revision of the Water Code alone. Appropriate combination of legal and organizational strengthening will be required. The actions cover:

(i) Legal Aspect

- Modify IRR Section 46 (Requirement of Drilled Well), Item d;

(ii) Organizational Aspect

- Empower the groundwater monitoring and enforcing function of the LGUs from the regional interests; and
- Establish a regional monitoring system to monitor regional groundwater level collaborated with EMB and LGUs including quantity and quality.

(5) Strategic Issue 5: Introduce Specific Law to Enhance Multipurpose Dam Projects

(a) Key Actions

The actions to empower legal arrangements cover:

(i) Legal Aspect

- Establish a specific account for flood control reservoir capacity instead of incidental functions for multipurpose dams;

- Establish a specific law (or introduce cost allocation rule for multipurpose dams in the Water Code) to define an equitable cost allocation rule among public (in particular flood control) and private beneficiaries for multipurpose projects to reduce dam construction cost shared among water users; and
- Link the reservoir operation rule with the cost share of reservoir volume allocation and the flood control basin plan.

(6) Strategic Issue 6: Enforce Measures to Maintain Environmental Flow

(a) Key Actions

The necessary actions to empower legal arrangements cover:

(i) Legal Aspect

- Provide concrete standard, enforcement measures and penalty to law breakers in order to execute strict regulation under Art. 66, and IRR Section 47; and
- Set up an institution to enforce and monitor all concessionaires to comply with the requirement of minimum stream flows for rivers and minimum water levels for lakes to ensure environmental conservation.

(7) Strategic Issue 7: Strengthen Water Quality Monitoring and Management

(a) Present Water Code and Clean Water Act

Chapter VI (Art. 66 to 78), Conservation and Protection of Waters and Watershed and Related Land Resources, deals with water quality management, where pollutants are defined by the National Pollution Control Commission. The Clean Water Act governs comprehensive water quality framework. However, there is no specific regulation or standards on the density of water quality monitoring stations, responsibility of water users, functions of establishment, and operation and maintenance of water quality monitoring. In particular, there is no specific responsibility for the water users in Pampanga river basin to share the cost of water quality monitoring and management.

(b) Key Actions

To resolve Issue 7, appropriate combination of legal, organizational and financial strengthening will be required as done in the advanced countries. The actions cover:

(i) Legal Aspect

- Execute the key actions for strategic Issues 6 simultaneously; and
- Establish responsibility and role of water users on the water quality management in the basin;

(ii) Organizational Aspect

- Strengthen the capacity of RBCO, EMB, FMB and related LGUs to execute and enforce water quality management effectively; and
- Strengthen the water quality monitoring system.

(iii) Financial Aspect

- Increase the fund of DENR to set up monitoring stations and O&M of the monitoring systems; and
- Introduce the beneficiary's pay principle (BPP) for the cost of water quality management.

(8) Strategic Issue 8: Manage and Mitigate the Risk from Water-Related Disasters

(a) Key Actions

The necessary actions to empower institutional arrangements cover:

(i) Legal Aspect

- Prepare the flood control basin plan (FCBP) for the severe flood prone areas based on Art. 53. of the Water Code (promote, coordinate protection of flood plain lands, and flood plain management plan by the Secretary of DPWH);
- Establish the IRR and planning standards for the FCBP;
- Link legally the FCBP with the reservoir operation rule of the large dams concerned;
- Amend the IRR for the Right-of-Way of the public domain of river regime; and
- Reconfirm the definition of the responsibility for O&M of the flood control and river facilities after transfer of the facilities from DPWH to LGUs (MOA).

(9) Strategic Issue 9: Improve Watershed and Forest Management

(a) Key Actions

The necessary actions to empower organization cover:

(ii) Organizational Aspect

- Monitor the progress and outcomes of the ongoing capacity development of the development projects and programs for forest and watershed management;
- Conduct capacity assessment on the outcomes from the ongoing projects and programs; and
- Strengthen the execution capacity of the weak functions of FMB and LGUs still remaining based on the capacity assessment.

(10) Strategic Issue 10: Set up Authority to Implement the Pampanga River Basin IWRM

(a) Key Actions

The necessary actions to empower organization cover:

(ii) Organizational Aspect

- Clarify the necessary functions and missing functions in the existing organizations for IWRM implementation;
- Supplement the function to the national agency (NWRB, DENR) or RDC and execute capacity strengthening for monitoring and execution; and
- Set up an appropriate RBO for Pampanga river basin based on the regional consensus.

(11) Strategic Issue 11: Strengthen Execution and Financial Capacity for Sustainability

(a) Key Actions

The necessary actions to empower financial capacity cover:

(iii) Financial Aspect

- Increase the share of O&M budget for the river facilities in both LGUs and NGAs/RLAs (DPWH);
- Establish specific finances in LGUs for O&M; and

- Set up special accounts for sustainable IWRM in Pampanga river basin.

12.3 Outcomes by Amendment of Related Laws, Rules and Guidelines

12.3.1 Outcomes by Amendment of Water Code and Related Laws and Rules

The highlighted actions to amend the Water Code and other related laws and rules for Strategic Issue 1 to 4 and 6 to 8 are:

- To establish an effective period of water permit for review by NWRB;
- To provide clear compensation rule for the loss due to the priority concessionaire in time of emergency;
- To modify the condition of the amount of water permit to specify concrete seasonal water use schedule;
- To make a water resources basin development plan (the Basin Plan) for the strategic river basins and to link legally with the water rights;
- To enable reallocation of the present water rights of public entities to actual water users;
- To establish reliable assurance and compensation rule for water transfer and trading; and
- To prepare the flood control basin plan (FCBP) for the severe flood prone areas and to link legally with the reservoir operation rules of large dams (refer to details in Section 12.2.2).

With these actions the following outcomes would materialize to cope with the corresponding strategic issues:

- The water resources supply security level in a region or the whole basin will be controlled within the target risk of failure (for Issue 1);
- The regional water rights conflict will be significantly mitigated by the quantitative regulation of the regional water budget covering the aggregated discharge and quantity of more than two water permits in a region where daily or seasonal water diversion conflict prevails (for Issue 1);
- Enforcing power of NWRB will effectively function to regulate issues or to control the aggregate rate and quantity of water permit, and the prevailing water rights conflict will be mitigated. Provision of the NWRB owned monitoring system is also essential (for Issue 1);
- Incentive of water saving activities for water users particularly, the irrigators, will be enhanced, the present wasteful consumption of water will be mitigated, and the growing scarcity of water will be mitigated (for Issues 2 & 3);
- The national and local governments will be legally responsible to maintain the sustainability of groundwater (for Issue 4);
- The national and local governments will be legally responsible to monitor the environmental flow and water quality for sustainability of the regional water environment (for Issues 6 & 7);
- The national and local governments will be legally responsible to mitigate regional risks from floods linked with the flood control basin plan (FCBP) (for Issue 8); and
- Flood control function of dam reservoirs will be legally justified to mitigate regional risk from floods linked with the FCBP (for Issue 8).

Details of the background and corresponding outcomes are as noted hereunder.

Verification of Regional Water Supply Security Level

With the foregoing outcomes it will also be made possible to assess if the water shortage in Angat River during the draught period could be mitigated in reality by the construction of the proposed two dams, Balintingon Dam and Bayabas Dam. It will also provide instrumentation to verify quantitatively if the water shortage in the Manila metropolitan area and the related water source area will occur only

in time of emergency (extreme draught event) as stipulated in Article 22 of the Water Code or as chronic events.

Incentive of Water User's Water Saving Activities

The purpose to provide an Article is to enable reallocation of the present water rights granted to the public entities such as NIA, MWSS and Bulacan Province to the water users such as irrigators and/or water supply companies to enhance water saving activities (Strategic Issue 2). With this provision the irrigators relying on the irrigation system of NIA will be required to pay the annual water charge for the water permit while NIA will be required by the irrigators to reduce the irrigation facilities fee (IFF) to balance the annual water charge to NWRB. NIA will also be required to change the charge system of IFF from the unit of irrigation area to the unit of used water quantity.

The disadvantages will be balanced by the advantages, surplus benefits between the advantages and disadvantages that are estimated to be positive and large based on the experiences in advanced countries. If the irrigators under the NIA system pay the annual water charge regularly, the payment will become a legal evidence of water use (water rights) and the irrigators would be legally entitled to charge compensation for the loss induced by the priority of municipal water supply in time of emergency to the water supply company. The surplus water right which will be created by the water-saving activities by the irrigators can be transferred to the municipal water supply companies with costs by regulation and/or by trading. The surplus water rights will become an income source of irrigators. The irrigators will also have an incentive to reduce the water permit charge and/or IFF.

Legal Basis to Determine Reservoir Operation Rule to Mitigate Risk from Floods

The reservoir operation rule during extreme floods has not been officially established yet for Angat Dam by the Joint Operation and Management Committee (JOMC).

The water rights have been vested among NIA, MWSS, NPC and Province of Bulacan, but Angat Dam's reservoir operation conflicts with the water users due to shortage of dependable flow inside the watershed and the limited storage capacity for flood control during the rainy season. On the other hand, flood control by the reservoir is the significant interest of the regional governments and residents downstream. Water uses in the dry season and flood control in the wet season are mutually tradeoff under the reservoir operation rule. The water users demand the dam operator to keep the reservoir water level at the highest level even just before the rainy season, while the local governments and DPWH in charge of mitigating flood risks demand to keep the reservoir water level at the lowest level. The construction cost of Angat Dam facilities were originally borne by NPC except a part by MWSS for the municipal water supply facilities. Neither storage volume allocation nor cost allocation of the common facilities of the dam was determined among the beneficiaries at the time of the dam commission. In particular flood control function was simply treated as incidental. The downstream residents have enjoyed the incidental flood control benefit without the cost share and the legal basis for the flood control function of the dam. In Japan the flood control function of large dams is defined legally by the allocation of reservoir volume to flood control. The cost allocation for the flood control volume is also shared legally among the concerned beneficiaries in terms of allocation of the common facilities cost of a dam.

In order to resolve the present issue the legal basis to determine the reservoir operation rule of a large dam shall be established by specifying the flood control function of dam reservoir linked with the flood control basin plan (FCBP) in which the regional flood control risk level in a river basin is legally defined. The cost required to keep flood control storage shall be borne by the public entity concerned.

12.3.2 Outcomes by Introducing Cost Allocation Rule for Multipurpose Dam

Issue 5 and Issue 8 (Manage and Mitigate Risks from Water-Related Disasters) are mutually correlated. The highlighted actions for strategic issues 5 and 8 are: to introduce an specific law to define an equitable cost allocation of multipurpose dams; to establish a flood control account for multipurpose dams; and to define water permit as a tradable property in the Civil Code. Aside from introducing a new specific multipurpose dam law, a cost allocation rule for the multipurpose dams can be incorporated in the Water Code.

With these actions to resolve strategic issues 5 and 8, the following outcomes could materialize:

- Multipurpose dam projects will be enhanced based on the legal basis on the cost and reservoir volume allocation rule among multiple water users including both public and private sectors (Issue 5);
- The national and regional governments will be legally responsible to share equitably the cost of flood control function of dam reservoirs with water users to mitigate regional risks from floods linked with the flood control basin plan (Issues 5 & 8); and
- Water permit will be defined as property or asset which can be treated as guaranty in the Civil Code (Issue 5).

The heavy cost burden owing to the reservoir operation rule for flood control function of a large dam will be equitably mitigated by the cost share by the relevant national and local governments.

12.4 Capacity Assessment of Organizations

Subsection 12.4.1 briefs the result of the capacity assessment of the existing NGAs and LGUs for respective sector roles: planning of provincial governments and integrated area development, water resources management, irrigation, municipal water supply, sanitation and sewerage, flood control and mitigation of natural disasters, forest and watershed management, water quality management, and mitigation of sediment disaster and soil control.

The key actions related with the capacity strengthening of the NGAs and LGUs in Subsection 12.2.2 are integrated and recompiled from the organizational aspect, and presented in Subsection 12.4.2 only for the organizations for which capacity strengthening is assessed as necessary. Subsection 12.4.3 presents the key actions required for capacity development of the missing functions focusing on the functions of river basin organizations.

12.4.1 Capacity Assessment of Existing NGAs and LGUs

(1) General

Under the decentralization and rationalization policies, the present institutional arrangements for the functional relationships among the national government agencies and local governments are still in transition. The roles of the national government and local governments have not been unified, and those vary depending on the sector policy and prevailing conditions. Annex-F 5.2.2 illustrates the present functional relationships among the water related national government agencies and local governments. The illustrated relation is still progressive as of March 2010.

(2) Planning of Provincial Governments and Integrated Area Development

Planning of the provincial government is well executed by the provincial planning and development office (PPDO) under the LGC of 1991. Integrated area development approach has been well deployed for integration and prioritization of inter-provincial and inter-municipal development projects under the Regional Development Council (RDC) of Region III. The RDC is the policy coordination and decision-making body in the region. The functions of RDC are: formulation of development plans and investment programs, project monitoring, and budgeting and investment programming. The organizational structure of RDC Region III is given in Annex-F 12.4.1.

No specific issue was identified to empower the existing PPDO and RDC management through the steering committee meetings, technical working group meetings and stakeholder consultations except missing functions for the IWRM Plan implementation.

(3) Water Resources Management

The various issues on water resources management identified include (refer to Section 6.7 and Section 9.7):

- Risk of failure of sustainable water sources for the municipal water supply in the region including groundwater;
- Risk of failure of securing water sources for expansion of large irrigation system;
- Inadequate reliability of water supply in Angat-Umiray System; and
- Expected increase of conflict among water users, municipal and irrigation water, and hydropower generation.

Both legal and organizational empowerment is required to resolve these issues.

(4) Irrigation

In the irrigation sector, NIA plays the main role of implementation, as well as operation and maintenance of the nation's irrigation systems in collaboration with the local governments except private irrigation systems [refer to present status of the irrigation sector in Subsection 5.2.3(2)].

No specific issue was identified to empower the existing irrigation management through the steering committee meetings, technical working group meetings and stakeholder consultations (refer to Section 6.2 and Section 9.2). Water rights of irrigators are weak in Pampanga river basin.

(5) Municipal Water Supply, Sanitation and Sewerage

Annex-T 5.2.3 illustrates the institutional structure of domestic and municipal water supply and sanitation among national government agencies and local governments. NWRB, Metropolitan Water Works and Sewerage System (MWSS), Local Water Utilities Administration (LWUA) and LGUs are regulatory agencies for water supply [refer to present status of the water supply and sanitation sector in Subsection 5.2.3(1)].

No specific issue was identified to empower the existing urban and rural water supply management in Pampanga River through the steering committee meetings, technical working group meetings and stakeholder consultations except implementation of sewerage system (refer to Section 6.3 and Section 9.3).

(6) Flood Control and Mitigation of Natural Disasters

Flood control requires a river basin approach participated by multiple government agencies. Annex-T 5.2.4 illustrates the institutional structure of national government agencies in flood control. The DPWH plays the main role in flood control and oversees its national and regional projects [refer to present status of the flood control and natural disasters sector in Subsection 5.2.3(3)].

No specific issue was identified to empower the existing flood control and natural disaster management in Pampanga River through the steering committee meetings, technical working group meetings and stakeholder consultations except O&M of the river facilities (refer to Section 6.4 and Section 9.4).

The issue on reservoir operation of the multipurpose dams mostly operated by NPC and NIA has been identified for improvement both during draught period and during extreme floods (refer to Subsection 12.3.2).

(7) Forest and Watershed Management

Annex-T 12.4.1 illustrates the regulatory functions and corresponding responsible national government agencies and LGUs in watershed and forest management. Pursuant to Executive Order No. 192 (10 June 2007), the DENR is the primary government agency responsible for the conservation, management, development and proper use of the environment and natural resources, including forests and watershed areas through the Forest Management Bureau (FMB). [Refer to present status of the watershed management sector in Subsection 5.2.3(4)].

The legal and organizational framework of forest and watershed management is well defined. The issue identified is how to empower the executing capacity at site in collaboration with RBCO, FMB, LGUs, NIA and NPC (refer to Section 6.5 and Section 9.5).

(8) Water Quality Management (freshwater, seawater)

The Clean Water Act (CWA), RA No. 9275 of 2004, provides, among others, that DENR in coordination with NWRB shall designate certain areas as water quality management areas using appropriate physiographic units such as watersheds, river basins or water resources regions [refer to present status of the water quality management sector in Subsection 5.2.3(5)].

The issue identified is how to empower the monitoring system and the executing capacity in collaboration with RBCO, EMB, LGUs and related NGAs through the steering committee meetings, technical working group meetings and stakeholder consultations (refer to Section 6.6 and Section 8.6).

(9) Mitigation of Sediment Disaster and Soil Control

The Bureau of Soils and Water Management (BSWM) under the Department of Agriculture (DA) remain responsible for the assessment, development and preservation of existing and potential soil and water resources for agriculture.

No specific issue was identified to empower the sediment disaster and soil control management in Pampanga river basin through the steering committee meetings, technical working group meetings and stakeholder consultations (refer to Section 6.4 and Section 9.4).

12.4.2 Key Actions to Strengthen NGAs/RLAs and LGUs

The national government agencies (NGAs) and the local government units (LGUs) subject to legal amendment and capacity improvement based on the organizational capacity assessment (refer to Section 12.4.1) are summarized in Table 12.4.1.

Table 12.4.1 Countermeasures and Corresponding NGAs/RLAs and LGUs for Empowerment

Key IWM Issues	Countermeasures	NGAs/RLAs and LGUs for Empowerment
1. Water rights allocation	Revision of Water Code, etc.	NWRB
	Capacity development	NWRB, DENR
2. Water quality management	Capacity development	EMB/DENR, LGUs
3. Flood control: Right-of-Way	Revision of Water Code, etc.	PMO/DPWH, LGUs, NWRB
	Land use law	NEDA, LGUs
3. Flood control: O&M cost	Capacity development	DPWH, DPWH-Region III, LGUs
	Establish RBO	NEDA Region III, RBCO/DENR, DPWH, NIA
4. Watershed and forest management	Capacity development	RBCO&FMB/DENR, LGUs
5. Localize, implement, O&M of IWRM Plan from regional interests	Capacity development	NEDA Region III, RBCO/DENR, NWRB, DPWH, NIA, LGUs
	Establish RBO	NEDA Region III, LGUs, RBCO/DENR, DPWH, NIA, RDC Region III, LGUs

Source: JICA Study Team

The key actions for the capacity strengthening of NGAs/RLAs and LGUs presented in Subsection 12.2.2 are compiled in Table 12.4.2.

Table 12.4.2 Key Actions to Strengthen NGAs and LGUs

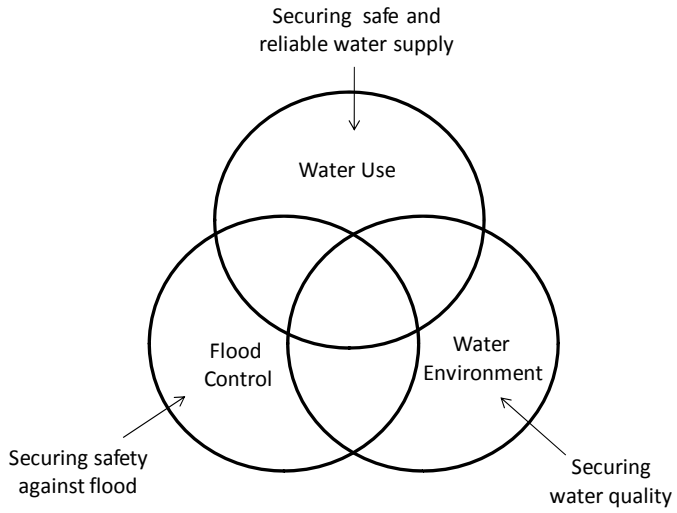
Strategic Issues	Key Actions of Capacity Strengthening of NGAs and LGUs
Issue 1, Water Rights	- Establish NWRB-owned reliable and accurate monitoring stations for discharge and ecological flow at key water conflict areas. - Strengthen the capacity of NWRB for monitoring and enforcing water rights.
Issue 4, Groundwater	- Empower the groundwater monitoring and enforcing function of the LGUs from the regional interests. - Establish a regional monitoring system to monitor regional groundwater level collaborated with EMB and LGUs including quantity and quality.
Issue 7, Water Quality	- Strengthen the capacity of EMB, FMB and related LGUs to execute and enforce water quality management effectively. - Strengthen the water quality monitoring system.
Issue 9 Watershed & Forest Management	- Monitor the progress and outcomes of the ongoing capacity development of the development projects and programs for forest and watershed management financed by donors. - Conduct capacity assessment on the outcomes from the ongoing projects and programs. - Strengthen preventive measures of forest fire including capacity development. - Strengthen the execution capacity of the weak functions of FMB and LGUs still remained for watershed and forest management.
Issue 10, Implementation of IWRM	- Clarify the necessary functions and missing functions in the existing organizations for IWRM implementation. - Supplement the function to the line agency (NWRB, DENR) or RDC and execute capacity strengthening for monitoring and execution.

Source: JICA Study Team

12.4.3 Capacity Building on Missing Functions for IWRM

(1) Mission and Functions for IWRM

To which extent the mission of IWRM is to be targeted? The IWRM mission covering the three key management elements illustrated in Figure 12.4.1 is recommended to be applied to Pampanga river basin (refer to Section L 2.1.3 of Supporting Report L). The three key management elements are: i) securing safe water supply to various users; ii) securing safety against flood and other water-related natural disasters: and iii) securing water quality for sanitation and ecology (effluent control and waste water treatment).



Source: JICA Study Team

Figure 12.4.1 Mission of Integrated Water Resources Management

The IWRM mission at any level is made functional with the provision of essential support from the monitoring and database systems for scientific and equitable coordination and management.

To achieve the mission of IWRM, the following functions are envisaged to be introduced:

- To make IWRM policy and plan, coordinate, localize the IWRM Plan;
- To implement and maintain the IWRM Plan including key water-related projects and corresponding operation and maintenance;
- To regulate and monitor water rights;
- To prepare water resources development plan for the basin's water rights; and
- To advocate IWRM and monitor water and watershed environment.

(2) Definition of Missing Functions under Existing Organizations

Creation of new agencies is not encouraged in Region III because the existing instrumentalities of the bureaucracy are very capable and in better position to implement IWRM initiatives. New entities may only be created out of the abolition of existing ones or merger of two or more government organizations under the scrap-and-build principle. The RDC is the policy coordination and decision-making body in the region. The functions of RDC are formulation of development plans and investment programs, project monitoring, and budgeting and investment programming. Integration and prioritization of development projects can be handled by RDC.

The mission and functions of the IWRM will not be materialized in Pampanga river basin by the capacity strengthening of the existing organizations presented in Subsection 12.4.2 and Subsection 12.4.3 only. The questions related with the missing functions are:

- Who will maintain and manage the IWRM Plan for Pampanga river basin after the JICA Study?
- Who will take charge of overseeing, advocating, localization and maintenance of the IWRM Plan for Pampanga river basin?
- How will the NWRB regulate the water rights conflicts which could be more serious in the future?
- Who will take charge of the financial burden of implementing IWRM in practice?
- How to authorize publicly a core or apex regulating organization with relevant mandates without creation of a conflicting layer of authority?

RBO has to be designed to take charge of the missing functions identified in Subsection 12.4.3(1), and it is also envisaged to provide the answer to these questions.

(3) Options of River Basin Organization

Description of Options

The TWG Meetings and the Stakeholder Consultation and Focus Group Discussions were held during the study period from February to March 2010 to discuss the IWRM mission, the position of regional water governance, the type, functions and options of the river basin organization (refer to Subsection 5.3.6). The advantages and disadvantages of the three options, RBO under RBCO/DENR, River Basin Committee (RBC) of RDC, and an independent River Basin Council (RBC), are summarized in Table 12.4.3. The organization charts for the three options are illustrated in Annex-F 12.4.2 for RBO under RBCO, Annex-F 12.4.3 for RBC of RDC and Annex-F 12.4.4 for independent Pampanga River Basin Council respectively. The position of water rights regulation of NWRB is illustrated in Annex-F 12.4.5.

Table 12.4.3 Advantages and Disadvantages of three RBO options

RBO Option	Advantage	Disadvantage
RBO under RBCO/DENR	- Strong integration of watershed, forest and water quality management under DENR; - Strong mandate under the President's Office; - Budgetary allocation from DENR;	- Weak leadership of LGUs; - Unclear function of water rights regulation; - Weak technical capacity at field works; - Potential overlapping functions with RDC - Implementation by NGAs/RLAs and LGUs is required because RBO has no execution function;
RBC of RDC	- Strong coordination by the existing RDC without overlapping authority; - NWRB keeps function of water rights regulation; - RDC leadership of IWRM Plan and investment programs;	- Implementation by NGAs/RLAs and LGUs is required because RBO has no execution function; - Weak technical capacity at field works; - Present MOA for O&M of Pampanga Delta FCF does not work well;
Independent RBC	- Strong advocacy power with regional interests; - NWRB keeps the function of water rights regulation;	- Implementation by NGAs/RLAs and LGUs is required because RBO has no execution function; - O&M budgetary allocation by LGUs and Regional NGAs/RLAs; - Potential overlapping of functions with RDC

Source: JICA Study Team

Share of functions between River Basin Committee and RDC Region III

The participants of the Focus Group Discussion and Technical Working Group (TWG) meetings supported the River Basin Committee (RBC) proposed by NEDA Region III under RDC Region III as the best option among the three options. The content of the proposed RBC was accepted by the 5th Joint Steering Committee meeting with TWG held on October 27, 2010. The mission and functions of IWRM recommended by the Study Team are not included in the existing functions of the RDC (the policy coordination and decision-making on area development projects in the region).

The advantage of the RBC of RDC is that advocate and maintenance of the IWRM Plan for Pampanga river basin can be executed with strong coordination by the existing RDC without overlapping authority while the implementation of project plans and programs will remain under the jurisdiction of the concerned LGUs, RLAs, or Government-Owned and Controlled Corporations (GOCC). The RBC will lead in the advocacy for the adoption of the IWRM Plan in the respective plans and investment programs of the bureaucratic levels. Working together, the Pampanga river basin/IWRM Plan implementation will be the joint and collective responsibility of all the sectors concerned.

Its disadvantage is that the technical execution capacity at field works is weak and financial support from the national government agencies (NGAs) is not available because the RBC is independent from NGAs.

12.4.4 Design of River Basin Committee

(1) Objective of River Basin Committee

The objective of the Pampanga River Basin Committee set up under the Regional Development Council of NEDA Region III, hereinafter referred to as the Committee, is to materialize the IWRM Plan for Pampanga river basin in collaboration with the implementing regional government agencies and local governments. The mission of the IWRM for Pampanga river basin is to manage the whole water resources and environment for securing safe water supply, safety against flood and other natural disasters, and water quality by a river basin unit in line with the National IWRM Plan Framework (November 2006).

(2) Territorial Jurisdiction

The Committee shall have jurisdiction over all the area within Pampanga river basin from the origins to the estuaries.

(3) Allocation of Power and Functions for Implementing IWRM

Key national government agencies (NGAs) are responsible for sector policy, planning, implementing and monitoring of national projects, and regulatory functions specific to their jurisdiction. Local Governments at all administrative levels retain de facto responsibilities of public utilities including water supply and sanitation for policy, planning, and regulatory functions specific to their jurisdictions, through the respective local government units (LGUs). The NGAs also take charge of public works and infrastructure projects and other facilities, programs and services funded under the National Government Appropriations Act, other special laws, pertinent executive orders, and those wholly or partially funded from foreign sources.

The Regional Development Council (RDC), a policy coordination and decision-making body regulates and approves inter-provincial and government loan projects (refer to Annex-F 12.4.1). NEDA requires endorsement for implementation from all concerned provinces for the RDC's approval. The secretariat of RDC is NEDA Region III.

The Committee takes charge of the decision making and coordination at the level of committee specific to the mission of the IWRM for Pampanga river basin only which is not included in the existing functions of NGAs/RLAs, LGUs and RDC, while NGAs, RLAs and LGUs are responsible for the implementation of decisions of the Committee specific to the IWRM (refer to Annex-F 12.4.3).

The provincial river basin sub-committee is an option that can be established depending on the necessity of the respective provinces.

(4) Power and Functions of the Committee

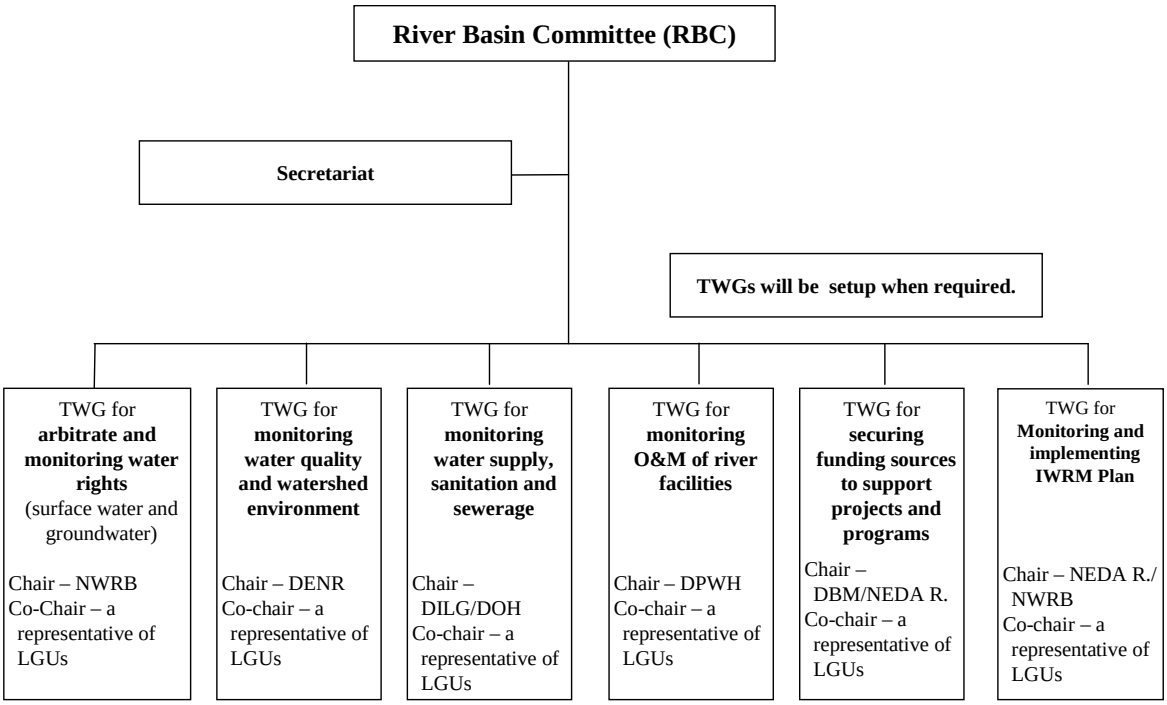
The Committee has the power to decide on its functions at the level of a committee of RDC. However RDC Region III has the authority to reverse the decision.

The Committee shall perform the following functions:

- To make the IWRM policy and plan, to coordinate, and to localize the IWRM Plan;
- To oversee and coordinate the implementation of the IWRM Plan;
  - To arbitrate (resolve issues/conflict) and monitor water rights;
  - To regularly review and update water resources development plan based on the monitoring data;
  - To advocate the IWRM and monitor water quality and quantity and watershed environment;
  - To monitor O&M of the river facilities;
- To secure funding sources to support the activities for the IWRM;
- To establish, to supplement or to scrap Technical Working Groups (TWG) for specific purposes which support the Committee such as providing necessary information and technical advocating and monitoring activities including data collection, clarification and analyses;
- To enforce the committee members (LGUs, RLAs, NGAs, NGOs) to execute the specific tasks as determined by the Committee;

(5) Organizational Structure and Secretariat

The Committee shall be composed of members, a chairperson, a co-chairperson, vice chairperson, secretariat and TWGs as shown in Figure 12.4.2.



Source: JICA Study Team

Figure 12.4.2 Organizational Structure of River Basin Committee

The members of the Committee are composed of major stakeholders in the water related sectors. The members, the chairperson, the secretariat, the technical working groups and the term are as follows[1]:

- Members of the Committee: Provincial Governors (7 provinces), Regional Directors of the Technical Secretariat (6), NWRB, DA, RBCO, NPC[2], a representative of NGOs[3], a representative of private sector, etc., in Pampanga river basin
- Chairperson of the Committee: a representative elected from the provincial governors by all the Committee members
  - Co-chairperson: a representative of NGO[4]
  - Vice chairperson: NWRB or RBCO/DENR[5]
- Secretariat to the Committee:; NEDA Region III
- Technical Working Group (TWG): to be established as required
  - Chairpersons of TWGs: a representative from the concerned NGAs/RLAs and other stakeholders such as NEDA Region III, NWRB, DENR, DILG, DOH, DPWH, DBM, NIA, NPC, LGUs, NGOs, private sectors, etc.
  - Co-chairperson of TWGs[6]:a representative from LGUs or NGO

[1] Those will be subject to clarification to the RDC.

[2] Region III, theCentral Luzon Region, is comprised of the 7 provinces of Tarlac, Nueva Ecija, Pampanga, Zambales, Bulacan, Aurora and Bataan, and the 5 cites of Angeles, Cabanatuan, Olongapo, Palayan, and San Jose (Nueva Ecija) with 2 Regional Centers, San Fernando and Pampanga. NEDA, DENR, DILG, DOH, DPWH (including BRS), DBM are included as the Regional Directors of the Technical Secretariat in the Committee. NWRB, DA, NPC and RBCO are also supplemented as the committee members. Legal basis will be necessary to include as members the provinces and cities which are inside the Pampanga river basin but are not included in Region III.

[3] People's Organizations are treated as one of NGOs.

[4] Option of Co-Chairperson was suggested in the focus group discussion (FGD), but the possibility of an NGO representative is subject to clarification if the NGO has the authority.

[5] Option of Vice-chairperson is suggested in the FGD to support the chairperson because the IWRM requires technical support.

- Term of chairperson, co-chairperson and vice chairperson: the same as the RDC chairperson (4 years) or power sharing (2 years)

(6) Responsibility of Committee Members

The organizations represented by the Committee members are responsible for the execution of specific tasks as determined by the Committee and shall contribute to the relevant TWG activities.

(7) Responsible Activities

(a) Activities of the Committee

The Committee is responsible for conducting its functions [refer to Item (4)], for organizing and operating the committee meetings with support from its Secretariat and the TWGs.

(b) Activities of Member from Regional Line Agencies, Member from Local Government Units, NWRB, NPC

(i) All members of the Committee (member from regional line agencies, member from local government units, NWRB, NPC, NGOs) and the TWGs are responsible for conducting the relevant activities of the TWG as determined by the Committee.

(ii) All members of the Committee are responsible for conducting the relevant activities of the relevant tasks based on the functions specific to their jurisdiction by the use of respective funds as determined by the Committee.

(8) Allocation of Operation Cost of the Committee and the Specific Tasks

The operation cost of the Committee is composed of the Secretariat operation cost, the office operation cost (rent, utilities, office facilities, etc.), the meeting costs of the Committee, and the costs for activities of the TWGs.

The operation cost of the Committee shall be allocated among its members depending on the relevant tasks.

Table 12.4.4 Allocation of Operation Cost of RBC

Task	Responsible Operation Cost
Secretariat	NEDA Region III
Office space including utilities, etc.	NEDA Region III
Meeting costs	Shared by NEDA Region III & other member organizations
Activities of TWGs	Concerned RLAs, LGUs and NGAs

Source: JICA Study Team

The cost for activities and meetings of TWGs shall be the responsibility of the concerned RLAs, LGUs and NGAs. On the other hand, the cost for specific tasks and activities of the implementing organizations (RLAs, LGUs and NGAs) which are determined and enforced by the Committee shall be the responsibility of the concerned implementing organization.

(9) Technical Working Groups

The technical working groups (TWGs) listed below shall be established to support the relevant functions and activities of the Committee. The Committee can supplement or scrap the TWGs depending on necessity.

- IWRM Plan (Chair: NWRB/NEDA Region III): Prepare the Pampanga river basin IWRM policy and plan, coordinate, oversee to localize, implement and maintain the Pampanga river basin IWRM Plan.

---

[6] Option of Co-Chairperson is suggested in the FGD to share the responsibility between NGAs and LGUs.

- Water Right Arbitration (Chair: NWRB): Prepare water resources development plan for the basin's water rights, and monitor water rights regulation and enforcement (surface and groundwater).
- Monitoring of Water Quality and Watershed Environment (Chair: DENR): Advocate IWRM in coordination with NWRB and monitor water quality, ecosystem and watershed.
- Monitoring of Water Supply, Sanitation & Sewerage (Chair: DILG/DOH): Monitor implementation, operation and maintenance of water supply, sanitation and sewerage projects.
- O&M of River Facilities (Chair: DPWH): Operate and maintain river facilities.
- O&M Costs (Chair: NEDA Region III/DBM): Monitor to secure availability of O&M cost for the Committee, river facilities and monitoring facilities.

(10) Monitoring System

It is necessary to establish a set of monitoring systems for surface water and groundwater and an information system for management and data-sharing. The roles of NGAs/RLAs and LGUs for the monitoring systems are as set out below.

Table 12.4.5 Role of NGAs/RLAs and LGUs for Monitoring System

Organization	Information System	Surface Water	Groundwater
NWRB	Specific system for Angat Dam Reservoir operation	Water Rights Regulation/Discharge gauging at key stations	Water Rights/Regulation, Monitoring regional water level
NIA/MWSS/ NPC	Share of O&M costs, data	Water use recording, system O&M	
BRS	Share of data	Discharge gauging under the mandate of BRS	
PAGASA	Weather & FFWS	Rainfall recording, FFWS, system O&M	
LGUs	Share of O&M costs, data		Recording & system O&M
DENR/DOH	Share of O&M costs, data	Water quality, Ecology & system O&M	Water quality & system O&M

Source: JICA Study Team

(11) Implementation Guidelines

The TWGs shall prepare the implementing guidelines to execute smooth operation of the Committee and the TWGs in consultation with the stakeholders.

(12) Legal Basis

The power and functions of the Committee and the source of funds to implement the Committee, the TWGs and the specific tasks of the executing organizations shall be materialized by MOA or Executive Order. In the long term, enactment of laws will be targeted.

12.5 Strengthening of Financial Capacity for Sustainable IWRM

12.5.1 Key Actions to Strengthen Financial Capacity

The strategic issues and key actions to strengthen financial capacity for sustainable IWRM of the NGAs and LGUs are compiled in Table 12.5.1.

Table 12.5.1 Key Actions to Strengthen Financial Capacity for Sustainable IWRM

Strategic Issues	Key Actions to Strengthen Financial Capacity for Sustainable IWRM
Issue 1 Water Rights	- Strengthen financial capacity of NWRB including annual water charge collection
Issue 7 Water Quality	- Increase the fund of DENR for monitoring stations and O&M of the monitoring systems - Introduce the beneficiary's pay principle (BPP) for the cost of water quality management
Issue 11 Strengthen Execution Capacity and Sustainability	- Increase the share of O&M budget for the river facilities in both LGUs and DPWH - Establish specific finances in LGUs for O&M - Set up special accounts for sustainable IWRM in the basin - Reconfirm the definition of the responsibility of O&M of the flood control and river facilities after transfer of the facilities from DPWH to LGUs (MOA)

Source: JICA Study Team

12.5.2 Fund Sources for Sustainable IWRM

(1) General

How to materialize the financial sustainability for Pampanga river basin IWRM is one of the biggest challenges in the prevailing policy of the Philippines. To achieve the financial sustainability sources of the necessary funds, method of collection and allocation of the funds are to be clarified. In-depth discussion and concrete actions will be necessary about this agenda during the course of implementing the IWRM for Pampanga river basin.

(2) Potential Fund Sources

There are various potential fund sources for the activities of RLAs, LGUs and NGAs and for operating the River Basin Committee (RBC). Enacting a law or issuing an executive order is a definitive solution but it may not be practicable. The concerned national and regional line agencies and LGUs will be required to find new fund sources by themselves. Potential fund sources are listed below as examples.

(a) For the Activities of RLAs, LGUs and NGAs for the IWRM

1) Annual operation and maintenance (O&M) budget for infrastructures such as dikes, pumping stations, flood gates, dredging, etc., of NGAs/RLAs and LGUs

2) Revenue in General Accounts of:

a. Exploitation fee/royalty of LGUs: gravel and sand, mining, floating logs, fish culture, etc.

b. Annual water charge for water permit (municipal, fisheries, livestock, irrigation, power generation, industrial, recreation, others) of NWRB

c. Land tax from new lands created by coast reclamation, former channel reclamation, etc., of LGUs

d. Utilization fee of the area inside the river regime (parks, tennis court, baseball ground, school ground, driving school, golf course) of LGUs

3) Financial Aid Program (Sector loan for rehabilitation of river facilities)

(b) For Operating the Committee

1) Allocation of the revenue of the General Accounts

a. Exploitation fee/royalty of LGUs

b. Annual water charge for water permit

Annual water charge for water permit collected by NWRB is the revenue of DBM at present but some portions of the charge may be allowed to be allocated to the specific purpose of water resources management and water rights regulation. The utilization of the area inside the river regime is a potential source of the public land use.

(3) Collection and Allocation

Potential methods of collecting necessary funds and allocating collected funds are listed as follows:

(a) Increase the share of the O&M budget of DPWH for river facilities which are much smaller than those of highways and roads, of NIA for the irrigation facilities (IFF is not sufficient), and of DENR for the monitoring systems.

(b) Make a part of the revenue in the general accounts as a special account for the O&M: items a, b, c, d of 12.5.2(2) (a) 2).

(c) Collect strictly the annual water charge for water permit based on the beneficiaries' pay principle (BPP) from the organization which does not pay now, such as NIA, NPC, etc. It can be used as a fund to establish and operate water right monitoring and enforcement. The annual charge for hydropower use is generally highest from BPP in the international standard.

Chapter 13. Environmental and Social Consideration on Programs and Projects of the IWRM Plan

13.1 Introduction

The IWRM Plan prepared during the present study consist of six (6) sectors including 18 proposed and 30 conceptual programs and projects[1], which cover multi-sector fields, such as agricultural and irrigation development, municipality water supply, sanitation, sewerage, flood and disaster management, watershed management, water-related environmental management, and water resource management, to support the Government of the Philippines in managing water resources in a sustainable manner.

In the course of identification of the programs and projects for the IWRM Plan, there was a need to assess if the implementation of any of the proposed programs and projects would create any adverse impact on the natural and social environment in the localities. Toward this end, the JICA Study Team conducted a simple initial environmental examination (IEE) of the proposed projects by using screening and scoping methods. In addition, the present legislative and institutional framework governing environmental assessment in the country was also reviewed. The results of the simple IEE are described in the following sections.

13.2 Existing Legislation and Legal Systems governing Environmental and Social Consideration in the Philippines

The existing legislation and legal systems on environmental and social considerations in the Philippines are summarized below (refer *Sector I of the Supporting Report* for detail).

13.2.1 Current Overall Legal Framework

In the Philippines, any private or public projects or activities which are envisaged to have a negative impact on the environment are subjects of EIA by the Philippine Environmental Impact Statement System (PEISS). EIA is the preliminary analysis of the potential impacts of the project on the environment. Aware of the possible negative effects of the implementation of industrial and other activities, the government had instituted measures to encourage the use of EIA as a planning and decision making tool.

PEISS is a set of laws, regulations, administrative orders and guidelines for Environmental Impact Assessment (EIA). Among them some of the most important laws and regulations are as follows:

- Environmental Impact Statement System, Presidential Decree No. 1586 (1978)
- Presidential Proclamation No. 2146 (1981) and No. 803 (1996)
- DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)
- Recent Issued Memorandum Circulars (MCs) Relevant to PEISS, such as MC No. 2010-14, Standardization of Requirements and Enhancement of Public Participation in the Streamlined Implementation of the Philippine EIS System and MC No. 2010-002, Clarification to DENR MC No. 2010-14 and other EIS system policy issuances.

13.2.2 Procedures of Environmental Impact Assessment (EIA)

(1) Projects Covered by PEISS

Projects which have been originally declared as Environmentally Critical Projects (ECPs) or projects in Environmentally Critical Areas (ECAs) are assumed to have significant impacts on the quality of the environment, and to be subjects of PEISS. The four (4) ECP project types and twelve (12) ECA categories declared are summarized in the tables below.

[1] The proposed programs and projects are planned by the relevant government agency, while the conceptual programs and projects are proposed by the Study Team and subject for further revision to determine the project components. Basically, the programs and projects in the IWRM Plan have been prepared in consultation with the stakeholders in the course of the Study.

Table 13.2.1 Summary of Environmentally Critical Projects (ECPs)

Main Categories	Sub-Category
A. Golf Course Project	- Golf course projects/complexes
B. Heavy Industries	- Iron and Steel Metals Non-ferrous Metal Industries Petroleum and Petrochemical Industries Smelting Plants
C. Resource Extractive Industries	- Fishery Projects-dikes for/and fishpond development projects - Forestry Projects - Major mining and quarrying projects
D. Infrastructure Projects	- Major Dams - Major Reclamation Projects Major Power Plants (Proc No. 2146 declared types: fossil-fueled, nuclear fueled, hydroelectric or geothermal)

Source: Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30) (2007)

Table 13.2.2 Summary of Environmentally Critical Areas (ECAs)

ECA Categories	Examples
A. Areas declared by law as national parks, watershed reserves, wildlife preserves, and sanctuaries	Areas of the National Integrated Protected Areas System (NIPAS)
B. Areas set aside as aesthetic, potential tourist spots	Areas declared and reserved by the Department of Tourism or other authorities for tourism development
C. Areas which constitute the habitat for any endangered or threatened species of indigenous Philippine wildlife (flora and fauna)	Areas inhabited by indeterminate species, threatened species, rare species, endangered species, such species categorized as Appendix I or II of CITES as well as listed in the The National List of Threatened Fauna
D. Areas of unique historic, archeological, geological, or scientific interests	- National historical landmarks, geological monuments, paleontological and anthropological reservations as designated or determined by the National Historical Institute, National Museum, National Commission for Culture and the Arts, National Commission on Geological Sciences, and other authorities
E. Areas which are traditionally occupied by cultural communities or tribes	- Areas that are occupied or claimed as Certificated Ancestral Domains/Lands by indigenous communities
F. Areas frequently visited and or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.	- Areas frequently visited or hard-hit by typhoons - Areas frequently visited or hard-hit by tsunamis - Areas frequently visited or hard hit by earthquakes - Storm surge-prone areas - Flood-prone areas - Areas prone to volcanic activities - Areas located along fault lines or within fault zones - Drought-prone areas
G. Areas with critical slope	- Lands with slope of 50% or more - Alienable and disposable forest lands and unclassified forests
H. Areas classified as prime agricultural lands	- Irrigated and irrigable areas and other areas mapped under the Network of Protected Areas for Agriculture (NPAA) of the Bureau of Soils and Water Management (BSWM)
I. Recharged areas of aquifers	- Areas of sources of water replenishment
J. Water bodies	- Areas that are tapped for domestic purposes - Areas which support wildlife and fishery activities
K. Mangrove Areas	- Tidal areas covered by salt-tolerant, intertidal tree species - Areas declared as mangrove swamp forest reserves
L. Coral Reefs	- Areas characterized by the assemblage of different types of marine plants and organisms - Areas identified by local sources such as PAWB-DENR to be rich in corals.

Source: Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30 (2007)

(2) Responsible Government Institutions for PEISS

The review and supervision of PEISS are conducted by the Environmental Management Bureau (EMB), Department of Environment and Natural Resources (DENR). The respective organization charts of DENR and EMB are shown in Sector I of the Supporting Report.

Under the framework of PEISS, EMB is responsible for the issuance of decision making documents such as Environmental Compliance Certificate (ECC), Certificate of Non-Coverage (CNC) and Denial Letter. Also, EMB regional offices in the respective regions are primarily responsible for the consultation and supervision of development projects.

(3) Documents Required by PEISS

To facilitate identification of the required documents under the PEISS for consultation and decision-making by DENR-EMB, the projects are classified into five (5) major groups as summarized in the table below.

Table 13.2.3 Project Groups for EIA under PEISS

Group I	ECPs (Environmentally Critical Projects) in either ECAs (Environmentally Critical Areas) or NECAs (Non-Environmentally Critical Areas)
Group II	NECPs (Non-Environmentally Critical Projects) in ECAs
Group III	NECPs in NECAs
Group IV	Co-located Projects in either ECA or NECA
Group V	Unclassified Projects

Source: Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DA) 03-30) (2007)

The EIA-covered projects listed above require either of the following documents depending on the project type, location, magnitude of potential impacts and project threshold:

- Environmental Impact Statement (EIS);
- Programmatic EIS (PEIS);
- Initial Environmental Examination Report (IEER);
- IEE Checklist (IEEC);
- Environmental Performance Report and Management Plan (EPRMP);
- Programmatic Environmental Performance Report and Management Plan (PEPRMP); or
- Application form to be processed in the Automated Processing System (APS)[2].

All documents should be prepared by the project proponent and submitted together with the following information to the EMB Central Office or the Environmental Impact Assessment Division in the concerned EMB Regional Office.

- Proof of compatibility with the existing land use plan, if necessary;
- Proof of ownership or authority over the project site;
- Accountability Statements of the proponent and the EIS preparers;
- Photographs or plates of the project site, impact areas an affected areas and communities;
- Duly Accomplished Project Environmental Monitoring and Audit Prioritization Scheme (PEMAPS)[3] Questionnaire;

[2] Currently APS is an internal system managed by EMB RO although EMB plans to develop an online application system for CNC with the possible management system of application fees according to the interview with EMB staff.
[3] PEMAPS is an internal EMB strategy for selecting and prioritizing projects to be subject to compliance monitoring, based on evaluation by EMB and the Proponent's responses to the Environmental Risk Categorization Questionnaire described in the Revised Procedural Manual for DAO 03-30.

- Copy of Previous ECC (if any); and
- Latest Self-Monitoring Report (SMR)[4] (if with previous ECC, Compliance Monitoring Report (CMR) Format[5]).

Also, the above information can be included or attached to the respective EIA report. Then, the decision documents may either be an ECC, CNC or a Denial Letter, described as follows:

(a) Environmental Compliance Certificate (ECC): An ECC is issued as a certificate of Environmental Compliance Commitment to which the proponent conforms after DENR-EMB explains the ECC conditions.

(b) Certificate of Non-Coverage (CNC): A CNC certifies that the project is not covered by the EIS System and is not required to secure an ECC, based on the review of submitted application form under APS.

(c) Denial Letter: A Denial Letter is issued for disapproval of the application. It shall contain an explanation for the disapproval and guidance on how the application can be improved to a level of acceptability in the EIA process.

In addition, an ECC Amendment is one of the decision documents for existing co-located projects for modification or re-startup as well as those operating without ECCs.

The following table shows the types of EIA report, decision document, deciding authority and processing duration by project group.

Table 13.2.4 Summary of Project Groups, EIA Report Types, Decision Documents, Deciding Authorities and Processing Duration

Project Groups		Documents Required for ECC/CNC Application	Decision Document	Deciding Authority (MC-2010-14)	Processing Duration (Working Days) (MC2010-14)
I: ECPs (single projects) in either ECA or NECA	I-A: New	EIS	ECC	EMB Director / DENR Secretary	40 days
	I-B: Existing Projects for Modification, Re-startup or Operating without ECC	EPRMP			
II: NECPs (single projects) in ECA	II-A: New	EIS	ECC	EMB RO (Regional Office) Director	20 days
		IEER /IEEC	ECC		
		App. for APS	CNC	EMB RO Director	1 day
	II-B: Existing Projects for Modification, Re-startup or Operating without ECC	EPRMP	ECC	EMB RO Director	20 days
		App. for APS	CNC	EMB RO Director	1 day
III: NECPs (single projects) in NECA	III-A: New	App. for APS	CNC	EMB RO Director	1 day
IV: Co-located Projects	IV-A: New	PEIS	ECC	DENR Secretary/EMB Director	40 days
	IV-B: Existing Projects for Modification, Re-startup or Operating without ECC	PEPRMP	ECC/ECC Amendment	EMB RO Director	20 days
V: Unclassified Projects		App. for APS	CNC	EMB RO Director	1 day

Source: Prepared by the JICA Study Team based on the Revised Procedural Manual for DENR Administrative Order No. 30 Series of 3003 (DAR 03-30) (2007), Memorandum Circular No. 2010-14, and the information obtained from the interview with EMB.

[4] SMR is a detailed report on compliance to environmental standards specific to environmental laws as described in the Revised Procedural Manual for DAO 03-30.
[5] CMR format is provided in the Revised Procedural Manual for DAO 03-30.

Besides, Memorandum Circular No. 2010-002 prescribes that the following projects shall be exempted from securing ECC regardless of the location:

- LPG storage and refilling stations with less than or equal to one (1) ton storage capacity;
- Gasoline stations prior to 1996 without any expansion or modification;
- Low-cost subdivision/housing and resettlement area projects with total gross lot area of one (1) hectare or less including amenities, if any; and
- Fast foods and restaurants with less than one (1) hectare total gross flood area including parking and other open spaces.

(4) Outline of Required Documents by PEISS

The outline of the required documents, namely; EIS, IEE, IEE Checklist, PEIS, EPRMP, PEPRMP and Application form for CNC under APS, are shown in *Supporting Report I*.

13.2.3 Public Participation in EIA Process

With the aim of enhancing public participation in the EIA process, PEISS states the procedures of Information, Education and Communication (IEC) and Public Scoping as well as Public Hearing/Consultation.

Also, in terms of involvement of indigenous peoples in decision-making process, the National Commission of Indigenous People (NCIP) developed Administrative Order No. 1, namely, the Free and Prior Informed Consent (FPIC) guidelines. The guidelines aims to ensure genuine participation of Indigenous Cultural Communities (ICCs) and Indigenous Peoples (IPs) in decision-making as well as to protect the rights of ICCs/IPs in the introduction and implementation of activities that will impact upon their Ancestral Domains/Lands(ADs/ALs).

13.2.4 Relevant Laws, Regulations and Guidelines

The laws, regulations and guidelines concerning: i) land acquisition and involuntary resettlement; ii) environmental standards; and iii) other social aspects relevant to IPs are shown in *Supporting Repor I.*

13.3 Preliminary Evaluation of Potential Environmental and Social Impacts

13.3.1 Outline of Programs and Projects in the IWRM Plan

The IWRM Plan prepared in November 2010 is composed of six (6) sectors including 18 proposed and 30 conceptual programs and projects. Annex-T 13.3.1 gives the outlines and scopes of the respective programs and projects.

13.3.2 Identification of Projects covered by the PEISS

In accordance with the PEISS mentioned in Subsection 13.2.2, the 22 programs and projects included in the IWRM Plan may require the preparation of documents for the ECC/CNC application, at least, in their F/S, as shown in Annex-T 13.3.1 and summarized in the table below below.

Table 13.3.1 Proposed and Conceptual Programs and Projects in the IWRM Plan Covered by PEISS

Groups	Description	Documents Required For ECC/CNC Application	Code of Projects Concerned*[1]
Group I	ECPs (Environmentally Critical Projects) in either ECAs (Environmentally Critical Areas) or NECAs (Non-Environmentally Critical Areas)	Environmental Impact Statement (EIS)/ Environmental Performance Report and Management Plan (EPRMP)	AI-P-01, 02*[2], 09, IS-C-02, MW-P-04, MW-C-05, 06, FL-C-01
Group II	NECPs (Non-Environmentally Critical Projects) in ECAs	EIS/EPRMP Initial Environmental Examination Report (IEER) / Initial Environmental Examination Checklist (IEEC) / App. for Application Format to be processed in the Automated Processing System (APS)	AI-P- 04,11, AI-C-01, MW-P-02, MW-C-01~04, FL-P-01~02, WQ-P-01, WQ-C-04 (Group II or III, depending on project location)
Group III	NECPs in NECAs	App. for APS	
Group IV	Co-located Projects in either ECA or NECA	Programmable Environmental Impact Statement (PEIS)/ Programmable Environmental Performance Report and Management Plan (PEPRMP)	-
Group V	Unclassified Projects	App. for APS	AI-P-03, 05

Note: 1*: The project codes correspond to the project titles as shown in Annex-T 13.3.1.
2*: The original ECC was issued on 21 January 1992 based on the Environmental Impact Assessment undertaken in 1986. An updated EIS was prepared during the F/S conducted in 2009 due to the possible changes of the baseline data.

Source: JICA Study Team

As shown above, there are four (4) proposed and four (4) conceptual projects identified as Environmentally Critical Project (ECP) under Group I which requires EIS for ECC application while there are six (6) proposed and six (6) conceptual projects defined as NECP, which shall be categorized into Group II or III depending on whether or not the project site is located in ECAs since there is limitation of the information to determine the project sites at this stage. Besides, there are two (2) projects categorized as Group V requiring preparation of the application format for Automated Processing System (APS).

In addition, other conceptual and planned projects of the IWRM Plan could be categorized into the groups mentioned above when their project components and sites are determined.

13.3.3 Alternative Options for Conceptual Projects Categorized as Environmentally Critical Project under the PEISS

As mentioned in the previous section, there are four (4) conceptual projects proposed by the Study Team and categorized as ECP under Group I. In order to mitigate the potential adverse impacts by the projects, the alternative options for the projects are considered, as tabulated below.[6]

[6] Since the project components shall be revised in the further studies, the alternative options are subject to be changed to select the optimum option in the following studies. Therefore, this report limits to the simple initial IEE for each option without the selection of the optimum options.

Table 13.3.2 Alternative Options for Conceptual Projects Categorized as Environmentally Critical Projects

Code of Projects*	Alternative Options Examined		Outline/Scope of Program/Project	Remarks
MW-C-05/ IS-C-02	Option 1	Bayabas storage dam	Major activity is the construction of the dam (H=110m) and its relevant structures aiming to have a reservoir with 144 MCM storage capacity.	-
	Option 2	Balintingon storage damand conveyance to AMRIS	Major activities are the construction of facilities: - Rock-fill center-core dam (H=140m) and its appurtenant structures aiming to have a reservoir with 572 MCM storage capacity. - Open-type powerhouse equipped with 2 Francis type turbines with the capacity of 15 MW - Diversion weir (L=140m) - Irrigation facilities: main canal (L=109km), laterals(L=168km) and sub-laterals, main and supplementary farm ditches, drainage channels (L=210km), and access roads	Same as AI-P-01
	Option 3	Upgrading and improvement of irrigation facilities and water management of AMRIS	Major activity is to upgrade the main canals in AMRIS by concrete lining to reduce the conveyance loss in the canals.	-
	Option 4	Excess water for MWSS from Ipo Dam (Laiban Dam)	Major activity is the construction of Laiban Dam which is expected to respond to the future water demand of Metro Manila.	-
MW-C-06	Option 1	Residual groundwater at surrounding cities/ municipalities	Major activity is the installation of wells with pipelines and pumps for intake of water from neighboring municipalities.	
	Option 2	Direct abstraction of surface water of Pampanga River at Cong Dadong Dam	Major activity is the installation of the system for direct abstraction of surface water of Pampanga river through the reservoirs.	-
	Option 3	Gumain Reservoir Project	Major activity is the construction of 108m high, zoned embankment dam to store irrigation water for 11,000 ha of paddy field and 5,200 ha of sugarcane plantation and to increase the water supply to 7,900 ha under the Porac Gumain & CaulamanRiver Irrigation System.	Same as AI-P-09
FL-C-01	Option 1	River Channel Improvement	Major activities are the construction of riverbank and channel dredging/excavation at the downstream of Pampanga river.	-
	Option 2	Flood Retarding Basin	Major activity is the construction of dike to set up the flood retarding basin in Pampanga river basin.	-

ote *: The project codes correspond to the project titles as shown in Annex-T 13.3.1.
ource: JICA Study Team

13.3.4 Screening and Scoping of Programs and Projects based on the JICA Guidelines for Environmental and Social Consideration

All the proposed and conceptual programs and projects of the IWRM Plan were re-examined in accordance with the former JICA Guidelines for Environmental and Social Considerations issued in 2004 due to the commencement timing of the Study, so that the Study Team could formulate the IWRM Plan to minimize any adverse impact. To do so, the following procedures were taken:

Step 1 Screening: All the 18 proposed and 30 conceptual programs and projects including the alternative options were screened by using a checklist, as shown in Annex-T 13.3.2.

Step 2 Scoping: The potential impacts which are expected by a project were further reviewed to evaluate the extent and nature of the respective impacts.

Step 3 Selection of mitigation measures: Based on the evaluation, mitigation measures for projects with potential adverse impacts were proposed.

13.3.5 Result of Initial Screening and Scoping of Programs and Projects in the IWRM Plan

As for the impact assessment of the Screening, the relevant environmental impact items were ranked depending on their environmental and social significance in accordance with the rating criteria listed below.

Rating Criteria

- A+/-: Significant positive/negative impact is expected.
- B+/-: Some positive/negative impact is expected.
- C+/-: Extent of positive/negative impact is unknown. (Further examination is required in the further project formulation)
- -: No negative impact is expected.

The results of the initial screening of all the proposed and conceptual programs and projects in the IWRM Plan are shown in Annex-T 13.3.2. Accordingly, there are 11 programs and projects including 10 options with the rating of A- and/or B- on the relevant environmental impact items as summarized in the table below.

Table 13.3.3 Proposed and Conceptual Programs and Projects in the IWRM Plan with Possible Negative Environmental Impacts Identified in the Initial Screening Process

Code of Projects Concerned*	Possible Negative Environmental Impacts by the Project	
	Items Expected to be Affected by Significant Adverse Impacts (A-)	Items Expected to be Affected by Less Adverse Impacts (B-)
AI-P-01/ MW-C-05/ IS-C-02 (Option 2)	- Planning Phase: Involuntary resettlement, Social vulnerable groups	- Construction Phase: Topography, Landscape, Air pollution, Waste, Noise and vibration - Construction and Operation Phases: Inequality between beneficiaries and project-affected peoples, Water use right, Water pollution - Operation Phase: Flow regime of lake and river, Flora and fauna, Bottom sediment
AI-P-02	- Planning Phase: Involuntary resettlement, Social vulnerable groups	- Construction Phase: Topography, Landscape, Air pollution, Waste, Noise and vibration - Construction and Operation Phases: Inequality between beneficiaries and project-affected peoples, Water use right, Flora and fauna, Water pollution - Operation Phase: Flow regime of lake and river, Bottom sediment, National park or equivalent area in terms of its ecological importance
AI-P-04	-	- Operation Phase: Flow regime of lake and river
AI-P-09/ MW-C-06 (Option 3)	-	- Construction Phase: Topography, Landscape, Air pollution, Waste - Construction and Operation Phases: Water use right, Flora and fauna, Water pollution - Operation Phase: Flow regime of lake and river, Bottom sediment
MW-P-01/02	-	- Operation Phase: Flow regime of lake and river
MW-P-04	-	- Construction Phase: Topography and geology, Landscape, Waste - Construction and Operation Phases: Water use right, Water pollution - Operation Phase: Flow regime of lake and river, Bottom sediment
MW-C-05/ IS-C-02 (Option 1)		- Construction Phase: Topography and geology, Landscape, Air pollution, Waste - Construction and Operation Phases: Water use right, Flora and fauna, Water pollution - Operation Phase: Flow regime of lake and river, Bottom sediment
MW-C-05/ IS-C-02 (Option-4)	- Planning Phase: Involuntary resettlement, Social vulnerable groups	- Construction Phase: Topography and geology, Landscape, Air pollution, Waste, Noise and vibration - Construction and Operation Phases: Inequality between beneficiaries and project-affected peoples, Flora and fauna, Water pollution - Operation Phase: Flow regime of lake and river, Bottom sediment
MW-C-06 (Option 1)	-	- Planning Phase: Conflict of interests
MW-C-06 (Option 2)	-	- Operation Phase: Flow regime of lake and river
FL-C-01 (Option 1)	- Planning Phase: Involuntary resettlement	- Construction Phase: Air pollution, Water pollution, Waste, Noise and Vibration - Construction and Operation Phases: Inequality between beneficiaries and project-affected peoples
FL-C-01 (Option 2)	- Planning Phase: Land use and utilization of local resources	- Planning Phase: Conflict of interests - Construction and Operation Phases: Existing social infrastructure, National park or equivalent area in terms of its ecological importance, Flora and fauna, Water pollution - Operation Phase: Flow regime of lake and river

Note *: The project codes correspond to the project titles as shown in Annex-T 13.3.1.
Source: JICA Study Team

13.3.6 Scoping Results and Proposed Mitigation Measures

(1) Significant Adverse Impacts (A-)

As a result of the screening mentioned in the preceding section, significant adverse impacts (A-) would be expected to have three (3) environmental components as shown in the following table. The table also indicates the timing of occurrence of impacts and the corresponding possible mitigation measures.

Table 13.3.4 Details, Timing of Occurrence and Mitigation Measures for Significant Adverse Impacts (A-)

Environmental Components	Details of the adverse impacts	Projects*	Timing of occurrence of Impacts	Mitigation Measures
i) Involuntary Resettlement	The installation of infrastructures would cause involuntary resettlement at the project sites.	AI-P-01, 02, MW-C-05(Opt. 2, 4), IS-C-02 (Opt. 2, 4), FL-C-01(Opt. 1)[7]	Planning Phase	- Selection of alternative project sites with less number of affected households through discussion with the community. - Proper planning, implementation and monitoring of appropriate resettlement action plans.
ii) Land Use/ Utilization of Local Resources	Land acquisition for the flood retarding basin (approx. 16,000 ha) could be implemented.	FL-C-01(Opt. 2)	Planning Phase	- Proper planning, implementation and monitoring of compensation measures for the land owners.
iii) Socially Vulnerable Groups	Involuntary resettlement would involve communities of Indigenous Peoples.	AI-P-01, 02, MW-C-05(Opt. 2, 4), IS-C-02(Opt. 2, 4)	Planning Phase	- Enhancement of full participation of IPs in accordance with Free and Prior Informed Consent (FPIC) guidelines in coordination with NCIP. - Preparation, implementation and monitoring of the action plans to recover the livelihoods of indigenous peoples affected considering their culture and traditional customs.

Note *: The project codes correspond to the project titles as shown in Annex-T 13.3.1.

(2) Less Significant Adverse Impacts (B-)

Also, less significant adverse impacts (B-) will be expected for the following 14 environmental components as tabulated below.

[7] For AI-P-01 and MW-C-05/IS-C-02 (Opt. 2), 800-1,000 families are expected to be resettled in the project, based on the interview with General Tino. In the case of AP-P-02, 548 families are expected to be resettled according to the interview with NIA. Also, MW-C-05/IS-C-02 (Opt. 4) could affect 4,300 families. As for FL-C-01 (Opt. 1), the involuntary resettlement of 2,365 families is expected based on the Pampanga Delta Development Project (Flood Control Component) Review Study for Phase 2, 2003, Nippon Koei Co., Ltd.

Table 13.3.5(1/3) Details, Timing of Occurrence and Mitigation Measures for Less Significant Adverse Impacts (B-)

Environmental Components	Details of Adverse Impact	Projects	Timing of Occurrence of Impacts	Mitigation Measures
i) Existing Social Infrastructures	Some of the existing roads could be affected by the construction of dike.	FL-C-01 (Opt. 2)	Construction and Operation Phases	- Supplementary infrastructures at the junctions of existing roads and planned dike aiming to secure the current accessibility of communities.
ii) Inequality between beneficiaries and Project-Affected-People (PAP)	The resettlement could impact the income level of Project-Affected-People.	AI-P-01, 02, MW-C-05 (Opt. 2, 4), IS-C-02 (Opt. 2, 4), FL-C-01 (Opt. 1)	Construction and Operation Phases	- Proper planning, implementation and monitoring of appropriate resettlement action plans.
iii) Conflict of interests	Some conflicts of interest may arise between relevant LGUs in terms of allocation of required groundwater sources.	MW-C-06(Opt.1)	Planning Phase	- Information sharing between relevant LGUs from the early stage of the project. - Organizational setup of inter-municipal bodies to mediate disputes.
	Some conflicts of interest may arise between implementing agencies and some environmental organizations due to potential impacts on biodiversity in the locality.	FL-C-01(Opt.2)	Planning Phase	- Information sharing between relevant stakeholders from the early stage of the project.
iv) Water use right and common land use right	Some conflict of the water use right would be expected considering that current status of water use right may not be conferred on the implementing agencies for respective project purposes.	AI-P-01,02,09, MW-P-04, MW-C-05 (Opt.1, 2), MW-C-06 (Opt. 3), IS-C-02 (Opt. 1, 2)	Construction and Operation Phases	- Information sharing with holders of current water use right at the project relevant area from the early stage of the project in order to reach mutual consensus on possible transference of water rights for project implementation. - Organizational setup to mediate disputes among stakeholders.
v) Topography and geology	Some changes on topography and geographical features are expected due to the relevant earthworks.	AI-P-01,02,09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), IS-C-02 (Opt. 1, 2, 4)	Construction Phase	- Introduction of slope protection works in case of high risk of soil erosion - Examination of alternative project sites which require less earthworks.
vi) Flow regime of lake and river	Some changes on flow regime of lake, river and swamp would be expected due to storage or extraction of river water by the infrastructure to be constructed.	AI-P-01,02,04, 09, MW-P-01,02,04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 2, 3), IS-C-02 (Opt. 1, 2, 4)	Operation Phase	- Examination and assurance of the amount of water flow required for the livelihood activities and biodiversity in the downstream.

…Continue to next page

Table 13.3.5 (2/3) Details, Timing of Occurrence and Mitigation Measures for Less Significant Adverse Impacts (B-)

Environmental Components	Details of Adverse Impact	Projects	Timing of Occurrence of Impacts	Mitigation Measures
vii)National park or equivalent area in terms of the ecological importance	Installation of reservoir may result in a habitat change of the area which is connected to Zambales Range which is considered as Important Bird Area[8].	AI-P-02	Operation Phase	- Examination and consideration of the amount of water flow required for the habitats of flora and fauna in the respective area.
	Project implementation may alter the current condition of Candaba swamp which has been declared as a bird sanctuary by LGU as well as recognized as a Ramsar candidate site and part of the East Asian-Australasian Flyway.	FL-C-01 (Opt. 2)	Construction and Operation Phases	- Conservation measures for the habitats of the important species, especially waterfowls, such as restoration of vegetations cleared in the course of project implementation, and assurance of the necessary water flow for the species. - Examination of alternative project sites.
viii)Flora and Fauna	The distribution of flora and fauna in the area may be altered due to the clearing of vegetation by the construction works and change of the flow regime in and around the area.	AI-P-01, 02, 09, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 2), IS-C-02 (Opt. 1, 2, 4)	Construction and Operation Phases	- Minimal cleaning of vegetation. - Restoration of vegetation cleared by project implementation, especially at the habitats for vulnerable species. - Examination and consideration of the amount of water flow required for the habitats of flora and fauna in the respective areas.
ix) Landscape	The original landscape can be changed by the slope cutting works at the installation of facilities.	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), IS-C-02 (Opt. 1, 2, 4)	Construction Phase	- Planting of grasses at the slope with the installation of structural measures, if necessary
x) Air pollution	Air pollution due to equipment used for the installation of infrastructures may impact on air quality in and around the project site.	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 1), IS-C-02 (Opt. 1, 2, 4)	Construction Phase	- Proper maintenance of equipment.
	Dust and particulate generation could impact on air quality.			- Spraying water on exposed surfaces of the construction area.

… Continue to next page

[8] Balog-Balog Multipurpose Project, Stage II, Feasibility Updating Study, December 2009, National Irrigation Administration

Table 13.3.5 (3/3) Details, Timing of Occurrence and Mitigation Measures for Less Significant Adverse Impacts (B-)

Environmental Components	Details of Adverse Impacts	Projects	Timing of Occurrence of Impacts	Mitigation Measures
xi) Water Pollution	Soil inflow due to the earthworks could deteriorate water quality of the localities.	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 1) IS-C-02 (Opt. 1, 2, 4)	Construction Phase	- Quarrying of gravels at the site apart from the rivers. - Slope protection works with vegetation cover.
	Soil inflow into the water bodies due to the erosion of upper catchments could impact on water quality of the localities.	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), IS-C-02 (Opt. 1, 2, 4)	Operation Phase	- Slope protection works with vegetation cover. - Check dams at the critical tributaries.
xii)Waste	The increment of the workers at the construction stage can increase the amount of the waste or generate waste scrap materials.	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 1) IS-C-02 (Opt. 1, 2, 4)	Construction Phase	- Proper treatment of waste in coordination with LGUs.
xiii)Noise and vibration	The local residents in and around the project sites would be disturbed by noise due to the construction works	AI-P-01,02, MW-C-05 (Opt. 2, 4), FL-C-01 (Opt. 1), IS-C-02 (Opt. 2, 4)	Construction Phase	- Time-limited use of equipment.
xvi)Bottom sediment	Some impacts caused by the bottom sediment at the water storages, such as limitation of the water storage capacity of the dams or water pollution, would be expected	AI-P-01,02,09, MW-P-04, MW-C-05 (Opt. 1, 2, 4) MW-C-06 (Opt. 3), IS-C-02 (Opt. 1, 2, 4)	Operation Phase	- Slope protection works with vegetation cover. - Check dams at the critical tributaries.

Note *: The project codes correspond to the project titles as shown in Annex-T 13.3.1.

13.4 Identification of Necessary Monitoring Items during the Project Cycle

Based on the adverse impacts identified in the former section, necessary items to be monitored were identified by phase of the project cycle.

13.4.1 Construction Phase

There are five (5) environmental parameters, soil erosion, air quality, water quality, waste, noise and vibration, to be monitored during the construction phase. The recommended monitoring measures including location, frequency of monitoring and analysis measures are summarized in the following table.

Table 13.4.1 Recommended Monitoring Measures for Environmental Parameters at the Construction Phase

Parameters to be Monitored	Projects*	Location	Frequency of Monitoring	Analysis Measures
1. Soil Erosion	AI-P-01,02,09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), IS-C-02 (Opt. 1, 2, 4)	Project sites	Monthly	- Measurement of the size of soil erosion and slope failures
2. Air Quality/ Dust Pollution/ Total Suspended Particulates (TSP)	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 1), IS-C-02 (Opt. 1, 2, 4)	Project sites and surrounding areas	Prior to operation	- Gravimetric method
3. Water Quality/ BOD, pH, DO	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 1), IS-C-02 (Opt. 1, 2, 4)	Project sites	Quarterly	- Water sampling
4. Waste	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 1), IS-C-02 (Opt. 1, 2, 4)	Project and camping sites	Twice a week	- Waste characterization - Waste Volume measurement
5. Noise and Vibration	AI-P-01,02, MW-C-05 (Opt. 2, 4), FL-C-01 (Opt. 1), IS-C-02 (Opt. 2, 4)	Project sites and surrounding areas	Quarterly	- Use of Sound Level Meter

Note *: The project codes correspond to the project titles as shown in Annex-T 13.3.1.

13.4.2 Operation Phase

The recommended monitoring measures for three (3) environmental parameters at the operation phase such as biodiversity, water quality and bottom sediment are shown in the table below.

Table 13.4.2 Recommended Monitoring Measures for Environmental Parameters at the Operation Phase

Parameters to be Monitored	Projects*	Location	Frequency of Monitoring	Analysis Measures
1. Biodiversity	AI-P-01, 02, 09, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 2), IS-C-02 (Opt. 1, 2, 4)	Project sites and/or affected surrounding area	Yearly	- Reconnaissance survey to grasp the current condition of fauna and flora. - Counting of important species.
2. Water Quality/ BOD, pH, DO	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4), MW-C-06 (Opt. 3), FL-C-01 (Opt. 1) IS-C-02 (Opt. 1, 2, 4)	Outfall of spillway, reservoir zone	Quarterly	- Water sampling
3. Bottom Sediment	AI-P-01, 02, 09, MW-P-04, MW-C-05 (Opt. 1, 2, 4) MW-C-06 (Opt. 3), IS-C-02 (Opt. 1, 2, 4)	Reservoir	Once in 5 years	- Measurement with equipment such as Echo Sounder

Note *: The project codes correspond to the project titles as shown in Annex-T 13.3.1.

13.4.3 Identification of Monitoring Items throughout the Project Cycle

For the impacts to project-affected-people (PAP) including the indigenous people caused by involuntary resettlement and land acquisition, as well as the implementation of the resettlement action plan, the compensation plan and the other action plans for the recovery of livelihood of the PAPs, they should be monitored by the implementation agencies throughout the project cycle of each project.

13.5 Important Notice on Implementation of the Projects

When the environmental and social consideration of the project, which consists of the IWRM Plan, is examined, the comments, suggestions and recommendations of the stakeholders have to be incorporated through stakeholder meetings. Moreover, the methodologies and procedures for organizing of the stakeholder meetings shall accord to the standards in the Philippines, and those in of the donor, if the project is implemented through assistance from the donor.

Chapter 14. Conclusions and Recommendations

14.1 Principal Water-related Problems in Pampanga River Basin

The particular water-related problems in Pampanga river basin are as enumerated below:

14.1.1 Conflicts on Surface Water Allocation and Distribution among the Water Users

Pampanga river basin (i.e. the study area) has ever played an important role as the food basket for the Philippines through its large scale of national irrigation schemes such as UPRIIS in Pampanga main river basin and AMRIS in Angat river basin. Such large scale of irrigation area requires the bulk surface irrigation water. Pampanga river basin has also functioned as the important surface water source to cover about 90% of the domestic water use in Metro Manila and its outskirts, which are located out of Pampanga river basin. These surface water demands for irrigation and domestic use have largely relied on the supply from the two large dam reservoirs; namely Pantabangan and Angat storage dams. Nevertheless, the surface water supply capacity of Angat storage dam in particular is judged to be critical causing the serious conflicts between the water supplies for irrigation in Pampanga river basin and the domestic water use in Metro Manila.

14.1.2 Deterioration of Groundwater and Relevant Problems Caused by the Excessive Abstraction of Groundwater

Almost whole domestic water use in Pampanga river basin relies on the groundwater as the water source. However, the ever increasing population/industrial activities and the concentration of the population/industrial estates into the regional urban centers induces the excessive abstraction of groundwater and causes the deterioration of quality of groundwater and lowering of groundwater level/land subsidence. As the results, the sustainable water supply for the domestic use is being hardly performed in many water districts. The land subsidence due to the excessive abstraction of the groundwater also aggravates the flood problems.

14.1.3 Flood and Sediment Disasters

The flood overflow along Pampanga River and its tributaries occurs almost every year due to inadequate channel flow capacity, which leads to a large flood damages. Moreover, the serious sediment accumulations in the downstream river channels are in progress. The flood and sediment problems are caused by the following unfavorable activities:

- Increment of the flood peak discharges inflicted by expansion of the urbanized areas in the river basin,
- Encroachment of the houses and fishponds into the river areas,
- Increment of population and assets in the habitual flood inundation areas, which lead to increment of the potential flood damages,
- Decrease of the basin flood detention capacity caused by the excessive logging in the upland forest areas, and
- Damage of the river structures caused by the excessive sand mining in the river channels.

14.1.4 Problems on Watershed Management

The present extent of forest cover is limited to only about 50% of the classified forestlands in Pampanga river basin. Moreover, forest fires, illegal loggings and other unfavorable activities in the forest area are causing the serious degradation of watersheds. The devastation of the watershed tends to cause various water-related adverse effects such as increment sediment runoff associated with acceleration of the slope failure, increment of flood peak runoff discharge and reduction of low flow discharge due to reduction of the basin rainfall detention capacity.

14.1.5 Water Pollution and Other Water-related Environment Problems

The serious water pollution such as mixture of toxic material into the surface water as well as the groundwater has not occurred in the most part of Pampanga river basin, yet. The quality of the groundwater in the coastal part of the river basin is, however, being aggravated due to the excessive abstraction associated with intrusion of the salinity water. Moreover, the domestic wastewater is now directly discharged into rivers and drainages without adequate treatment. Pollution control for industrial discharge is also not enough due to lack of proper control and monitoring system. In addition, there is illegal dumping of solid waste. All of these could degrade the water quality and may possibly bring out the critical pollution of the surface water, groundwater as well as the ocean water in Manila Bay in the future.

14.2 Significance and Necessity of IWRM for Pampanga River Basin

In order to cope with the aforesaid water-related problems, the relevant government agencies as well as the non-government entities have ever implemented a variety of the projects for water resources management and development. Many of the problems are, however, still left behind without any fundamental solution. Moreover, the completed and/or proposed projects are not always based on the adequate coordination with all water-related sectors, and at the same time, the requirements of the stakeholders have not been well reflected to the projects.

As the results, the project in a specific water-sector has often caused the adverse effect to other water related sectors, which led to difficulties in achieving the accountable, effective and sustainable project. Moreover, the problems in the water sector would be unavoidably more significant as the population increase, the economic activities expand and other socio-economic conditions change in the future.

In view of the above natures of the water-related problems, it is indispensable to adapt the concept of IWRM for Pampanga river basin, which stresses the following four different principles:

- Integrated and holistic approach crossing multi-water sectors,
- Adaptable response to the future dynamic changes of the socio-economic conditions and the natural conditions inflicted by increment of population, change of industrial structures, change of the vegetation, climate changes and other factors,
- Involvement of stakeholders at every stages and steps of plan formulation and implementation of the water-related project and
- Broader focus points such as fairness, economical effect, efficiency and sustainability of the water-related projects.

14.3 Recommendations on the Proposed IWRM Plan for Pampanga River Basin

The various proposals on IWRM for Pampanga river basin are made in this study. The principal recommendations on the proposals are as described hereinafter.

14.3.1 Guideline for Formulation of IWRM Plan

The member of NWRB formulated the “IWRM Plan Framework in the Philippines” in 2006 clarifying the concept and the direction of the IWRM Plan. Taking the “IWRM Plan Frame Work” in to account, the guideline on the methodologies and procedures for formulation of the IWRM Plan was prepared in this study and used as the basic material for consensus buildings of the stakeholders on the procedures of the plan formulation. The guideline is also expected to be used as the references to formulation of IWRM Plans for other river basins.

The guideline prepared in the study is, however, likely to still contain an immature part, and it would be necessary to improve such immature part through actual implementation of the IWRM Plan. The immature part to be improved is addressed especially to the project evaluation method for determination of the priority orders of the projects for IWRM.

The project evaluation is made through viewpoints of 6 different categories such as “Viability of the Project”, “Enhanced Livelihood”, “Improved Quality of Life”, “Decentralized Development”,

"Sustained Ecosystem" and "Empowered People". Each of the 6 categories further involves 4 to 5 detailed points of evaluation, and thereby the evaluation is made from 25 detailed viewpoints in total. Introduction of such multi-evaluation points aims at enhancing the objective and precise evaluation of the inter-sector projects based on the comprehensive viewpoints. However, the members of TWG for the study pointed out that the proposed evaluation method would contain too many evaluation points and some of the evaluation points would be ambiguous. Hence, it would be necessary to monitor the results of project implementation and improve the project evaluation method through clarification of difference between the results of project evaluation before project implementation and the outcomes of the actual project implementation.

14.3.2 Principal Visions of the IWRM Plan for Pampanga River Basin

The "Poverty Alleviation" and the "Economic Development" are adopted as the principal visions of the IWRM Plan for Pampanga river basin, and all development scenarios in the Plan shall be oriented to these principal visions. However, the following particular attentions shall be given to these principal visions:

(1) Poverty Alleviation

The "Poverty Alleviation" is oriented to betterment of the livelihood/increase of the income for the poverty thresholds and at the same time, it aims at securing the basic human needs such as the safe drinking water and safe living conditions against flood and other water-related disasters. Moreover, the approaches to the "Poverty Alleviation" shall not be made by sacrifice of the vital ecosystem.

The average ratio of the poverty thresholds in the study area as of 2006 is about 20%, which is lower than the national average of about 33%. However, a particular attention shall be given to the ratio of the poverty thresholds in Nueva Ecija Province in the study area. The ratio in the Province is about 38%, which exceed the national average. The majority of the employees in the Province are engaged to the agriculture/forestry sector and one of the crucial issues on the poverty alleviation for the province shall be addressed to increment of the income of the employees in the sector.

(2) Economic Development

The "Economic Development" is oriented to not only development of the regional economy but also preserving and/or recovery of the ecosystem in Pampanga river basin. It is further noted that the manufacturing and the agriculture are the major industries in Region III, which produce the Gross Value Added of more than 50% in the Region. Accordingly, these industrial sectors shall take the principal roles for the "Economic Development" in Pampanga river basin, and thereby enhancement of the bulk water supply system for the manufacturing and the irrigation system for the agriculture shall be the important water-related works to promise the economic development in the study area.

14.3.3 Projects Proposed as the Components of IWRM Plan for Pampanga River Basin

The proposed IWRM Plan involves the inter-sector projects, which belong to various water-related sectors such as "the agriculture/fishery development", "the municipal water supply, sanitation and sewerage development", "management of flood and sediment disasters", "the watershed management" and "the water-related environmental management" The following special attentions on implementation of these projects shall be given:

(1) Project Implementation Schedule

The IWRM Plan for Pampanga river basin include the 84 projects in total, which are to be implemented in the short-term (2011-2015), the mid-term, (2016-2020) and/or the long-term (2021-2025). Of these projects, those to be implemented in the short-term shall be provided with the earlier budgetary arrangement as well as other necessary preparatory works for project implementation. As for the projects to be implemented in the mid-term and long-term, however, the changes of social and natural environments relevant to the project implementation shall be carefully monitored and the reexamination may be required to the

project implementation schedule as well as the contents of the projects in accordance with the results of monitoring.

(2) Project Investment Plan

The projects as the components of the IWRM Plan for Pampanga river basin is classified into the on-going projects, the proposed projects and the conceptual projects. The necessary investment cost of about 99 billion pesos for the on-going and proposed projects have been arranged and/or they are being programmed by the projects proponents. However, there is nothing to be done with the project investment cost of about 70.1 billion pesos for the conceptual projects. Hence, the budgetary arrangement for the conceptual projects is newly required and the following particular attentions shall be given:

- The feasibility studies for many of the conceptual projects shall be carried out before project implementation in order to verify the project viability, decide the project implementation bodies and estimate the precise project investment cost.
- The project investment shall be shouldered by the central government, the LGUs and/or the corporation/private firm. Of these project investors, the corporation/the private firm would be required to arrange a substantial part of the necessary project investment cost for development of the municipal water supply system and sanitation facilities. The investment cost by the corporation/private firm has to be fully recovered through collection of the water service charges. Such full cost recovery has been preliminarily verified based on the comparison between the necessary investment cost and the possible amount of water service charge. Nevertheless, the details on the full-cost recovery for development of the municipal water supply shall be reexamined before project implementation.

(3) Implementation of the Inter-sector Projects

The projects as the components of the IWRM Plan for Pampanga river basin involve the inter-sector projects, which are related to the plural water-sectors. The inter-sectors projects would need to be implemented jointly by the several government agencies and private firms under the umbrella of the under-mentioned River Basin Committee (RBC). At the same time, it is necessary to clarify the demarcations of each of the relevant agencies for the inter-sector projects based on the prevailing laws and regulations. The inter-sector projects and their principal issues in Pampanga river basin are as enumerated below:

(a) Water Allocation and Distribution for Multipurpose Dam

There exist two (2) large scale multipurpose dam reservoirs in Pampanga river basin; namely Pantabangan Dam and Angat Dam. Moreover, in order to cope with the incremental water demands, several new multipurpose dams are proposed in this study. The existing and proposed multipurpose dams aim at allocating and distributing the water for various purposes such as irrigation, municipal water use and hydropower generation. Such water allocation and distribution would require the proper coordination among the water users, and thereby, the typical potential conflicts, which would require the proper coordination, are as enumerated below:

- Conflict between water allocations and distributions for irrigation and municipal water use during a drought period,
- Conflict between the intensive discharges released from dam for peak hydropower generation and .the constant discharge from dam for water distribution to irrigation and municipal water uses, and.
- Cost share of the relevant agencies for development of new multipurpose dams.

(b) Flood Control by Multipurpose Dam

The clear reservoir operation rule for flood control has not been set forth for Angat

multipurpose dam in spite of the flood control capacity of 42 MCM allocated to the dam during the wet season. As the results, the flood control capacity is sometimes curtailed and a part of it is used for water supply, which may lead to the excessive discharge released from the dam during a flood and man-made floods in the lower leaches of the dam. In order to avoid such man-made flood damage, it is indispensable to set forth the definite reservoir operation rule for flood control through coordination among the various agencies related to dam reservoir operation, flood control and use of discharge released from the dam.

(c) Watershed Management in Cooperation with Flood/Sediment Disaster Management and Water Resources Development/Management

The extensive deforestation would reduce the basin detention capacity of the rainfall, whereby the excessive basin peak runoff would occur during a flood, while the river flow discharge would be reduced during a dry season. Such dynamic hydrological change would lead to the various calamities such as: (i) the flood disasters in a wet season, (ii) the water deficit in a dry season, and (iii) reduction of the river environmental flow. Moreover, the deforestation in the upper reaches of the dam reservoir would cause a large volume of sediment inflow into the dam reservoir causing the serious deterioration of the function of the reservoir.

As described above, the watershed management, which could control the excessive deforestation, is closely related to the management of flood/sediment disaster and/or the water resources development/management. Accordingly, the projects in these three (3) sectors would need to be implemented through the close mutual cooperation.

(d) Coordination between the Flood Management and the Fishery Development

The fishery development is one of the important sectors for the water-related economic development in Pampanga river basin. However, some of the fish ponds developed as a part of fishery development encroach to the river area reducing the river channel flow capacity. In order to check such encroachment of the fishponds and preserve the river channel flow capacity, development of fish ponds shall be jointly monitored and controlled by the agencies in charge of flood control and fishery development.

(e) Flood Management in Cooperation with Agricultural Development

One of serious problems for the agricultural development in Pampanga river basin is addressed to the flood overflow from the river to the irrigation areas by the river and/or the poor drainage in the irrigation area. In order to cope with the flood problems in the irrigation area, it is required to identify the habitual flood inundation area and formulate the strategic flood mitigation plan for protection of the irrigation area in cooperation each other of flood management and agricultural development sectors.

(f) Approaches to Preservation of Environmental River Flow

The environmental river flow is the important factor to preserve the appropriate river ecosystem, and it is indispensable to estimate the necessary minimum river discharge as the environmental river flow and secure it throughout a year. The environmental river flow is largely influenced by the forest conservation in the upper reaches, the discharge released from the dams and the water intakes from the rivers. Accordingly, securing of the environmental river flow shall be jointly undertaken by the agencies in charge of the river ecosystem as well as the watershed management, the dam reservoir management and the management of water resources in corporation each other.

14.4 Proposed Institutional Setup for IWRM in Pampanga River Basin

14.4.1 Organization Setup

The River Basin Committee (RBC) shall be newly established under the existing Regional Development Council (RDC) Region III in order to lead the relevant government agencies and the

private entities to the effective IWRM for Pampanga river basin. The RBC is composed of the Committee, the Secretariat and TWG. The roles and members of these components are as below:

- The Committee is at the top of the RBC having the roles of formulation of the policy and framework for IWRM Plan of Pampanga river basin and coordination/direction to the under-mentioned TWG members for implementation of IWRM Plan. The Committee shall involve the relevant provincial governors and the representatives of the TWG, and NGOs.
- The NEDA Region III supports the Committee as the Secretariat.
- The TWG formulate the details of the IWRM Plan and monitors the project implementation relevant to IWRM. The members of the TWG are summoned from the relevant national government agencies/regional line agencies, NGOs and private firms, as required.

14.4.2 Legal Set up

Amendments of the existing regulations and/or laws and establishment of the new legal frameworks shall be made to attain the appropriate and effective IWRM for Pampanga river basin. The principal work items required to the legal setup are as below:

(1) Establishment of the New Legal Basis for Regulation of Water Use Right

In order to attain the more rational and equitable water permit system, it is required to set the new legal basis, which specifies the seasonal variations of the allowable maximum limits of the water uses, and the minimum water supply security level for the water uses. A detailed implementation rule and regulation (IRR) shall be also prepared to clarify the rules, processes, compensation and all other necessary conditions for lease and transfer of the water right so as to enhance the more efficient water uses.

(2) Amendments of the Present Legal Set up for Overlapping Water Charge System

The Water Code prescribes that NWRB is entitled to collect the water fees and charges for the water permit, while the Local Government Code prescribes that the LGU is entitled to collect a share from the proceeds of water resources within its jurisdiction area. It is required to unify the overlapping provisions on the water charges in the Water Code and the Local Government Code.

(3) Establishment of New Legal Basis on Cost Allocation Rule for Multipurpose Dam Projects

The legal basis on cost allocation rule for multipurpose dam projects shall be newly established to achieve the rational and equitable water allocation for irrigation/municipal water use and hydropower generation during a drought.

(4) Establishment of New Legal Basis on Environmental River Flow

The legal basis on the minimum the environmental river flow shall be newly established in order to preserve the appropriate rivet ecosystem.

(5) Establishment of New Legal Basis on River Basin Committee (RBC) for IWRM in Pampanga River Basin

The power and functions of the RBC and the necessary financial source for activities of RBC shall be appropriated by MOAs or Executive Order.

14.5 Application of the Results of the Study to the Future IWRM in Philippines

The results of the study include various items such as: (a) the guideline for formulation of IWRM Plan, (b) the development scenarios for IWRM by the target year 2025, (c) the eligible projects as the components of the IWRM Plan as well as their implementation and investment schedule and (d) the organization and legal setup required to implementation of IWRM Plan for Pampanga river basin. These results of study shall be applied to the actual IWRM immediately after completion of the study and sustainably developed through the continuous efforts by the relevant agencies. NWRB in

particular as the leading counterpart agency for the study, is expected to accomplish the following missions:

14.5.1 Support for Establishment of and Activities by River Basin Committee (RBC)

NWRB would take the following missions to support establishment and activities of the RBC proposed in the study:

- To support preparation of the Minutes of Agreement (MOA) or Executive Order (EO), which appropriates the power and functions of the RBC and the financial source for activities of RBC,
- To monitor the outcomes of the activities by RBC (i.e., the results of implementation of the proposed IWRM plans), and
- To review and revise the proposed IWRM plans based on the results of the above monitoring.

14.5.2 Missions as the Member of RBC

NWRB would accomplish the following missions related to management of water use right and water allocation/distribution as a core member of RBC:

- To make capacity development on appraisal of water use right and adjustment of water allocation and distribution including capacity development on estimation of eligible water supply capacity and development of the basic database,
- To strengthen the monitoring system for usage of surface water and groundwater,
- To arbitrate the conflicts among the various water users, when the arbitration could not be made at the level of RBC, and
- To amend the present legal setup related to approval of water use right and water allocation/distribution.

14.5.3 Development of Concept of IWRM as the Nationwide Movement

NWRB would be required to develop the concept of IWRM all over the country trough the following activities:

- To formulate the strategic plan for development of the concept of IWRM,
- To review and make the necessary revisions on the guideline for formulation of IWRM Plan proposed in the study, and
- To introduce the IWRM Plan to other river basins.

Annex-Tables

Annex-T 1.2.1 Overlapping Ration of Study Area with the Administrative Area of City/Municipality

Province		City/Municipality	Total Area (km^2)	Area Inside Study Area (km^2)	Area out of Study Area (km^2)	Overlapping Ration with Study Area
Bulacan		Angat	59	53	6	89.8%
		Baliuag	44	44	0	100.0%
		Bulacan	69	11	58	16.1%
		Bustos	40	18	23	43.8%
		Calumpit	47	47	0	100.0%
		Dona Remedios Trinidad	879	854	25	97.2%
		Guiguinto	25	2	23	6.6%
		Hagonoy	95	95	0	100.0%
		Malolos City	73	73	0	100.0%
		Norzagaray	247	207	40	83.9%
		Pandi	50	1	49	2.8%
		Paombong	46	46	0	100.0%
		Plaridel	35	20	15	56.5%
		Pulilan	44	44	0	100.0%
		San Ildefonso	167	167	0	100.0%
		San Miguel	236	236	0	100.0%
		San Rafael	105	105	0	100.0%
		Santa Maria	79	1	78	1.0%
		Total	**2,337**	**2,021**	**317**	**86.4%**
Nueva Ecija		Aliaga	92	92	0	100.0%
		Bongabon	229	225	5	97.9%
		Cabanatuan City	198	198	0	100.0%
		Cabiao	113	113	0	100.0%
		Carranglan	739	693	46	93.7%
		Gabaldon	253	252	0	99.9%
		Gapan	165	165	0	100.0%
		Gen Mamerto Natividad	98	98	0	100.0%
		General Tinio	581	580	1	99.9%
		Guimba	219	137	82	62.6%
		Jaen	90	90	0	100.0%
		Laur	221	221	0	100.0%
		Licab	60	60	0	100.0%
		Llanera	114	114	0	100.0%
		Lupao	143	130	13	90.9%
		Palayan City	136	136	0	100.0%
		Pantabangan	421	421	0	100.0%
		Penaranda	79	79	0	100.0%
		Quezon	68	68	0	100.0%
		Rizal	124	124	0	100.0%
		San Antonio	157	157	0	100.0%
		San Isidro	58	58	0	100.0%
		San Jose City	162	162	0	100.0%
		San Leonardo	52	52	0	100.0%
		Santa Rosa	117	117	0	100.0%
		Santo Domingo	83	83	0	100.0%
		Science City Of Munoz	142	142	0	100.0%
		Talavera	135	135	0	100.0%
		Talugtug	73	39	35	52.8%
		Zaragosa	72	72	0	100.0%
		Total	**5,195**	**5,013**	**182**	**96.5%**
Pampanga		Angeles City	63	63	0	100.0%
		Apalit	60	60	0	100.0%
		Arayat	177	177	0	100.0%
		Bacolor	74	74	0	100.0%
		Candaba	208	208	0	100.0%
		City Of San Fernando	69	69	0	100.0%
		Floridablanca	121	83	38	69.0%
		Guagua	49	49	0	100.0%
		Lubao	155	149	6	96.0%
		Mabalacat	146	140	6	96.2%
		Macabebe	102	102	0	100.0%
		Magalang	105	105	0	100.0%
		Masantol	46	46	0	100.0%
		Mexico	122	122	0	100.0%
		Minalin	45	45	0	100.0%
		Porac	293	292	1	99.5%
		San Luis	55	55	0	100.0%
		San Simon	60	60	0	100.0%
		Santa Ana	40	40	0	100.0%
		Santa Rita	23	23	0	100.0%
		Santo Tomas	14	14	0	100.0%
		Sasmuan	45	45	0	99.9%
		Total	**2,073**	**2,022**	**51**	**97.6%**
Tarlac		Bamban	251	147	104	58.5%
		Capas	422	134	288	31.7%
		Concepcion	221	221	0	100.0%
		La Paz	117	117	0	100.0%
		Tarlac City	261	132	129	50.6%
		Victoria	112	83	29	74.4%
		Total	**1,384**	**834**	**550**	**60.3%**
Other Province	Aurora	Dingalan	330	62	268	18.9%
		Maria Aurora	415	9	406	2.1%
		San Luis	568	123	445	21.7%
	Bataan	Hermosa	126	5	121	4.0%
		Orani	47	9	38	19.0%
	Nueva Vizcaya	Alfonso Castaneda	570	144	426	25.2%
		Aritao	275	7	268	2.6%
		Dupax del Sur	380	5	375	1.3%
		Santa Fe	347	7	339	2.1%
	Pangasinan	Umingan	230	26	204	11.3%
	Quezon	General Nakar	1,438	30	1,408	2.1%
	Rizal	Rodriguez	309	42	267	13.6%
	Zambales	Botolan	654	3	652	0.5%
		San Marcelino	393	71	322	18.0%
	Total		**6,083**	**544**	**5,539**	**8.9%**
Grand Total			**17,073**	**10,434**	**6,639**	**61.1%**

Source: JICA Study Team

Annex-T 2.3.1 List of Meteorological Gauging Stations (for Precipitation)

No.	Station Name	Province	Type	Coordinates *1			Monthly Precipitation Data Available Record Years
				Latitude N	Longitude E	Source	1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
01	CLSU Munoz	NUEVA ECIJA	PAGASA-Synoptic	15°43′00″	120°54′00″	1	
02	Cabanatuan	NUEVA ECIJA	PAGASA-Synoptic	15°29′18″	120°57′42″	6	
03	Port Area	NCR	PAGASA-Synoptic	14°35′00″	120°59′00″	1	
04	Science Garden	NCR	PAGASA-Synoptic	14°38′41″	121°02′31″	6	
05	Infanta	QUEZON	PAGASA-Synoptic	14°45′00″	121°38′48″	6	
06	Baler	QUEZON	PAGASA-Synoptic	15°46′00″	121°34′00″	1	
07	Casiguran	AURORA	PAGASA-Synoptic	16°17′00″	122°07′00″	1	
08	Dagupan	PANGASINAN	PAGASA-Synoptic	16°03′00″	120°20′00″	1	
09	Iba	ZAMBALES	PAGASA-Synoptic	15°20′00″	119°58′00″	1	
10	Balungao	PANGASINAN	PAGASA	15°54′00″	120°40′00″	1	
11	Consuelo	NUEVA VIZCAYA	PAGASA	16°10′00″	120°57′00″	3	
12	Bai Magalang	PAMPANGA	PAGASA	15°13′00″	120°42′00″	1	
13	San Fernando	PAMPANGA	PAGASA	15°02′00″	120°42′00″	3	
14	Mayantoc	TARLAC	PAGASA	15°36′00″	120°21′00″	4	
15	Santa Rita	ZAMBALES	PAGASA	15°10′00″	120°03′00″	4	
16	Hacienda Luisita	TARLAC	PAGASA	15°26′00″	120°36′00″	4	
17	Becuran	PAMPANGA	PAGASA	15°00′00″	120°34′00″	4	
18	SantaCruz	PAMPANGA	PAGASA	15°04′00″	120°33′00″	4	
19	Base AFB	PAMPANGA	Air Force Base	15°01′00″	120°30′00″	4	
20	Gabong	NUEVA VIZCAYA	NIA	16°01′40″	121°21′00″	3	
21	Pantabangan Dam	NUEVA ECIJA	NIA-UPRIIS	15°49′06″	121°06′34″	2	
22	Sapang Buho	NUEVA ECIJA	TelemetryNetwork	15°35′39″	121°07′09″	2	
23	Gabaldon	NUEVA ECIJA	TelemetryNetwork	15°29′55″	121°21′20″	2	
24	Zaragoza	PAMPANGA	TelemetryNetwork	15°26′36″	120°45′03″	2	
25	Papaya	PAMPANGA	TelemetryNetwork	15°21′17″	121°03′56″	2	
26	San Isidro	PAMPANGA	TelemetryNetwork	15°18′49″	120°54′09″	2	
27	Arayat	PAMPANGA	TelemetryNetwork	15°10′06″	120°46′56″	2	
28	Candaba	PAMPANGA	TelemetryNetwork	15°06′56″	120°51′01″	2	
29	Sibul Spring	BULACAN	TelemetryNetwork	15°10′04″	121°03′27″	2	
30	Sasmuan	PAMPANGA	TelemetryNetwork	14°56′14″	120°37′37″	2	
31	Sulipan	PAMPANGA	TelemetryNetwork	14°56′22″	120°45′31″	2	
32	Ipo Dam	BULACAN	TelemetryNetwork	14°52′30″	121°08′44″	2	
33	San Rafael	BULACAN	TelemetryNetwork	14°57′31″	120°57′53″	JST	
34	Masanga	QUEZON	others	14°59′36″	121°32′06″	5	
35	Tuno	QUEZON	others	14°45′50″	121°32′30″	5	
36	Lumutan	QUEZON	others	14°45′00″	121°21′00″	5	

Note (*1): 1- identified in Ref(1), 2- identified in Ref(2), 3- identified in Ref(3), 4- identified in Ref(4), 5- identified in Ref(5), 6- identified in PAGASA data, JST- estimated by Jica Study Team ■: data available ▨: include missing data

References:

Ref(1): NWIN, http://www.nwin.nwrb.gov.ph/

Ref(2): PAGASA-JICA, Basic Design Study Report on the Project for Upgrading of Flood Forecasting and Warning System in Pampanga and Agno River and Basins in Republic of Philippines, 2007.

Ref(3): NIA, Defenitive Development Plan, Irrigation Component of the Casecnan Multipurpose Irrigation and Power Project (CMIPP-IC), Appendix-I, 2000.

Ref(4): Pinatubo Hazard Urgent Rehabilitation Project, Mornitoring and Planning of Flood Control Works on the Pasac Delta (including the Porac-Gumain River) and Third River Channel, Final Report, Appendix No.2, Meteorology and Hydrology, 2002

Ref(5): JICA,NWRB, The Study on Water Resources Development for Metro Manila in the Republic of the Philippines, Final Report, Vol.III, Master Plan Study, Supporting Report, 2003.

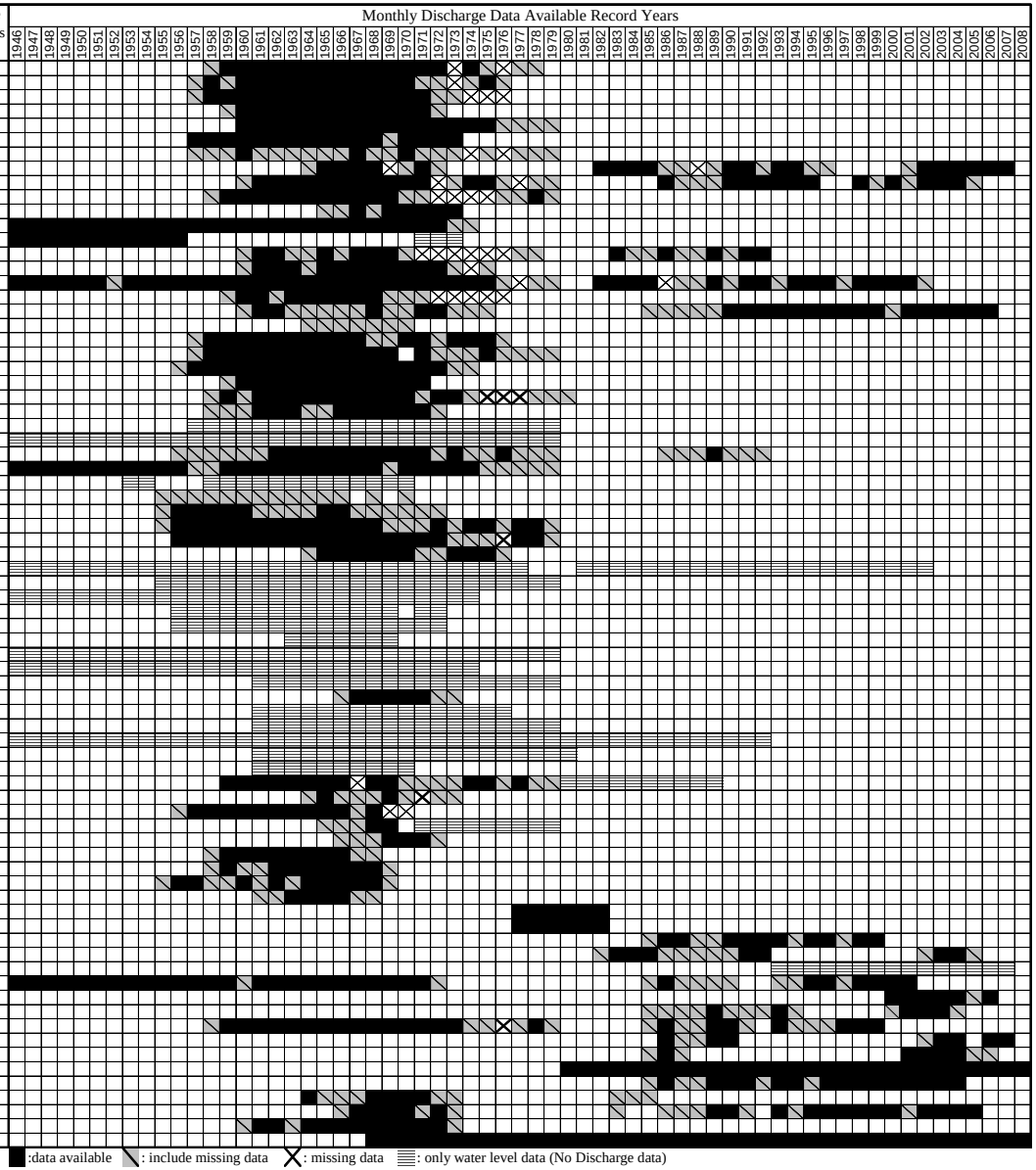
Annex-T 2.3.2 List of Meteorological Gauging Stations

(for Climatic Data other than Precipitation)

No.	Station Name	Type	Available data period
Monthly Mean Temperture (°C)			
1	CABANATUAN	PAGASA-Synoptic	1961 - 1980
			1991 - 2007
2	CLSU MUNOZ	PAGASA-Synoptic	1977 - 2007
Monthly Relative Humidity Data			
1	CABANATUAN	PAGASA-Synoptic	1961 - 1980
			1991 - 2007
2	CLSU MUNOZ	PAGASA-Synoptic	1974 - 2007
Monthly Wind speed Data			
1	CABANATUAN	PAGASA-Synoptic	1961 - 1980
			1991 - 2007
2	CLSU MUNOZ	PAGASA-Synoptic	1974 - 1999
Monthly Sunshine duration Data			
1	CLSU MUNOZ	PAGASA-Synoptic	1974 - 2007
Monthly Evaporation Data			
1	CLSU MUNOZ	PAGASA-Synoptic	1977 - 2007
Maximum Mean Temperture (°C)			
1	CLSU MUNOZ	PAGASA-Synoptic	1974 - 1999
Minimum Mean Temperture (°C)			
1	CLSU MUNOZ	PAGASA-Synoptic	1974 - 1999

Annex-T 2.4.1 List of Hydrological Gauging Stations

No.	ID	RiverName	Location	Drainage Area (Original)	Drainage Area (This Study)	Monthly Discharge Data Available Record Years
01	326	Carranglan	Baluarte, Carranglan, Nueva Ecija	258	246	
02	327	Santor	San Vicente, Laur, Nueva Ecija	544	545	
03	328	Santor	Cuyapa, Gabaldon, Nueva Ecija	89	88	
04	329	Digmala	Labi, Bongabon, Nueva Ecija	52	54	
05	330	Coronel	Bangkerohan, Bongabon, Nueva Ecija	709	712	
06	332	Pampanga	Malate, Bongabon, Nueva Ecija	2015	2038	
07	333	Cabu	Cabu, Cabanatuan City	143	142	
08	334	Pampanga	Valdefuente, Cabanatuan City	2441	2455	
09	335	Tabuating	Soledad, Sta.Rosa, Nueva Ecija	79	81	
10	337	Pampanga	San Anton, San Leonardo, Nueva Ecija	2851	2778	
11	338	Penaranda	San Vicente, Gapan, Nueva Ecija	575	566	
12	339	Penaranda	San Josef, Penaranda, Nueva Ecija	512	519	
13	340	Penaranda(Headworks)	San Josef, Penaranda, Nueva Ecija	511	519	
14	341	Chico	Ilog na Munti, Gen.Tinio, Nueva Ecija	160	157	
15	342	Sumacbao	Pias, Gen.Tinio, Nueva Ecija	287	309	
16	343	Pampanga	Camba(San Agustin), Arayat, Pampanga	6487	6315	
17	344	Talavera	Caboboloonan, Talavera, Nueva Ecija	431	391	
18	345	Rio Chico	Sto. Rosario, Zaragoza, Nueva Ecija	1177	1604	
19	346	Rio Chico	Banga, Arayat, Pampanga	2982	2888	
20	347	Benituan	Pasong Intsik, Guimba, Nueva Ecija	208	117	
21	348	Baliwag	Catalanacan, Munoz, Nueva Ecija	284	248	
22	349	Talavera	Lomboy, San Jose, Nueva Ecija	261	281	
23	350	Pampanga	Pialuan, Pantabangan, Nueva Ecija	838	834	
24	351	Pampanga	Pasig, Candaba, Pampanga	7468	6324	
25	352	Pantabangan	Poblacion, Pantabangan, Nueva Ecija	253	268	
26	353	Pampanga	Sta. Cruz, San Luis, Pampanga	7756		
27	354	Pampanga	San Juan, San Simon, Pampanga	7776		
28	355	Maasim	Bahay-Pare, Candaba, Pampanga	174	187	
29	356	Maasim	Diliman, San Rafael, Bulacan	150	146	
30	357	Candaba Swamps	Ducma, Candaba, Pampanga	7458		
31	358	Garlang Creek	Garlang, San Ildefonso, Bulacan	5	6	
32	359	Garlang	Garalang, San Ildefonso, Bulacan	85	80	
33	360	San Miguel	San Vicente, San Miguel, Bulacan	256	234	
34	361	Balaong-Madlum	Sta. Ines, San Miguel, Bulacan	204	206	
35	362	Bulo	Malibay, San Miguel, Bulacan	57	58	
36	363	Pampanga	Sulipan, Apalit, Pampanga	7849		
37	364	Sulipan Cut-off Channel	Sulipan, Apalit, Pampanga	7874		
38	365	Francis	San Miguel Calumpit, Bulacan	0		
39	366	Bebe Cut-off Channel No.1	Bebe, Masantol, Pampanga	0		
40	367	Bebe Cut-off Channel No.2	Bebe, Masantol, Pampanga	0		
41	368	Pampanga	Budbud, Masantol, Pampanga	0		
42	369	Pampanga	Poblacion, Calumpit, Bulacan	7910		
43	370	Pampanga	San Miguel, Calumpit, Bulacan	7914		
44	371	Labangan	Halang, Hagonoy, Bulacan	0		
45	372	Sta.Maria	Bagbagin, Sta.Maria, Bulacan	187		
46	373	Labangan	Tibagin, Hagonoy, Bulacan	0		
47	374	Labangan	San Antonio, Hangonoy, Bulacan	0		
48	375	Labangan	Bagbag, Calumpit, Bulacan	1016		
49	376	Angat	Pungo, Calumpit, Bulacan	1014		
50	377	Angat	Poblacion, Pulilan, Bulacan	963		
51	378	Angat	Longos, Pulilan, Bulacan	959	882	
52	379	Bayabas	Pulong Sampaloc, Angat, Bulacan	74	70	
53	380	Angat	Below Ipo Dam, Norzagaray, Bulacan	629	619	
54	381	Pasig-Potrero	Cabetican, Bacolor, Pampanga	242		
55	382	Pasig-Potrero	HDA. Dolores, Porac, Pampanga	28		
56	3100	Pampanga	San Vicente, Cabiao, Nueva Ecija	3467	3404	
57	3101	Parua	San Nicolas, Bamban, Tarlac	148		
58	3103	Madlum	Sibul Spring, San Miguel, Bulacan	102	118	
59	3104	Rio Chico	Sta. Monica, Concepcion, Tarlac	2090	1818	
60	233	Casecnan	Dakgan, Madella, Nueva Vizcaya	872	859	
61	236	Casecnan	Gabong, Nueva Vizcaya	532	584	
62	3110	Talavera	San Andres Llanera, San Jose City	380	375	
63	3116	Pampanga	San Isidro Bridge, San Isidro, Nueva Ecija	3387	3368	
64	3119	Abacan	San Juan, Mexico, Pampanga	86		
65	384	Porac	Del Carmen, Floridablanca, Pampanga	111	116	
66	3121	Porac	Poblaciaon, Porac, Pampanga	37	38	
67	3122	Angat	Sabang, Angat, Bulacan	794	781	
68	385	Gumain Floodway	Sta Cruz, Lubao, Pampanga	370	259	
69	3115	Pampanga	Poblacion, Sta. Rosa, Nueva Ecija	2681	2607	
70	3111	Baliuag	Catalanacan, Sto.Domingo, Munoz, Nueva Ecija	313	303	
71	3999	Pantabangan	Pantabangan Dam	853	938	
72	3114	Coronel	Sapang Buho, Bongabon, Nueva Ecija	718	712	
73	311	O'donnel	Palublub, Capas, Tarlac	240	259	
74	312	Bangot	Sta.Lucia, Capas, Tarlac	91	92	
75	310	Bulsa	Villa Aglipay, Tarlac, Tarlac	405	447	
76	3998	AngatDam	AngatDam		546	



A

Annex-T 2.5.1 Geology in the Study Area

Era, Period	Stage-Epoch	Symbol	Description - lithology	Topography
Cenozoic, Quaternary	Holocene (Recent)	R	Alluvium (flood plain, lacustrine, levee, sandbar, lagoon, hinterland deposits)	Plain. Level to nearly level
	Pleistocene to Pliocene	N3+Q1	Sandstone (ss), conglomerate (cg). (Guadalupe Formation)	Undulated
Tertiary	Upper-Miocene	N2	Ss, cg, mudstone (md) overlain by pyroclastics (mainly tuff) & tuffaceous sedimentary rocks. (Tartaro Formation)	Hilly. Gently sloping
	Middle-Miocene to Late-Oligocene	N1	Thick, extensive shale (flysch) with minor cg, ss. Upper part is limestone. Folded and intruded by quartz diorite.	Mountainous. Moderately sloping
	Upper-Paleocene	PG2	ss, cg and shales with minor limestone and andesite flows.	Mountainous. Strongly sloping
	Lower-Paleocene	PG1	Thick, extensive ss, cg & shales with minor basal conglomerate. Generally moderately folded and intruded by quartz diorite.	Mountainous.
Mesozoic, Cretaceous	Paleocene to Cretaceous	KPG	Ss, cg & metamorphosed shales with basalt to andesite, pyroclastics.	Mountainous.
	Cretaceous	K	Ss, cg & shales with spilites.	Mountainous.
Unknown	Basement Complex	BC	Amphiolite, mica schist, phyllites. Folded by upthrusts.	Mountainous.
Igneous rocks				
Cenozoic, Quaternary	Quaternary pyroclastics	QVP	Volcanic piedmont deposits. Chiefly pyroclastics and/or volcanic debris at foot of volcanos.	Hilly
	Quaternary volcanics	QV	Non-active cones. Generally pyroxene andesite.	Mountainous. Strongly sloping
Tertiary	Miocene	IN	Quartz diorite dyke	
	Before Miocene	IPG1	Quartz diorite, dacite & andesite flows & dikes.	
Paleogene-Creataceous	Undifferentiated volcanics	UV	Metamorphosed submarine flows: largely spilites and basalts	

P, K: Ophiolite. N: marine sedimentary rocks and diorite intrusive rocks. Q: volcanic rocks-Mt. Pinatubo
Source: MGB, Geological Map of Philippines 1/1,000,000

Annex-T 2.7.1 Monitoring Record of Water Quality for Pampanga River

Monitoring Period		Station No.*	BOD, mg/liter	DO, mg/liter	TDS, mg/liter	TSS, mg/liter
2003	1st Quarter	S1	3.0	6.3	196.0	73.0
		S2	4.0	6.4	291.0	75.0
		S3	4.0	6.6	289.0	83.0
	2nd Quarter	S1	-	5.5	195.0	68.0
		S2	-	5.3	198.0	63.0
		S3	-	0.5	210.0	42.0
	3rd Quarter	S1	2.0	5.7	144.0	254.0
		S2	3.0	5.8	153.0	249.0
		S3	34.0	3.9	181.0	93.0
	4th Quarter	S1	2.0	5.8	207.0	232.0
		S2	2.0	5.8	193.0	193.0
		S3	2.0	5.7	184.0	338.0
2004	1st Quarter	S1	2.0	6.7	227.0	65.0
		S2	2.0	5.3	232.0	61.0
		S3	3.0	5.2	236.0	74.0
	2nd Quarter	S1	2.0	4.7	142.0	285.0
		S2	4.0	5.4	144.0	176.0
		S3	2.0	4.5	135.0	145.0
	3rd Quarter	S1	2.0	6.9	210.0	68.0
		S2	3.0	7.0	231.0	69.0
		S3	6.0	6.5	204.0	48.0
	4th Quarter	S1	-	-	-	-
		S2	-	-	-	-
		S3	-	-	-	-
2005	1st Quarter	S1	3.0	7.2	197.0	62.0
		S2	6.0	7.7	203.0	52.0
		S3	6.0	5.9	242.0	121.0
	2nd Quarter	S1	-	3.5	370.0	73.0
		S2	-	3.9	644.0	66.0
		S3	-	1.7	864.0	52.0
	3rd Quarter	S1	24.0	4.1	840.0	133.0
		S2	2.0	6.2	500.0	63.0
		S3	3.0	6.3	650.0	85.0
	4th Quarter	S1	2.0	6.7	198.0	123.0
		S2	1.0	6.6	190.0	83.0
		S3	4.0	6.0	210.0	180.0
2006	1st Quarter	S1	-	-	-	-
		S2	-	-	-	-
		S3	-	-	-	-
	2nd Quarter	S1	-	-	-	-
		S2	-	-	-	-
		S3	-	-	-	-
	3rd Quarter	S1	2.0	6.1	-	114.0
		S2	1.0	6.4	-	86.0
		S3	2.0	6.3	-	76.0
	4th Quarter	S1	1.3	6.7	-	455.0
		S2	1.0	7.1	-	332.0
		S3	1.0	7.0	-	635.0
Over-Year	1st Quarter	Ave.	3.7	6.4	234.8	74.0
		Max.	6.0	7.7	291.0	121.0
	2nd Quarter	Ave.	2.7	3.9	322.4	107.8
		Max.	4.0	5.5	864.0	285.0
	3rd Quarter	Ave.	7.0	5.9	345.9	111.5
		Max.	34.0	7.0	840.0	254.0
	4th Quarter	Ave.	1.8	6.4	197.0	285.7
		Max.	4.0	7.1	210.0	635.0
	Throughout-Year	Ave.	4.3	5.7	282.1	142.2
		Max.	34.0	7.7	864.0	635.0

Note * : S1-Badeo, S2- Sullipan Bridge, S3 - Feaco Outfall
Source: DENR-EMB Region III, 2009

Annex-T 2.7.2 Monitoring Record of Water Quality for San Fernando River

Monitoring Period		Station No.*	BOD, mg/liter	DO, mg/liter	TDS, mg/liter	TSS, mg/liter
2007	1st Quarter	Stn1	36.0	7.2	466.0	36.0
		Stn2	22.0	7.7	539.0	214.0
		Stn3	34.0	7.0	510.0	30.0
		Stn4	5.0	7.0	201.0	71.0
	2nd Quarter	Stn1	-	6.4	-	63.0
		Stn2	-	7.0	-	54.0
		Stn3	-	6.4	-	46.0
		Stn4	-	6.3	-	62.0
	3rd Quarter	Stn1	13.0	5.8	-	29.0
		Stn2	9.0	6.3	-	24.0
		Stn3	7.0	7.0	-	21.0
		Stn4	6.0	6.8	-	119.0
	4th Quarter	Stn1	20.0	-	-	27.0
		Stn2	8.0	-	-	53.0
		Stn3	7.0	-	-	67.0
		Stn4	6.0	-	-	54.0
2008	1st Quarter	Stn1	14.0	-	-	21.0
		Stn2	16.0	-	-	32.0
		Stn3	19.0	-	-	21.0
		Stn4	3.0	-	-	25.0
	2nd Quarter	Stn1	27.0	4.1	-	26.0
		Stn2	24.0	3.8	-	21.0
		Stn3	12.0	1.6	-	15.0
		Stn4	12.0	3.1	-	19.0
	3rd Quarter	Stn1	25.0	3.2	-	-
		Stn2	8.0	3.3	-	-
		Stn3	15.0	1.8	-	-
		Stn4	2.0	3.0	-	-
	4th Quarter	Stn1	6.0	3.1	-	-
		Stn2	5.0	4.4	-	-
		Stn3	2.0	3.1	-	-
		Stn4	1.0	4.6	-	-
Over-Year	1st Quarter	Ave.	18.6	7.2	429.0	56.3
		Max.	36.0	7.7	539.0	214.0
	2nd Quarter	Ave.	24.8	5.4	539.0	62.6
		Max.	36.0	7.7	539.0	214.0
	3rd Quarter	Ave.	10.6	4.7	-	48.3
		Max.	25.0	7.0	-	119.0
	4th Quarter	Ave.	6.9	3.8	-	50.3
		Max.	20.0	4.6	0.0	67.0
	Throughout-Year	Ave.	13.0	5.0	429.0	47.9
		Max.	36.0	7.7	539.0	214.0

Note*: S1-Del Pilar Bridge, MacArthur Highway, S2-NLEX/San Felipe Foot Bridge, S3-San Jose Matulid, S4-Pederosa Bridge, McArthur Highway

Source: DENR-EMB Region III, 2009

Annex-T 2.7.3 Groundwater Quality Test Results for Wells Operated by Water Districts (Bulacan Province)

Name of Water District	Location	Year of Sampling	Phisical Parameter		Cheminal Parameter				Metal Parameter	
			Turbidity (NTU)	True Color (Color Units)	Ph	Hardness (mg/L CaCo3)	TDS (mg/L)	Chloide (mg/L)	Iron (total)	Manganese (total)
Baliwang	Tarcan PS	2008	0.23	2.50	7.69	166.00	307.00	21.00	0.02	0.20
	Navarro	2008	0.38	2.00	7.91	65.00	418.00	105.00	0.02	0.03
	B.S. Aquino	2008	0.40	2.50	8.01	108.00	1427.00	727.00	0.03	0.10
	Linmers P.S.	2008	0.37	2.00	7.96	98.00	373.00	58.00	0.02	0.10
	Tiaong	2008	0.37	2.00	7.11	95.00	401.00	100.00	0.01	0.20
	Milfora P.S.	2008	0.69	4.00	7.96	88.00	365.00	68.00	0.04	0.20
	Tibag P.S.	2008	0.41	2.50	8.08	73.00	1169.00	582.00	0.02	0.00
	Sabang P.S.	2008	0.47	2.50	7.72	137.00	576.00	174.00	0.09	0.03
	Sta. Barbara	2008	0.49	2.50	8.41	77.00	999.00	524.00	0.04	0.10
Calumpit	Balungo P.S.	2008	0.21	2.00	7.47	34.00	259.00	44.00	0.00	0.00
	Famces Tata Leon P.S.	2008	0.35	2.50	7.01	29.00	230.00	22.00	0.00	0.00
	Corazon P.S.	2008	0.25	2.50	7.66	39.00	267.00	44.00	0.00	0.00
	Ganiogan P.S.	2008	0.24	2.50	7.46	64.00	470.00	119.00	0.10	0.00
	Meytop P.S.	2008	0.24	2.00	7.37	44.00	321.00	53.00	0.00	0.00
	Gugo P.S.	2008	0.39	4.00	7.86	69.00	570.00	133.00	0.20	0.00
	Frances Tata Padang P.S.	2008	0.27	2.00	7.76	49.00	431.00	105.00	0.00	0.00
	Meyosulao Luma	2008	2.81	4.00	7.17	59.00	466.00	91.00	0.00	0.00
	Danga P.S.	2008	0.34	2.50	7.81	29.00	182.00	136.00	0.00	0.00
	Calizon P.S.	2008	0.31	2.00	7.69	54.00	499.00	151.00	0.10	0.00
	Garden Ville	2008	0.82	2.50	7.66	108.00	668.00	186.00	0.20	0.00
	Green Plains	2008	0.35	2.00	7.68	78.00	577.00	170.00	0.00	0.00
	Longos P.S.	2008	0.45	2.00	7.86	68.00	564.00	135.00	0.00	0.00
Malolos	Mojon PS	2003	5.00	7.00	7.09	150.00	689.00	86.00	N/A	N/A
	Longos PS	2003	1.00	2.00	7.70	100.00	576.00	261.00	N/A	N/A
	Masile PS	2003	0.00	4.00	7.49	60.00	332.00	71.00	N/A	N/A
	Mabolo PS	2003	0.00	0.00	7.13	330.00	851.00	442.00	N/A	N/A
	Lugam PS	2003	2.00	26.00	6.90	60.00	437.00	97.00	N/A	N/A
	Caniogan	2003	0.00	1.00	7.30	110.00	536.00	252.00	N/A	N/A
	Calero	2006	0.00	0.00	7.73	90.00	421.00	109.00	N/A	N/A
	Catmon II PS	2006	1.00	3.00	7.06	175.00	895.00	388.00	0.11	0.20
	Sto. Rosano PS	2006	0.00	2.00	6.92	196.00	907.00	326.00	0.00	0.20
	Sam Ishidro PS	2006	1.00	1.00	7.14	41.00	425.00	102.00	0.00	0.20
	Wawa PS	2006	2.00	20.00	6.75	52.00	392.00	84.00	0.00	0.10
Hiyas	Romar Ville	2007	1.71	5.00	6.35	612.00	1043.00	395.00	0.20	0.40
	Sta. Clara PS	2007	0.39	5.00	8.40	118.00	678.00	340.00	0.00	0.00
	St. Agatha PS	2007	0.41	3.00	7.53	296.00	1549.00	680.00	0.40	0.15
	Kabilang Bacood PS	2007	1.11	3.00	7.56	148.00	1037.00	380.00	0.10	0.00
	Tabang Relay	2007	0.24	3.00	7.43	168.00	1357.00	580.00	0.20	0.15
	Ping Lacson PS	2007	0.41	2.50	8.77	30.00	517.00	170.00	0.20	0.00
	Crown Asia PS	2007	0.33	2.50	8.76	59.00	520.00	160.00	0.00	0.00
	St. Rita De Tabe	2007	0.22	2.50	8.55	49.00	549.00	185.00	0.00	0.00
	Real Homes PS	2007	1.41	5.00	8.68	39.00	444.00	130.00	0.10	0.00
	Sta. Village, Sta Ria	2007	0.36	5.00	8.73	79.00	649.00	225.00	0.00	0.00
	Panginau Gauging Station	2007	0.59	10.00	8.55	59.00	462.00	135.00	0.00	0.00
	Bel-Air Malis Guiguinto	2007	0.49	3.00	7.48	168.00	1024.00	405.00	0.20	0.00
Pulian	Sto. Cristo Poumping Station	2008	0.60	2.50	8.40	87.00	N/A	21.00	0.05	0.02
	Sto Cristo Filtration Plant	2008	1.60	0.00	8.30	97.00	498.00	34.00	0.05	0.02
	Sto Cristo Filtration Plant	2008	0.30	2.50	8.50	122.00	N/A	19.00	0.05	0.02
San Ildefonso	Basc Pinaod	2007	0.61	5.00	6.97	54.00	524.00	145.00	0.10	0.02
	Borja's	2008	0.85	3.00	7.91	20.00	569.00	177.00	0.30	0.02
	Malipampang	2008	26.60	2.50	7.25	25.00	569.00	175.00	0.30	0.02
	Matimbubong P.S.	2008	1.01	2.50	8.00	25.00	571.00	180.00	0.20	0.02
	Makapilapil P.S.	2008	0.42	3.00	8.03	30.00	664.00	250.00	0.10	0.02
	Ortin Villa	2008	0.70	2.50	7.26	196.00	580.00	82.00	1.00	0.40
Plaridel	PS #3 Bintog	2007	0.25	3.00	6.58	197.00	283.00	17.00	0.10	0.02
	PS #2 Tabang	2007	0.35	3.00	7.02	99.00	613.00	152.00	0.10	0.02
	PS #4 Sipat	2007	0.65	3.00	6.58	79.00	511.00	140.00	0.10	0.02
San Rafael	Sampaloc P.S.	2008	0.30	N/A	8.40	61.00	N/A	61.50	0.07	N/A
	Tambubong P.S.	2008	2.00	N/A	6.40	346.00	N/A	13.10	2.07	N/A
	Caingin P.S	2008	0.45	N/A	6.40	247.00	N/A	20.50	0.05	N/A
	Tambubong, San Rafael	2008	10.00	N/A	6.70	123.00	N/A	7.50	0.16	N/A
	Caingin, San Rafael	2008	0.05	N/A	6.70	167.00	N/A	14.30	0.03	N/A
	Sampaloc, San Rafael	2008	0.05	N/A	8.10	32.00	N/A	60.00	0.03	N/A
San Miguel	Poblacion Well (PS#1)	2008	0.28	2.50	8.50	49.00	879.00	375.00	0.10	0.02
	Payawal Well (PS#2)	2008	0.43	3.00	7.94	99.00	370.00	30.00	0.50	0.02
	Buencamino Well (PS#3)	2008	0.27	3.00	8.56	89.00	589.00	185.00	0.10	0.02
	Sta. Rita Well (PS#4)	2008	0.24	4.00	7.28	276.00	430.00	35.00	0.10	0.02
	Rosemoor Well (PS#5)	2008	0.29	5.00	8.60	59.00	536.00	165.00	0.10	0.02
	Balite Well (PS#6)	2008	0.22	2.50	7.92	69.00	445.00	120.00	0.15	0.02
	Batasan Well (PS#7)	2008	0.26	2.50	8.31	20.00	424.00	55.00	0.10	0.02
	Tartaro	2008	N/A	N/A	7.48	207.00	466.00	61.00	N/A	0.00

Note: : The value in the Column of this mark exceeds the PNSDW (Philippine National Standards for Drinking) Limit

Source: Water Districts in Bulacan Province

Annex-T 2.7.4 Groundwater Quality Test Results for Wells Operated by Water Districts (Pampanga Province)

Name of Water District	Location		Phisical Parameter		Cheminal Parameter				Metal Parameter	
			Turbidity (NTU)	True Color (Color Units)	Ph	Hardness (mg/L CaCo3)	TDS (mg/L)	Chloide (mg/L)	Iron (total)	Manganese (total)
Angeles	P.S. 1	2008	0.21	0.00	6.50	109.45	190.80	44.99	0.06	0.00
	P.S. 2	2008	0.36	0.00	6.90	129.35	118.50	9.99	0.05	0.00
	P.S. 3	2008	0.22	0.00	6.50	208.95	90.50	9.99	0.00	0.00
	P.S. 1	2008	0.21	0.00	6.50	109.45	190.80	44.99	0.06	0.00
	P.S. 2	2008	0.36	0.00	6.90	129.35	118.50	9.99	0.05	0.00
	P.S. 3	2008	0.22	0.00	6.50	208.95	90.50	9.99	0.00	0.00
	P.S. 7	2008	0.25	0.00	6.50	199.00	159.20	19.99	0.07	0.02
	Anunas P.S.	2008	0.35	0.00	6.50	129.35	93.50	9.99	0.18	0.05
	Bagong Bayan P.S.	2008	0.40	0.00	6.60	169.15	106.90	14.99	0.08	0.02
	Belen Homesite P.S.	2008	0.14	0.00	6.50	119.40	104.50	4.99	0.03	0.04
	Cuayan P.S.	2008	0.25	0.00	6.80	119.40	81.40	9.99	0.00	0.00
	City Hall P.S.	2008	1.07	0.00	7.20	149.25	153.00	9.99	0.32	0.20
	Epza P.S.	2008	1.15	0.00	7.50	179.10	153.40	4.99	0.16	0.20
	Magalang Ave P.S.	2008	0.20	0.00	6.60	109.45	107.10	19.99	0.00	0.00
	Mabini P.S.	2008	0.28	0.00	6.60	159.20	172.00	19.99	0.00	0.01
	Mc Arthur Hiway P.S.	2008	0.15	0.00	6.50	119.40	110.30	9.99	0.08	0.01
	Metrogate P.S.	2008	2.77	1.80	7.00	129.35	111.70	14.99	0.15	0.03
	Old Pampang	2008	0.41	0.00	6.50	119.40	91.20	14.99	0.00	0.04
	Robinsons Homes P.S.	2008	0.27	0.00	6.50	89.55	93.80	9.99	0.00	0.00
	Rosewood P.S.	2008	0.64	1.20	6.60	139.30	77.90	4.99	0.05	0.00
	Sapang Bato P.S.	2008	0.19	0.00	6.60	89.55	99.00	9.99	0.00	0.03
	Sapalibutad P.S.	2008	1.88	1.70	7.30	0.00	148.30	9.99	0.04	0.07
	Sta. Teresita P.S.	2008	0.21	0.00	6.60	0.00	96.00	4.99	0.00	0.00
	Town & Country P.S.	2008	0.47	1.80	7.00	0.00	104.70	4.99	0.00	0.04
Florida Blanca	Poblacion	2008	0.27	2.50	6.85	N/A	104.00	3.00	0.00	0.00
	Fortuna	2008	0.28	2.50	7.11	N/A	132.00	5.00	0.00	0.00
	San Jose	2008	0.50	2.50	7.08	N/A	109.00	3.00	0.00	0.00
	P-1	2008	0.32	2.50	6.71	N/A	252.00	13.00	0.00	0.06
	Phase III	2008	3.56	4.00	6.96	N/A	414.00	26.00	0.19	0.00
	Bodega	2008	0.53	3.00	6.75	N/A	196.00	10.00	0.00	0.00
	Valdez	2008	0.65	2.50	6.72	N/A	144.00	5.00	0.00	0.00
	Paguiruan	2008	0.37	2.50	6.63	N/A	156.00	5.00	0.00	0.03
	San Pedro	2008	0.31	2.50	6.96	N/A	120.00	5.00	0.02	0.00
	Palmayo	2008	0.33	2.50	6.93	N/A	404.00	16.00	0.00	0.00
	Dampa	2008	0.10	N/A	6.82	N/A	198.00	13.00	0.33	0.23
Guagua	P.S. No.7 - San Pablo	2007	0.33	0.50	7.60	100.00	142.30	9.99	0.11	0.07
	P.S. No.8 - Samsaman, Betis	2007	0.20	0.50	7.20	80.00	193.10	19.99	0.05	0.07
	P.S. No.10 - LM Subd. Sta. Filon	2007	0.48	2.10	6.80	80.00	171.70	19.99	0.02	0.36
	P.S. No.11 - LM Subd. Sta. Anto	2007	0.34	0.60	6.50	90.00	130.20	14.99	0.16	0.20
	P.S. No.12 - Bancal	2007	0.35	1.70	7.20	70.00	146.90	14.99	0.04	0.05
	P.S. No.1 - San Nicolas	2007	0.27	0.50	6.80	140.00	156.50	14.99	0.04	0.59
	P.S. No.5 - Sto. Cristo	2007	0.50	0.50	7.60	110.00	161.70	19.99	0.02	0.11
	Pupm No.6 - San Miguel, Betis	2007	0.15	0.50	6.90	190.00	191.80	34.99	0.03	0.12
Lubao	San Nicolaes P.S.	2008	0.28	2.50	7.49	108.00	230.00	10.00	0.00	0.00
	Sta. Crus P.S.	2008	0.34	2.50	7.52	59.00	499.00	92.00	0.00	0.00
	Sto. Tomas P.S.	2008	0.30	2.50	7.61	68.00	219.00	7.00	0.00	0.00
	Sto. Nino	2008	0.28	2.50	6.95	235.00	460.00	111.00	0.00	0.00
Mabalacat	P.S. No.1 - Palengke	N/A	0.80	N/A	6.84	66.00	212.00	0.98	0.22	0.25
	P.S. No.3 - Dona Maria Subd.	N/A	0.80	N/A	6.58	85.00	223.00	3.90	0.26	0.05
	P.S. No.4 - Cacutud	2008	N/A	N/A	7.10	132.00	312.00	8.10	0.26	0.50
	P.S. No.5 - Filipininana Subd.	N/A	2.00	N/A	6.61	61.00	196.00	2.90	0.96	0.08
	P.S. No.6 - Dona Anastacia Subd	N/A	0.80	N/A	6.60	68.00	208.00	3.90	0.32	0.22
	P.S. No.7 - Canidha, Camachiles	N/A	2.00	N/A	6.51	83.00	222.00	3.90	0.21	0.05
	P.S. No.8 - Barangay Subd. Dau	N/A	0.80	N/A	6.60	61.00	190.00	2.90	0.74	0.03
	P.S. No.9 - Dela Cruz Lim Subd.	N/A	2.00	N/A	6.70	50.00	163.00	0.98	0.50	0.11
	P.S. No.10 - Duquit	N/A	1.60	N/A	6.69	86.00	206.00	2.00	0.65	0.26
	P.S. No.11 - Sta. Ines	N/A	0.80	N/A	6.89	60.00	182.00	0.98	0.42	0.21
	P.S. No.12 - San Rafael Village	N/A	2.00	N/A	6.59	73.00	206.00	4.90	0.63	0.09
	P.S. No.13 - Lemens Village	N/A	0.80	N/A	6.62	80.00	196.00	3.90	0.26	0.05
	P.S. No.14 - Camachiles Road	N/A	2.00	N/A	6.59	80.00	214.00	4.90	0.69	0.09
	Phase # 2 CRC	N/A	2.00	N/A	6.61	71.00	216.00	3.90	0.61	0.11
	P.S. No.1 - Metroclark	N/A	0.80	N/A	7.06	81.00	266.00	3.90	0.42	0.45
	P.S. No.3 - Madapdap	N/A	2.00	N/A	7.04	58.00	204.00	2.90	0.61	0.44
	P.S. No.4 - Madapdap	N/A	0.80	N/A	6.96	70.00	213.00	3.90	0.51	0.50
	P.S. No.5 - Madapdap	N/A	0.80	N/A	6.90	62.00	204.00	2.90	0.62	0.46
	P.S. No.7 - Madapdap	N/A	2.00	N/A	7.07	57.00	174.00	2.00	0.64	0.27
	P.S. No.8 - Madapdap	N/A	5.00	N/A	6.81	110.00	258.00	6.40	1.40	0.90
	P.S. No.9 - Madapdap	N/A	2.00	N/A	7.01	84.00	239.00	2.90	0.84	0.35
San Fernando	P.S. No.18 - San Felipe	2008	0.31	0.50	7.20	90.00	153.30	24.99	0.04	0.03
	P.S. No.3 - Del Pilar	2008	0.41	0.50	7.10	100.00	173.50	29.99	0.02	0.07
	P.S. No.12 - Moras	2008	0.36	0.50	6.80	100.00	163.10	24.99	0.05	0.84
	P.S. No.5 - San Pedro	2008	0.35	0.50	6.80	90.00	194.70	14.99	0.02	0.04
	P.S. No.11 - Sta. Lucia	2008	0.25	2.00	6.70	110.00	183.20	24.99	0.04	0.04
	P.S. No.2 - Poblacion	2008	0.33	0.50	7.10	80.00	182.70	24.99	0.17	0.06
	P.S. No.4 - Dolores	2008	0.17	0.50	7.20	70.00	161.90	24.99	0.05	0.02
	P.S. No.6 - Villa Barosa	2008	0.48	1.10	7.00	70.00	184.90	19.99	0.11	0.01
	P.S. No.9 - Villa Del Sol	2008	0.45	0.50	6.60	90.00	157.90	19.99	0.08	0.09
	P.S. No.2 - St. Jude	2008	0.47	0.50	6.70	130.00	159.80	39.99	0.01	0.74
	P.S. No.20 - San Jose	2008	0.31	0.50	7.00	69.65	159.30	29.99	0.01	0.04
	P.S. No.20 - Greenville	2008	0.31	0.50	6.90	89.55	140.00	19.99	0.06	0.02
	P.S. No.10 - St. Francis	2008	0.36	0.50	7.10	69.65	172.90	19.99	0.02	0.02
	P.S. No.15 - Quebiawan	2008	0.27	0.70	6.50	59.70	150.60	39.99	0.07	0.08
	P.S. No.13 - Maimpis	2008	0.35	1.20	8.60	79.60	114.00	14.99	0.20	0.19
	P.S. No.16 - Villa Isabel	2008	1.19	0.50	6.60	89.55	96.50	9.99	0.10	0.19
	P.S. No.3 - Near River	2008	0.46	0.90	6.50	89.50	101.10	14.99	0.03	0.39
	P.S. No.19 - San Vicente	2008	0.76	0.60	6.50	119.40	119.90	9.99	0.28	0.22
	P.S. No.21 - San Fernando Subd.	2008	0.28	1.20	6.80	69.65	210.00	24.99	0.04	0.04

Note: : The value in the Column of this mark exceeds the PNSDW (Philippine National Standards for Drinking) Limit

Source: Water Districts in Pampanga Province

Annex-T 2.7.5 Groundwater Quality Test Results for Wells Operated by Water Districts (Nueva Ecija Province)

Name of Water District	Location		Phisical Parameter		Cheminal Parameter				Metal Parameter	
			Turbidity (NTU)	True Color (Color Units)	Ph	Hardness (mg/L CaCo3)	TDS (mg/L)	Chloide (mg/L)	Iron (total)	Manganese (total)
Bngabon	P.S. No. 2 High School	2008	3.00	0.00	6.92	145.00	176.00	24.00		0.20
	P.S. No. 4 Sinipit	2008	2.00	3.00	6.50	140.00	182.00	24.00	0.00	0.00
	P.S. No. 5 Vega	2008	1.00	0.00	6.50	170.00	222.00	27.00	0.00	0.00
	Bongabon N.E.	2005	1.50	2.50	7.91	90.00	254.00	50.00	0.40	0.02
	P.S. No. 5 Vega	2004	1.20	1.00	7.55	185.00	276.00	28.00	0.00	0.00
	Well 1	2004	0.00	0.00	7.87	110.00	204.00	15.00	0.00	0.00
	Well 2/Control Bldg.	2004	0.00	0.00	8.18	340.00	373.00	108.00	0.00	0.00
Penaranda	St. Tomas	2008	0.10	0.00	7.91	35.00	221.00	12.00	0.00	0.00
	Poblacion	2008	0.20	0.00	7.95	35.00	213.00	14.00	0.00	0.00
Guimba	P.S. Sta. Veronica	2008	0.10	N/A	7.80	170.00	N/A	47.70	N/A	N/A
	P.S. Bantug	2008	0.60	N/A	8.00	123.00	N/A	49.20	N/A	N/A
Munoz	P.S. Villa Pi0i	2007	0.15	0.50	7.80	110.00	209.00	24.99	0.06	0.05
	P.S. Villa Pinli	2008	0.11	2.10	7.10	179.10	188.80	24.99	0.00	0.06
	P.S. Bayunga	2008	0.21	3.60	6.90	199.00	192.40	29.99	0.00	0.06
	P.S. Maligaya	2008	0.46	2.30	6.90	179.10	161.80	9.99	0.07	0.05
Santa Rosa	P.S. Gomez	2008	0.40	2.50	7.95	147.00	322.00	14.00	0.11	0.16
	P.S. Rizal	2008	0.70	2.50	7.42	206.00	366.00	17.00	0.08	0.32
	P.S. Rajal	2008	0.80	2.50	7.30	245.00	357.00	14.00	0.06	0.55
Talavera	Main P.S.	2008	0.60	N/A	7.70	321.00	174.00	5.05	N/A	N/A
	P.S. Dinarayat	2008	0.35	N/A	7.60	167.00	365.00	4.80	N/A	N/A
	P.S. San Pascual	2008	0.50	N/A	7.40	176.00	334.00	6.55	N/A	N/A
	P.S. Bacal 1	2008	0.50	N/A	7.40	186.00	286.00	5.95	N/A	N/A

Note: : The value in the Column of this mark exceeds the PNSDW (Philippine National Standards for Drinking) Limit

Source: Water Districts in Nueva Ecija Province

Annex-T 2.10.1 Recorded Flood Damage in Provinces of Nueva Ecija, Pampanga and Bulacan

Month of Flood Occurrence	Typhoon	Province	Population Affected		Population Evacuated		Casualty		Number of Houses Damaged		Cost of Damage (P million)		
			Families	Population	Families	Population	Dead	Injured	Totally	Partially	Infra-structure	Agri-culture	Total
Jul. 2003	Haurot	Nueva Ecija	33,013	163,038	1,179	3,861	3				18.8	16.8	35.6
		Pampanga	81	271	14	76	2				12.3	0.8	13.1
		Sub-total	33,094	163,309	1,193	3,937	5				31.1	17.6	48.7
Aug. 2004	Marce	Nueva Ecija	24,896	128,405					118	1,200	10.1	37.3	47.4
		Pampanga	112,186	529,299	1,383	5,490	8	1	2		63.3	170.6	233.9
		Bulacan	20,278	99,366	5,079	24,916	6				22.1		22.1
		Sub-total	157,360	757,070	6,462	30,406	14	1	120	1,200	96	208	303
Nov. 2004	Violeta	Nueva Ecija	2,090	9,562			2						0.0
Nov. 2004	Winnie	Nueva Ecija	57,367	277,668	4,443	20,786	9	2	523	1,236	25.5	220.0	245.5
		Bulacan	51,909	259,390	1,303	7,475	7		79	173	11.4	250.1	261.5
		Sub-total	109,276	537,058	5,746	28,261	16	2	602	1,409	37	470	507
Nov. 2004	Toyong	Nueva Ecija	124	620	124	620	6	2	10				9.5
		Pampanga	4,200	18,400	452	2,343						88.9	88.9
		Bulacan	61,974	305,478	2,793	13,965	2		84	162	11.1	250.1	261.2
		Sub-total	66,298	324,498	3,369	16,928	8	2	94	162	11	339	360
Sep. 2005	Labuyo	Nueva Ecija	2,743	12,958									
		Pampanga	6,077	30,673									
		Sub-total	8,820	43,631									
Jul. 2006	Glenda	Pampanga	6,659	30,831								24.3	24.3
Oct. 2006	Mienyo	Pampanga	7,698	34,045	15	75			224	1,234		71.3	71.3
		Bulacan			480	2,301	1		50	376		7.7	7.7
		Sub-total	7,698	34,045	495	2,376	1	0	274	1,610	0	79.0	79

Source: RDCC-Region III

Annex-T 3.1.1 Population and Population Growth within the Study Area

Province	City/Minicipality	Population within the Basin Boundary					Annual Ave. Population Growth Ratio			
		1980	1990	1995	2000	2007	1980-1990	1990-2000	2000-2007	1980-2007
Bulacan	Angat	22,311	30,977	35,057	41,340	47,701	3.34%	2.93%	2.07%	2.85%
	Baliuag	70,555	89,719	103,054	119,675	136,982	2.43%	2.92%	1.95%	2.49%
	Bulacan	5,632	7,866	8,747	10,145	11,659	3.40%	2.58%	2.01%	2.73%
	Bustos	11,283	15,328	18,136	20,643	26,601	3.11%	3.02%	3.69%	3.23%
	Calumpit	45,454	59,042	70,839	81,113	98,017	2.65%	3.23%	2.74%	2.89%
	Dona Remedios Trinidad	4,625	8,372	10,880	13,253	18,551	6.11%	4.70%	4.92%	5.28%
	Guiguinto	1,838	2,950	3,483	4,476	5,911	4.84%	4.26%	4.05%	4.42%
	Hagonoy	73,158	90,190	99,398	111,397	126,298	2.12%	2.13%	1.81%	2.04%
	Malolos City	95,699	125,178	147,414	175,291	223,069	2.72%	3.42%	3.50%	3.18%
	Norzagaray	21,836	28,088	42,792	64,571	88,470	2.55%	8.68%	4.60%	5.32%
	Pandi	624	899	1,115	1,324	1,669	3.71%	3.95%	3.37%	3.71%
	Paombong	26,267	32,052	33,149	41,077	53,510	2.01%	2.51%	3.85%	2.67%
	Plaridel	22,120	29,942	37,519	45,506	56,440	3.07%	4.27%	3.12%	3.53%
	Pulilan	38,110	48,199	59,682	68,188	85,008	2.38%	3.53%	3.20%	3.02%
	San Ildefonso	44,931	59,598	69,319	79,956	93,438	2.87%	2.98%	2.25%	2.75%
	San Miguel	73,113	91,124	108,147	123,824	138,839	2.23%	3.11%	1.65%	2.40%
	San Rafael	36,803	49,528	58,387	69,770	85,284	3.01%	3.49%	2.91%	3.16%
	Santa Maria	559	871	962	1,373	1,954	4.53%	4.66%	5.16%	4.74%
	Total	**594,920**	**769,921**	**908,081**	**1,072,923**	**1,299,400**	**2.61%**	**3.37%**	**2.77%**	**2.94%**
Nueva Ecija	Aliaga	32,349	40,425	45,815	50,004	61,270	2.25%	2.15%	2.95%	2.39%
	Bongabon	31,762	38,775	43,904	48,209	72,076	2.02%	2.20%	5.91%	3.08%
	Cabanatuan City	138,298	173,065	201,033	222,859	259,267	2.27%	2.56%	2.19%	2.35%
	Cabiao	37,922	48,850	55,902	62,624	68,382	2.56%	2.52%	1.26%	2.21%
	Carranglan	18,642	24,427	28,069	29,728	31,146	2.74%	1.98%	0.67%	1.92%
	Gabaldon	17,148	21,718	25,719	28,290	29,583	2.39%	2.68%	0.64%	2.04%
	Gapan City	60,014	70,489	77,735	89,199	98,795	1.62%	2.38%	1.47%	1.86%
	Gen. Mamerto Natividad	17,388	21,984	26,140	29,195	33,354	2.37%	2.88%	1.92%	2.44%
	Gen. Tinio	23,373	29,450	32,867	35,302	38,586	2.34%	1.83%	1.28%	1.87%
	Guimba	36,853	45,944	48,807	54,669	60,193	2.23%	1.75%	1.38%	1.83%
	Jaen	39,064	47,346	53,541	58,274	63,474	1.94%	2.10%	1.23%	1.81%
	Laur	17,729	21,464	25,143	26,902	30,997	1.93%	2.28%	2.04%	2.09%
	Licab	14,543	17,202	21,555	21,593	23,675	1.69%	2.30%	1.32%	1.82%
	Llanera	18,652	23,285	28,127	30,361	33,493	2.24%	2.69%	1.41%	2.19%
	Lupao	20,954	24,982	27,268	31,081	33,483	1.77%	2.21%	1.07%	1.75%
	Munoz	43,211	50,356	60,162	65,586	71,669	1.54%	2.68%	1.28%	1.89%
	Palayan City	14,959	20,393	26,851	31,253	33,506	3.15%	4.36%	1.00%	3.03%
	Pantabangan	13,916	18,341	22,183	23,868	25,520	2.80%	2.67%	0.96%	2.27%
	Penaranda	16,753	20,500	22,661	24,749	26,725	2.04%	1.90%	1.10%	1.74%
	Quezon	20,846	25,574	29,172	31,720	33,988	2.07%	2.18%	0.99%	1.83%
	Rizal	31,407	38,970	45,834	48,166	52,465	2.18%	2.14%	1.23%	1.92%
	San Antonio	42,969	51,815	56,130	63,672	67,446	1.89%	2.08%	0.83%	1.68%
	San Isidro	28,550	34,349	36,283	40,984	44,687	1.87%	1.78%	1.24%	1.67%
	San Jose City	64,254	82,836	96,860	108,254	122,353	2.57%	2.71%	1.76%	2.41%
	San Leonardo	34,706	39,740	46,545	50,478	54,596	1.36%	2.42%	1.13%	1.69%
	Santa Rosa	32,424	40,439	47,522	51,804	58,762	2.23%	2.51%	1.82%	2.23%
	Santo Domingo	29,013	35,864	40,992	45,934	47,960	2.14%	2.51%	0.62%	1.88%
	Talavera	62,225	77,256	85,797	97,329	105,122	2.19%	2.34%	1.11%	1.96%
	Talugtug	6,200	7,453	9,573	9,983	10,922	1.86%	2.97%	1.29%	2.12%
	Zaragosa	24,418	28,743	33,826	37,645	40,355	1.64%	2.73%	1.00%	1.88%
	Total	**990,542**	**1,222,034**	**1,402,016**	**1,549,715**	**1,733,849**	**2.12%**	**2.40%**	**1.62%**	**2.10%**
Pampanga	Angeles	188,834	236,686	234,011	263,971	314,493	2.28%	1.10%	2.53%	1.91%
	Apalit	48,253	62,373	65,720	78,295	97,296	2.60%	2.30%	3.15%	2.63%
	Arayat	56,742	73,189	85,940	101,792	118,312	2.58%	3.35%	2.17%	2.76%
	Bacolor	50,942	67,259	13,097	16,147	25,238	2.82%	-13.30%	6.59%	-2.57%
	Candaba	52,945	68,145	77,546	86,066	96,589	2.56%	2.36%	1.66%	2.25%
	Floridablanca	35,612	45,608	52,874	58,880	71,287	2.50%	2.59%	2.77%	2.60%
	Guagua	72,609	88,290	95,363	96,858	104,284	1.97%	0.93%	1.06%	1.35%
	Lubao	74,387	95,698	105,260	120,648	137,309	2.55%	2.34%	1.87%	2.30%
	Mabalacat	77,903	116,533	125,073	164,575	195,616	4.11%	3.51%	2.50%	3.47%
	Macabebe	45,830	55,505	59,469	65,346	70,332	1.93%	1.65%	1.06%	1.60%
	Magalang	34,840	43,940	52,607	77,530	98,595	2.35%	5.84%	3.49%	3.93%
	Masantol	35,350	41,964	45,326	48,120	50,984	1.73%	1.38%	0.83%	1.37%
	Mexico	53,491	69,546	91,696	109,481	141,298	2.66%	4.64%	3.71%	3.66%
	Minalin	27,414	34,795	35,670	35,150	40,084	2.41%	0.10%	1.89%	1.42%
	Porac	50,672	67,901	75,061	80,386	102,489	2.97%	1.70%	3.53%	2.64%
	San Fernando	110,891	157,851	193,025	221,857	269,365	3.59%	3.46%	2.81%	3.34%
	San Luis	25,701	31,920	36,005	41,554	47,517	2.19%	2.67%	1.93%	2.30%
	San Simon	23,518	30,678	35,474	41,253	48,050	2.69%	3.01%	2.20%	2.68%
	Santa Ana	25,361	32,540	37,975	42,990	49,756	2.52%	2.82%	2.11%	2.53%
	Santa Rita	24,995	28,296	32,321	32,780	36,723	1.25%	1.48%	1.64%	1.44%
	Santo Tomas	24,951	33,309	29,628	32,695	37,866	2.93%	-0.19%	2.12%	1.56%
	Sasmuan	17,881	21,125	23,121	23,333	26,601	1.68%	1.00%	1.89%	1.48%
	Total	**1,159,123**	**1,503,152**	**1,602,261**	**1,839,706**	**2,180,084**	**2.63%**	**2.04%**	**2.45%**	**2.37%**
Tarlac	Bamban	15,244	20,838	21,701	27,106	36,043	3.18%	2.66%	4.15%	3.24%
	Capas	14,755	19,412	25,701	30,200	38,720	2.78%	4.52%	3.61%	3.64%
	Concepcion	80,647	103,146	101,243	115,171	135,213	2.49%	1.11%	2.32%	1.93%
	La Paz	35,330	41,946	45,207	52,907	61,324	1.73%	2.35%	2.13%	2.06%
	Tarlac City	88,879	105,589	116,586	132,785	158,926	1.74%	2.32%	2.60%	2.18%
	Victoria	25,984	31,500	35,356	37,873	42,450	1.94%	1.86%	1.64%	1.83%
	Total	**260,839**	**322,431**	**345,794**	**396,042**	**472,676**	**2.14%**	**2.08%**	**2.56%**	**2.23%**
Bataan	Hermosa	1,023	1,380	1,544	1,843	2,091	3.04%	2.94%	1.82%	2.68%
	Orani	6,291	8,270	9,259	9,983	11,320	2.77%	1.90%	1.81%	2.20%
Aurora	Dingalan	1,643	2,733	3,649	3,806	4,152	5.22%	3.37%	1.25%	3.49%
	Maria Aurora	576	610	662	721	758	0.57%	1.69%	0.72%	1.02%
	San Luis	2,570	3,637	4,551	4,618	5,164	3.53%	2.42%	1.61%	2.62%
Quezon	General Nakar	255	385	444	498	523	4.21%	2.60%	0.72%	2.70%
Nueva Vizcaya	Alfonso Castaneda	705	945	1,121	1,212	1,677	2.98%	2.51%	4.75%	3.26%
	Aritao	582	686	771	838	905	1.66%	2.03%	1.09%	1.65%
	Dupax del Sur	125	159	180	212	225	2.47%	2.90%	0.84%	2.20%
	Santa Fe	136	214	254	278	288	4.62%	2.66%	0.51%	2.82%
Pangasinan	Umingan	4,681	5,433	5,850	6,632	7,073	1.50%	2.02%	0.92%	1.54%
Rizal	Rodriguez	5,709	9,149	10,867	15,709	30,498	4.83%	5.55%	9.94%	6.40%
Zambales	Botolan	123	161	186	211	234	2.76%	2.73%	1.49%	2.42%
	San Marcelino	4,504	6,603	4,407	4,590	5,241	3.90%	-3.57%	1.91%	0.56%
	Total	**28,922**	**40,365**	**43,744**	**51,150**	**70,148**	**3.39%**	**2.40%**	**4.62%**	**3.34%**
Grand Total		**3,034,346**	**3,857,903**	**4,301,897**	**4,909,536**	**5,756,156**	**2.43%**	**2.44%**	**2.30%**	**2.40%**

Source: (1) Population Census in 1980, 1990, 1995, 2000, and 2007 by NSCB (for Basic Population Data)
(2) JICA Study Team (for Overlapping Ratio of Study Area with Cities/Municipalities)

Annex-T 3.1.2 Rank of Cities/Municipalities in Terms of Higher Population Density in the Study Area

Rank	City/Minicipality	Province	Area (km2)	Population Desity				
				1980	1990	1995	2000	2007
1	Angeles	Pampanga	63	3,007	3,769	3,726	4,203	5,008
2	San Fernando	Pampanga	69	1,617	2,302	2,815	3,235	3,928
3	Guiguinto	Bulacan	2	1,119	1,796	2,120	2,725	3,598
4	Baliuag	Bulacan	44	1,617	2,057	2,362	2,743	3,140
5	Malolos City	Bulacan	73	1,318	1,725	2,031	2,415	3,073
6	Plaridel	Bulacan	20	1,104	1,494	1,872	2,271	2,816
7	Santo Tomas	Pampanga	14	1,725	2,303	2,048	2,260	2,618
8	Santa Maria	Bulacan	1	747	1,163	1,285	1,834	2,610
9	Guagua	Pampanga	49	1,484	1,804	1,949	1,979	2,131
10	Calumpit	Bulacan	47	977	1,269	1,523	1,744	2,107
11	Pulilan	Bulacan	44	874	1,105	1,368	1,563	1,949
12	Apalit	Pampanga	60	803	1,038	1,094	1,303	1,619
13	Santa Rita	Pampanga	23	1,078	1,220	1,394	1,414	1,584
14	Bustos	Bulacan	18	636	864	1,022	1,163	1,499
15	Mabalacat	Pampanga	140	556	831	892	1,174	1,395
16	Hagonoy	Bulacan	95	774	954	1,051	1,178	1,336
17	Cabanatuan City	Nueva Ecija	198	698	873	1,014	1,125	1,308
18	Orani	Bataan	9	699	919	1,029	1,110	1,258
19	Santa Ana	Pampanga	40	627	805	939	1,063	1,230
20	Pandi	Bulacan	1	450	648	804	954	1,203
21	Tarlac City	Tarlac	132	673	799	883	1,005	1,203
22	Paombong	Bulacan	46	573	699	723	896	1,167
23	Mexico	Pampanga	122	438	570	752	897	1,158
24	Masantol	Pampanga	46	770	913	987	1,047	1,110
25	San Leonardo	Nueva Ecija	52	671	769	901	977	1,056
26	Bulacan	Bulacan	11	503	703	782	907	1,042
27	Magalang	Pampanga	105	333	420	503	742	943
28	Lubao	Pampanga	149	500	643	707	811	923
29	Angat	Bulacan	53	424	589	667	786	907
30	Minalin	Pampanga	45	603	766	785	773	882
31	San Luis	Pampanga	55	465	578	652	752	860
32	Floridablanca	Pampanga	83	427	547	634	706	855
33	San Rafael	Bulacan	105	351	472	556	665	813
34	San Simon	Pampanga	60	392	512	592	688	802
35	Talavera	Nueva Ecija	135	461	572	635	721	778
36	San Isidro	Nueva Ecija	58	492	592	625	706	770
37	San Jose City	Nueva Ecija	162	397	512	599	669	756
38	Rodriguez	Rizal	42	135	217	257	372	723
39	Jaen	Nueva Ecija	90	432	523	592	644	702
40	Macabebe	Pampanga	102	448	542	581	638	687
41	Arayat	Pampanga	177	321	414	486	576	670
42	Aliaga	Nueva Ecija	92	351	439	497	542	665
43	Concepcion	Tarlac	221	364	466	457	520	611
44	Cabiao	Nueva Ecija	113	334	430	493	552	603
45	Gapan City	Nueva Ecija	165	365	428	473	542	601
46	Sasmuan	Pampanga	45	400	472	517	521	594
47	San Miguel	Bulacan	236	310	386	458	525	588
48	Santo Domingo	Nueva Ecija	83	351	434	496	555	580
49	San Ildefonso	Bulacan	167	270	358	416	480	561
50	Zaragosa	Nueva Ecija	72	339	399	470	523	561
51	La Paz	Tarlac	117	303	360	388	454	526
52	Victoria	Tarlac	83	312	378	424	454	509
53	Santa Rosa	Nueva Ecija	117	278	347	408	445	504
54	Munoz	Nueva Ecija	142	303	354	422	460	503
55	Quezon	Nueva Ecija	68	305	374	427	464	497
56	Candaba	Pampanga	208	254	327	372	413	464
57	Guimba	Nueva Ecija	137	268	335	355	398	438
58	San Antonio	Nueva Ecija	157	274	330	358	406	430
59	Norzagaray	Bulacan	207	106	136	207	312	428
60	Rizal	Nueva Ecija	124	254	315	370	389	424
61	Hermosa	Bataan	5	204	275	307	367	416
62	Licab	Nueva Ecija	60	241	285	357	357	392
63	Porac	Pampanga	292	174	233	257	275	351
64	Gen. Mamerto Natividad	Nueva Ecija	98	177	224	267	298	340
65	Penaranda	Nueva Ecija	79	213	261	289	315	340
66	Bacolor	Pampanga	74	686	906	176	217	340
67	Bongabon	Nueva Ecija	225	141	173	196	215	321
68	Llanera	Nueva Ecija	114	163	204	246	266	293
69	Capas	Tarlac	134	110	145	192	225	289
70	Talugtug	Nueva Ecija	39	160	192	247	257	281
71	Umingan	Pangasinan	26	180	208	224	254	271
72	Lupao	Nueva Ecija	130	162	193	210	240	258
73	Palayan City	Nueva Ecija	136	110	150	197	230	246
74	Bamban	Tarlac	147	104	142	148	185	246
75	Laur	Nueva Ecija	221	80	97	114	122	140
76	Aritao	Nueva Vizcaya	7	80	94	106	115	124
77	Gabaldon	Nueva Ecija	252	68	86	102	112	117
78	Maria Aurora	Aurora	9	65	68	74	81	85
79	Botolan	Zambales	3	41	54	63	71	79
80	San Marcelino	Zambales	71	64	93	62	65	74
81	Dingalan	Aurora	62	26	44	59	61	67
82	Gen. Tinio	Nueva Ecija	580	40	51	57	61	67
83	Pantabangan	Nueva Ecija	421	33	44	53	57	61
84	Dupax del Sur	Nueva Vizcaya	5	25	32	37	43	46
85	Carranglan	Nueva Ecija	693	27	35	41	43	45
86	San Luis	Aurora	123	21	29	37	37	42
87	Santa Fe	Nueva Vizcaya	7	18	29	34	37	39
88	Dona Remedios Trinidad	Bulacan	854	5	10	13	16	22
89	General Nakar	Quezon	30	8	13	15	16	17
90	Alfonso Castaneda	Nueva Vizcaya	144	5	7	8	8	12

Source: (1) Population Census in 1980, 1990, 1995, 2000, and 2007 by NSCB (for Basic Population Data)

(2) JICA Study Team (for Overlapping Ratio of Study Area with Cities/Municipalities)

Annex-T 3.3.1 Category for Land Cover

Category in data source	Category in the present study	Forest	Brushland	Cultivated Area		Populated Area		Wetland		Fishpond	Water Body	Others	
				Paddy Field	Other Cultivated Area	Built-up Area	Settlement	Swamp	Mangrove			Others (Natural)	Others (Artificial)
NEW NAMRIA topographic map	Cultivated Land, 150mx150m or more				x								
	Orchard, Plantation and nursery, 150mx150m or more				x								
	Rice paddy, 150mx150m or more			x									
	Fish ponds or Hatcheries, 150mx150m or more									x			
	Woods-bushwood (Dense forest, mixed coniferous and deciduous trees) 150mx150 or more	x											
	Airport Area with hard surface												x
	Cemetery, 150mx150m or more												x
	Park, 150mx150m or more												x
	Park, less than 150mx150m												x
	Runway with hard surface												x
	Awashed Rocks, Large Group											x	
	Fill, 150m or more in length and 3.0m or more in height difference											x	
	Foreshore flat (Sand, Mud, Gravel, etc)											x	
	Gravelly Sand											x	
	Mining site, 150mx150m or more											x	
	Open area, 150mx150m or more											x	
	Runway with loose surface											x	
	Salt evaporator, 150mx150m or more											x	
	Sandbank											x	
	Sandy Area											x	
	Soil Cliff											x	
	Densely Built-up area and moderately built-up area 100mx100m or more					x							
	Settlement						x						
	Bush (Scrub), 150mx150m or more		x										
	Clearing, 150mx150m or more		x										
	Scattered Trees		x										
	Topical grass, 150mx150m or more		x										
	Lake										x		
	River (Wide), Perennial 50m or more in width										x		
	Mangrove, 150mx150m or more								x				
	Swamp, 150mx150m or more							x					
Land Cover by DENR	Other land, natural, grassland		x										
	Other wooded land, fallow		x										
	Other wooded land, shrubs		x										
	Other wooded land, wooded grassland		x										
	Other land, cultivated, pastures				x								
	Other land, cultivated, annual crop			x									
	Other land, cultivated, perennial crop			x									
	Other land, fishpond	x								x			
	Bamboo/palm formation	x											
	Closed forest, broadleaved	x											
	Closed forest, coniferous	x											
	Closed forest, mixed	x											
	Forest plantation, broadleaved	x											
	Forest plantation, coniferous	x											
	Forest plantation, mangrove	x											
	Open forest, broadleaved	x											
	Open forest, coniferous	x											
	Open forest, mixed	x											
	Other land, natural, barren land											x	
	Other land, built-up area					x							
	Inland Water										x		
	Mangrove forest								x				
	Other land, natural, marshland							x					

Source: JICA Study Team

Annex-T 3.4.1 (1/2) Rate Systems by Water Districts for Municipal Water

Bulacan Province

Municipality	Rate Systems of Municipal Water (Pesos)							Effective Date of the Rate System: After;
	Service Conn'n Fee	Basic Water Charge (Minimum Charge) (< 10 m^3)	Specific Charges (Pesos/m^3)					
			(11-20m^3)	(21-30m^3)	(31-40m^3)	(41-50m^3)	(51 m^3 <)	
Angat	4,758	160.00	17.50	19.25	21.25	23.50	26.00	8/1/06
Balagtas	2,116	130.00	13.15	13.45	13.90	14.45	15.10	7/1/01
Baliuag	13,635	120.00	13.50	15.25	17.25	19.50	22.00	3/1/06
Bocaue	6,824	173.00	18.75	21.00	24.00	27.75	32.00	12/1/06
Bulacan	7,780	145.00	15.25	16.25	17.50	19.00	19.00	11/1/07
Bustos	7,370	110.00	11.00	12.10	14.30	14.30	14.30	5/1/00
Calumpit	13,176	125.00	13.50	15.00	17.00	19.50	22.50	10/1/05
Dona R. Trinidad	-	-	-	-	-	-	-	-
Guiguinto	300	140.00	15.00	16.25	17.75	19.50	21.50	9/1/01
Hagonoy	20,836	90.00	10.00	11.00	12.00	12.00	12.00	7/1/02
Malolos City	27,926	125.00	13.50	14.75	16.25	18.00	20.00	1/1/07
Marilao	9,068	186.00	22.00	26.15	30.45	34.90	39.50	4/1/06
Meycauayan City	12,464	384.00	41.25	47.00	54.20	54.20	62.80	3/1/05
Norzagaray	4,888	219.00	22.75	24.35	26.50	29.15	32.10	10/1/07
Obando	7,780	367.00	40.95	49.15	61.65	78.40	99.25	1/1/06
Pandi	787	170.00	19.50	21.75	24.25	27.00	30.00	1/1/06
Paombong	-	-	-	-	-	-	-	-
Plaridel	8,214	80.00	8.50	9.50	10.60	11.80	13.10	9/1/01
Pulilan	3,600	150.00	16.00	17.25	18.75	20.50	22.50	1/1/02
San Ildefonso	4,771	160.00	17.00	18.25	19.75	21.50	23.50	4/15/08
San Jose Del Monte	51,114	280.00	30.95	34.00	37.25	40.55	40.55	5/20/08
San Miguel	4,517	143.00	15.50	16.75	18.25	20.00	22.00	6/1/06
San Rafael	4,200	175.00	19.00	20.50	22.25	24.25	26.50	1/1/05
Santa Maria	5,854	175.00	18.65	20.20	22.45	25.40	28.70	3/1/08

Nueva Ecija Province

Municipality	Rate Systems of Municipal Water (Pesos)							Effective Date of the Rate System: After;
	Service Conn'n Fee	Basic Water Charge (Minimum Charge) (< 10 m^3)	Specific Charges (Pesos/m^3)					
			(11-20m^3)	(11-20m^3)	(11-20m^3)	(11-20m^3)	(11-20m^3)	
Aliaga	-	-	-	-	-	-	-	-
Bongabon	1,097	265.00	27.50	29.25	31.65	34.70	38.05	1/1/06
Cabanatuan City	22,425	115.00	12.50	13.75	15.25	17.15	19.50	2/1/05
Cabiao	1,700	125.00	12.60	12.75	13.00	13.00	13.00	4/4/00
Carranglan	-	-	-	-	-	-	-	-
Cuyapo	602	240.00	25.35	27.85	29.95	29.95	31.95	3/4/08
Gabaldon	-	-	-	-	-	-	-	-
Gapan City	2,992	193.00	20.50	22.00	24.00	26.60	30.35	12/1/06
Gen. M. Natividad	420	240.00	24.70	25.50	26.35	27.25	28.20	1/1/04
Gen. Tinio	1,767	170.00	17.50	18.50	20.00	22.00	24.50	1/1/00
Guimba	2,246	235.00	26.15	28.75	31.70	35.10	38.85	1/1/07
Jaen	1,354	245.00	26.20	27.55	29.05	31.00	33.20	7/8/07
Laur	-	-	-	-	-	-	-	-
Licab	-	184.00	19.50	20.75	22.25	24.00	26.00	7/1/07
Llanera	-	-	-	-	-	-	-	-
Lupao	-	-	-	-	-	-	-	-
Munoz	2,559	178.00	18.70	19.60	20.85	22.35	24.00	1/1/08
Nampicuan	-	-	-	-	-	-	-	-
Palayan City	895	205.00	21.65	23.10	24.85	26.90	29.25	1/1/06
Pantabangan	-	-	-	-	-	-	-	-
Penaranda	2,560	180.00	18.80	19.95	21.35	22.85	24.75	7/1/05
Quezon	-	-	-	-	-	-	-	-
Rizal	-	-	-	-	-	-	-	-
San Antonio	1,931	180.00	19.50	21.20	23.20	25.40	25.40	1/29/08
San Isidro	-	-	-	-	-	-	-	-
San Jose City	4,994	189.00	20.00	21.50	23.50	25.90	28.80	1/1/07
San Leonardo	-	-	-	-	-	-	-	-
Santa Rosa	2,598	150.00	16.00	17.25	18.75	20.50	22.50	10/1/05
Santo Domingo	-	-	-	-	-	-	-	-
Talavera	4,378	180.00	18.30	18.70	19.30	20.10	21.00	1/1/03
Talugtug	0	174.00	18.75	20.25	22.00	24.00	26.25	9/1/07

Source: "*Philippine Water Districts Directory*" Local Water Utilities Administration (LWUA) in the Philippines.

Annex-T 3.4.1 (2/2) Rate Systems by Water Districts for Municipal Water

Pampanga Province

Municipality	Rate Systems of Municipal Water (Pesos)							Effective Date of the Rate System: After;
	Service Conn'n Fee	Basic Water Charge (Minimum Charge) (< 10 m^3)	Specific Charges (Pesos/m^3)					
			(11-20m^3)	(11-20m^3)	(11-20m^3)	(11-20m^3)	(11-20m^3)	
Angeles City	28,830	140.00	15.25	16.75	18.50	20.50	22.75	3/1/06
Apalit	-	-	-	-	-	-	-	-
Arayat	-	-	-	-	-	-	-	-
Bacolor	-	150.00	16.50	17.75	19.25	21.00	23.00	2/1/07
Candaba	-	195.00	22.00	24.25	26.75	29.50	32.50	8/1/05
Floridablanca	10,023	132.00	14.25	15.25	16.50	18.00	19.75	2/1/06
Guagua	7,724	120.00	13.20	15.00	17.40	20.40	24.00	1/1/05
Lubao	4,073	112.00	12.30	13.20	14.40	14.40	14.40	4/1/05
Mabalacat	20,179	144.00	15.35	16.70	18.70	18.70	18.70	2/1/06
Macabebe	3,228	135.00	14.50	15.75	17.25	19.00	21.00	2/1/06
Magalang	-	-	-	-	-	-	-	-
Masantol	1,142	180.00	18.75	19.55	20.40	21.30	22.25	1/1/07
Mexico	-	-	-	-	-	-	-	-
Minalin	-	-	-	-	-	-	-	-
Porac	1,457	145.00	16.25	17.75	19.50	21.50	23.75	2/1/05
San Fernando City	17,199	175.00	19.65	22.25	25.15	28.50	32.20	1/1/06
San Luis	-	-	-	-	-	-	-	-
San Simon	-	-	-	-	-	-	-	-
Santa Ana	-	-	-	-	-	-	-	-
Santa Rita	-	-	-	-	-	-	-	-
Santo Tomas	-	-	-	-	-	-	-	-
Sasmuan	1,400	150.00	16.00	16.65	17.00	17.00	17.00	12/1/05

Tarlac Province

Municipality	Rate Systems of Municipal Water (Pesos)							Effective Date of the Rate System: After;
	Service Conn'n Fee	Basic Water Charge (Minimum Charge) (< 10 m^3)	Specific Charges (Pesos/m^3)					
			(11-20m^3)	(11-20m^3)	(11-20m^3)	(11-20m^3)	(11-20m^3)	
Bamban	-	-	-	-	-	-	-	-
Capas	-	-	-	-	-	-	-	-
Concepcion	6,093	163.00	17.80	19.45	21.45	23.75	26.40	10/1/05
La Paz	-	-	-	-	-	-	-	-
Tarlac City	16,323	185.00	20.00	21.75	23.75	26.00	28.50	6/1/07
Victoria	-	-	-	-	-	-	-	-

Source: "*Philippine Water Districts Directory*" Local Water Utilities Administration (LWUA) in the Philippines.

Annex-T 3.4.2 Fluctuation of Average Unit Price of Water Distributed by Water District in Last 10 Years

(Peso/m^3)

Water District	First half of 2000	Latter half of 2000	First half of 2001	Latter half of 2001	First half of 2002	Latter half of 2002	First half of 2003	Latter half of 2003	First half of 2004	Latter half of 2004	First half of 2005	Latter half of 2005	First half of 2006	Latter half of 2006	First half of 2007	Latter half of 2007	First half of 2008	Latter half of 2008	First half of 2009	Latter half of 2009
Bulacan	**12.23**	**11.56**	**11.71**	**12.12**	**13.64**	**13.83**	**14.24**	**14.24**	**14.39**	**14.80**	**16.20**	**17.03**	**17.62**	**18.19**	**18.34**	**18.71**	**19.13**	**19.13**	**19.13**	**19.13**
Angat	11.08	11.08	11.08	11.08	11.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08	17.58	17.58	17.58	17.58	17.58	17.58	17.58
Balagtas			13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	16.35	16.35	16.35	16.35	16.35	16.35
Baliwag		10.92	10.92	10.92	10.92	10.92	10.92	10.92	10.92	10.92	10.92	10.92	13.58	13.58	13.58	13.58	13.58	13.58	13.58	13.58
Bocaue					16.75	16.75	16.75	16.75	16.75	16.75	17.58	17.58	17.58	19.02	19.02	19.02	19.02	19.02	19.02	19.02
Bulacan				11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75	15.33	15.33	15.33	15.33	15.33
Bustos	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37	11.37
Calumpit	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	13.67	13.67	13.67	13.67	13.67	13.67	13.67	13.67	13.67
Guiguinto				15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08	15.08
Hagonoy					10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Malolos	11.15	11.15	11.15	11.15	11.15	11.15	11.15	11.15	11.15	11.15	11.15	11.15	11.15	13.58	13.58	13.58	13.58	13.58	13.58	13.58
Marilao					16.55	18.05	18.05	18.05	18.05	18.05	18.05	18.05	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25
Meycauayan					26.40	26.40	26.40	26.40	26.40	26.40	42.22	42.22	42.22	42.22	42.22	42.22	42.22	42.22	42.22	42.22
Norzagaray		6.87	6.87	6.87	6.87	6.87	15.73	15.73	15.73	15.73	15.73	18.35	18.35	18.35	18.35	23.00	23.00	23.00	23.00	23.00
Obando					22.92	22.92	22.92	22.92	22.92	22.92	31.50	42.27	42.27	42.27	42.27	42.27	42.27	42.27	42.27	42.27
Pandi	10.72	10.72	10.72	10.72	10.72	10.72	10.72	10.72	10.72	10.72	16.17	19.42	19.42	19.42	19.42	19.42	19.42	19.42	19.42	19.42
Plaridel				8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67
Pulilan				16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08
San Ildefonso	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	12.08	15.08	15.08	15.08	15.08	17.08	17.08	17.08	17.08
San Jose del Monte City	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	17.00	21.55	21.55	21.55	21.55	25.85	25.85	25.85	30.98	30.98	30.98	30.98
San Miguel	12.42	12.42	12.42	12.42	12.42	12.42	12.42	12.42	12.42	12.42	12.42	12.42	15.52	15.52	15.52	15.52	15.52	15.52	15.52	15.52
San Rafael						12.75	12.75	12.75	16.17	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00
Sta Maria				13.47	13.47	15.08	15.08	15.08	15.08	16.72	16.72	16.72	16.72	16.72	16.72	16.72	18.78	18.78	18.78	18.78
Nueva Ecija	**13.85**	**14.67**	**13.92**	**13.98**	**13.93**	**15.31**	**15.48**	**16.12**	**16.44**	**17.35**	**17.41**	**18.19**	**18.19**	**19.38**	**19.39**	**19.60**	**20.23**	**20.32**	**20.32**	**20.69**
Bongabon			11.58	11.58	11.58	16.25	16.25	16.25	21.45	21.45	21.45	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
Cabanatuan City				11.67	11.67	11.67	11.67	11.67	11.67	11.67	12.58	12.58	12.58	12.58	12.58	12.58	12.58	12.58	12.58	12.58
Cabiao	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62	12.62
Cuyapo	9.70	9.70	9.70	9.70	9.70	9.70	12.38	16.63	16.63	16.63	16.63	16.63	16.63	16.63	16.63	16.63	25.73	25.73	25.73	25.73
Gapan		18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	20.60	20.60	20.60	20.60	20.60	20.60	20.60
Gen. M. Natividad			15.50	15.50	15.50	20.62	20.62	24.73	24.73	24.73	24.73	24.73	24.73	24.73	24.73	24.73	24.73	24.73	24.73	24.73
Gen. Tinio	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	23.33
Guimba						17.53	17.53	17.53	17.53	20.88	20.88	20.88	20.88	26.13	26.13	26.13	26.13	26.13	26.13	26.13
Jaen	16.28	16.28	16.28	16.28	16.28	19.53	19.53	19.53	19.53	19.53	19.53	19.53	19.53	24.55	24.55	24.55	24.55	26.08	26.08	26.08
Licab															19.55	19.55	19.55	19.55	19.55	19.55
Lupao																				19.53
Muñoz				12.32	12.32	12.32	12.32	14.18	14.18	14.18	14.18	14.18	14.18	14.18	14.18	18.70	18.70	18.70	18.70	20.83
Palayan City			11.83	11.83	11.83	14.33	14.33	14.33	14.33	18.58	18.58	21.75	21.75	21.75	21.75	21.75	21.75	21.75	21.75	21.75
Peñaranda				16.83	16.83	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92	18.92
San Antonio				15.70	15.70	16.53	16.53	16.53	16.53	17.33	17.33	17.33	17.33	17.33	17.33	17.33	19.57	19.57	19.57	19.57
San Jose City					13.30	13.30	13.30	13.30	13.30	13.30	13.30	13.30	13.30	20.13	20.13	20.13	20.13	20.13	20.13	20.13
Sta Rosa	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08	16.08
Taravera			12.23	12.23	12.23	12.23	12.23	12.23	12.23	18.33	18.33	18.33	18.33	18.33	18.33	18.33	18.33	18.33	18.33	18.33
Talugtug																18.80	18.80	18.80	18.80	18.80
Pampanga	**11.15**	**11.16**	**11.16**	**11.87**	**12.01**	**12.01**	**12.01**	**12.01**	**12.42**	**12.95**	**13.38**	**14.60**	**15.64**	**16.16**	**16.18**	**16.18**	**16.18**	**16.56**	**16.69**	**17.36**
Angeres City	11.80	11.80	11.80	11.80	13.08	13.08	13.08	13.08	13.08	13.08	13.08	13.08	15.33	15.33	15.33	15.33	15.33	15.33	15.33	18.08
Bacolor															16.42	16.42	16.42	16.42	16.42	16.42
Candaba												21.92	21.92	21.92	21.92	21.92	21.92	21.92	21.92	21.92
Florida b lanca	8.60	8.60	8.60	8.60	8.60	8.60	8.60	8.60	12.25	12.25	12.25	12.25	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23
Guagua		8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40	17.87	17.87	17.87
Lubao		11.13	11.13	11.13	11.13	11.13	11.13	11.13	11.13	11.13	12.23	12.23	12.23	12.23	12.23	12.23	12.23	12.23	12.23	12.23
Mabalacat		11.63	11.63	11.63	11.63	11.63	11.63	11.63	11.63	11.63	11.63	11.63	15.48	15.48	15.48	15.48	15.48	15.48	15.48	19.57
Macabebe	11.18	11.18	11.18	11.18	11.18	11.18	11.18	11.18	11.18	11.18	11.18	11.18	14.58	14.58	14.58	14.58	14.58	14.58	16.18	18.87
Masantol	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	18.77	18.77	18.77	18.77	18.77	18.77	18.77
Porac											16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17
San Fernando City				17.53	17.53	17.53	17.53	17.53	17.53	17.53	17.53	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80
Sasmuan		13.30	13.30	13.30	13.30	13.30	13.30	13.30	13.30	13.30	13.30	15.88	15.88	15.88	15.88	15.88	15.88	15.88	15.88	15.88
Sta Rita																				15.83
Tarlac	**16.25**	**13.86**	**14.22**	**14.03**	**13.47**	**14.05**	**14.50**	**14.93**	**15.11**	**15.11**	**16.09**	**17.45**	**18.00**	**18.00**	**18.30**	**18.30**	**18.76**	**20.66**	**20.66**	**21.14**
Camiling			17.33	17.33	17.33	17.33	17.33	17.33	19.00	19.00	21.17	21.17	21.17	21.17	21.17	21.17	21.17	24.00	24.00	24.00
Concepcion			11.83	11.83	11.83	11.83	13.58	13.58	13.58	13.58	13.58	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85
Gerona				13.28	13.28	13.28	13.28	13.28	13.28	13.28	13.28	18.25	18.25	18.25	18.25	18.25	18.25	21.57	21.57	21.57
Mayantoc	16.25	16.25	16.25	16.25	16.25	16.25	16.25	16.25	16.25	16.25	18.37	20.85	20.85	20.85	20.85	20.85	20.85	20.85	20.85	20.85
Moncada					12.08	13.08	13.08	13.08	13.08	13.08	13.08	16.08	16.08	16.08	16.08	16.08	20.15	20.15	20.15	20.15
Paniqui						17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70	17.70
Ramos					13.70	13.70	13.70	13.70	13.70	13.70	16.20	16.20	16.20	16.20	16.20	16.20	16.20	20.77	20.77	20.77
Sta Ignacia					11.80	11.80	14.10	14.10	14.10	14.10	14.10	16.55	16.55	16.55	16.55	16.55	16.55	22.98	22.98	27.25
Tarlac City		11.47	11.47	11.47	11.47	11.47	11.47	15.33	15.33	15.33	17.33	17.33	17.33	17.33	20.08	20.08	20.08	20.08	20.08	20.08

Source: LWUA Official Web Site Home Page.

Annex-T 3.4.3 Rate Systems of CPC Grantees for Municipal/Commercial/Industrial Water

Bulacan Province

Service Location/	City/ Municipality	Rate Systems of Municipal Water (Pesos)											Rate Systems of Commercial and Industrial Water		
		Service Conn'n Fee in Average[1]	Basic Water Charge (Minimum Charge) (< 10 m^3)	Specific Charges (Pesos/m^3)									Variable Charges (Pesos/m^3)		
				(0 - 10 m^3)	(11 - 20 m^3)	(21 - 30 m^3)	(31 - 40 m^3)	(41 - 50 m^3)	(51 - 60 m^3)	(61 - 70 m^3)	(71 - 100 m^3)	(100 m^3 <)	(0 - 25 m^3)	(26 - 1,000 m^3)	(1,000 m^3 <)
San Gabriel Rural Waterworks & Development Cooperative	Santa Maria	288.53	130.00	-	13.50	14.25	15.50	17.50	20.00	23.00	26.00	29.00	-	-	-
Bulihan Rural Waterworks Cooperative and Allied Services	Malolos	-	-	12.00	13.00	14.00	15.00	16.00	16.00	(Over 51m^3)			-	-	-
Tabe Rural Waterworks and Sanitation Assoziation Inc.	Guiguinto	2,269.83	-	12.00	13-14	15-16	17-18	19-20	20.00	(Over 51m^3)			-	-	-
Malhakan Rural Waterworks Multipurpose Cooperative	Meycauayan	-	210.00	-	22.50	24.00	25.50	27.00	28.50	(Over 51m^3)			-	-	-
Confed Properties, Inc., CPI-HH2 Waterworks	Marilao[6]	-	210.00	-	22.00	23.00	24.00	25.00	26.00	(Over 51m^3)			-	-	-

Pampanga Province

Service Location/	City/ Municipalit	Rate Systems of Municipal Water (Pesos)											Rate Systems of Commercial and Industrial Water		
		Service Conn'n Fee in Average[1]	Basic Water Charge (Minimum Charge) (< 10 m^3)	Specific Charges (Pesos/m^3)									Variable Charges (Pesos/m^3)		
				(0 - 10 m^3)	(11 - 20 m^3)	(21 - 30 m^3)	(31 - 40 m^3)	(41 - 50 m^3)	(51 - 60 m^3)	(61 - 70 m^3)	(71 - 100 m^3)	(100 m^3 <)	(0 - 25 m^3)	(26 - 1,000 m^3)	(1,000 m^3 <)
Lago Waterworks, Inc.	Angeles City	7,245.00	-	16.50	17.00	17.50	18.00	18.50	19.00	(Over 51m^3)			-	-	-
-	Mexico[4]	12,836.75	160.00	-	16.00	16.25	16.50	17.00	21.00	(Over 51m^3)			220.00	27[ii]	
"Sinukuan Water System, Inc"	Angeles City	-	97.00	-	8.00	8.20	8.40	8.60	9.00	(Over 51m^3)			130.00	-	-
Calsons Development Corporations	Angeles City	-	147.00	-	15.00	15.50	16.00	16.50	17.00	(Over 51m^3)			735.00	32.00	34.00
Taguete Waterworks In	Angeles City	-	130.00	-	14.50	16.00	17.75	19.90	21.50	(Over 51m^3)			-	-	-
Trilan Waterworks Inc.	Angeles City	-	-	13.00	13.50	14.00	14.50	15.00	15.50	(Over 51m^3)			18.00	19.00	23.00
"Santa Lucia Water Incorporated	Magalang	-	68.00	-	7.15	8.00	9.00	10.00	11.00	(Over 51m^3)			140.00	-	-

Tarlac Province

Service Location/	City/ Municipalit	Rate Systems of Municipal Water (Pesos)											Rate Systems of Commercial and Industrial Water		
		Service Conn'n Fee in Average[1]	Basic Water Charge (Minimum Charge) (< 10 m^3)	Specific Charges (Pesos/m^3)									Variable Charges (Pesos/m^3)		
				(0 - 10 m^3)	(11 - 20 m^3)	(21 - 30 m^3)	(31 - 40 m^3)	(41 - 50 m^3)	(51 - 60 m^3)	(61 - 70 m^3)	(71 - 100 m^3)	(100 m^3 <)	(0 - 25 m^3)	(26 - 1,000 m^3)	(1,000 m^3 <)
"JQG Homes Development Corporation".	Tarlac City	-	85.00		11.00	12.00	13.00	14.00	15.00	(Over 51m^3)			-	-	-

Source : "Annual Report" of CPS-WSP.

Annex-T 4.3.1 Present Coverage Ratio of the Water Supply Service System in the Study Area

Province	City / Municipality	HHs 2008	ACCESS TO SAFE WATER HHs					Service Level Ratio / Unsafe Ratio				
			Safe				Unsafe	Service Level				Unsafe
			Level 3	Level 2	Level 1	Total		Level 3	Level 2	Level 1	Total	
Bulacan	Angat	12,044	5,138	0	4,861	9,999	2,045	51%	0%	49%	100%	17%
	Baliuag	34,430	17,623	0	14,309	31,932	2,498	55%	0%	45%	100%	7%
	Bulacan	18,069	12,281	0	5,136	17,417	652	71%	0%	29%	100%	4%
	Bustos	11,762	7,270	0	4,003	11,273	489	64%	0%	36%	100%	4%
	Calumpit	20,454	19,380	0	593	19,973	481	97%	0%	3%	100%	2%
	Doña Remedios Trinidad	4,119	2,817	0	171	2,988	1,131	94%	0%	6%	100%	27%
	Guiguinto	23,322	8,469	0	14,256	22,725	597	37%	0%	63%	100%	3%
	Hagonoy	27,155	23,410	0	2,843	26,253	902	89%	0%	11%	100%	3%
	Malolos City	49,388	18,832	0	21,520	40,352	9,036	47%	0%	53%	100%	18%
	Norzagaray	19,380	12,743	0	5,798	18,541	839	69%	0%	31%	100%	4%
	Pandi	13,928	4,676	0	172	4,848	9,080	96%	0%	4%	100%	65%
	Paombong	10,651	7,785	0	942	8,727	1,924	89%	0%	11%	100%	18%
	Plaridel	24,774	16,589	0	6,912	23,501	1,273	71%	0%	29%	100%	5%
	Pulilan	17,132	610	0	15,956	16,566	566	4%	0%	96%	100%	3%
	San Ildefonso	17,866	3,356	0	7,539	10,895	6,971	31%	0%	69%	100%	39%
	San Miguel	28,907	13,451	0	15,456	28,907	0	47%	0%	53%	100%	0%
	San Rafael	21,898	5,038	0	14,515	19,553	2,345	26%	0%	74%	100%	11%
	Santa Maria	41,006	23,373	0	15,582	38,955	2,051	60%	0%	40%	100%	5%
Nueva Ecija	Aliaga	9,693	898	0	2,928	3,826	5,867	23%	0%	77%	100%	61%
	Bongabon	9,020	1,317	1,742	5,961	9,020	0	15%	19%	66%	100%	0%
	Cabanatuan City	42,151	31,265	9	11,507	42,781	0	73%	0%	27%	100%	0%
	Cabiao	12,204	2,171	466	9,325	11,962	242	18%	4%	78%	100%	2%
	Carranglan	6,225	0	0	2,787	2,787	3,438	0%	0%	100%	100%	55%
	Gabaldon	5,532	0	2,176	1,182	3,358	2,174	0%	65%	35%	100%	39%
	Gapan	14,798	3,318	1,450	10,029	14,797	1	22%	10%	68%	100%	0%
	Gen Mamerto Natividad	5,473	1,036	125	4,250	5,411	62	19%	2%	79%	100%	1%
	General Tinio	6,506	1,968	435	3,490	5,893	613	33%	7%	59%	100%	9%
	Guimba	14,496	2,793	66	11,720	14,579	0	19%	0%	80%	100%	0%
	Jaen	10,678	2,049	176	7,851	10,076	602	20%	2%	78%	100%	6%
	Laur	5,180	1,121	890	3,088	5,099	81	22%	17%	61%	100%	2%
	Licab	4,136	395	0	891	1,286	2,850	31%	0%	69%	100%	69%
	Llanera	6,170	229	195	4,698	5,122	1,048	4%	4%	92%	100%	17%
	Lupao	5,679	0	0	4,053	4,053	1,626	0%	0%	100%	100%	29%
	Science City of Munoz	11,629	4,761	940	4,135	9,836	1,793	48%	10%	42%	100%	15%
	Palayan City	7,082	2,318	457	3,856	6,631	451	35%	7%	58%	100%	6%
	Pantabangan	5,007	0	2,275	427	2,702	2,305	0%	84%	16%	100%	46%
	Penaranda	4,487	3,168	171	1,150	4,489	0	71%	4%	26%	100%	0%
	Quezon	5,931	0	0	2,440	2,440	3,491	0%	0%	100%	100%	59%
	Rizal	9,603	0	50	9,551	9,601	2	0%	1%	99%	100%	0%
	San Antonio	10,859	2,050	458	7,532	10,040	819	20%	5%	75%	100%	8%
	San Isidro	6,919	2,754	173	3,960	6,887	32	40%	3%	57%	100%	0%
	San Jose City	20,777	5,312	0	0	5,312	15,465	100%	0%	0%	100%	74%
	San Leonardo	9,717	3,026	1,847	4,237	9,110	607	33%	20%	47%	100%	6%
	Santa Rosa	10,244	4,533	499	5,212	10,244	0	44%	5%	51%	100%	0%
	Santo Domingo	8,451	671	50	6,826	7,547	904	9%	1%	90%	100%	11%
	Talavera	18,250	7,858	0	11,527	19,385	0	41%	0%	59%	100%	0%
	Talugtug	3,465	500	0	2,442	2,942	523	17%	0%	83%	100%	15%
	Zaragosa	6,746	715	736	5,462	6,913	0	10%	11%	79%	100%	0%
Pampanga	Angeles City	67,838	51,590	0	10,065	61,655	6,183	84%	0%	16%	100%	9%
	Apalit	35,509	7,747	0	4,391	12,138	23,371	64%	0%	36%	100%	66%
	Arayat	21,999	0	0	15,295	15,295	6,704	0%	0%	100%	100%	30%
	Bacolor	6,673	1,679	590	4,075	6,344	329	26%	9%	64%	100%	5%
	Candaba	22,465	2,206	100	10,063	12,369	10,096	18%	1%	81%	100%	45%
	Floridablanca	17,834	12,067	0	3,515	15,582	2,252	77%	0%	23%	100%	13%
	Guagua	22,782	10,720	95	7,555	18,370	4,412	58%	1%	41%	100%	19%
	Lubao	29,485	5,040	72	17,861	22,973	6,512	22%	0%	78%	100%	22%
	Mabalacat	35,435	25,218	0	6,219	31,437	3,998	80%	0%	20%	100%	11%
	Macabebe	14,108	4,190	0	1,491	5,681	8,427	74%	0%	26%	100%	60%
	Magalang	14,228	0	0	11,250	11,250	2,978	0%	0%	100%	100%	21%
	Masantol	8,434	0	0	7,710	7,710	724	0%	0%	100%	100%	9%
	Mexico	23,743	4,580	0	17,335	21,915	1,828	21%	0%	79%	100%	8%
	Minalin	8,011	3,033	0	3,684	6,717	1,294	45%	0%	55%	100%	16%
	Porac	23,180	3,084	1,976	12,985	18,045	5,135	17%	11%	72%	100%	22%
	City of San Fernando	49,690	20,249	6,869	15,128	42,246	7,444	48%	16%	36%	100%	15%
	San Luis	10,109	0	0	4,431	4,431	5,678	0%	0%	100%	100%	56%
	San Simon	8,302	3,372	0	2,926	6,298	2,004	54%	0%	46%	100%	24%
	Santa Ana	8,316	1,024	7,966	7,614	16,604	0	6%	48%	46%	100%	0%
	Santa Rita	9,646	1,229	0	6,240	7,469	2,177	16%	0%	84%	100%	23%
	Santo Tomas	8,111	3,438	0	1,729	5,167	2,944	67%	0%	33%	100%	36%
	Sasmuan	6,791	0	0	3,649	3,649	3,142	0%	0%	100%	100%	46%
Tarlac	Bamban	10,169	1,669	0	7,004	8,673	1,496	19%	0%	81%	100%	15%
	Capas	23,000	6,062	0	9,757	15,819	7,181	38%	0%	62%	100%	31%
	Concepcion	23,051	5,267	0	11,511	16,778	6,273	31%	0%	69%	100%	27%
	La Paz	10,653	1,243	0	7,580	8,823	1,830	14%	0%	86%	100%	17%
	Tarlac City	56,291	19,604	0	31,081	50,685	5,606	39%	0%	61%	100%	10%
	Victoria	12,417	1,076	0	6,731	7,807	4,610	14%	0%	86%	100%	37%
Total		1,281,663	484,454	33,054	551,956	1,069,464	222,504	45%	3%	52%	100%	17%

	Bulacan	396,285	202,841	0	150,564	353,405	42,880	57%	0%	43%	100%	11%
	Nueva Ecija	297,108	86,226	15,386	152,517	254,129	44,996	34%	6%	60%	100%	15%
	Pampanga	452,689	160,466	17,668	175,211	353,345	107,632	45%	5%	50%	100%	24%
	Tarlac	135,581	34,921	0	73,664	108,585	26,996	32%	0%	68%	100%	20%
	Total	1,281,663	484,454	33,054	551,956	1,069,464	222,504	45%	3%	52%	100%	17%

Note: Inside the study area only

Source: PHO for Bulacan, Nueva Ecija, Pampanga and Tarlac (arranged by JICA Study Team)

Annex-T 4.3.2 Present Sanitation Facilities

Province	City / Municipality	HHs 2008	HH with Sanitary Toilet	HH with Insanitary Toilet	HH without Toilet	Ratio	
						with	without
Bulacan	Angat	12,044	10,716	1,328		89%	11%
	Baliuag	34,430	31,788	2,642		92%	8%
	Bulacan	18,069	16,726	1,343		93%	7%
	Bustos	11,762	11,301	461		96%	4%
	Calumpit	20,454	18,490	1,964		90%	10%
	Doña Remedios Trinidad	4,119	2,156	1,963		52%	48%
	Guiguinto	23,322	21,941	1,381		94%	6%
	Hagonoy	27,155	24,056	3,099		89%	11%
	Malolos City	49,388	44,661	4,727		90%	10%
	Norzagaray	19,380	17,942	1,438		93%	7%
	Pandi	13,928	11,848	2,080		85%	15%
	Paombong	10,651	10,165	486		95%	5%
	Plaridel	24,774	23,877	897		96%	4%
	Pulilan	17,132	15,685	1,447		92%	8%
	San Ildefonso	17,866	15,760	2,106		88%	12%
	San Miguel	28,907	25,727	3,180		89%	11%
	San Rafael	21,898	20,155	1,743		92%	8%
	Santa Maria	41,006	39,378	1,628		96%	4%
Nueva Ecija	Aliaga	9,693	8,239	969	485	85%	15%
	Bongabon	9,020	6,834	1,674	512	76%	24%
	Cabanatuan City	42,151	42,781	0	0	100%	0%
	Cabiao	12,204	10,124	914	1,166	83%	17%
	Carranglan	6,225	3,563	2,162	500	57%	43%
	Gabaldon	5,532	4,148	1,003	381	75%	25%
	Gapan	14,798	13,944	0	854	94%	6%
	Gen Mamerto Natividad	5,473	4,979	391	736	82%	18%
	General Tinio	6,506	5,452	211	843	84%	16%
	Guimba	14,496	12,648	0	1,932	87%	13%
	Jaen	10,678	8,500	1,172	1,005	80%	20%
	Laur	5,180	4,115	1,135	0	78%	22%
	Licab	4,136	3,849	320	0	92%	8%
	Llanera	6,170	5,424	745	0	88%	12%
	Lupao	5,679	4,606	681	392	81%	19%
	Science City of Munoz	11,629	10,595	1,035	0	91%	9%
	Palayan City	7,082	5,984	582	516	84%	16%
	Pantabangan	5,007	3,566	705	736	71%	29%
	Penaranda	4,487	3,910	205	374	87%	13%
	Quezon	5,931	4,627	938	366	78%	22%
	Rizal	9,603	8,180	1,123	300	85%	15%
	San Antonio	10,859	9,275	0	1,584	85%	15%
	San Isidro	6,919	6,170	749	0	89%	11%
	San Jose City	20,777	18,462	0	2,315	89%	11%
	San Leonardo	9,717	7,841	0	1,876	81%	19%
	Santa Rosa	10,244	8,490	774	980	83%	17%
	Santo Domingo	8,451	6,432	2,019	0	76%	24%
	Talavera	18,250	16,327	1,381	542	89%	11%
	Talugtug	3,465	3,294	0	171	95%	5%
	Zaragosa	6,746	5,466	560	726	81%	19%
Pampanga	Angeles City	67,838	46,528			69%	31%
	Apalit	35,509	20,424	959	2,590	85%	15%
	Arayat	21,999	17,384	760	4,824	76%	24%
	Bacolor	6,673	6,318	0	37	99%	1%
	Candaba	22,465	13,454	204	4,312	75%	25%
	Floridablanca	17,834	15,560	140	1,108	93%	7%
	Guagua	22,782	17,948	660	305	95%	5%
	Lubao	29,485	19,244	1,031	5,096	76%	24%
	Mabalacat	35,435	28,591	502	1,246	94%	6%
	Macabebe	14,108	16,037	1,407	2,101	82%	18%
	Magalang	14,228	10,171	287	953	89%	11%
	Masantol	8,434	7,674	760	0	91%	9%
	Mexico	23,743	21,720	0	2,023	91%	9%
	Minalin	8,011	5,707	0	2,159	73%	27%
	Porac	23,180	17,907	15	1,051	94%	6%
	City of San Fernando	49,690	39,563	403	4,664	89%	11%
	San Luis	10,109	5,893	581	1,832	71%	29%
	San Simon	8,302	6,437	0	1,319	83%	17%
	Santa Ana	8,316	7,229	0	1,064	87%	13%
	Santa Rita	9,646	6,886	373	227	92%	8%
	Santo Tomas	8,111	5,588	0	1,150	83%	17%
	Sasmuan	6,791	4,487	187	917	80%	20%
Tarlac	Bamban	10,169	9,158	587	424	90%	10%
	Capas	23,000	17,486	345	5,169	76%	24%
	Concepcion	23,051	16,561	582	5,908	72%	28%
	La Paz	10,653	9,474	0	1,179	89%	11%
	Tarlac City	56,291	52,905	870	2,516	94%	6%
	Victoria	12,417	10,214	0	2,203	82%	18%
Total		1,281,663	1,076,745	66,014	75,669	88%	12%
	Bulacan	396,285	362,372	33,913	0	91%	9%
	Nueva Ecija	297,108	257,825	21,448	19,292	86%	14%
	Pampanga	452,689	340,750	8,269	38,978	88%	12%
	Tarlac	135,581	115,798	2,384	17,399	85%	15%
	Total	1,281,663	1,076,745	66,014	75,669	88%	12%

Note: Inside the study area only
Source: JICA Study Team based on PHO for Bulacan, Nueva Ecija, Pampanga and Tarlac,

Annex-T 5.1.1 (1/2) Water Sector Laws and Policies

National Legislation and Policies	Salient Provision
Republic Act No. 6324 of 1971	Creating the MWSS and making it responsible for water supply in Metro Manila. In 1997, the MWSS was privatized with the management and operations transferred to MWSI and MWCI under a 25-years concession contract.
Presidential Decree No.198 of 1973 (Provincial Water Utilities Act as amended)	Creating the LWUA and the local WDs. It established LWUA as the government resources provider and the WDs as the local water service providers. It is also gives authority to LWUA as a specialized lending institution for, and provides technical and training assistance to the WD's.
Presidential Decree No. 424 of 1974 (National Water Resources Council-NWRC Charter)	Creating the NWRC, now the NWRB, to coordinate the planning of some 30 water resources agencies of the government.
Presidential Decree No. 856 of 1975 (Sanitation Code of the Philippines)	Codifying and enforcing the various sanitation policies of the government including standards for water supply, food processing and servicing, sanitary facilities, sewerage and sewage management, markets and abattoirs, industrial hygiene and funeral parlors.
Presidential Decree No.1067 of 1976 (Water Code of the Philippines, as amended)	Provides the framework for complementing the provisions of the constitution on water resources development and management with regard to water quality. This includes the rule governing the rights and obligation of water uses as well as the administrative structure to enforce the provisions of the water code. The code adopts prior appropriation doctrine of "first in time, first in right" for water allocation.
Presidential Decree No.1152 of 1977 (The Philippine Environmental Code)	Provides the comprehensive program on environmental protection and management covering air, water quality, land use, natural resources and waste management for fisheries and aquatic resources; wildlife; forestry etc.
Presidential Decree No. 1206 of 1977 (Public Service Law)	Mandates NWRB to supervise, control and regulate all water utilities except those falling under the jurisdiction under the MWSS and the LWUA. EO 123 of September 2002 mandates NWRB to approve tariffs of local water districts.
The Philippine Constitution of 1987	Provides the basic principles of water resources development and management, which stipulate that all water of the Philippines belong to the states.
Executive Order No. 292 of 1987 (The Administrative Code)	Vested the President with residual powers to reorganize the Executive Branch.
Executive Order No. 124-A of 1987	Converted NWRC into the NWRB.
EO 192 of 1987 (Department of Environmental and Natural Resources-DENR Charter)	Provides for the organization of the DENR as the lead agency in, among others, promulgating the (a) rules and regulation for the control of water, air and land pollution, and (b) ambient and effluent standards for water and air quality.
Executive Order No. 215 of 1987	The first legal framework for privatization of power projects by President Corazon Aquino resulting in the implementation of about 20 power projects.
Republic Act No. 6957 of July 1990	Authorized the financing, construction, operation and maintenance of government infrastructure projects by the private sector resulting in the implementation of only two projects.
Republic Act No. 7160 of 1991 (Local Government Code)	Defines the function and powers of LGUs) i.e., provinces, cities, municipalities and barangays, in environmental protection. R.A No.7160 mandates LGUs to undertake watershed- related activities, initially confined to community- based management (CBFM) social forestry and watershed projects. Since then, a number of environmental functions of various NGAs have been developed to LGUs.

Annex-T 5.1.1 (2/2) Water Sector Laws and Policies

National Legislation and Policies	Salient Provision
Republic Act No. 7718 of April 1994 (The Philippine BOT Law)	Amending certain sections of Republic Act No. 6957-1990, entitled "An Act Authorizing the Financing, Construction, Operation and Maintenance of Infrastructure Projects by the Private Sector, and for Other Purposes".
National Water Crisis Act of 1995	Provided the legal basis for the privatization of the MWSS in 1997.
Executive Order No. 123 of September 2002 (Reconstructing the NWRB)	Straightening the NWRB including assumption of LWUA's WD tariff approving authority.
Republic Act No. 9206 of 2003 (General Appropriation Act)	Reenact, authorize the President to direct changes in the organizational units or key positions in any department or agency, and require all department/agencies of the Executive Branch to conduct a comprehensive review of their respective mandates, missions, objectives, functions, programs, projects, etc., and to improve government's service delivery and productivity.
Republic Act No. 9275 of 2004 (Philippine Clean Water Act)	Provisions for comprehensive water quality management. It also provides the framework for sustainable development to achieve a policy of economic growth in a manner consistent with the protection, preservation and revival of the quality of fresh, brackish and marine waters. The passage of R.A 9275 is also the first attempt to consolidate different fragmented laws of the Philippines on water resources management and sanitation.
Executive Order No. 279 of February 2004	Instituted reforms in the financing policies for the water supply and sewerage sector and water service providers; rationalizing the LWUA's organizational structure and transferring it to the Office of the President.
Executive Order No. 366 of October 2004 (Strategic Review of the Operations of the Executive Branch)	Directing to all Department Secretaries a strategic review of the operations of the Executive Branch and providing options and incentives for government employees who may be affected by the rationalization of the functions and agencies of the Executive Branch.
Executive Order No. 387 of November 2004	Transferred LWUA from the Office of the President to DPWH.
Executive Order No. 421 of April 2005	Refocusing LWUA's functions and organizational structure as envisioned in EO 279.
Executive Order No. 510 of March 2006 (Creating River Basin Control Office)	Creating River Basin Control Office (RBO) in DENR. RBCO has power and function, together with DPWH, to rationalize the various existing river basin projects such as: Mt. Pinatubo Hazard Urgent Mitigation, Iloiro Flood Control, Lower Agusan Flood Control, Bicol River Basin and Watershed Management, etc., to develop a national master plan for flood control together with DPWH and National Disaster Coordinating Council, to rationalize and prioritize reforestation in watersheds, and to perform other functions as President and DENR secretary may direct.

Annex-T 5.2.1 (1/3) Mandate of Key Government Agencies in Water Resources Management

Unit of Government	Line Bureau or Concerned Agency	Responsibility / Concerns Related to Water
1. National Economic and Development Authority (NEDA)	Infrastructure Staff	Formulates and approves policies on water resources, and coordinate social and development planning as the government central planning body
	Regional Development Councils (RDCs)	Sets direction of economic and social development in region through which regional development efforts are coordinated
	Investment Coordination Committee/NEDA Board	Evaluates/appraises/approves major development projects
2. Office of the President (OP)	National Water Resources Board (NWRB)	Coordinates and regulates water activities in the country; supervise and regulates operations of water utilities outside jurisdiction of LWUA and MWSS; formulates and recommends policies on water resources
	The National Commission on Indigenous Peoples (NCIP)	Protects and promotes the interest and well-being of the Indigenous Cultural Communities/Indigenous Peoples (ICCs/IPs) with due regard to their beliefs, customs, traditions and institutions
3. Department of Public Works and Highways (DPWH)	Metropolitan Waterworks and Sewerage System (MWSS)	Constructs, maintains and operates domestic/municipal water supply and sewerage projects in Metro Manila and Contiguous areas including watershed management
	Bureau of Research and Standards (BRS)	Undertakes hydrological survey and data collection
	PMO - Major Flood Control Projects (PMO-MFCP)	Manage the planning, design, construction, operation and maintenance of major flood control projects
	PMO - Rural Water Supply (PMO-RWS-CARP)	Manage the planning, design, construction, operation and maintenance of foreign-assisted rural water supply projects
	PMO - Small Water Impounding Projects (PMO-SWIM) devolved to LGUs	Manages the planning, design, construction, operation and maintenance of locally-founded and foreign assisted SWIM projects
4. Department of Agriculture (DA)	National Irrigation Administration (NIA)	Undertakes program-oriented and comprehensive water resources projects for irrigation purposes as well as concomitant activities such as flood control, drainage, land reclamation, hydropower development, watershed management, etc.
	Bureau of Soils and Water Management (BSWM)	Undertakes assessment, development and conservation of existing and potential soil and water sources for agriculture; undertakes cloud seeding activities
	Bureau of Fisheries and Aquatic Resources (BFAR)	Formulates plans for the proper management, accelerated development and proper utilization of country's fisheries and aquatic resources
5. Department of Energy (DOE)	National Power Corporation (NPCOR/NPC)	Develops electricity power generation facilities including hydroelectric and geothermal power; constructs dams, reservoirs, diversion facilities and plants and watershed management
	National Electrification Administration (NEA)	Promotes, encourages and assists public service entities to achieve service objectives, implements
	Office of Energy Affair (OEA)	Promotes development of indigenous energy resources such as mini-hydro projects

Annex-T 5.2.1 (2/3) Mandate of Key Government Agencies in Water Resources Management

Unit of Government	Line Bureau or Concerned Agency	Responsibility / Concerns Related to Water
6. Department of Environment and Natural Resources (DENR)	Environmental Management Bureau (EMB)	Formulates environment quality standards for water, air, land, noise and radiation; approves environmental impact statements and issues Environmental Compliance Certificate
	Mines and Geo-Science Bureau (MGSB)	Manages, develops and conserves the country's mineral resources; monitors and maps groundwater resources
	Forest Management Bureau (FMB)	Formulates and recommends policies and programs for the effective protection, development, management and conservation of forest lands and watersheds
	Protected Areas and Wildlife Bureau (PAWB)	Undertakes the protection and conservation of natural wetlands such as lakes, marshes, swamps, etc.
	National Mapping and Resources Inventory Authority (NAMRIA)	Responsible for integrated surveys, mapping, charting, oceanography, land classification, aerial photography, remote sensing, etc.
	Laguna Lake Development Authority (LLDA)	Responsible for regional water resources development and management in the Laguna Lake catchment area
7. Department of Health (DOH)	Environmental Health Service (EHS)	Responsible for water supply and sanitation programs and strategies to forestall environment-related diseases
	Bureau of Research Laboratories (BRL)	Monitors quality drinking water
	Local Water Utilities Administration (LWUA)	Specialized lending institution for promoting, developing, regulating and financing water utilities, excluding Metro Manila
8. Department of Science and Technology (DST)	Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)	Disseminates atmospheric, geophysical and astronomical data for use by economic sectors, the scientific and engineering communities, and the general public
	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCAFNRRD)	Formulates national agriculture, forestry, and natural resources research and development programs on multi-disciplinary, inter-agency approach for the various commodities including water resources
9. Department of Interior and Local Government (DILG)	Water Supply and Sanitation Program Management Office (WSS-PMO)	Supports the provision of water supply and sanitation services by local government units (LGUs)
10. Local Government Units (LGUs)	Provincial Governments	Promotes the development of infrastructure including irrigation, water supply, electricity power and roads
	Municipal and Barangay Governments	Promotes municipal and barangay WS & S, watershed and other programs

Annex-T 5.2.1 (3/3) Mandate of Key Government Agencies in Water Resources Management

Unit of Government	Line Bureau or Concerned Agency	Responsibility / Concerns Related to Water
11. Department of National Defense (DND)	Office of Civil Defense (OCD)	Monitors safety dams and other water resources projects; prepares and supports the general public in emergencies
	Philippines Air Force (PAF)	Undertakes rain enhancement through cloud seeding
12. Department of Transportation and Communication(DTC)	Philippine Ports Authority (PPA)	Plans, develops, operates and maintains ports and port facilities
13. Department of Tourism (DOT)	Philippine Tourism Authority (PTA)	Promotes and develops the recreational use of water resources
14. Department of Trade and Industry (DTI)	Board of Investment (BOI)	Proponent of the CALABARZON integrated area study, covering water resources, among other aspects
15. Department of Social Welfare and Development (DSWD)		Implements the government's flagship anti - poverty project - Kapit - Bisig Laban sa Kahirapan - Comprehensive and Integrated Delivery of Social Services (KALAHI-CIDSS) which includes water system construction in priority municipalities
16. Department of Agrarian Reform (DAR)		Lead implementing agency of Comprehensive Agrarian Reform Program (CARP) and orchestrates the delivery of support service to farmer-beneficiaries in the KALAHI ARZones, expanded agrarian reform communities composed of cluster of contiguous land-reform barangays

Source: Philippine Water Supply Sector Roadmap, 2008-2010 Secretariat's Report to the INFRACOM such –Committee on Water Resources, November 2008, pp17-18

Annex-T 5.2.2 Key Water Supply Sector Agencies: Delineated Roles and Responsibilities

Agency	Roles and Responsibility
NEDA	Coordinates the preparation of national development plan and investment programs: • Formulation of sector policies and strategies • Monitoring implementation of policies, programs and projects
NWRB	Regulation of WSPs including some (consenting) LGU- managed water utilities • Traffic regulation • Coverage and service regulation
LGUs	Based on the Local Government Code, LGUs bear multiple mandates in the sector such as resources regulation, water supply provision, economic regulation of their utilities, and planning and implementation of water supply and sanitation programs • Preparation of water and sanitation master plans • Monitoring of local water and sanitation coverage and update of sector profile • Provision of support to water supply providers (WSPs) such as the RWSAs, BWSAs and cooperative including funding IRA
LWUA	Capacity building support to WSPs • Provision of technical advisory services and financial assistance to water districts • Provision of technical and institutional support to LGUs and WSPs • Setting design standards for water supplies operated by water districts and other WSPs
DILG	Capacity building support to LGUs • Provision of capacity building training to LGUs • Coordination of LGU master plan preparation • Provision of information to LGUs on available sector programs and financing
DPWH	Provision of technical support to LGUs upon request including implementation of level I and level II projects
DOF/GFIs	Financing support for the water supply sector • DOF oversees performance of GFIs like DBP, LBP and LWUA • GFIs (DBP, LBP and LWUA) provides funding for the water supply sector
NAPC-WASCO	Coordinates the P3W water supply projects for the 432 municipalities outside of Metro where people's access to water supply is below 50 percent, 210 communities within Metro Manila and 201 municipalities in conflict zone covered by peace agreements with the RPMP/RPA/ABB (in 2000), CPLA (in 1986) and MNLF (in 1996).
DENR	Based on E.O 192 (1987), the DENR serves as lead agency in, among others, promulgating the (1) rules and regulations for the control of water, air and land pollution and (2) ambient and effluent standard for water and air quality.
MWSS	For water supply and sewerage services in Metro Manila through private water utilities. It is also serves as the economic regulatory agency in the national capital region.

Source: PWSS Roadmap Institutional Development Framework Validation Workshop, Richmond Plaza Ortigas Center, October 13, 2006

Annex-T 5.2.3 Institutional Structure of Water Supply and Sanitation

Type of Service	DILG			DOH			DPWH		
(Central Agencies)	Water Supply & Sanitation PMO			LWUA		Hospital	MWSS	Infrastructures	PMO-RWS
	Regional Office					Regional Health Office	Metro Manila	Regional Office	Foreign Assisted Rural WS Projects
(LGUs)	Government Owned and Controlled Corporation					Provincial Hospital		District Engineer's Office	
	Province	City/Municipal	Barangay						
Formal Level of WS Service	Rural			Urban WS	CPSO				
No Access	-		SSIP/SHH						
Level 1: Point Source	LGUs/CBOs								
Level 2: Fixed Communal Faucets	LGUs/CBOs								
Level 3: Piped Household Connections	LGUs/CBOs		POs	WDs			MWCI/MWSI		
Financing	O		O	O					
Technical Services to LGUs - Prioritization of Projects/Programs - Technical Standards & Guidelines - Construction, O&M	O			O				O	O

CBO = Community-Based Organization; PO= Private Operator; SSIP = Small-Scale Independent Provider; SHH = Self-provision by household

CPSO = Central Project Support Office for sewerage and sanitation projects

Annex-T 5.2.4 Institutional Structure of National Government Agencies in Flood Mitigation

ROLES & RESPONSIBILITIES	AGENCY MANDATE / COVERAGE														REMARKS
	DENR	DPWH	OCD/NDCC	DA-NIA	DA-BSWM	DOST-PHIVOLCS	DOST-PAGASA	NPC	NWRB	NEDA	NHRC	DILG / LGU	NGO	DCC	
A. Non-Structural Measures (Reducing Vulnerability)															
Harmonization of Hazards / Vulnerability Maps	●					●	●								DENR - MGB
Watershed Management/Reforestation	●											●			DENR - FMB
Monitroing, Forecasting and Warning System							●							●	
Land Use Zoning and Regulations	●	●										●			
Information Education and Communication Programs	●	●	●			●	●					●		●	DECS
Evacuation Plan			●				●					●		●	
B. Structural Measures (Reducing Hazard Magnitude)															
Planning, Design, Construction and Maintenance of Flood Control, Sabo Structures, Dams, Small Water Impounding Projects & other mitigating structures incl. evacuation centers		● Major Flood Control Projects		● Dams 15m and above	● SWIP Dam for erosion control			● Multi-purpose Dam				● Local Drainage and river works			MMDA, DPWH-MFCP, FCSEC
Strenthening/Rehabilitation/Maintenance of Existing Structures		●		●	●			●				●			DPWH-MFCP RO/DEO
Updating of Master Plan of Major River Basins	●	●							●						DPWH-MFCP RO/DEO
Master Plan for Principal and Critical River Basins	●	●							●						DPWH-MFCP RO/DEO
C. Response, Recovery and Development (Mitigating Impacts)															
Damage and Needs Assessment		●	●									●			
Flood Fighting		●	●									●		●	
Rescue and Recovery Operations			●									●	●	●	
Evacuation and Relief Works			●									●	●	●	
Rehabilitation and Reconstruction Works															
-Psycho-social Programs			●									●	●		
-Livelihood Programs			●									●	●		
Resettlement												●	●		HLURB
D. Institutional Strengthening															
Capacity Building for Agencies and LGUs	●	●	●			●	●			●		●		●	
Technical Standards & Guidelines on Planning, Design, Construction and Maintenance	●	●		● Dams	● Dams			● Dams				●			
Research and Development	●	●									●				
Criteria on Prioritization of Projects / Programs	●	●								●					
Viable Financing Mechanism for Projects / Programs	●	●								●		●	●		
Linkages and Networking with Foreign Forecasting Institutions						●	●								
Rapid Media-Link System for Near Real Time Dissemination			●			●	●							●	
Databases on Natural Hazards to Identify Trends	●	●	●			●	●								

Source: DENR, River Basin Control Office, "Integrated River Basin Management and Development Master Plan, Executive Summary", 2006, p.77

Annex-T 5.3.1 (1/2) NWRB 2005 Fees and Charges

Pursuant to Executive Order No. 197 series of 2000 and per NWRB Resolution No. 010-0305 dated March 2005, the National Water Resources Board on its 29th Meeting approved the following fess and charges:

NATURE OF SERVICE	APPROVED RATES* (in Pesos)
A. Application/Filing Fee	
1. Water Permit	
(a) Municipal	5,000
(b) Irrigation	
(1) National/Corporation	5,000
(2) Communal/Individual	500
(c) Power generation	5,000
(d) Fisheries	5,000
(e) Livestock Raising	
(1) Backyard	
(2) Commercial	1,000
(f) Industrial	3,000
(g) Recreational	5,000
(h) Other Purposes	5,000
	5,000
2. Transfer of Water Permit	
(a) Municipal	5,000
(b) Irrigation	
(1) Communal/Individual	3,000
(2) National Corporation	5,000
(c) Power Generation	5,000
(d) Fisheries	3,000
(e) Livestock Raising	
(1) Backyard	1,000
(2) Commercial	3,000
(f) Industrial	5,000
(g) Recreational	5,000
(h) Other Purposes	5,000
3. Registration for Domestic Use	100
4. Registration as Well Driller and Renewal	(annual)
(a) Sole Proprietor	1,000
(b) Partnership or Corporation	2,000
5. Certificate of Public Convenience (CPC)/certificate of Public Convenience and Necessity(CPCN)	3,000
6. Provisional Authority	3,000
7. Extension of CPC/CPCN Validity Renewal	3,000
8. Authority to Increase Capital Stock	2,000
9. Time Extension to Submit Annual Report of Operation	1,500
10. Authority to Charge Water Rate	2,500
11. Protests/Water Use Conflicts	3,000
12. Appeal Fee	1,000
13. Rate Adjustment/Increase	3,000
14. Sale/Transfer/Lease of Water System with CPC/CPCN	2,000
15. Donation of Water System with CPC/CPCN	2,000
16. Authority of Extension of Service	2,000
17. Re-Appraisal/Re-Evaluation of Assets	5,000

Annex-T 5.3.1 (2/2) NWRB 2005 Fees and Charges

B. Annual Water Charge				
CLASSIFICATION	**WITHDRAWAL COST/LPS (In Php)**			
	Base Cost	**Not more than 10 lps (liter / second)**	**More than 10 lps but not exceeding 50 lps**	**More than 50 lps**
a) Municipal	5,000	5.50	8.50	11.00
b) Fisheries	500	2.75	4.25	5.50
c) Livestock (Backyard/Commercial)	500	2.75	4.25	5.50
d) Irrigation (Communal/Individual)	500	2.75	4.25	5.50
	5,000	5.50	8.50	11.00
(National/Corporation)	5,000	2.75	4.25	5.50
e) Power Generation	5,000	10.25	15.80	20.45
f) Industrial	5,000	10.25	15.80	20.45
g) Recreation	5,000	10.25	15.80	20.45
h) Others				

NOTE: For declared critical areas in Metro Manila, the following rates shall apply:
a) In area adequately serviced by MWSS concessionaires: 100% of water tariff of the concessionaires
b) In areas not adequately serviced by MWSS concessionaires: 35% of water tariff of the concessionaires

i) Charge for overy extraction for non-critical areas	P 3,000 for every 1 lps or fraction thereof over extracted
j) Other Charges	
(j-1) Use of Water at its Natural Location for Fish Culture	
(j-1-a) For surface area < 15 has.	Base Cost of 500 + P110/ha.
(j-1-b) For surface are > 15 has.	Base Cost of P500 + P 1,650 for 15 has. Plus P0.65/ha. in excess of 15 has.
k) Waterworks Supervision	
(k-1) Supervising /Regulation Fee	P0.50 per P100 capital stock subscribed or paid or if no shares have been issued, of the capital invested, or of the property and equipment, whichever is higher.

C. Other Charges	**Approve Rates (in Pesos)**
1. Annual Report Form	200
2 Certification Charge	
a) Certification for Memorial Parks	3,500
b) Certificate of the Water Availability	1,500
c) Other Technical Certification	1,000
d) Certified photo copy.	50
3. CPC/CPCN Certificate	500
4. Certificate of Compliance	3,500
5. Testing and Sealing Fee of Water Meters	50
D. Penalties	
1. Owner	
(a) Operation of a system without a CPC/CPCN	P5,000 per year reckoned from date of operation or five years whichever comes first but not to exceed P25,000
(b) Non-payment of Annual Water Charge	50% of due per year or fraction thereof plus additional interest for delinquency under Sec. 84 of Amended IRR.
(c) Non-submission of Annual Report Form	P2,500 per year + P25/day of delay but not to exceed P5,000
(d) Refusal to have meters and tested and sealed	Additional 20% of approved testing and sealing fee for water meter times total active connection per year.
(e) Illegal extraction of groundwater	More than P800 but not exceeding P1,000 per day of violation
2. Well Drillers	
(a) Drilling without Permit to Drill	20,000 (1st offense) 30,000 (2nd offense) Revocation and Registration (3rd offense)
(b) Non-registered well drillers	50,000
E. Penalty for Delinquency (Sec. 84 of the Amended IRR)	
Where the penalty imposed is a fine, additional penalty interest equivalent to 2% per month of delay or a fraction thereof until fully paid shall be charged.	

UNANIMOUSLY ADOPTED AT THE 29TH MEETING OF THE NATIONAL WATER RESOURCES BOARD ON MARCH 21, 2005.

MICHAEL T. DEFENSOR, Chairman, National Water Resources Board, Republic of Philippines

Annex-T 6.7.1 Evaluation of Water Usage Condition for Groundwater Source

CityMun	Province	Total Area (km^2)	Area inside the Study Area (km^2)	Ratio	GWP_H	GWP_L	SWE_H	SWE_L	Demand for other uses in 2008	GWP_H for Level 2&3 and Industrial use in 2008	GWP_L for Level 2&3 and Industrial use in 2008	Demand for Level 2&3 and Industrial use in 2008	Demand for other uses in 2025	GWP_H for Level 2&3 and Industrial use in 2025	GWP_L for Level 2&3 and Industrial use in 2025	Demand for Level 2&3 and Industrial use in 2025	Evalu-ation in 2008	Evalu-ation in 2025
					(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)		
Angat	Bulacan	59	53	0.898	10.4	4.3	0.0	0.0	1.0	9.4	3.4	1.6	1.5	8.9	2.8	2.4		
Baliuag	Bulacan	44	44	1.000	8.7	3.6	0.0	0.0	1.7	7.0	1.9	5.4	1.8	6.9	1.8	10.9	R	HR
Bulacan	Bulacan	69	11	0.161	2.6	1.1	2.6	1.1	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.7	HR	HR
Bustos	Bulacan	40	18	0.438	3.7	1.5	0.0	0.0	0.3	3.4	1.3	1.1	0.5	3.2	1.1	1.6		R
Calumpit	Bulacan	47	47	1.000	9.6	4.0	9.1	3.8	0.1	0.6	0.2	6.7	0.0	0.6	0.2	10.5	HR	HR
Dona Remedios Trinidad	Bulacan	879	854	0.972	44.8	18.7	0.0	0.0	0.0	44.8	18.6	1.0	0.1	44.8	18.6	1.5		
Guiguinto	Bulacan	25	2	0.066	0.4	0.2	0.3	0.1	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.4	HR	HR
Hagonoy	Bulacan	95	95	1.000	20.0	8.3	20.0	8.3	0.3	0.0	0.0	8.0	0.0	0.0	0.0	13.5	HR	HR
Malolos City	Bulacan	73	73	1.000	16.0	6.7	14.4	6.0	2.7	1.5	0.6	7.7	2.6	1.5	0.6	17.1	HR	HR
Norzagaray	Bulacan	247	207	0.839	14.5	6.0	0.0	0.0	0.7	13.8	5.4	3.9	1.2	13.3	4.9	5.9		R
Pandi	Bulacan	50	1	0.028	0.3	0.1	0.0	0.0	0.0	0.3	0.1	0.1	0.0	0.3	0.1	0.2	R	R
Paombong	Bulacan	46	46	1.000	9.8	4.1	9.8	4.1	0.1	0.0	0.0	2.9	0.2	0.0	0.0	4.4	HR	HR
Plaridel	Bulacan	35	20	0.565	4.4	1.8	0.0	0.0	0.4	4.0	1.4	2.8	0.4	4.0	1.5	5.3	R	HR
Pulilan	Bulacan	44	44	1.000	9.1	3.8	0.0	0.0	2.0	7.2	1.8	0.7	1.9	7.3	1.9	4.9		R
San Ildefonso	Bulacan	167	167	1.000	31.1	13.0	0.0	0.0	2.0	29.1	11.0	1.9	3.2	27.9	9.7	2.8		
San Miguel	Bulacan	236	236	1.000	40.2	16.7	0.0	0.0	2.7	37.5	14.1	4.1	4.3	35.9	12.5	6.2		
San Rafael	Bulacan	105	105	1.000	20.9	8.7	0.0	0.0	1.6	19.3	7.1	1.4	2.6	18.3	6.1	2.2		
Santa Maria	Bulacan	79	1	0.010	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.2	R	HR
Aliaga	Nueva Ecija	92	92	1.000	18.5	7.7	0.0	0.0	1.0	17.5	6.7	1.0	1.1	17.4	6.6	2.4		
Bongabon	Nueva Ecija	229	225	0.979	25.3	10.5	0.0	0.0	1.0	24.3	9.5	1.0	1.5	23.8	9.0	1.3		
Cabanatuan City	Nueva Ecija	198	198	1.000	39.9	16.6	0.0	0.0	1.7	38.2	14.9	13.3	1.2	38.8	15.5	21.0		R
Cabiao	Nueva Ecija	113	113	1.000	20.5	8.5	0.0	0.0	1.2	19.2	7.3	1.0	1.1	19.4	7.4	3.3		
Carranglan	Nueva Ecija	739	693	0.937	42.4	17.7	0.0	0.0	0.7	41.7	17.0	0.0	0.8	41.6	16.9	0.6		
Gabaldon	Nueva Ecija	253	252	0.999	17.9	7.4	0.0	0.0	0.4	17.5	7.1	0.6	0.5	17.4	7.0	1.0		
Gapan	Nueva Ecija	165	165	1.000	29.2	12.2	0.0	0.0	1.5	27.7	10.6	1.8	1.8	27.4	10.4	4.0		
Gen Mamerto Natividad	Nueva Ecija	98	98	1.000	19.3	8.0	0.0	0.0	0.6	18.7	7.5	0.5	0.8	18.5	7.2	0.7		
General Tinio	Nueva Ecija	581	580	0.999	85.1	35.5	0.0	0.0	0.6	84.5	34.9	1.0	2.1	83.0	33.4	1.6		
Guimba	Nueva Ecija	219	137	0.626	28.0	11.7	0.0	0.0	1.3	26.7	10.3	0.8	1.8	26.2	9.9	1.1		
Jaen	Nueva Ecija	90	90	1.000	16.5	6.9	0.0	0.0	1.0	15.5	5.9	0.9	1.4	15.1	5.4	1.5		
Laur	Nueva Ecija	221	221	1.000	33.1	13.8	0.0	0.0	0.4	32.7	13.4	0.6	0.6	32.6	13.2	0.9		
Licab	Nueva Ecija	60	60	1.000	11.1	4.6	0.0	0.0	0.4	10.7	4.3	0.5	0.5	10.5	4.1	0.6		
Llanera	Nueva Ecija	114	114	1.000	23.7	9.9	0.0	0.0	0.6	23.1	9.2	0.1	3.5	20.2	6.3	0.3		
Lupao	Nueva Ecija	143	130	0.909	28.1	11.7	0.0	0.0	1.1	27.0	10.6	0.0	5.0	23.1	6.7	0.1		
Science City Of Munoz	Nueva Ecija	142	142	1.000	32.7	13.6	0.0	0.0	0.9	31.8	12.8	2.5	1.2	31.5	12.4	3.3		
Palayan City	Nueva Ecija	136	136	1.000	20.7	8.6	0.0	0.0	0.5	20.2	8.1	0.9	0.7	20.0	7.9	1.1		
Pantabangan	Nueva Ecija	421	421	1.000	21.9	9.1	0.0	0.0	0.1	21.8	9.0	0.6	14.6	7.3	0.0	0.7		R
Penaranda	Nueva Ecija	79	79	1.000	13.9	5.8	0.0	0.0	0.2	13.7	5.6	1.1	0.3	13.6	5.5	1.5		
Quezon	Nueva Ecija	68	68	1.000	13.6	5.7	0.0	0.0	0.7	12.9	4.9	0.0	3.1	10.5	2.6	0.4		
Rizal	Nueva Ecija	124	124	1.000	17.2	7.2	0.0	0.0	1.2	16.0	6.0	0.0	1.6	15.6	5.5	0.3		
San Antonio	Nueva Ecija	157	157	1.000	29.6	12.3	0.0	0.0	1.1	28.5	11.2	1.0	1.5	28.1	10.8	1.6		
San Isidro	Nueva Ecija	58	58	1.000	10.4	4.3	0.0	0.0	0.6	9.8	3.7	1.3	0.5	9.9	3.8	2.7		
San Jose City	Nueva Ecija	162	162	1.000	33.4	13.9	0.0	0.0	0.3	33.1	13.6	7.7	0.4	33.1	13.6	10.0		
San Leonardo	Nueva Ecija	52	52	1.000	10.0	4.1	0.0	0.0	0.7	9.3	3.5	1.7	0.9	9.1	3.3	2.7		
Santa Rosa	Nueva Ecija	117	117	1.000	21.5	8.9	0.0	0.0	0.7	20.8	8.3	1.6	1.0	20.5	7.9	2.1		
Santo Domingo	Nueva Ecija	83	83	1.000	17.8	7.4	0.0	0.0	1.0	16.8	6.4	0.3	1.0	16.8	6.4	1.8		
Talavera	Nueva Ecija	135	135	1.000	30.0	12.5	0.0	0.0	1.5	28.4	11.0	3.0	1.5	28.5	11.0	6.0		
Talugtug	Nueva Ecija	73	39	0.528	8.8	3.7	0.0	0.0	0.3	8.5	3.4	0.1	1.1	7.7	2.5	0.2		
Zaragosa	Nueva Ecija	72	72	1.000	12.7	5.3	0.0	0.0	0.7	12.0	4.6	0.4	0.9	11.8	4.4	1.0		
Angeles City	Pampanga	63	63	1.000	13.3	5.5	0.0	0.0	1.1	12.1	4.4	18.4	0.0	13.3	5.5	29.2	HR	HR
Apalit	Pampanga	60	60	1.000	12.0	5.0	4.4	1.8	0.8	7.7	3.2	5.8	0.7	7.7	3.2	9.1	R	HR
Arayat	Pampanga	177	177	1.000	26.1	10.9	0.0	0.0	2.5	23.5	8.3	0.0	3.4	22.6	7.4	0.9		
Bacolor	Pampanga	74	74	1.000	17.0	7.1	0.0	0.0	0.6	16.4	6.5	0.5	0.7	16.2	6.3	0.8		
Candaba	Pampanga	208	208	1.000	35.6	14.8	0.0	0.0	1.8	33.7	13.0	1.2	2.7	32.9	12.2	1.5		
Floridablanca	Pampanga	121	83	0.690	14.9	6.2	0.0	0.0	0.6	14.3	5.6	3.5	0.8	14.1	5.4	4.7		
Guagua	Pampanga	49	49	1.000	10.4	4.3	1.7	0.7	1.0	8.7	3.3	4.3	1.0	8.7	3.3	7.4	R	R
Lubao	Pampanga	155	149	0.960	31.4	13.1	16.7	6.9	2.5	14.8	6.2	2.1	6.3	14.8	6.2	3.7		
Mabalacat	Pampanga	146	140	0.962	21.3	8.9	0.0	0.0	1.2	20.1	7.7	17.7	3.9	17.4	5.0	25.9	R	HR
Macabebe	Pampanga	102	102	1.000	20.8	8.7	20.8	8.7	0.4	0.0	0.0	3.1	0.6	0.0	0.0	4.1	HR	HR
Magalang	Pampanga	105	105	1.000	25.5	10.6	0.0	0.0	2.4	23.1	8.2	0.0	4.9	20.6	5.7	3.0		
Masantol	Pampanga	46	46	1.000	9.4	3.9	9.4	3.9	1.0	0.0	0.0	0.0	1.3	0.0	0.0	0.7		HR
Mexico	Pampanga	122	122	1.000	27.7	11.5	0.0	0.0	2.5	25.2	9.1	2.1	3.3	24.4	8.3	4.0		
Minalin	Pampanga	45	45	1.000	9.2	3.8	7.4	3.1	0.5	1.8	0.7	1.2	0.8	1.8	0.7	1.6	R	R
Porac	Pampanga	293	292	0.995	27.2	11.3	0.0	0.0	1.8	25.3	9.5	1.9	2.8	24.3	8.5	3.9		
City Of San Fernando	Pampanga	69	69	1.000	15.9	6.6	0.0	0.0	2.8	13.1	3.8	34.9	3.5	12.4	3.1	47.5	HR	HR
San Luis	Pampanga	55	55	1.000	10.0	4.2	0.0	0.0	1.0	9.0	3.1	0.0	1.2	8.8	3.0	1.1		
San Simon	Pampanga	60	60	1.000	11.6	4.8	0.0	0.0	0.5	11.1	4.4	1.7	0.7	10.9	4.1	2.2		
Santa Ana	Pampanga	40	40	1.000	7.7	3.2	0.0	0.0	1.6	6.1	1.6	1.0	2.4	5.4	0.8	2.4		R
Santa Rita	Pampanga	23	23	1.000	5.2	2.2	0.0	0.0	0.8	4.4	1.3	0.4	2.6	2.5	0.0	1.9		R
Santo Tomas	Pampanga	14	14	1.000	3.0	1.3	1.1	0.4	0.3	2.0	0.8	1.8	0.3	2.0	0.8	2.9	R	HR
Sasmuan	Pampanga	45	45	0.999	8.9	3.7	8.9	3.7	0.5	0.1	0.0	0.0	0.7	0.1	0.0	0.3		HR
Bamban	Tarlac	251	147	0.585	2.2	0.9	0.0	0.0	0.7	1.5	0.2	0.5	2.5	0.0	0.0	1.5	R	HR
Capas	Tarlac	422	134	0.317	13.0	5.4	0.0	0.0	2.7	10.3	2.7	0.9	8.6	4.4	0.0	1.2		R
Concepcion	Tarlac	221	221	1.000	49.9	20.8	0.0	0.0	4.4	45.5	16.4	3.0	12.8	37.1	8.0	4.1		
La Paz	Tarlac	117	117	1.000	21.8	9.1	0.0	0.0	3.9	17.9	5.2	0.6	5.5	16.3	3.6	1.0		
Tarlac City	Tarlac	261	132	0.506	28.6	11.9	0.0	0.0	6.4	22.2	5.5	6.6	6.9	21.7	5.0	10.0	R	R
Victoria	Tarlac	112	83	0.744	16.9	7.0	0.0	0.0	1.5	15.3	5.5	0.4	1.9	15.0	5.1	0.5		
Total		10,990	9,890		1,476.3	615.1	126.5	52.7	88.2	1,272.2	484.5	209.2	157.7	1,207.3	430.0	344.1		

R=At Risk, HR=At high risk

Source: JICA Study Team

Annex-T 6.7.2 Deficit of Sustainable Local Groundwater Source by Municipality/City

CityMun	Province	Total Area (km^2)	Area inside the Study Area (km^2)	Ratio	GWP_H for Level 2&3 and Industrial use in 2008	GWP_L for Level 2&3 and Industrial use in 2008	Demand for Level 2&3 and Industrial use in 2008	Deficit in 2008	GWP_H for Level 2&3 and Industrial use in 2025	GWP_L for Level 2&3 and Industrial use in 2025	Demand for Level 2&3 and Industrial use in 2025	Deficit in 2025
					(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)	(MCM/y)
Angat	Bulacan	59	53	0.898	9.4	3.4	1.6	0.0	8.9	2.8	2.4	0.0
Baliuag	**Bulacan**	**44**	**44**	**1.000**	**7.0**	**1.9**	**5.4**	**0.0**	**6.9**	**1.8**	**10.9**	**4.0**
Bulacan	**Bulacan**	**69**	**11**	**0.161**	**0.0**	**0.0**	**0.5**	**0.5**	**0.0**	**0.0**	**0.7**	**0.7**
Bustos	Bulacan	40	18	0.438	3.4	1.3	1.1	0.0	3.2	1.1	1.6	0.0
Calumpit	**Bulacan**	**47**	**47**	**1.000**	**0.6**	**0.2**	**6.7**	**6.2**	**0.6**	**0.2**	**10.5**	**9.9**
Dona Remedios Trinidad	Bulacan	879	854	0.972	44.8	18.6	1.0	0.0	44.8	18.6	1.5	0.0
Guiguinto	**Bulacan**	**25**	**2**	**0.066**	**0.0**	**0.0**	**0.2**	**0.1**	**0.0**	**0.0**	**0.4**	**0.4**
Hagonoy	**Bulacan**	**95**	**95**	**1.000**	**0.0**	**0.0**	**8.0**	**8.0**	**0.0**	**0.0**	**13.5**	**13.5**
Malolos City	**Bulacan**	**73**	**73**	**1.000**	**1.5**	**0.6**	**7.7**	**6.2**	**1.5**	**0.6**	**17.1**	**15.6**
Norzagaray	Bulacan	247	207	0.839	13.8	5.4	3.9	0.0	13.3	4.9	5.9	0.0
Pandi	Bulacan	50	1	0.028	0.3	0.1	0.1	0.0	0.3	0.1	0.2	0.0
Paombong	**Bulacan**	**46**	**46**	**1.000**	**0.0**	**0.0**	**2.9**	**2.9**	**0.0**	**0.0**	**4.4**	**4.4**
Plaridel	**Bulacan**	**35**	**20**	**0.565**	**4.0**	**1.4**	**2.8**	**0.0**	**4.0**	**1.5**	**5.3**	**1.2**
Pulilan	Bulacan	44	44	1.000	7.2	1.8	0.7	0.0	7.3	1.9	4.9	0.0
San Ildefonso	Bulacan	167	167	1.000	29.1	11.0	1.9	0.0	27.9	9.7	2.8	0.0
San Miguel	Bulacan	236	236	1.000	37.5	14.1	4.1	0.0	35.9	12.5	6.2	0.0
San Rafael	Bulacan	105	105	1.000	19.3	7.1	1.4	0.0	18.3	6.1	2.2	0.0
Santa Maria	**Bulacan**	**79**	**1**	**0.010**	**0.1**	**0.0**	**0.1**	**0.0**	**0.1**	**0.0**	**0.2**	**0.0**
Aliaga	Nueva Ecija	92	92	1.000	17.5	6.7	1.0	0.0	17.4	6.6	2.4	0.0
Bongabon	Nueva Ecija	229	225	0.979	24.3	9.5	1.0	0.0	23.8	9.0	1.3	0.0
Cabanatuan City	Nueva Ecija	198	198	1.000	38.2	14.9	13.3	0.0	38.8	15.5	21.0	0.0
Cabiao	Nueva Ecija	113	113	1.000	19.2	7.3	1.0	0.0	19.4	7.4	3.3	0.0
Carranglan	Nueva Ecija	739	693	0.937	41.7	17.0	0.0	0.0	41.6	16.9	0.6	0.0
Gabaldon	Nueva Ecija	253	252	0.999	17.5	7.1	0.6	0.0	17.4	7.0	1.0	0.0
Gapan	Nueva Ecija	165	165	1.000	27.7	10.6	1.8	0.0	27.4	10.4	4.0	0.0
Gen Mamerto Natividad	Nueva Ecija	98	98	1.000	18.7	7.5	0.5	0.0	18.5	7.2	0.7	0.0
General Tinio	Nueva Ecija	581	580	0.999	84.5	34.9	1.0	0.0	83.0	33.4	1.6	0.0
Guimba	Nueva Ecija	219	137	0.626	26.7	10.3	0.8	0.0	26.2	9.9	1.1	0.0
Jaen	Nueva Ecija	90	90	1.000	15.5	5.9	0.9	0.0	15.1	5.4	1.5	0.0
Laur	Nueva Ecija	221	221	1.000	32.7	13.4	0.6	0.0	32.6	13.2	0.9	0.0
Licab	Nueva Ecija	60	60	1.000	10.7	4.3	0.5	0.0	10.5	4.1	0.6	0.0
Llanera	Nueva Ecija	114	114	1.000	23.1	9.2	0.1	0.0	20.2	6.3	0.3	0.0
Lupao	Nueva Ecija	143	130	0.909	27.0	10.6	0.0	0.0	23.1	6.7	0.1	0.0
Science City Of Munoz	Nueva Ecija	142	142	1.000	31.8	12.8	2.5	0.0	31.5	12.4	3.3	0.0
Palayan City	Nueva Ecija	136	136	1.000	20.2	8.1	0.9	0.0	20.0	7.9	1.1	0.0
Pantabangan	Nueva Ecija	421	421	1.000	21.8	9.0	0.6	0.0	7.3	0.0	0.7	0.0
Penaranda	Nueva Ecija	79	79	1.000	13.7	5.6	1.1	0.0	13.6	5.5	1.5	0.0
Quezon	Nueva Ecija	68	68	1.000	12.9	4.9	0.0	0.0	10.5	2.6	0.4	0.0
Rizal	Nueva Ecija	124	124	1.000	16.0	6.0	0.0	0.0	15.6	5.5	0.3	0.0
San Antonio	Nueva Ecija	157	157	1.000	28.5	11.2	1.0	0.0	28.1	10.8	1.6	0.0
San Isidro	Nueva Ecija	58	58	1.000	9.8	3.7	1.3	0.0	9.9	3.8	2.7	0.0
San Jose City	Nueva Ecija	162	162	1.000	33.1	13.6	7.7	0.0	33.1	13.6	10.0	0.0
San Leonardo	Nueva Ecija	52	52	1.000	9.3	3.5	1.7	0.0	9.1	3.3	2.7	0.0
Santa Rosa	Nueva Ecija	117	117	1.000	20.8	8.3	1.6	0.0	20.5	7.9	2.1	0.0
Santo Domingo	Nueva Ecija	83	83	1.000	16.8	6.4	0.3	0.0	16.8	6.4	1.8	0.0
Talavera	Nueva Ecija	135	135	1.000	28.4	11.0	3.0	0.0	28.5	11.0	6.0	0.0
Talugtug	Nueva Ecija	73	39	0.528	8.5	3.4	0.1	0.0	7.7	2.5	0.2	0.0
Zaragosa	Nueva Ecija	72	72	1.000	12.0	4.6	0.4	0.0	11.8	4.4	1.0	0.0
Angeles City	**Pampanga**	**63**	**63**	**1.000**	**12.1**	**4.4**	**18.4**	**6.3**	**13.3**	**5.5**	**29.2**	**15.9**
Apalit	**Pampanga**	**60**	**60**	**1.000**	**7.7**	**3.2**	**5.8**	**0.0**	**7.7**	**3.2**	**9.1**	**1.4**
Arayat	Pampanga	177	177	1.000	23.5	8.3	0.0	0.0	22.6	7.4	0.9	0.0
Bacolor	Pampanga	74	74	1.000	16.4	6.5	0.5	0.0	16.2	6.3	0.8	0.0
Candaba	Pampanga	208	208	1.000	33.7	13.0	1.2	0.0	32.9	12.2	1.5	0.0
Floridablanca	Pampanga	121	83	0.690	14.3	5.6	3.5	0.0	14.1	5.4	4.7	0.0
Guagua	Pampanga	49	49	1.000	8.7	3.3	4.3	0.0	8.7	3.3	7.4	0.0
Lubao	Pampanga	155	149	0.960	14.8	6.2	2.1	0.0	14.8	6.2	3.7	0.0
Mabalacat	**Pampanga**	**146**	**140**	**0.962**	**20.1**	**7.7**	**17.7**	**0.0**	**17.4**	**5.0**	**25.9**	**8.5**
Macabebe	**Pampanga**	**102**	**102**	**1.000**	**0.0**	**0.0**	**3.1**	**3.1**	**0.0**	**0.0**	**4.1**	**4.1**
Magalang	Pampanga	105	105	1.000	23.1	8.2	0.0	0.0	20.6	5.7	3.0	0.0
Masantol	**Pampanga**	**46**	**46**	**1.000**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**	**0.7**
Mexico	Pampanga	122	122	1.000	25.2	9.1	2.1	0.0	24.4	8.3	4.0	0.0
Minalin	Pampanga	45	45	1.000	1.8	0.7	1.2	0.0	1.8	0.7	1.6	0.0
Porac	Pampanga	293	292	0.995	25.3	9.5	1.9	0.0	24.3	8.5	3.9	0.0
City Of San Fernando	**Pampanga**	**69**	**69**	**1.000**	**13.1**	**3.8**	**34.9**	**21.8**	**12.4**	**3.1**	**47.5**	**35.2**
San Luis	Pampanga	55	55	1.000	9.0	3.1	0.0	0.0	8.8	3.0	1.1	0.0
San Simon	Pampanga	60	60	1.000	11.1	4.4	1.7	0.0	10.9	4.1	2.2	0.0
Santa Ana	Pampanga	40	40	1.000	6.1	1.6	1.0	0.0	5.4	0.8	2.4	0.0
Santa Rita	Pampanga	23	23	1.000	4.4	1.3	0.4	0.0	2.5	0.0	1.9	0.0
Santo Tomas	**Pampanga**	**14**	**14**	**1.000**	**2.0**	**0.8**	**1.8**	**0.0**	**2.0**	**0.8**	**2.9**	**1.0**
Sasmuan	**Pampanga**	**45**	**45**	**0.999**	**0.1**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.3**	**0.2**
Bamban	**Tarlac**	**251**	**147**	**0.585**	**1.5**	**0.2**	**0.5**	**0.0**	**0.0**	**0.0**	**1.5**	**1.5**
Capas	Tarlac	422	134	0.317	10.3	2.7	0.9	0.0	4.4	0.0	1.2	0.0
Concepcion	Tarlac	221	221	1.000	45.5	16.4	3.0	0.0	37.1	8.0	4.1	0.0
La Paz	Tarlac	117	117	1.000	17.9	5.2	0.6	0.0	16.3	3.6	1.0	0.0
Tarlac City	Tarlac	261	132	0.506	22.2	5.5	6.6	0.0	21.7	5.0	10.0	0.0
Victoria	Tarlac	112	83	0.744	15.3	5.5	0.4	0.0	15.0	5.1	0.5	0.0
Total		10,990	9,890		1272.2	484.5	209.2	55.1	1207.3	430.0	344.1	118.3

Source: JICA Study Team

Annex-T 7.8.1 (1/3) Scoring Criteria for Evaluation of the Project

Point of Evaluation			Scoring		
			3	2	1
1 Viability of the Project	1.1	Economic viability	The EIRR of the Project is above 15%.	The Project is in either of the following cases: • The EIRR of the Project is in a range of 9 to 15%, • Any economic evaluation of the project has not been made but Project is likely to be economically viable	The Project is in either of the following cases: • The EIRR of the Project is below 9%, • Any economic evaluation for the Project has not been made yet and the project is not likely to be economically viable.
	1.2	Technical viability	Technical viability of the Project has been confirmed through relevant studies and/or through previous implementation.	Technical viability of the Project has not been confirmed but no particular technical difficulty in executing the project is foreseeable.	There remain uncertainties in the technical viability of the Project.
	1.3	Financial affordability	The necessary budgetary arrangement has been made.	The necessary budget arrangement has not been made but any difficulties in arranging the budget are not foreseeable.	Difficulties in budgetary arrangement are foreseeable.
	1.4	Impacts on natural and social environment	The project is not likely to cause any significant adverse impact to the natural and social environment.	The Project is in either of the following cases: • The potential adverse impacts on natural and social environment could be mitigated • The ecological and social benefits far outweigh the likely adverse impacts	The potential adverse impacts on the natural and social environment are likely to be serious and beyond mitigation
	1.5	Adaptation to climate change	The Project would possess the direct mechanism adaptable to the climate change.	The Project would possess the indirect mechanism adaptable to the climate change.	The Project would hardly possess anyt mechanism adaptable to the climate change.
2 Enhanced Livelihood	2.1	Creation of new job opportunities in the Region	The Project would directly contribute to creation of the new job opportunities in the Region.	The Project would make an indirect contribution to creation of the job opportunities in the region.	The Project would hardly make any contribution to creation of the job opportunities in the region.
	2.2	Increase of the income levels in the region	The Project would directly contribute to increase of the income levels in the Region.	The Project would make an indirect contribution to increase of the income levels in the region.	The Project would hardly make any contribution to increase of income levels in the region.
	2.3	Improvement of livelihood for the poor, the indigenous peoples, the women-headed households, the out-of-school youths, the handicapped, the elderly and other vulnerable groups.	The Project would directly contribute to improvement of livelihood for the poor, the women-headed households, the out-of-school youths, the handicapped, the elderly and other vulnerable groups.	The Project would make an indirect contribution to improvement of livelihoo for the poor, the women-headed households, the out-of-school youths, the handicapped, the elderly and other vulnerable groups.	The Project would hardly make any contribution to improvement of livelihood for the poor, the women-headed households, the out-of-school youths, the handicapped, the elderly and other vulnerable groups.
	2.4	Reduction of the income gaps between the urban areas and the rural areas	The Project would directly contribute to a reduction in income gaps between the urban and rural areas	The Project would make an indirect contribution to reduction in income gaps between the urban and rural areas.	The Project would hardly make any contribution to the reduction in income gaps between the urban and rural areas.

Annex-T 7.8.1 (2/3) Scoring Criteria for Evaluation of the Project

Point of Evaluation			Scoring		
			3	2	1
3 Improved Quality Life	3.1	Increase of access to safe drinking water	The Project would directly contribute to increase of access to safe drinking water.	The Project would make an indirect contribution to increase of access to safe drinking water.	The Project would hardly make any contribution to increase of access to safe drinking water.
	3.2	Increase of the municipal water supply volume	The Project would directly contribute to increase of the municipal water supply volume	The Project would make an indirect contribution to increase of the municipal water supply volume.	The Project would hardly make any contribution to increase of the municipal water supply volume.
	3.3	Improvement of sanitary and health conditions	The Project would directly contribute to improvement of the sanitary conditions and/or reduction of water-related diseases.	The Project would make an indirect contribution to the improvement of sanitary conditions and/or reduction of water-related diseases.	The Project would hardly make any contribution to the improvement of sanitary conditions and/or reduction of water-related diseases..
	3.4	Mitigation of flood risks and hazards	The Project would directly reduce risks to life and damage to property/assets due to chronic flooding.	The Project would make an indirect contribution to the reduction of risks to life and damage to property/assets due to chronic flooding.	The Project would hardly make any contribution to the reduction of risks to life and damage to property/assets due to chronic flooding.
4 Decentralized Development	4.1	Development of regional economic centers	The Project is indispensable to the development of regional economic centers. (Typical examples of the Project are such as the bulk water supply project and the urban flood control/drainage improvement project.)	The Project is not necessarily indispensable to but could support the development of the regional economic centers	The Project would hardly make any contribution to development of the regional centers.
	4.2	Increase of productivity in the Region's agriculture, industrial and service sectors.	The Project would directly contribute to the increase of productivity in the Region's agriculture, industrial and service sectors.	The Project would make an indirect contribution to the increase of productivity in the Region's agriculture, industrial and service sectors.	The Project would hardly make any contribution to the increase of productivity in the Region's agriculture, industrial and service sectors.
	4.3	Creation of a favorable climate for enterprise and private investment in the Region	The Project would directly contribute to the creation of a favorable climate for enterprise development and private investments in the Region.	The Project would make an indirect contribution to the creation of a favorable climate for enterprise development and private investments in the Region.	The Project would hardly make any contribution to the creation of a favorable climate for enterprise development and private investments in the Region.
	4.4	Enhancement of social equity in the Region	The Project would directly contribute to the equitable distribution of access to the following: • economic opportunities • economic goods and services • social services	The Project would make an indirect contribution to the equitable distribution of access to the following: • economic opportunities • economic goods and services • social services	The Project would hardly make any contribution to the equitable distribution of access to the following: • economic opportunities • economic goods and services • social services.

Annex-T 7.8.1 (3/3) Scoring Criteria for Evaluation of the Project

Point of Evaluation			Scoring		
			3	2	1
5 Sustained Ecosystem	5.1	Enhancement of the sustainable monitoring on the ecosystem	The Project would directly contribute to enhancement of the sustaining monitoring of vital ecosystems.	The Project would make an indirect contribution to enhancement of the sustaining monitoring of vital ecosystems.	The Project would hardly make any contribution to enhancement of the sustaining monitoring of vital ecosystems.
	5.2	Protection of the ecologically vulnerable areas	The Project would directly contribute to the protection of ecologically vulnerable areas.	The Project would make an indirect contribution to the protection of ecologically vulnerable areas.	The Project would hardly make any contribution to the protection of ecologically vulnerable areas .
	5.3	Promotion of vegetation in the watersheds	The Project would directly contribute to the increase of vegetation cover of the watersheds.	The Project would make an indirect contribution the increase of vegetation cover in the watersheds.	The Project would hardly make any contribution to the increase of vegetation cover in the watersheds.
	5.4	Reduction of potential pollution loads	The Project would directly contribute to the reduction of potential pollution loads.	The Project would make an indirect contribution to the reduction of potential pollution loads.	The Project would hardly make any contribution to the reduction of potential pollution loads.
6 Empowered People	6.1	Promotion of stakeholder participation in project planning and execution	The Project is inherently designed to promote stakeholder participation throughout the project cycle.	Some of the Project activities would support and encourage stakeholder participation.	The nature of the Project precludes any opportunity for meaningful stakeholder participation.
	6.2	Improvement/transfer of knowledge and skills, beliefs and attitudes through participatory approaches in water-related projects	The Project is designed to facilitate the transfer of skills and knowledge as well as promote changes in beliefs, values and attitudes related to water resource use, protection and management.	Some of the Project activities would support and encourage the transfer of skills and knowledge as well as promote changes in beliefs, values and attitudes related to water resource use, protection and management.	The nature of the Project precludes any opportunity to transfer of skills and knowledge as well as promote changes in beliefs, values and attitudes related to water resource use, protection and management.
	6.3	Promotion of community-based activities	The Project is inherently designed to promote community-based activities.	The Project would make a certain indirect support to or partly encourage community-based activities.	The nature of the Project precludes any possibility for community-based undertakings.
	6.4	Empowerment of the indigenous peoples, the women-headed HH, handicapped, the out-of-school youths, the elderly and other vulnerable stakeholders	The empowerment of such vulnerable stakeholders is inherent in the Project design.	The empowerment of such vulnerable stakeholders may be incidental but is not latent in the Project design.	The nature of the Project precludes any meaningful opportunity to empower such vulnerable stakeholders.

Annex-T 9.2.1 (1/16) Project profile for Agricultural Sector

Project Code	AI-G-01	
Project Title	Balog-Balog Multipurpose Project Phase I	
Status of Project	On-going	
Objective Area	Tarlac Province	
Implementing Agency	NIA	
Objectives	Development of national irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 1999-2010	Estimated by Study Team for 2011-2025
	2,362 as of 2009	236 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	1999-2010*	

Project Description
- Construction of 113m high earth & rock fill dam across Bulsa River to generate electricity & provide year round irrigation water to service area of 39,150ha.(Phase I & 2)
- Phase I involves rehabilitation of existing systems (TARRIS & SMORIS), raising Tarlac Diversion dam ogee by 1.3m, construction of irrigation & drainage facilities for an expansion area of 2,200ha, resettlement works, construction of north main canal, improvement of drainage system.
- Beneficiaries: 7,340 farm-families
- Target area (new): 2,220ha
- Target area (rehabilitation): 10,255ha

Remarks
- *: Estimated and/or proposed by project proponent
- For 2011-2025, 10% of the project cost (236 Mil. Pesos) is considered.

Source of Information
- NIA: Project Briefer (As of September 30, 2009).
- NIA: Indicative Irrigation Development Program, 2010-2019.

Project Code	AI-G-02	
Project Title	Along-along Creek Irrigation Project (UPRIIS Div3)	
Status of Project	On-going	
Objective Area	San Antonio, Nueva Ecija Province	
Implementing Agency	NIA	
Objectives	Development of national irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2009-2010	Estimated by Study Team for 2011-2025
	250 as of 2009	25 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	2009-2010*	

Project Description
- Construction of check gate, irrigation and drainage facilities to generate additional service area of 2,500ha for UPRIIS District III, and address inundation problems in some barangays of San Antonio
- Water sources ; Cabungan Creek (New) & Along-Along Creek (Rehab)
- Project works ; (New) Irrigation Canal along Brgy. San Jose
  (Rehab) 1) Canal, 2) Raising of embankment, & 3) Dredging
- Beneficiaries: 300 farm-families
- Target area (new): 2,500ha

Remarks
- *: Estimated and/or proposed by project proponent
- For 2011-2025, 10% of the project cost (25 Mil. Pesos) is considered.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.

Project Code	AI-G-03	
Project Title	Repair, Rehabilitation of Existing Groundwater Irrigation Systems, Establishment of Groundwater Pump Project (REGIP)	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA	
Objectives	Rehabilitation and development on NIA assisted irrigation system as a regular program to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2019	Estimated by Study Team for 2011-2025
	333 as of 2009	398 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	Annual Program, 2010 – 2019*	

Project Description
- Rehabilitation/repair and improvement of groundwater pump irrigation projects to sustain the operation of the existing wells.
- Construction & installation of new deep wells and shallow tube wells nationwide
- Proposed components for 2010-2019 in the study area
  - No of system: CIS-29
  - Beneficiaries: 4,169 farmer
  - Target area: 7,622ha

Remarks
- *: Estimated and/or proposed by project proponent
- The project cost estimated is only for inside the study area.
- It is assumed that the project continues till 2025 and the cost for 2020-2025 is equal to that for 2016-2019.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Regional Irrigation Development Program, 2010-2019, Region III.

Project Code	AI-G-04	
Project Title	Balikatan Sagip Patubig Program (BSPP)	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA	
Objectives	Rehabilitation and development on NIA assisted irrigation system as a regular program to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2019	Estimated by Study Team for 2011-2025
	58 as of 2009	46 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	Annual Program, 2010 – 2019*	

Project Description
- Rehabilitation program designed to bring back idle and non-functioning CIS into operation & provide irrigation to new areas. Program promotes participation among national government - DA/NIA, LGU, IAs
- Proposed components for 2010-2019 in the study area
  - No of system: CIS-9
  - Beneficiaries: 764farmer
  - Target area: 1,347ha

Remarks
- *: Estimated and/or proposed by project proponent
- The project cost estimated is only for inside the study area.
- It is assumed that the project continues till 2025 and the cost for 2020-2025 is equal to that for 2016-2019.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Regional Irrigation Development Program, 2010-2019, Region III.

Annex-T 9.2.1 (3/16) Project profile for Agricultural Sector

Project Code	AI-G-05	
Project Title	Repair, Rehabilitation, Restoration & Preventive Maintenance of Existing National & Communal Irrigation Facilities (RRENIS/CIS)	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA	
Objectives	Rehabilitation and development on NIA assisted irrigation system as a regular program to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2019	Estimated by Study Team for 2011-2025
	1,579 as of 2009	1,579 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	Annual Program, 2010 – 2019*	

Project Description
- A. Rehabilitation of irrigation facilities and structures of new & existing NIS/CIS
- B. Preventive maintenance of existing irrigation facilities & structures in NIS. Activities include minor repairs of lining, raising of embankment, grouted rip raping, construction of new canals, clearing & weeding modification of turn-outs, repair of diversion/irrigation structures, repair of steel gates/flash boards/staff gauges, installation of reinforcing concrete and repair of transmission lines.
- Proposed components for 2010-2019 in the study area
  - No of system: NIS-3, CIS-24
  - Beneficiaries: 41,105farmer
  - Target area: 50,038ha

Remarks
- *: Estimated and/or proposed by project proponent
- The project cost estimated is only for inside the study area.
- It is assumed that the project continues till 2025 and the cost for 2020-2025 is equal to that for 2016-2019.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Regional Irrigation Development Program, 2010-2019, Region III.

Project Code	AI-G-06	
Project Title	Restoration/Rehabilitation of Existing NIA Assisted Irrigation System (PRE-NAIS)	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA	
Objectives	Rehabilitation and development on NIA assisted irrigation system as a regular program to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2019	Estimated by Study Team for 2011-2025
	7,353 as of 2009	8,767 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	Annual Program, 2010 – 2019*	

Project Description
- Proposed components for 2010-2019 in the study area
  (UPRIIS)
  - No of system: NIS-5
  - Beneficiaries: 67,733farmer
  - Target area: 167,125ha
  (Others in Study Area)
  - No of system: NIS-1, CIS-33
  - Beneficiaries: 2,907farmer
  - Target area:5,029ha

Remarks
- *: Estimated and/or proposed by project proponent
- The estimated project cost by the project proponent is as follows; UPRISS: 6,990Mil. Pesos, Others: 363Mil. Pesos.
- It is assumed that the project continues till 2025 and the cost for 2020-2025 is equal to that for 2016-2019.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Regional Irrigation Development Program, 2010-2019, Region III and UPRISS.

Project Code	AI-G-07	
Project Title	Participatory Irrigation Development Project APL1-Infrastructure Development	
Status of Project	On-going	
Objective Area	Bulacan and Pampanga Provinces	
Implementing Agency	NIA	
Objectives	Rehabilitation of NIS to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2009-2013	Estimated by Study Team for 2011-2025
	68.5 as of 2009	41 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	2009 – 2013*	

Project Description
- Nationwide project
- The project seeks to improve NIA's financial viability through institutional reform & capability building including better service delivery to farmers; enhance farmers participation & their capability to manage NIS transferred from NIA to Ias & further narrow the gap between service areas & actual irrigated areas.
- APL1-Infrastructure development: Physical infrastructure improvement (14core A NIS) & sustenance (44core B NIS); policy instruments & institutional development for improved IMT in O&M (58 NIS under NIMF, 5 pilot CIS under CIDF); capacity building for IA; organization & financial corporate strengthening.
- APL1-Irrigation Sector Program (NIA-Rationalization Plan), incentives & terminal leaves,

- AMRIS is selected as a project site in the study area.
- Target area (rehabilitation): 26,791ha
- Beneficiaries: 49,000 farm-families
- Proposed civil works includes; 1) rehabilitation of North and South constant gates, 2) repair and improvement of control house, 3) construction of measuring device, 4) canal lining, 5) replacement of steel gates, and 6) manual and mechanized desisting in the canals.

Remarks
- *: Estimated and/or proposed by project proponent
- For 2011-2025, 60% of the project cost (41 Mil. Pesos) is considered.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Regional Irrigation Development Program, 2010-2019, Region III.
- WB: Project Appraisal Document, 2009.

Project Code	AI-G-08	
Project Title	Rehabilitation of Small Water Impounding Projects / Diversion Dams	
Status of Project	On-going	
Objective Area	Nueva Ecija, Bulacan Province	
Implementing Agency	BSWM	
Objectives	Development of communal and small scale irrigation system as a regular program to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2009-2011	Estimated by Study Team for 2011-2025
	25.4 as of 2009	128 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	2009 – 2011*	

Project Description
- Regular Rehabilitation of small water impounding project
- Proposed components for 2009-20111 in the study area
  - 7 SWIPs in Nueva Ecija and Bulacan
  - Restored area = 235ha

Remarks
- *: Estimated and/or proposed by project proponent
- It is assumed that the project continues till 2025 and the annual cost is equal to 25.4Mil Pesos/ 3years (8.5Mil Pesos/year).

Source of Information
- BSWM

Annex-T 9.2.1 (5/16) Project profile for Agricultural Sector

Project Code	AI-G-09	
Project Title	Comprehensive Agrarian Reform Program, Irrigation Component (CARP-IC)	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces, covering Agrarian Reform Communities (ARCs)	
Implementing Agency	DAR/NIA	
Objectives	Rehabilitation and development on NIA assisted irrigation system as a regular program to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	1,020 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA / World Bank / JICA*	
Expected Implementation Schedule	1993 -*	

Project Description
- The program provides facilities necessary to enhance farm productivity and income of CARP beneficiaries.
- The Program involves pre-engineering, construction / rehabilitation of irrigation and drainage facilities, farm roads, marketing facilities, and institutional development.
- Irrigation component covers development of CIS/CIP and strengthening of the IAs through the irrigation development projects

Remarks
- *: Estimated and/or proposed by project proponent
- According to the previous investment for CARP-IC, 356Mil.Pesos/year has been allocated for CARP-IC for the entire country. The ratio of the rice production for four provinces (Nueva Ecija, Pampanga, Tarlac and Bulacan) and that for the entire country in 2007 is about 0.19, based on the country STAT by Bureau of Agricultural Statistics, DA. Assuming that necessary budget is proportional to the rice production, it is estimated that 68Mil. Pesos/year would be necessary for the study area.

Source of Information
- DAR : Agrarian Reform Infrastructure Support Project, Phase-III.
- NIA : CARP-IC Project
- NIA: Indicative Irrigation Development Program, 2010-2019.

Project Code	AI-G-10	
Project Title	Upper Tabuating SRIP	
Status of Project	On-going	
Objective Area	General Tino, Nueva Ecija Province	
Implementing Agency	NIA	
Objectives	Development of national irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2009-2011	Estimated by Study Team for 2011-2025
	251.7 as of 2009	76 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	2009 – 2011*	

Project Description
- Construction of a zoned earth fill dam with a height of 25m and a reservoir area of 71.50ha for irrigation, flood control and aquaculture
- Target area (New): 700ha

Remarks
- *: Estimated and/or proposed by project proponent
- For 2011-2025, 30% of the project cost (76 Mil. Pesos) is considered.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA : UPRIIS Div-3.

Annex-T 9.2.1 (6/16) Project profile for Agricultural Sector

Project Code	AI-P-01	
Project Title	Balintingon Reservoir Multipurpose Project (BRMP)	
Status of Project	On-going	
Objective Area	Nuva Ecija Province	
Implementing Agency	Municipality of General Tinio	
Objectives	Development of national irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2016	Estimated by Study Team for 2011-2025
	13,591 as of 2009	13,591 as of 2009
EIRR	15.14 %*	
Expected Source of Fund	Selected Investor*	
Expected Implementation Schedule	2010 – 2016*	

Project Description

- The project envisions the construction of a 140m high rock fill center-core dam and its appurtenant structures across Sumacbao River to regulate the discharge of the catchment's area of about 228km^2. A reservoir with a storage capacity of 572MCM would be created. At the toe of the dam on the right abutment, an open type powerhouse equipped with two Francis type turbines with a capacity of 15MW each would be constructed. These main features, would be supplemented by a diversion weir (140m long) and new irrigation facilities (109km of main canal, 168km of laterals and sub-laterals, main and supplementary farm ditches, 210km of drainage channels, and access roads). At full implementation, the project would serve an area of about 14,900 hectares in the Balintingon area.
- Beneficiaries: 9,152 farm-families
- Target area (new): 14,900ha
- Installed capacity of hydropower plant: 30MW
- Expected generated power: 119.6GWH

Remarks

- *: Estimated and/or proposed by project proponent
- Revised ICC form submitted to NEDA in February, 2008
- Resolution No.84-2008: LGU is in partnership with NIA
- Resolution No.85-2008: the BRMP is a public domain of Gen. Tinio
- Resolution No.86-2008: Gen. Tinio to secure financing
- Resolution No.87-2008: Governor of Nueva Ecija to allocate Php0.1billion for social fund for the people displaced in the project.
- Resolution No.21-2009: Mayer of Gen.Tinio to invite investors to undertake design and secure financing package for the construction of BRMP
- Invitation for bidding in April, 2009
- Eight investors from China, US showed interest to participate through BOT
- MOA was singed on February 17, 2010 between NIA and Investor (Concordo Pacific Investment Holding Ltd. Inc.) for “Full Blown Study” to be completed within 120 days
- EO from the president to be able to proceed with the project mobilization. It is expected to be released before the end of the year.
- The project cost is as follows; Peso: 4,206, Loan: 9,385.
- It is estimated that 800-1,000families would be affected by the project.

Source of Information

- Supplemental Report, Balintingon RMP, Nueva Ecija, 2008 with revised ICC form as of February 2008
- PPT presentation on Balintingon RMP by Municipality of General Tinio.
- Interview by JST.

Annex-T 9.2.1 (7/16) Project profile for Agricultural Sector

Project Code	AI-P-02	
Project Title	Balog-Balog Multipurpose Project Phase II	
Status of Project	Planned	
Objective Area	Tarlac Province	
Implementing Agency	NIA	
Objectives	Development of national irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2011-2019	Estimated by Study Team for 2011-2025
	16,095 as of 2009	16,095 as of 2009
EIRR	19.09 %*	
Expected Source of Fund	ODA loan / GAA*	
Expected Implementation Schedule	2011- 2019*	

Project Description

- Construction of 113m high earth & rock fill dam with storage capacity of 575MCM (effective storage: 525MCM) across Bulsa River to generate electricity & provide year round irrigation water to service area of 39,150ha as well as flood control in low-lying areas. The project envisions to provide upland communities to enlarge in inland fish production on the reservoir.
- Beneficiaries: 15,660 farm-families
- Target area (new): 28,330ha
- Target area (rehabilitation): 6,080ha
- Installed capacity of hydropower plant: 43.5MW
- Expected generated power: 89GWH

Remarks

- *: Estimated and/or proposed by project proponent
- Updated FS was completed in December 2009
- Submitted to NEDA for evaluation, possible BOT
- The project cost estimated is for Phase II.
- It is estimated that 548faimilies would be affected by the project.

Source of Information

- NIA: Indicative Irrigation Development Program, 2010-2019
- NIA: Project Briefer (As of September 30, 2009).
- Interview by JST

Annex-T 9.2.1 (8/16) Project profile for Agricultural Sector

Project Code	AI-P-03	
Project Title	Sector Loan on Rehabilitation of Irrigation Facilities	
Status of Project	Planned	
Objective Area	Pampanga Province	
Implementing Agency	NIA	
Objectives	Rehabilitation of NIS to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2011-2016	Estimated by Study Team for 2011-2025
	222 as of 2009	222 as of 2009
EIRR	28.4 % for all*	
Expected Source of Fund	JICA / GAA*	
Expected Implementation Schedule	2011 – 2016*	

Project Description

- Nationwide project
- Optimization of irrigation potentials of NIS & CIS not covered by PIDP & ISOEIP.
- Involves restoration, rehabilitation, construction of irrigation facilities.

(Study Area)

Rehabilitation of Porac-Gumain NIS of 3,126ha.

In this existing NIS, the irrigable area is devastated during the eruption of Mt. Pinatubo, where lahar and volcanic ash covered the whole irrigable area by an average of depth of 30cm, and hence drainage canals were totally blocked. As a result, excess water during rainy season has no place to way out at farm level, which submerge the area or underwater. This project is essential to resolved all problems prior to Irrigation Management Transfer (IMT) such as squatters, water usage control, environment awareness, conservation and protection of irrigation and drainage facilities.

- Outline of the Project includes, 1) Construction of civil works for rehabilitation of diversion works, canal system, drainage system, road, and O&M facilities, and 2) Institutional Strengthening Program

Remarks

- *: Estimated and/or proposed by project proponent
- F/S completed
- Total project cost is 10,155Mil. Pesos(Peso:1.523, Loan:8.632)
- The project cost estimated is for Porac-Gumain NIS.

Source of Information

- NIA: Indicative Irrigation Development Program, 2010-2019.
- JICA preparatory study in 2009.

Project Code	AI-P-04	
Project Title	Casecnan Multi-purpose Irrigation & Power Project Irrigation Component Phase II	
Status of Project	Planned	
Objective Area	Nueva Ecija Province	
Implementing Agency	NIA	
Objectives	Development of national irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2012-2018	Estimated by Study Team for 2011-2025
	7,000 as of 2009	7,000 as of 2009
EIRR	28.00%*	
Expected Source of Fund	ODA loan / GAA*	
Expected Implementation Schedule	2012 – 2018*	

Project Description
- Construction of the remaining 33 km Super Diversion Canal (SDC), irrigation facilities to generate 21,000 new service area & rehabilitation of downstream portion of UPRIIS covering 40,000ha.
  - Beneficiaries: 81,000 farm-families
  - Target area (new): 21,000ha
  - Target area (Rehabilitation): 40,000ha
- Project component of Phase II includes 1) new construction such as extension of SDC, construction of lateral and sub-lateral canals, drainage canals and related structures in 20,321ha, and 2) rehabilitation / improvement of UPRIIS area, such as rehabilitation of the PENRIS main and lateral canals, and related structures.

Remarks
- *: Estimated and/or proposed by project proponent
- Updated F/S was completed in October 2009

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019
- Updated Feasibility Study for the Casecnan Multi-purpose Irrigation & Power Project, Irrigation Component Phase II.

Project Code	AI-P-05	
Project Title	Procurement of Pumps, Drilling Rigs & Related Equipment	
Status of Project	Planned	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA	
Objectives	Development of communal and small scale irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2011-2013	Estimated by Study Team for 2011-2025
	206 as of 2009	206 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Spanish Loan / GAA*	
Expected Implementation Schedule	2011 – 2013*	

Project Description
- Nationwide project
- Central Luzon area includes the procurement of
  - 1,000 units of centrifugal pumps
  - 1 units of trailer mounted rotary/percussion type drilling rigs
  - 2 units of resistively machines & electric logger
  - back-up spare parts
  - 4 units of service vehicles to be used in the identification, resistively, testing, drilling, installation & monitoring activities of project
  - Beneficiaries: 3,900 farm-families
  - Target area (Rehabilitation): 3,900ha.

Remarks
- *: Estimated and/or proposed by project proponent
- for DA, Need evaluation
- Total project cost is 1,028Mil. Pesos (Peso: 321, Loan: 707).
- The project cost estimated is for Region III.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Comprehensive Infrastructure Integrated Program, 2007.

Annex-T 9.2.1 (10/16) Project profile for Agricultural Sector

Project Code	AI-P-06	
Project Title	Irrigation Water Resources Augmentation Pump Establishment Project	
Status of Project	Planned	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA	
Objectives	Development of communal and small scale irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2013-2016	Estimated by Study Team for 2011-2025
	130 as of 2009	130 as of 2009
EIRR	(N/A)	
Expected Source of Fund	ODA loan*	
Expected Implementation Schedule	2013 – 2016*	

Project Description
- Nationwide project
- Central Luzon area includes;
  - Procurement of 1,330 units of pumps including diesel engines
  - Total of 301 units of shallow tube wells
  - 1,029 units of surface water pump irrigation to cover an area of 2,360 hectares.
  - Beneficiaries: 1,333 farm -families
  - Target area (New): 1,437ha
  -Target area (Rehabilitation): 924ha

Remarks
- *: Estimated and/or proposed by project proponent
- F/S completed
- Total project cost is 973Mil. Pesos (Peso: 422, Loan: 551).
- The project cost estimated is for Region III.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Comprehensive Infrastructure Integrated Program, 2007.

Project Code	AI-P-07	
Project Title	Appropriate Irrigation Technologies for Enhanced Agricultural Production	
Status of Project	Planned	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA	
Objectives	Improvement of irrigation efficiency in the basin as well as improving productivity with less water	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2015-2020	Estimated by Study Team for 2011-2025
	654 as of 2009	654 as of 2009
EIRR	(N/A)	
Expected Source of Fund	ODA loan / GAA*	
Expected Implementation Schedule	2015 – 2020*	

Project Description
- Nationwide project(Region III, IV, VI, XI&XII)
- The project involves the use of innovative and appropriate technology including photovoltaic energy in power generation and drip tape for water dispersion. Irrigation technology to be implemented includes drip sprinkler and flood irrigation facilitated by solar power.
- Central Luzon area includes the followings.
  - Beneficiaries: 2,000 farm-families
  -Target area (New): 4,000ha

Remarks
- *: Estimated and/or proposed by project proponent
- MOA signed with donor
- Total project cost is 3,250Mil. Pesos (Peso:0.650, Loan:2.600).
- The project cost estimated is for Region III.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.
- NIA: Comprehensive Infrastructure Integrated Program, 2007.

Annex-T 9.2.1 (11/16) Project profile for Agricultural Sector

Project Code	AI-P-08	
Project Title	Central Luzon Groundwater Irrigation Systems Reactivation Project	
Status of Project	Planned	
Objective Area	Nueva Ecija and Pampanga Provinces	
Implementing Agency	NIA	
Objectives	Development of communal and small scale irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2015-2019	Estimated by Study Team for 2011-2025
	1,429 as of 2009	1,429 as of 2009
EIRR	(N/A)	
Expected Source of Fund	ODA loan / GAA*	
Expected Implementation Schedule	2015 – 2019*	

Project Description
- Construction of 100 deep well pump systems covering 5,000ha; provision of rural water supply in selected barangays; procurement of equipment
- Target area (New): 5,000ha

Remarks
- *: Estimated and/or proposed by project proponent
- F/S completed
- According to NIA RegionIII, the project area in the Casecnan Phase II project should be excluded.
- The project cost estimated is as follows; Peso: 626, Loan: 803.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.

Project Code	AI-P-09	
Project Title	Gumain Reservoir Project t	
Status of Project	Planned	
Objective Area	Pampanga Province	
Implementing Agency	NIA	
Objectives	Development of national irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2020-2027	Estimated by Study Team for 2011-2025
	13,729 as of 2009 (2,768 as of 1984)	13,729 as of 2009
EIRR	(N/A)	
Expected Source of Fund	ODA loan / GAA	
Expected Implementation Schedule	2020 - 2027	

Project Description
- Construction of 108m high, zoned embankment dam to store irrigation water to serve irrigation water to serve 11,000ha of paddy & 5,200ha of sugercane area & augment water supply to 7,900ha in Porac-Gumain & Caulaman RIS.
- Target area : 16,200ha (11,000ha of paddy and 5,200ha of sugercane) including the existing Porac-Gumain & Caulaman RIS

Remarks
- *: Estimated and/or proposed by project proponent
- F/S completed in 1985
- Re-study would be necessary.

Source of Information
- NIA: Indicative Irrigation Development Program, 2010-2019.

Annex-T 9.2.1 (12/16) Project profile for Agricultural Sector

Project Code	AI-P-10	
Project Title	Rehabilitation of AMRIS	
Status of Project	Planned	
Objective Area	Bulacan Province	
Implementing Agency	NIA	
Objectives	Rehabilitation of NIS to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	983 as of 2009	983 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description
- The project, located in Bulacan, Region III, will rehabilitate Bustos, Lower & Upper Maasim Dam to recover the function of major irrigation facilities in Angat-Maasim RIS.
- Beneficiaries: 26,000 farm-families

Remarks
- Proposed project already forwarded by NEDA thru DFA to GOJ for Grant Aid Assistance.
- Implementation plan are under preparation by NIA supported by JICA as of March 2010.

Source of Information
- NIA: Comprehensive Infrastructure Integrated Program, 2007.
- Interview by JST.

Project Code	AI-P-11	
Project Title	Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects (SWIP), Small Diversion Dam Projects (SDD)	
Status of Project	Planned	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	DA Region III/LGUs	
Objectives	Development of communal and small scale irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	168.6 as of 2009 (91.5 as of 2002)	168.6 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description
- Bulacan (1SWIP and 2SDD, service area = 125ha)
- Nueva Ecija (1SWIP, service area = 95ha)
- Pampanga (1SWIP and 3SDD, service area = 195ha)
- Tarlac (1SWIP, service area =45ha)
- Nueva Ecija (new construction of 1 DD and rehabilitation of 11 DD and 5 SWIP) proposed by PPDO, Nueva Ecija

Remarks
- D/D completed.

Source of Information
- DA Region III
- PPDO, Nueva Ecija
- Interview by JST

Annex-T 9.2.1 (13/16) Project profile for Agricultural Sector

Project Code	AF-G-01	
Project Title	Aquaculture Fisheries Development Programs	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	BFAR	
Objectives	Improvement of fishery activities toward sustainable fishery development as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	450 as of 2009 (total for AF-G-01 to 04)
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	Annual Program	

Project Description

The program includes the following components.

- Support to accredited/registered private and provincial Tilapia Hatcheries.
  a) Input assistance, b) Training/consultations, c)Upgrading of bloodstocks,
  d) Monitoring of production, e) Strengthening of linkages between hatchery operators
- Seeding of existing communal bodies of water including SFR and SWIP and continuous replenishment of fish stock in the area.
  a) Fingering stocking and dispersal,
  b) Water quality monitoring and assessment of inland waters including SWIPs & SFR
- Extension support, education and training services
  a) Conduct of training in fisheries, b) Technical assistance & advisory services, c) Establishment of techno-demo (Stocking of Large-size Tilapia, Culture of Pangasisu, Culture of Saline Tilapia), d) Input assistance on Tilapia-Ulang

Remarks

- Based on the budget allocation for fishery operation in BFAR region III in 2009, it is assumed that the total budget for the AF-G-01 to 04 is 30Mil. Pesos/year.

Source of Information

- BAFR Central Luzon: Pampanga Priority Plans & Programs, CY2009.

Project Code	AF-G-02	
Project Title	Comprehensive Regulatory Services	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	BFAR	
Objectives	Improvement of fishery activities toward sustainable fishery development as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	*Refer to AF-G-01*
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	Annual Program	

Project Description

The programs includes the following components.

- Fish Health Management & Inspection
  a) Residue monitoring and surveillance of feed mills and registered farms for EU accreditation,
  b) Aquatic animal disease surveillance, monitoring and control
- Monitoring, control & surveillance (MCS)
  a) Deputation of fish warden & fish examiners,
  b) Filing of illegal fishing cases & apprehensions,
  c) Coordination with law enforcement agencies
- Issuance of regulatory documents
  a) FLS,
  b) Import and export permits
- Quarantine services
- Diosdado Macapagal International Airport in Clark, Mabalacat, Pampanga

Remarks

Source of Information

- BAFR Central Luzon: Pampanga Priority Plans & Programs, CY2009.

Annex-T 9.2.1 (14/16) Project profile for Agricultural Sector

Project Code	AF-G-03	
Project Title	Support Projects and Activities	
Status of Project	On-going	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	BFAR	
Objectives	Improvement of fishery activities toward sustainable fishery development as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	*Refer to AF-G-01*
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	Annual Program	

Project Description

The programs include the following components.

- Market development services
- Market-matching and consumer information services, b) Participation to Agri-Aqua trade fairs, c) Marketing assistance
- Project and activities on credit facilitation services
- Assistance to fisher folk in accessing agricultural credit & loan (ACEF, QUEDANCOR, Land Bank of Philippines)
- Fisheries post harvest services
- Distribution of post-harvest equipment & machineries such as live tilapia container box and smokehouse

Remarks

Source of Information

- BAFR Central Luzon: Pampanga Priority Plans & Programs, CY2009.

Project Code	AF-G-04	
Project Title	Fisheries Resources Management for Improved and Sustainable Harvest	
Status of Project	On-going	
Objective Area	Bulacan Province (Hagonoy, Paombongm, City of Malolos, Bulacan)	
Implementing Agency	Provincial Government of Bulacan	
Objectives	Improvement of fishery activities toward sustainable fishery development as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	*Refer to AF-G-01*
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	Annual Program	

Project Description

Obectives

(1) General:

to ensure the attainment of rationally and properly managed and sustained fisheries and aquatic resources in the coastal areas

(2) Specific:

a) Design strategies and projects to address issues and problems in resource management

b) Create awareness and generate support from stakeholders towards

Program components

1) Resource inventory, 2) Policy/Regulatory, 3) Capability building, 4) Livelihood support,
5) Resource enhancement, and 6) Public awareness

On-going activities includes;

1) Advocacy to adoption of Municipal Fisheries Ordinance
2) Mangrove Planting
3) Lecture and Film showing
4) Community river clean-up day

Remarks

Source of Information

- BAFR Central Luzon: Pampanga Priority Plans & Programs, CY2009.

Annex-T 9.2.1 (15/16) Project profile for Agricultural Sector

Project Code	AI-C-01	
Project Title	New Construction of Small Scale Irrigation Project under BSWM	
Status of Project	Conceptual	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	BSWM	
Objectives	Development of communal and small scale irrigation system to address water shortage in existing NISs and CISs	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	514 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description
- Construction of small scale irrigation systems consisting of Small Water Impounding Projects (SWIP), Small Diversion Dam Projects (SDD), Small Farm Reservoir (SFR), Shallow Tube Well (STW) and other rainwater harvesting systems
- The project support the construction of small scale irrigation systems which are not covered by the on-going and planed projects under BSWM
- Proposed Projects

- Diversion Dam (DD)	18 nos	959ha
- Small Water Impounding Project (SWIP)	24 nos	1,635 ha
- Small Farmers Reservoir (SFR)	4 nos	112 ha
(Total)	(46 nos)	(2,706 ha)

Remarks
- It is assumed that the project cost is 0.19Mil. Pesos/ha, referring the project cost of AI-P-11.

Required Action to Upgrade to a Proposed Project for Implementation
- F/S level study would be required.

Source of Information
- BSWM

Project Code	AI-C-02	
Project Title	Introduction of Water Saving Irrigation Technology	
Status of Project	Conceptual	
Objective Area	Bulacan, Nueva Ecija, Pampanga and Tarlac Provinces	
Implementing Agency	NIA / (DA / PhilRice)	
Objectives	Improvement of irrigation efficiency in the basin as well as improving productivity with less water	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	150 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule		

Project Description
- The program aims at;
  - raising water user's awareness on the importance of technology and promote compulsory adoption by farmers
  - minimize water delivery and distribution losses;
  - increasing water use efficiency for increased rice production towards water saving at the system level
  - saving water from the reservoir to increase cropping intensity thru the adoption of quick turn around or third cropping
- The program components include;
  - Trial and research
  - Demonstration farm operation
  - Training to trainers and technical campaign to IAs
  - Monitoring
  - Capacity development of IAs

Remarks
- For the project cost, input on technical assistance by foreign expert team (60mil/pesos/year) for 3yeras is considered.

Required Action to Upgrade to a Proposed Project for Implementation
- TOR for the T.A. should be determined.

Source of Information
- Interview by JST to NIA, NIA-JICA Irrigation Association Strengthening Support Project (TCP2) and Phil Rice

Annex-T 9.2.1 (16/16) Project profile for Agricultural Sector

Project Code	AI-C-03	
Project Title	Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs	
Status of Project	Conceptual	
Objective Area	Bulacan and Pampanga Provinces	
Implementing Agency	NIA	
Objectives	Improvement of irrigation efficiency in the basin as well as improving productivity with less water	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	150 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule		

Project Description

The programs include the following components.

- Installation of additional discharge measurement device
- Improvement of discharge monitoring system
- Review of calibration of conversion tables
- Establishment of communication system
- Capacity development

Remarks

- The project cost is roughly estimated by referring the cost for the proposed central operation and monitoring system in the F/S for Casecnan Project Phase II.

Required Action to Upgrade to a Proposed Project for Implementation

- Basic project components should be studied.

Source of Information

-

Annex-T 9.3.1 (1/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-G-01	
Project Title	Angat Water Utilization and Aquaduct Improvement Project (AWUAIP) Phase II	
Status of Project	On-going	
Objective Area	Bulacan Province and Metro Manila	
Implementing Agency	MWSS	
Objectives	Rehabilitation of water conveyance facilities for municipal water supply to address inadequate water supply source	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2013	Estimated by Study Team for 2011-2025
	6,090 of 2009	4,568 as of 2009
EIRR	(N/A)	
Expected Source of Fund	China Loan*	
Expected Implementation Schedule	2010-2013*	

Project Description

- This Project is being considered with the aim of maintaining and optimizing the quantity of raw water delivered daily from Angat Dam via the Ipo Dam-Bicti-La Mesa Portal System to the water treatment plants. The project can mitigate the leakage that occurs on some segments of the existing aquaduct No.5 (AQ-5), which was constructed in 1990 and conveys 2,000MLD of raw water to Metro Manila. The leakage is estimated to be equivalent to about 150MLD.
- This project involves the construction of new aquaduct No.6 and the rehabilitation of existing aquaduct No.5 to secure the raw water supply from Ipo dam to Metro Manila.
- The Phase II project includes the followings; 1) L=9.9km aquaduct extension including the rehabilitation of existing AQ-5, and 2) Interconnection works for the six (6) aqueducts and resettlement.

Remarks

- *: Estimated and/or proposed by project proponent
- Bidding among the three (3) nominated Chinese contractors was held on July 7, 2009 and the project was awarded to China International Water & Electric Corp (CWE) having submitted the lowest bid. Contract documentation works is in progress.
- MWSS has just submitted to DOF its loan application for the project proposed to be funded under the preferential buyer's credit facility of the Export-Import Bank of China (China Eximbank), hence activities pertaining to loan application and negotiation is in progress. Once the loan is approved and the loan agreement is signed, then MWSS can now issue the Notice To Proceed to CWE and the construction works is expected to commence by the 1st quarter of this year 2010.
- NEDA, in its letter of August 11, 2009 informed MWSS that the Investment Coordination Committee-Cabinet Committee (ICC=CC) has approved the subject project on August 10, 2009.
- For 2011-2025, 75% of the project cost (4,568Mil. Pesos) is considered.

Source of Information

- MWSS: Summary of Projects & Updates as of 30 September, 2009.
- MWSS: Briefing on the project, available through MWSS web-site.
- Interview by JICA Study Team

Annex-T 9.3.1 (2/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-P-01	
Project Title	Rehabilitation of Umiray-Macua Facilities	
Status of Project	Proposed	
Objective Area	General Nakar and Bulacan Province	
Implementing Agency	MWSS	
Objectives	Rehabilitation of water intake and conveyance facilities for municipal water supply to address inadequate water supply source	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2011	Estimated by Study Team for 2011-2025
	454 as of 2009	454 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Concessionaries*	
Expected Implementation Schedule	2010 – 2011*	

Project Description

- This project is to ensure the flow of raw water from Umiray River to Angat Reservoir as this contributes 20-30% of the present water supply. On November 29, 2004, typhoon "Winnie" has caused severe damages to our Umiray-Angat Transbasin Tunnel and its facilities resulting to the complete stoppage of operation particularly the conveyance of raw water from the Umiray River to the Angat Reservoir. This damage was recovered by the immediate works.
- This project is for the permanent rehabilitation works which includes the following components;1) Complete restoration of the access road to tunnel outlet, 2) Construction of permanent RCDG Bridge for the tunnel outlet, 3) Widening of oxbow channel at the tunnel outlet, 4) Intake structures such as the various mechanical gates; trash rack, waterway protection works, retaining wall, ogee dam, etc, 5) Rehabilitation of mini-hydro plant, 6) Construction of log arresters, 7) Installation of power/communication cables inside the tunnel, 8) Village/Housing relocation

Remarks

- *: Estimated and/or proposed by project proponent
- Updating of cost estimate for bidding was recently completed.
- Processing of the MOA with the municipality of General Nakar, Quezon, is in progress.
- Implementation including bidding process will be done by MWSS but to be funded by the Concessionaries.

Source of Information

- MWSS: Summary of Projects & Updates as of 30 September, 2009.
- MWSS: Briefing on the project, available through MWSS web-site.
- Interview by JICA Study Team

Project Code	MW-P-02	
Project Title	Sumag River Diversion Project	
Status of Project	Proposed	
Objective Area	General Nakar Province	
Implementing Agency	MWSS	
Objectives	New water resources development for municipal water supply to address inadequate water supply source	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2011	Estimated by Study Team for 2011-2025
	540 as of 2009	540 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Common Purpose Facility (CPF) by Concessionaries*	
Expected Implementation Schedule	2010 – 2011*	

Project Description

- This project is to tap of the Sumag River in General Nakar, Quezon, originally part of the Umiray-Angat transbasin project with a supply volume of 188MLD.
- To maximize the potential water transfer from the Umiray-Angat transbasin project, this project is necessary to be implemented.

Remarks

- *: Estimated and/or proposed by project proponent
- Updating of cost estimate already completed.
- This will be funded by the concessionaires through the Common Purpose Facility (CPF) Framework of the Concession Agreement.

Source of Information

- MWSS: Summary of Projects & Updates as of 30 September, 2009.
- Interview by JICA Study Team

Annex-T 9.3.1 (3/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-P-03	
Project Title	Bulacan Treated Bulk Water Supply Project	
Status of Project	Proposed	
Objective Area	Bulacan Province	
Implementing Agency	MWSS / Bulacan Government	
Objectives	Development of bulk water supply system to address inadequate water supply source as well as to secure safe drinking water	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2010-2012	Estimated by Study Team for 2011-2025
	5,500 as of 2009	11,935 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Common Purpose Facility (CPF) by Concessionaries*	
Expected Implementation Schedule	2010 – 2012*	

Project Description

- This project will address the water supply requirements of the Province of Bulacan through its water district with a total volume of 230MLD.
- In 2007, MOA between MWSS and provincial government of Bulacan on Bulacan water supply plan was signed. According to this, MWSS would implement the Bulacan bulk water supply project in three phases.
- The project is the first phase of the entire plan, which involves the construction of water supply facilities, including a raw aqueduct, a treatment plant, reservoirs, pumping station and primary lines, to cater to the demand of 10 municipalities/cities in Bulacan.
- The concessionaries will convey the raw water to the proposed water-treatment plant. Bulk water after treatment will then be stored in a reservoir, where it is delivered to the delivery point of each water district of the different municipalities and cities of Bulacan. The water districts, in turn, will distribute the water to Bulacan residents.
-

Remarks

- *: Estimated and/or proposed by project proponent
- MWSS decided to have this project be implemented by Concessionaries under the Common Purpose Facility (CPF) Framework of the Concession Agreement.
- The annualized unit raw water development cost of 8pesos/ m^3 (with discount rate of 10% and lifetime of 50years) is additionally considered for the estimation of the total project cost.
-

Source of Information

- MWSS: Summary of Projects & Updates as of 30 September, 2009.
- MWSS: Summary of Projects & Updates as of 15 February, 2009.
- Interview by JICA Study Team
-

Annex-T 9.3.1 (4/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-P-04	
Project Title	Metro Clark Bulk Surface Water Project	
Status of Project	Proposed	
Objective Area	Metro Clark (Angeles City, Mabalacat, Porac in Pampanga Province, Bamban, Concepcion, Capas in Tarlac Province)	
Implementing Agency	Clark Development Corporation (CDC)	
Objectives	Development of bulk water supply system to address inadequate water supply source	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	3,527 as of 2009
EIRR	(N/A)	
Expected Source of Fund	CDC with private sector participation*	
Expected Implementation Schedule	(N/A)	

Project Description

- Water supply project for development of new frontier area in Clark Special Economic Zone, which would provide 20,793m^3/day (7.6MCM/year or 0.26m^3/s) of municipal water, was proposed in the master plan to develop new area in Clark Special Economic Zone. The target year is set at 2035 in the master plan. The estimated project cost is 640Mil. Pesos. The potential sites for water resources development are Marimula, Sacobia and Bangut.
- The proposed project has been upgraded into "Metro Clark Bulk Surface Water Project", as of October 2010, according to CDC. The upgraded project involves the development of sustainable new surface water sources to supply treated bulk water to public and private water providers serving Metro Clark as an alternative/supplement to current groundwater sources and to address current supply gaps and future projected demand. Implementation of the project (design, financing, construction, operation and maintenance) is proposed for private sector participation.

Remarks

- *: Estimated and/or proposed by project proponent
- Feasibility study is on-going under support from International Finance Corporation (IFC), which investigates three potential sites for water resources development; Marimula, Sacobia and Bangut.
- Because the result of the F/S is not available as of October 2010, it is assumed that the projected deficit of sustainable groundwater source in Metro Clark (Angeles City, Mabalacat, Porac in Pampanga Province, Bamban, Concepcion, Capas in Tarlac Province) at 2025 by the present study, which is 0.8m^3/s, be supplied through MetroClark Bulk Surface Water Project.
- It should be noted that it would be necessary to construct storage dams at some of the potential sites for water sources (Marimula, Sacobia and Bangut) in order to provide municipal water of 0.8m^3/s, according to the result of the preliminary water balance by the study team.
- The estimated project cost assumed the same annualized unit cost for water supply system development used in Bulacan Treated Bulk Water Supply Project (Code: MW-P-03), i.e. 6.8pesos/m^3 (with discount rate of 10% and lifetime of 50years) , and the annualized unit raw water development cost of 8pesos/m^3 (with discount rate of 10% and lifetime of 50years).

Source of Information

- CDC: Master Development Plan for 10,684Hectares in the Clark Special Economic Zone, Utilities Requirement Projections, 2008.
- CDC: Metro Clark Bulk Surface Water Project, 2010.

Annex-T 9.3.1 (5/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-C-01	
Project Title	Additional Level 3,2, 1 Facilities towards 2025 in Bulacan	
Status of Project	Conceptual	
Objective Area	Bulacan Province	
Implementing Agency	LWUA/WDs/ LGUs/Private WSPs	
Objectives	Municipal water supply system development	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	3,839 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- To address the issue on the inadequate water supply, the development of new water supply system for all water service level for both urban and rural areas are proposed to meet the growing water demand requirement in Bulacan Province. The new water supply system for level 3 will also include the expansion and rehabilitation of the existing water system in the respective cities and municipalities. In the present study, the strategy for physical targets on the water service level ratios is set as follows; increasing with the past trend and additional consideration to level up the municipalities with low level 3 ratio.
- The estimated additional population to be served toward 2025 is as follows (inside the study area only).
  1)Level 1: 140thousand, 2)Level 2: 0, 3)Level 3: 558thoudand.
- These projects also include the soft components addressing the following countermeasures; 1) Utilization of high technology equipment in development of water system, 2) Carrying out immediate water repairs, provide water meters, and perform periodic maintenance, 3) Strict implementation/enforcement of laws and penalties on pilferage, 4) Efficient system operation and maintenance, 5) Quality checked design and well supervised construction, 6) Strict implementation of well design.

Remarks

- The project cost estimated is only for inside the study area.
- Annual O&M cost for level3 system is estimated at about 10pesos/m^3.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

Project Code	MW-C-02	
Project Title	Additional Level 3,2, 1 Facilities towards 2025 in Pampanga	
Status of Project	Conceptual	
Objective Area	Pampanga Province	
Implementing Agency	LWUA/WDs/ LGUs/Private WSPs	
Objectives	Municipal water supply system development	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	4,914 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- To address the issue on the inadequate water supply, the development of new water supply system for all water service level for both urban and rural areas are proposed to meet the growing water demand requirement in Pampanga Province. The new water supply system for level 3 will also include the expansion and rehabilitation of the existing water system in the respective cities and municipalities. In the present study, the strategy for physical targets on the water service level ratios is set as follows; increasing with the past trend and additional consideration to level up the municipalities with low level 3 ratio.
- The estimated additional population to be served toward 2025 is as follows (inside the study area only).
  1)Level 1: 205thousand, 2)Level 2: 3thousand, 3)Level 3: 701thoudand.
- These projects also include the soft components addressing the following countermeasures; 1) Utilization of high technology equipment in development of water system, 2) Carrying out immediate water repairs, provide water meters, and perform periodic maintenance, 3) Strict implementation/enforcement of laws and penalties on pilferage, 4) Efficient system operation and maintenance, 5) Quality checked design and well supervised construction, 6) Strict implementation of well design.

Remarks

- The project cost estimated is only for inside the study area.
- Annual O&M cost for level3 system is estimated at about 10pesos/m^3.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

Annex-T 9.3.1 (6/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-C-03	
Project Title	Additional Level 3,2, 1 Facilities towards 2025 in Nueva Ecija	
Status of Project	Conceptual	
Objective Area	Nueva Ecija Province	
Implementing Agency	LWUA/WDs/ LGUs/Private WSPs	
Objectives	Municipal water supply system development	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	2,903 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- To address the issue on the inadequate water supply, the development of new water supply system for all water service level for both urban and rural areas are proposed to meet the growing water demand requirement in Nueva Ecija Province. The new water supply system for level 3 will also include the expansion and rehabilitation of the existing water system in the respective cities and municipalities. In the present study, the strategy for physical targets on the water service level ratios is set as follows; increasing with the past trend and additional consideration to level up the municipalities with low level 3 ratio.
- The estimated additional population to be served toward 2025 is as follows (inside the study area only).
  1)Level 1: 178thousand, 2)Level 2: 22thousand, 3)Level 3: 415thoudand.
- These projects also include the soft components addressing the following countermeasures; 1) Utilization of high technology equipment in development of water system, 2) Carrying out immediate water repairs, provide water meters, and perform periodic maintenance, 3) Strict implementation/enforcement of laws and penalties on pilferage, 4) Efficient system operation and maintenance, 5) Quality checked design and well supervised construction, 6) Strict implementation of well design.

Remarks

- The project cost estimated is only for inside the study area.
- Annual O&M cost for level3 system is estimated at about 10pesos/m^3.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

Project Code	MW-C-04	
Project Title	Additional Level 3,2, 1 Facilities towards 2025 in Tarlac	
Status of Project	Conceptual	
Objective Area	Tarlac Province	
Implementing Agency	LWUA/WDs/ LGUs/Private WSPs	
Objectives	Municipal water supply system development	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	559 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- To address the issue on the inadequate water supply, the development of new water supply system for all water service level for both urban and rural areas are proposed to meet the growing water demand requirement in Tarlac Province. The new water supply system for level 3 will also include the expansion and rehabilitation of the existing water system in the respective cities and municipalities. In the present study, the strategy for physical targets on the water service level ratios is set as follows; increasing with the past trend and additional consideration to level up the municipalities with low level 3 ratio.
- The estimated additional population to be served toward 2025 is as follows (inside the study area only).
  1)Level 1: 72thousand, 2)Level 2: 0, 3)Level 3: 77thoudand.
- These projects also include the soft components addressing the following countermeasures; 1) Utilization of high technology equipment in development of water system, 2) Carrying out immediate water repairs, provide water meters, and perform periodic maintenance, 3) Strict implementation/enforcement of laws and penalties on pilferage, 4) Efficient system operation and maintenance, 5) Quality checked design and well supervised construction, 6) Strict implementation of well design.

Remarks

- The project cost estimated is only for inside the study area.
- Annual O&M cost for level3 system is estimated at about 10pesos/m^3.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

Annex-T 9.3.1 (7/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-C-05	
Project Title	Extended Bulacan Bulk Water Supply Project	
Status of Project	Conceptual	
Objective Area	Bulacan Province	
Implementing Agency	Bulacan Government / (Bulk water supplier has not yet been identified)	
Objectives	Development of bulk water supply system to address inadequate water supply source as well as to secure safe drinking water	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	16,754 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- It is expected that the population of Bulacan would reach to 4 million in 2025 with urban population of 3miliion, although half of the population is counted outside the study area. It is roughly estimated that the entire Bulacan could require surface water source with about 6.5m^3/s in total in 2025, by assuming the followings; 1) Estimated all deficit for level 2&3 municipal water use and industrial water use inside the study area would be supplied by surface water source, 2) All water demand for level 2&3 municipal water use and industrial water use outside the study area require surface water source, and 3) Industrial water demand outside the study area is proportional to level 2&3 municipal water demand and the proportional coefficient is 12%, which is same as the estimated one for the entire study area. It is expected that additional 3.8m^3/s (6.5-2.7m^3/s) of surface water source would be necessary to be prepared toward 2025. Considering this situation, in the present study, the conceptual project for Extended Bulacan Bulk Water Supply Project is proposed to emphasize more on preparing necessary surface water source in future.
- The possible surface water sources for Bulacan in future would be almost same for Project for Recovery of Reliability of Water Supply in Angat-Umiray System (Code: IS-C-02) as follows; 1) Bayabas storage dam, 2) Balintingon storage dam and conveyance to AMRIS, 3) Upgrading and improvement of irrigation facilities and water management of AMRIS, 4) Excess water for MWSS from Ipo dam. Among these, option 1) and 3) are conditionally recommended for Project for Recovery of Reliability of Water Supply in Angat-Umiray System (Code: IS-C-02) in the present study. Therefore, the remaining options of 2) and 4) would be possible options for the water source for this project.
- The project includes the water resources development as well as the water supply system development with transmission pipeline and water treatment plant.

Remarks

- The estimated project cost assumed the same annualized unit cost for water supply system development used in Bulacan Treated Bulk Water Supply Project (Code: MW-P-03), i.e. 6.8pesos/m^3 (with discount rate of 10% and lifetime of 50years) , and the annualized unit raw water development cost of 8pesos/ m^3 (with discount rate of 10% and lifetime of 50years).

Required Action to Upgrade to a Proposed Project for Implementation

- Revision of MWSS master plan, which considers municipal & industrial water demand of Bulacan, is recommended in order to optimize the water resources distribution in the entire MWSS service area in future. Depending upon the revision, F/S level study could be required.

Source of Information

Annex-T 9.3.1 (8/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MW-C-06	
Project Title	Pampanga Bulk Water Supply Project	
Status of Project	Conceptual	
Objective Area	Pampanga Province	
Implementing Agency	Pampanga Government / (Bulk water supplier has not yet been identified)	
Objectives	Development of bulk water supply system to address inadequate water supply source as well as to secure safe drinking water	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	5,732 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The present study evaluated that the many cities and municipalities in Pampanga province will be at high risk in terms of sustainable groundwater source, based on the water demand and potential balance of groundwater. In these cities and municipalities, the groundwater source would be necessary to be converted to either residual groundwater source at adjacent municipalities/cities or surface water source by 2025. The deficit of sustainable groundwater source is estimated at 2.1m^3/s. The part of the deficit would be supplied through Metro Clark Bulk Surface Water Project (Code: MW-P-04) covering Metro Clark (Angeles City, Mabalacat, Porac in Pampanga Province, Bamban, Concepcion, Capas in Tarlac Province). However, there exist no other plans for supplying surface water source to WDs in Pampanga at this moment. The conceptual project for Pampanga Bulk Water Supply Project is thereby proposed in the present study.
- The possible surface water sources would be as follows; 1) Residual groundwater at surrounding cities/municipalities, 2) Pampanga river at Cong Dadong dam, 3) Gumain storage dam.
- The project includes the water resources development as well as the water supply system development with transmission pipeline and water treatment plant.

Remarks

- It is assumed that 0.8m^3/s be provided through Metro Clark Bulk Surface Water Project (Code: MW-P-04) and the remaining 1.3m^3/s be supplied through Pampanga Bulk Water Supply Project.
- The estimated project cost assumed the same annualized unit cost for water supply system development used in Bulacan Treated Bulk Water Supply Project (Code: MW-P-03), i.e. 6.8pesos/m^3 (with discount rate of 10% and lifetime of 50years) , and the annualized unit raw water development cost of 8pesos/ m^3 (with discount rate of 10% and lifetime of 50years).

Required Action to Upgrade to a Proposed Project for Implementation

- Bulk water supplier has not yet been identified. M/P or F/S level study to select the most appropriate water source for bulk water supply would be required. Although the current agreement between two concessioners and MWSS does not include the water supply service in Bulacan province, a revision of MWSS water supply master plan, which considers municipal & industrial water demand of Bulacan, is recommended, in order to optimize the water resources distribution in Metro Manila and Bulacan in future.

Source of Information

Annex-T 9.3.1 (9/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MS-C-01	
Project Title	Additional Sanitary Facilities towards 2025 in Bulacan	
Status of Project	Conceptual	
Objective Area	Bulacan Province	
Implementing Agency	LGUs	
Objectives	Development of sanitation facilities to address unsafe water supply	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	3,676 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The 100% provision of sanitary toilet in the entire service area by year 2025 is recommended to achieve the sector goal of 100% safe water. The MDGs had targeted that about 90% of the household in the Central Luzon should be able to access to the safe drinking water by the year 2015. The 2008 sanitary toilet ratio of each city and municipality in the service area is projected to increase by 10% by the year 2015 and to target the 100% sanitary toilet coverage in the service area by year 2025.
- The following two types of sanitary toilet are considered; 1) Conventional toilet, 2) EcoSan toilet.
- The estimated additional number of toilet to be installed toward 2025 is as follows (inside the study area only); 1)Conventional: 140thousand, 2) EcoSan: 11thousand
- The project also include the capacity development of implementing agency addressing the following countermeasures; Social preparation for users.

Remarks

- The project cost estimated is only for inside the study area.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

-

Project Code	MS-C-02	
Project Title	Additional Sanitary Facilities towards 2025 in Pampanga	
Status of Project	Conceptual	
Objective Area	Pampanga Province	
Implementing Agency	LGUs	
Objectives	Development of sanitation facilities to address unsafe water supply	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	4,725 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The 100% provision of sanitary toilet in the entire service area by year 2025 is recommended to achieve the sector goal of 100% safe water. The MDGs had targeted that about 90% of the household in the Central Luzon should be able to access to the safe drinking water by the year 2015. The 2008 sanitary toilet ratio of each city and municipality in the service area is projected to increase by 10% by the year 2015 and to target the 100% sanitary toilet coverage in the service area by year 2025.
- The following two types of sanitary toilet are considered; 1) Conventional toilet, 2) EcoSan toilet.
- The estimated additional number of toilet to be installed toward 2025 is as follows (inside the study area only); 1) Conventional: 151thousand, 2) EcoSan: 40thousand
- The project also include the capacity development of implementing agency addressing the following countermeasures; Social preparation for users.

Remarks

- The project cost estimated is only for inside the study area.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

-

Annex-T 9.3.1 (10/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MS-C-03	
Project Title	Additional Sanitary Facilities towards 2025 in Nueva Ecija	
Status of Project	Conceptual	
Objective Area	Nueva Ecija Province	
Implementing Agency	LGUs	
Objectives	Development of sanitation facilities to address unsafe water supply	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	3,477 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The 100% provision of sanitary toilet in the entire service area by year 2025 is recommended to achieve the sector goal of 100% safe water. The MDGs had targeted that about 90% of the household in the Central Luzon should be able to access to the safe drinking water by the year 2015. The 2008 sanitary toilet ratio of each city and municipality in the service area is projected to increase by 10% by the year 2015 and to target the 100% sanitary toilet coverage in the service area by year 2025.
- The following two types of sanitary toilet are considered; 1) Conventional toilet, 2) EcoSan toilet.
- The estimated additional number of toilet to be installed toward 2025 is as follows (inside the study area only); 1) Conventional: 112thousand, 2) EcoSan: 29thousand
- The project also include the capacity development of implementing agency addressing the following countermeasures; Social preparation for users.

Remarks

- The project cost estimated is only for inside the study area.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

-

Project Code	MS-C-04	
Project Title	Additional Sanitary Facilities towards 2025 in Tarlac	
Status of Project	Conceptual	
Objective Area	Tarlac Province	
Implementing Agency	LGUs	
Objectives	Development of sanitation facilities to address unsafe water supply	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	968 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The 100% provision of sanitary toilet in the entire service area by year 2025 is recommended to achieve the sector goal of 100% safe water. The MDGs had targeted that about 90% of the household in the Central Luzon should be able to access to the safe drinking water by the year 2015. The 2008 sanitary toilet ratio of each city and municipality in the service area is projected to increase by 10% by the year 2015 and to target the 100% sanitary toilet coverage in the service area by year 2025.
- The following two types of sanitary toilet are considered; 1) Conventional toilet, 2) EcoSan toilet.
- The estimated additional number of toilet to be installed toward 2025 is as follows (inside the study area only); 1) Conventional: 30thousand, 2) EcoSan: 9thousand
- The project also include the capacity development of implementing agency addressing the following countermeasures; Social preparation for users.

Remarks

- The project cost estimated is only for inside the study area.

Required Action to Upgrade to a Proposed Project for Implementation

- Updated provincial water supply, sanitation and sewerage sector plan should be prepared.

Source of Information

-

Annex-T 9.3.1 (11/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MP-G-01	
Project Title	Cabanatuan Sewerage System	
Status of Project	On-going	
Objective Area	Cabanatuan City	
Implementing Agency	Cabanatuan City	
Objectives	Sewerage system development to reduce pollution load to water body	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	189 as of 2009 (96 as of 2000)	189 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- In Cabanatuan City, the sewerage system is designed as combined storm and sewage system with biological STP. The system is designed to serve 33,085 populations by year 2015, about 12% of the projected urban population. Although the sewerage pipelines have been completed, the STP has not yet been completed in the Cabanatuan sewerage system. The STP should be completed as soon as possible.
- The proposed combined sewerage system composed of the followings; 1) drainage / sewer lines, 2) lift stations, 3) waste water treatment plant with capacity of 8,171m^3/day for dry weather flow.
- The proposed biological treatment plant includes anaerobic lagoon and chemical disinfection.

Remarks

- Combined drainage and sewer lines have been started operation.
- Treatment plant has not yet been constructed due to budgetary constraints.

Source of Information

- Cabanatuan City: Water District Development Project, WDDP-USSD, Sewage Treatment Plant (STP) for Cabanatuan City, Design Report, Vol.I, Main Report, 2003.

Project Code	MP-G-02	
Project Title	Expansion of Clark Sewerage System	
Status of Project	Proposed	
Objective Area	Clark Special Economic Zone	
Implementing Agency	Clark Water	
Objectives	Sewerage system development to reduce pollution load to water body	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	456 as of 2009	456 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The sewerage system in Clark is presently serving 80% of the Clark area, about 16,280 population and the non domestic influent of commercial, industrial, government offices and resorts. The current capacity of the STP is 8,023m^3/day. Clark is working on the design for the upgrade of the present WWTP to serve 100% of the Clark Area. There are two stages to be implemented, the first stage with the capacity of 13,500m^3/day will be implemented by June 2010 and the second stage will be implemented on year2012. The plant is designed at 33,000m^3/day for the stage 2 to accommodate the increasing waste water generation in Clark covering the year 2020 design period.

Remarks

- There is no information on the project cost for the Phase II. The total cost is roughly estimated by assuming the unit cost of 0.018mil pesos/m^3, which is derived from the project cost for the Phase I and the incremental capacity.

Source of Information

-

Annex-T 9.3.1 (12/12) Project profile for Municipal Water Supply, Sanitation and Sewerage Sector

Project Code	MP-C-01	
Project Title	Septage Treatment and Disposal Facility	
Status of Project	Conceptual	
Objective Area	Tarlac Province and 10 selected municipalities and cities (Angeles, San Fernando, Malolos, Cabanatuan, Tarlac, Hagonoy, Baliuag, Calumpit, Mabalacat and Guagua)	
Implementing Agency	LWUA/WDs/LGUs/Private WSPs	
Objectives	Improvement of septage treatment and disposal to reduce pollution load to water body	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	510 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The provision of septage treatment and disposal facilities to about 40% of the 2025 urban population of the cities of Angeles, San Fernando, Malolos, Cabanatua , Tarlac, and the municipalities of Hagonoy, Baliuag, Calumpit, Mabalacat and Guagua have been proposed as a conceptual project.
- On the septage treatment and disposal facilities, there is an existing sanitary landfill in Kalangitan, Capas, Tarlac which is being managed by the Clark Waste Management (CWM) and they have the plan to upgrade the facilities to receive treated and untreated septage for the whole Region III as well as the neighboring regions. The sanitary land is designed to cater for 25years projected waste generation of the said service area and the facility is about 100hectares in area. In the present study, it is assumed that this facility will be used for the septage treatment and disposal facilities.
- The capital cost for purchasing truck is considered as the project cost. The O&M cost for collection and tipping fee as well as the transportation cost for the collected septage is also considered for the possible tariff.

Remarks

- The estimated project cost is for initial purchase of trucks for transportation. The lifetime of the trucks would be 7years.
- The estimated annual O&M cost is 2,934pesos/m^3 for septage.

Required Action to Upgrade to a Proposed Project for Implementation

- F/S level study would be required.

Source of Information

-

Annex-T 9.4.1 (1/7) Project profile for Flood and Sediment Disaster Management Sector

Project Code	FL-G-01	
Project Title	Pinatubo Hazard Urgent Mitigation Plan (PHUMP) Phase III Part I	
Status of Project	On-going	
Objective Area	502 km^2 covering Pasac river basin including San Fernando City and nine municipalities Mexico, Santo Tomas, Bacolor, Guagua, San Sasmuan, Floridablanca, Porac, Santa Rita and Lubao.	
Implementing Agency	DPWH	
Objectives	Flood mitigation by new structural measures to address insufficient structural capacity for flood mitigation	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2005-2010	Estimated by Study Team for 2011-2025
	4,700 as of 2009	470 as of 2009
EIRR	19%*	
Expected Source of Fund	GAA and JICA*	
Expected Implementation Schedule	2005-2010*	

Project Description

This Project aims at mitigating the flood risk along Pasac mainstream and its tributaries such as Porac-Gumain River and Guagua River through structural measures, which include construction of a diversion channel for Porac-Gumain River, excavation/dredging of the river channels and rising of the road.

The following components are included:

- Construction of Porac-Gumain Diversion (L=18.7km)
- Construction new bridge (5 bridge)
- Excavation & dredging of main rivers (Porac-Gumain, Dalan Bapor, Lower Guagua, and Pasac River) and local drainage channels
- Raising of road height of raising road by 1.1m (L=19km)
- Raising of bridges (12 bridges)
-

Remarks

- *: Estimated and/or proposed by project proponent
- Resettlement of 40 to 80 families required.
- For 2011-2025, 10% of the project cost (470Mil. Pesos) is considered.
-

Source of Information

- M/P and F/S completed in 1996 and 2002
-

Annex-T 9.4.1 (2/7) Project profile for Flood and Sediment Disaster Management Sector

Project Code	FL-G-02	
Project Title	Pinatubo Hazard Urgent Mitigation Plan (PHUMP) Phase III Part II (Monitoring and Planning of Non-structural Measures and Institutional capacity Building)	
Status of Project	On-going	
Objective Area	502 km^2 covering Pasac river basin including San Fernando City and nine municipalities Mexico, Santo Tomas, Bacolor, Guagua, San Sasmuan, Floridablanca, Porac, Santa Rita and Lubao.	
Implementing Agency	DPWH	
Objectives	Flood mitigation by new non-structural measures to address increment of flood damage potential	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2009-2010	Estimated by Study Team for 2011-2025
	50 as of 2009	5 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA and JICA*	
Expected Implementation Schedule	2009-2010*	

Project Description

This Project is a non-structural component of the PHUMP Phase III, and strengthens the flood mitigation effects achieved by the above structural component in the PHUMP Phase III Part I. The Project contains the following items as its principal tasks:

- Watershed management plan for reforestation/agro-forestry, improvement of the upland farming techniques, control for development of the upland farming activities, capacity building and community-based structural measures (hill-side works)
- Flood management plan for development of flood hazard map, FFWS/CBFEWS, CDP and community-based structural measures
- Land use management plan taking the areas vulnerable to flood and soil erosion into account

Remarks

- *: Estimated and/or proposed by project proponent
- For 2011-2025, 10% of the project cost (5Mil. Pesos) is considered.
-

Source of Information

- M/P for PHUMP in 1996
- F/S-Phase II for PHUMP in 2002
- PHUMP Phase III Part I (On-going, 2005-2010)

Annex-T 9.4.1 (3/7) Project profile for Flood and Sediment Disaster Management Sector

Project Code	FL-G-03	
Project Title	Maintenance and Rehabilitation Works for River Dike and Slope	
Status of Project	On-going	
Objective Area	Pampanga river basin	
Implementing Agency	DPWH	
Objectives	River channel maintenance and rehabilitation (dike slope protection, dike rehabilitation, and channel excavation & dredging) of Pampanga Main River Channel, Rio Chico River and Pasac river system as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2008-2014	Estimated by Study Team for 2011-2025
	450 as of 2009	679 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	2008-2014*	

Project Description

Most of the existing river dikes, levees, river slope protection and other river structures in Pampanga river basin in particular were originally constructed more than 40 years ago, and they are seriously damaged at present. Moreover, a large volume of sediment accumulation in the river channel is now in progress due to the lahar deposit in the eastern area of Mt. Pinatubo and logging activities in the upper reached of river basin. In order to cope with such degradation of the river structures as well as river channels, DPWH Region III proposed to rehabilitate the deteriorated dike and river slope protection of 54km. Of the 54km in total, 28.6km is for the Pampanga main river channel and Rio Chico River. The remaining 25.4km is for Pasac river system.

Remarks

- *: Estimated and/or proposed by project proponent
- It is assumed that the project continues till 2025 and the annual project cost for the maintenance and rehabilitation of Pampanga main river channel, Rio Chico River is 200Mil.Pesos/7years (28.6Mil.Pesos/year) and the annual project cost for the maintenance and rehabilitation of Pasac river system is 250Mil.Pesos/15years (16.7Mil.Pesos/year). The estimated annual project cost is 45.3Mil/ Pesos/year.

Source of Information DPWH Region III

Project Code	FL-G-04	
Project Title	Flood Forecasting and Warning System Capacity Building Project upon Dam Release in the Philippines	
Status of Project	On-going	
Objective Area	The catchment areas of the following six (6) dams and their vicinities: - Angat Dam and, Pantabangan Dam in Pampanga river Basin - Ambuklao Dam and San Roque Dam in Agno river basin - Magat Dam and Binga Dam in Cagayan river basin	
Implementing Agency	PAGASA	
Objectives	Capacity building on the flood forecasting and waning for the appropriate dam reservoir operation in Pampanga river basin as well as Agno and Cagayan river basin	
Project Cost (Million Pesos)	Estimated by Project Proponent for 2009-2012	Estimated by Study Team for 2011-2025
	600 as of 2009	300 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA and JICA*	
Expected Implementation Schedule	2009-2012*	

Project Description

The flood forecasting and warning system (FFWS) for Pampanga river basin was initially established in 1973 by PAGASA through financial and technical assistance from Government of Japan. The financial assistance from the Government of Japan was further extended to Pampanga river basin providing with the supplementary facilities and equipment for the effective reservoir operation of Pantabangan and Angat Dams in 1982. A Japan Grant Aid Project was also undertaken, in a period from 2007 to 2009, in collaboration with PAGASA as the counterpart agency to upgrade the FFWSs, which have been constructed through the two projects.

This Project has been just commenced, with duration of 1,200days, immediately after the above upgrading of FFWS in order to achieve the capacity building on the flood forecasting and waning for the appropriate dam reservoir operation in Pampanga river basin as well as Agno and Cagayan river basin.

Remarks

- *: Estimated and/or proposed by project proponent
- For 2011-2025, 50% of the project cost (300Mil. Pesos) is considered.

Source of Information

- JICA

Annex-T 9.4.1 (4/7) Project profile for Flood and Sediment Disaster Management Sector

Project Code	FL-P-01	
Project Title	Flood Control Measures in Mt. Pinatubo Devastated Area- Focus on Pasac Delta	
Status of Project	Proposed	
Objective Area	573km^2 in the drainage area of Abacan River below Mexico Bridge of Gapan-San Fernando-Olongapo Road, and eastern drainage area of the existing "Tail Dike"	
Implementing Agency	DPWH	
Objectives	Flood mitigation by new structural measures to address insufficient structural capacity for flood mitigation	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	4,320 as of 2009	4,320 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA and Export-Import Bank of Korea*	
Expected Implementation Schedule	(N/A)	

Project Description

This Project has been proposed in 2009 on the premises of the financial and technical assistance from Export-Import Bank of Korea (Korea Eximbank) and Korea Water Resources Corporation (K-Water). The principal task of this Project is to increase the channel flow capacity of the existing Pilot Channel from the present 2-year return period to 20-year return period. The task of the Project is further expanded to repair/rehabilitation of seven sluice gates, which were constructed along the right bank of Pampanga mainstream through the under mentioned Pampanga Delta Development Project, Flood Component (PDDP FC) Phase I.

Flood mitigation for Abacan River, San Fernando River and their connecting creeks/drainage channels through the following works:

- Widening of the existing "Pilot Third River Channel" (22.6km in length from the confluence with Abacan River/ San Fernando River up to the confluence with the Pasac River) to 60m in the bottom width from the existing bottom width of 30 to 60m
- Excavation of the Pasac River as an eastern alignment of the Pilot Third River Channel,
- Local drainage improvement connecting the San Fernando River to the Third River and the San Fernando River excavation (total length:29.6km)
- Key road raising to ensure that transportation routes can be maintained during floods

Remarks

- *: Estimated and/or proposed by project proponent

Source of Information

- DPWH

Project Code	FL-P-02	
Project Title	Bacolor Comprehensive Rehabilitation Master Plan	
Status of Project	Proposed (Draft of M/P has been completed in 2009)	
Objective Area	Bacolor Municipality covering an area of 74km^{22}	
Implementing Agency	Bacolor Municipality and DPWH	
Objectives	Flood mitigation by new structural measures to address insufficient structural capacity for flood mitigation	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	1,500 as of 2009	1,500 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	(N/A)	

Project Description

Bacolor Municipality has proposed the draft of the Rehabilitation Master Plan, which aims at rehabilitating and promoting the growth of the municipality's physical and socio-economic environments, which were damaged by eruption of Mt. Pinatubo. The Master Plan includes various flood mitigation projects such as improvement of creeks/drainage, construction of drainage pumps and construction of diversion channel from Pasig Potrero River to West Mega Dike.

The following components are included.

- Construction of Gugu Ring Dike (7.80km in length)
- Completion of the Unfinished Portion of Gugu Dike (1.00km in length)
- Channel excavation of Gugu Creek and other various creeks (20.00km in length)
- Slope protection of various creeks in Bacolor Municipality (11.00km in length)
- Construction of new drainage canals (47.50km in length)
- Installation of Floodwater Pumps in the southern part of Bacolor (2 units)
- Construction of Diversion Channel for Pasig-Potrero River

Remarks

- *: Estimated and/or proposed by project proponent

Source of Information

- Bacolor Comprehensive Rehabilitation Master Plan

Annex-T 9.4.1 (5/7) Project profile for Flood and Sediment Disaster Management Sector

Project Code	FL-C-01	
Project Title	Flood Mitigation for Pampanga Delta	
Status of Project	Conceptual	
Objective Area	255 km^2 in Pampanga Delta including the municipalities of (a) Macabebe, Apalit and San Simon in Pampanga Province and (b) Calumpit and Hagonoy in Bulacan Province	
Implementing Agency	DPWH	
Objectives	Flood mitigation for Pampanga Delta along Pampanga mainstream and Labangan Floodway	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	5,468 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	(N/A)	

Project Description

The PDDP FC had aimed at mitigating the flood damage along the downstream of Pampanga by the river channel improvement, and the PDDP-FC Phase I was completed in 2002. The PDDP FC Phase II was scheduled to follow but has been differed due to a large number of house resettlements required.

The structural measures adapted in the above PDDP-FC Phase II are the river channel implement by construction of river bank and channel dredging/excavation. The major hindrance to such river channel improvement is addressed to the houses densely packed along the river channel, which require a large number of house relocations. In order to cope with such hindrance, adaptation of an appropriate resettlement plan and/or the alternative flood mitigation measures other than the construction of river bank would be required to pursue the PDDP-FC Phase I.

Remarks

- *: Estimated and/or proposed by project proponent
- The estimated project cost assumed the least cost option among the possible alternatives considered in the study.

Required Action to Upgrade to a Proposed Project for Implementation

- F/S level study would be required to re-study and select optimum measures to mitigate the flood condition based upon the result of the Phase I project.

Source of Information

- DPWH: Pampanga Delta Development Project (Flood Control Component), Review Study for Phase II, 2003.
- JICA Study Team

Annex-T 9.4.1 (6/7) Project profile for Flood and Sediment Disaster Management Sector

Project Code	FL-C-02	
Project Title	Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and Neva Ecija	
Status of Project	Conceived (The CBFEWS for Bulacan Province has been established in 2005, and that for Pampanga Province is now being examined.)	
Objective Area	Provinces of Pampanga, Tarlac and Neva Ecija	
Implementing Agency	Provincial Gov. .of Pampanga, Tarlac and Neva Ecija, and PAGASA	
Objectives	Development of flood monitoring and dissemination system to address inadequate information and knowledge relevant to flood mitigation	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	75 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Budget of Provincial Gov. .of Pampanga, Tarlac and Neva Ecija*	
Expected Implementation Schedule	(N/A)	

Project Description

The major tasks of the CBFEWS includes (i) establishment of the simple monitoring and communication system managed by the community for flood warning, (ii) capacity building for the municipal/barangay persons to effectively operate, maintain and manage the flood warning system and (iii) Information Education Campaign (IEC) for the residents on the eligible flood evacuation routes/evacuation centers. These tasks would facilitate the participatory approach of the community to the effective flood warning and evacuation works. Moreover, the tasks would not require the huge cost for the project implementation.

The following components are included.

- Establishment of the System, which consists of network of rainfall and water level monitoring stations and communication equipment for data and information transfer,
- Capacity building dot the municipal and/or barangay personnel for operation and management of the System, and
- Information Education Campaign (IEC) for the residents on the CBFEWS
-

Remarks

- *: Estimated and/or proposed by project proponent

Required Action to Upgrade to a Proposed Project for Implementation

- Basic project components should be determined, referring the similar project in Bulacan

Source of Information

- JICA Study Team

Project Code	FL-C-03	
Project Title	Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs	
Status of Project	Proposed	
Objective Area	Provinces of Bulacan, Pampanga, Tarlac and Neva Ecija	
Implementing Agency	Provincial Gov. .of Bulacan, Pampanga, Tarlac and Neva Ecija	
Objectives	Maintenance and rehabilitation of drainage and flood control facilities, which are under jurisdiction of LGUs	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	3,000 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Budget of LGUs (City/Municipality) and DPWH*	
Expected Implementation Schedule	(N/A)	

Project Description

The city/municipal governments proposed the master plan called “Medium Term Development Plan 2010-2013”, which includes the component for maintenance, rehabilitation and improvement of the existing drainage and flood control facilities under the jurisdictions of city/municipal governments. Implementation period of the said maintenance, rehabilitation and improvement works is limited to a three-year period of 2010-2013. However, the sustainable maintenance, rehabilitation and improvement are deemed to be indispensable. From this point of view, a conceptual plan for the captioned project is worked out assuming that the project shall be implemented as the annual regular program toward 2025.

Remarks

- *: Estimated and/or proposed by project proponent

Source of Information

- JICA Study Team

Annex-T 9.4.1 (7/7) Project profile for Flood and Sediment Disaster Management Sector

Project Code	FL-C-04	
Project Title	Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula	
Status of Project	Conceptual	
Objective Area	Whole Study Area	
Implementing Agency	Department of Education, Region III	
Objectives	Education on the subjects related to IWRM for Pampanga river basin through integration of the salient points of IWRM to the primary and secondary school curricula	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	8 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Budget of Department of Education Region III*	
Expected Implementation Schedule	(N/A)	

Project Description

One of the important issues on IWRM is addressed, in the stakeholder meeting, to improvement of the residents' awareness on the water-related management works. Moreover, improvement of public morals is important to refraining of the unfavorable activities against IWRM such as garbage dumping into the waterways, and encroachment along the river areas. In order to attain such improvement of public awareness and public morals, the captioned project is worked out.

Remarks

- *: Estimated and/or proposed by project proponent

Source of Information

- JICA Study Team

Annex-T 9.5.1 (1/16) Project profile for Watershed Management Sector

Project Code	WS-G-01	
Project Title	Forest Protection and Law Enforcement Program (FPLEP)	
Status of Project	On-going	
Objective Area	About 1,984km^2 of untenured forestlands within PRB, with particular attention to so called "hotspots" in Pantabangan-Carranglan, Penaranda and DRT-Gen. Tinio WFRs, Mt. Arayat National Park and O'Donnell Watershed	
Implementing Agency	DENR 3 - PENRO/CENRO	
Objectives	To protect untenured forestlands from illegal activities such as timber poaching, unauthorized resource extraction, encroachment, land conversion and forest fires as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	39 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	Continuing*	

Project Description

The program is a regular undertaking of the DENR Region III through the respective Provincial/Community ENR Offices. It involves surveillance, apprehension, confiscation and initiation of legal proceedings against perpetrators of timber poaching and other illegal forest extraction activities. It includes prevention and management of forest fires by organized and trained community brigades through Forest Fire Control and Management (FFCM).
The following activities are included.

1) Protection (patrolling and surveillance) of untenured forestlands: 1,984km^2
2) Capacity building/ Strengthening of multi-sectoral forest protection councils (MFPC): 10 councils/year
3) Implementation of fire mgt. plan: 3 CENROs/year
4) Support to anti-illegal logging/timber poaching (IEC, Monitoring, Court litigation): 4 provinces/year
5) Vulnerability assessment and geo-hazard mapping: 4 provinces/year

Remarks

- *: Estimated and/or proposed by project proponent
- No. of forest rangers deployed (as of 2008): 102
- The allocated budget for 2009 was 2.4mil.pesos/year.
- Unit cost assumed
  1) 6.4 pesos/ha/year for Protection (patrolling and surveillance) of untenured forestlands
  2) 70,000pesos/council/year for Capacity building/ Strengthening of multi-sectoral forest protection councils (MFPC)
  3) 7,000pesos/ CENRO/year for Implementation of fire mgt. plan
  4) 50,000pesos/ province/year for Support to anti-illegal logging/timber poaching (IEC, Monitoring, Court litigation)
  5) 50,000pesos/ provinces/year for Vulnerability assessment and geo-hazard mapping
- Required annual budget is calculated at 2.59 mil. pesos/year.

Source of Information

- DENR-FMS III

Annex-T 9.5.1 (2/16) Project profile for Watershed Management Sector

Project Code	WS-G-02	
Project Title	Community Based Forest Management Program (CBFMP)	
Status of Project	On-going	
Objective Area	20.24 km^2 of forestlands in Pampanga (Angeles City, Arayat, Magalang, Porac); Bulacan (DRT); and N. Ecija (Bongabon, Carrangalan. Gabaldon, Gen. Tinio, Laur, Llanera, Lupao, Pantabangan, Rizal, San Jose City), which are under active Community-based Forest Management Agreement (CBFMA) tenure.	
Implementing Agency	DENR- FMS 3 - RCBFMO	
Objectives	Sustainable forest management through granting of 25-year renewable tenurial rights and authority to organized forest occupants to manage, develop, protect and utilize forest resources as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	71 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	1999- Continuing*	

Project Description

The CBFM program is the national forestry program formulated in 1995, and adopted as the nationwide strategy for sustainable forest management pursuant to EO 318 of 2004. The activities include: (i) reforestation (675ha), (ii) agro-forestry (1,349ha), (iii) forest protection (2,024ha), and (iv) livelihood development.
The livelihood development is anchored on agro-forestry, which provides additional income sources from fruit bearing trees along with the production of forestry seedlings, cash crops (such as vegetables, ginger, coffee, pineapple and cassava), livestock, poultry, freshwater fish culture, etc.

Remarks
- *: Estimated and/or proposed by project proponent
- Tenured Area: 18,150 ha (Tenured area will continue to increase over time as the DENR continues to evaluate and approve applications for CBFMA under the program.)
- Actual area planted as of 2009: 1,310 ha in 10 years
- Number of Beneficiaries: 40 POs; 3,020 households
- Unit cost assumed
  1) 13,500 pesos/ha for reforestation
  2) 28,000 pesos/ha for agro-forestry
  3) 2,100 pesos/ha for forest protection
  4) 490,000 pesos/year for livelihood development
- Required annual budget is calculated at 4.71 mil. pesos/year.

Source of Information
- DENR-FMS III- CBFM Office

Annex-T 9.5.1 (3/16) Project profile for Watershed Management Sector

Project Code	WS-G-03	
Project Title	Integrated Agro-forestry Development Program (IAFDP or CBFM-CARP)	
Status of Project	On-going	
Objective Area	779 ha in Bongabon, N. Ecija and Norzagaray, Bulacan	
Implementing Agency	DENR III- FMS (RCBFMO) in partnership with DAR	
Objectives	To adopt sustainable upland agricultural production through agro-forestry using CBFM approach, in areas occupied by agrarian reform communities	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	31 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Dept. of Agrarian Reform (DAR)*	
Expected Implementation Schedule	2007- 2015*	

Project Description

The IAFD program is a special CBFM program for upland agrarian reform beneficiaries under the Comprehensive Agrarian Reform Program (CARP). It is being undertaken by the DENR through a Memorandum of Understanding with the Department of Agrarian Reform (DAR). The DAR provides funding support for agro-forestry and livelihood development while the DENR provides technical assistance to the POs.

The following activities are included.

1) Agro-forestry: 779ha
2) Forest protection: 779ha
3) Relocation survey, mapping & monitoring: 779ha
4) Organizational development and stakeholder capability building, Sustenance of livelihood projects, Technical support

Remarks

- *: Estimated and/or proposed by project proponent
- Tenured Area : 1,297 ha (CBFM-CARP) in N. Ecija and Bulacan
- Actual Area Planted (as of 2008): 520 ha in 2 years
- Number of Beneficiaries: 2 POs; 79 households
- Unit cost assumed
  1) 28,000 pesos/ha for agro-forestry
  2) 1,500 pesos/ha for forest protection
  3) 2,500 pesos/ha for relocation survey, mapping & monitoring
  4) 230,000 pesos/year for other activities
- Required annual budget is calculated at 6.15 mil. pesos/year.

Source of Information:

- DENR-FMS III-CBFM Office

Annex-T 9.5.1 (4/16) Project profile for Watershed Management Sector

Project Code	WS-G-04	
Project Title	Coastal Resource Management Program (CRMP)	
Status of Project	On-going	
Objective Area	774 ha of mangrove areas in Pampanga and Bulacan	
Implementing Agency	DENR - PAWZCMS	
Objectives	To reforest and rehabilitate coastal/mangrove areas as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	37 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	Continuing*	

Project Description

Through this program, the DENR-PAWCZMS-CMMD will continue to reforest logged over mangrove areas and protect old-growth mangrove forests within the coast of Bulacan and Pampanga. This lends support to the initiative of the Operational Plan of the Manila Bay Coastal Strategy which aims to conserve critical marine habitats and biodiversity within Manila Bay while providing alternative livelihood to fisher folks. The program also involves participatory coastal resource assessment, mapping, updating of municipal coastal resource database and formulation and implementation of Coastal Zone and Sea Use Plans.

The following activities are included.

1) Mangrove reestablishment/rehabilitation of swamp areas (nursery establishment, reforestation, silviculture): 539ha
2) Protection and maintenance of remaining old-growth mangrove forests: 235ha
3) Protection and maintenance of newly established mangrove plantations: 539ha
4) Participatory coastal resource assessment & Preparation and implementation of coastal resource mgt. plans, establishment of coastal and marine sanctuaries, monitoring, law enforcement and policy support, including Organizational development: community organization, capacity development, IEC: 6 municipalities
5) Technical support

Remarks

- *: Estimated and/or proposed by project proponent
- Area reforested (as of 2008): 85 ha newly planted in 4 years
- Area protected: 170 ha of old-growth mangrove forests in 4 years
- Unit cost assumed
  1) 33,000 pesos/ha for mangrove reestablishment/rehabilitation
  2) 5,300 pesos/ha for protection and maintenance of remaining old-growth mangrove forests
  3) 1,500 pesos/ha for protection and maintenance of newly established mangrove plantations
  4) 265,000 pesos/year for participatory coastal resource assessment, etc.
  5) 310,000 pesos/year for technical support
- Required annual budget is calculated at 2.45mil. pesos/year.

Source of Information

- DENR-PAWCZMS, 2008/2009.

Annex-T 9.5.1 (5/16) Project profile for Watershed Management Sector

Project Code	WS-G-05	
Project Title	Protected Area Community Based Resource Management Program (PACBRMP)	
Status of Project	On-going	
Objective Area	168 ha of tenured and untenured areas within priority protected areas in N.Ecija, Pampanga and Bulacan, subject to the issuance of PACBRMA	
Implementing Agency	DENR - PAWZCMS	
Objectives	Sustainable forest management which grants occupants of protected areas 25 year s of tenure rights and authority to manage, develop, protect and utilize forest resources within allowable zones of the protected forests by virtue of the issuance of PACBRMA(a regular program)	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	13 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	1999- Continuing*	

Project Description

The program covers the buffer and multiple use zones of priority protected areas and some ancestral domains of indigenous communities. The main strategy is CBFM with timber establishment in 56ha and agro-forestry in 112ha. It is expected to provide alternative sources of income to IPs through agro-forestry.
The following activities are included.

1) Forest plantation development and management (nursery establishment, enrichment planting, ANR, silviculture): 56ha
2) Agro-forestry development (nursery establishment, agro-forestry, crop production: 112ha
3) Protection of old timber stands and newly established plantation: 168ha
4) Relocation survey, mapping & monitoring: 168ha
5) Organizational development, livelihood development, technical support

Remarks

- *: Estimated and/or proposed by project proponent
- Tenured Area: 50 ha, which is part an ancestral domain claim in Mt. Arayat, Pampanga
- One PO with 107 household-members benefited
- Unit cost assumed
  1) 13,500 pesos/ha for Forest plantation
  2) 28,000 pesos/ha for agro-forestry
  3) 1,500 pesos/ha for protection of old timber stands and newly established plantation
  4) 600 pesos/ha for relocation survey, mapping & monitoring
  5) 490,000 pesos/year for other activities
- Required annual budget is calculated at 0.84 mil. pesos/year.

Source of Information

- DENR - PAWZCMS-CMMD III, 2008/2009.

Annex-T 9.5.1 (6/16) Project profile for Watershed Management Sector

Project Code	WS-G-06	
Project Title	Private Forest Plantation Development Program (PFPDP)	
Status of Project	On-going	
Objective Area	1,865ha in Pampanga (Porac); Bulacan (DRT, San Miguel) ; and N.Ecija (Laur, Gabaldon, Gen. Tinio, San Jose, Palyan City, Bongabon) that are covered by various private forest lease agreements with commercial timber plantation companies and private individuals	
Implementing Agency	DENR-FRCD	
Objectives	Sustainable forest management through granting of tenurial rights and authority to organized forest occupants to manage, develop, protect and utilize forest resources as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	93 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	1982- Continuing*	

Project Description

Private forest plantation development is covered by various forms of forest lease contracts and management agreements with private companies or individuals, such as IFMA, SIFMA, AFFLA, PFDA, TFLA and FLGMA. The concessionaires plant commercial species of timber and derive their income from harvested tree stands. The DENR regulates the volume of timber extraction in accordance with the annual allowable cut (ACC) specified in the lease agreement.
The following activities are included.

1) Tree plantation development (nursery establishment, timber plantation establishment, agro-forestry: 1,865ha
2) Maintenance of newly established plantations and protection of natural forests/buffer strips: 1,865ha
3) Relocation survey, mapping & monitoring: 1,865ha
4) Monitoring, regulation and capability building, technical support

Remarks

- *: Estimated and/or proposed by project proponent
- Tenured Area: 15,539ha of production forests covered by various private forms of forest lease agreements
- Actual Area Planted (as of 2008): 2,917 ha in 26years
- Unit cost assumed
  1) 30,000 pesos/ha for tree plantation development
  2) 3,000 pesos/ha for maintenance of newly established plantations and protection of natural forests/buffer strips
  3) 5,000 pesos/ha for relocation survey, mapping & assessment
  4) 1,000,000 pesos/year for other activities
- Required annual budget is calculated at 6.21 mil. pesos/year.

Source of Information

- DENR-FMS III – FRDD

Annex-T 9.5.1 (7/16) Project profile for Watershed Management Sector

Project Code	WS-G-07	
Project Title	NIA-UPRIIS's Watershed Management Program	
Status of Project	On-going	
Objective Area	Protection: 10,356 ha of the Pantabangan-Carranglan Watershed Forest Reserve (WFR) under NIA-UPRIIS management; Reforestation: 1500 ha surrounding Masiway Dam	
Implementing Agency	NIA-UPRIIS	
Objectives	To protect, manage, maintain and/or rehabilitate 10,356 ha of the established forests and agro-forestry plantations in Pantabangan-Carranglan Watershed Forest Reserve (WFR); Specifically, to rehabilitate 100 ha of denuded forests around Masiway Dam as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	180 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA with financial assistance from EDC *	
Expected Implementation Schedule	1997- Continuing*	

Project Description

The NIA-UPRIIS co-manages (with the DENR) and derives earnings from the established agro-forestry areas with organized POs and cooperatives within the 10,356 ha of Pantabangan-Carranglan WFR. Recently, the NIA-UPRIIS started to rehabilitate and reforest an initial 100 ha of Pantabangan-Masiway watersheds jointly with the Energy Development Corporation. EDC operates the Masiway dam for hydroelectric power generation. Reforestation efforts will be sustained until 2025. Under this joint management arrangement, EDC provides funds and technical assistance in the propagation and use of indigenous species to reforest the denuded areas surrounding the dam. The NIA helps create additional income sources by hiring locals in contract reforestation.

The following activities are included.

1) Protection (patrolling, surveillance, monitoring, fire management): 10,356ha
2) Plantation Development (nursery establishment, reforestation, agro-forestry): 1,500ha
3) Maintenance of newly established plantations: 1,500ha
4) Road grading, infra support etc., Maintenance works, Organizational development and stakeholder capability building, Sustenance of livelihood project, Technical support

Remarks

- *: Estimated and/or proposed by project proponent
- Management Area: 10,356 ha of Pantabangan-Carranglan WFR per LOI No. 1002 issued on March 1980 and subsequent joint Memorandu of Agreement with the NPC
- 100 ha of Pantabangan watershed around Masiway dam for rehabilitation under joint management with EDC
- Unit cost assumed
  1) 500 pesos/ha for protection
  2) 28,000 pesos/ha for plantation development
  3) 2,500 pesos/ha for maintenance of newly established plantation
  4) 2,000,000 pesos/year for other activities
- Required annual budget is calculated at 11.98 mil. pesos/year.

Source of Information

- NIA-UPRIIS, 2009

Annex-T 9.5.1 (8/16) Project profile for Watershed Management Sector

Project Code	WS-G-08	
Project Title	NPC's Watershed Management Program	
Status of Project	On-going	
Objective Area	14,166 ha of Pantabangan-Carranglan WFR in N. Ecija and 55,079 ha of Angat WFR in Bulacan; Reforestation and silvi-pasture in 1,950ha of these areas	
Implementing Agency	National Power Corporation	
Objectives	Primarily, to protect the remaining forest cover and related resources of the two watershed forest reserves against illegal activities and encroachment; On a limited scale, to reforest severely denuded areas within the buffer zone of the Angat WFR as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	107 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Universal Consumers' Environmental Charge (UCEC)/Universal Levy Fund (ULF)*	
Expected Implementation Schedule	1995- Continuing*	

Project Description

The NPC is in charge of the management of the watersheds that support the two hydro-electric dams in the basin through the Pantabangan Watershed Action Team (PWAT) and Angat Watershed Action Team (AWAT), respectively. Activities are financed out of the charges collected from power consumers. The NPC's programs are anchored primarily on forest protection involving patrolling, surveillance and apprehension of violations in partnership with organized community volunteers. In Angat WFR, the NPC maintains the strong support of the Armed Forces of the Philippines military contingent. To strengthen protection, the immediate thrusts include resettlement and livelihood development for forest occupants, which consist of rattan production, inland fishery and honey bee culture.

In the Pantabangan-Carranglan area of responsibility, the NPC is an active member of the Inter-Agency Task Force together with the NIA, the DENR, the LGU and the Protected Area Management Board (PAMB), which is now formulating a comprehensive Forest Land Use Plan (FLUP) with the technical assistance of EcoGov, an environmental NGO. The major hurdles for PWAT include the management of forest fires, which are rampant in the Pantabangan-Carranglan area, and protection against illegal activities such as timber poaching, charcoal making and "kaingin" farming. PWAT partners with universities and colleges to implement livelihood programs for forest occupants, such as handicraft making, mushroom growing, honey bee culture and charcoal briquette production.

The following activities are included.

1) Forest protection (patrolling, surveillance, monitoring, apprehension): 69,245ha
2) Reforestation and maintenance of newly established forest: 450ha
3) Silviculture (Assisted Natural Regeneration) and Erosion Control: 1,500ha
4) Maintenance of newly established forests: 1,950ha
5) Resettlement and socio-economic survey: 1,200HH
6) Livelihood development, Stakeholder capability building, IEC and Public Awareness, Monitoring, Research and Development (Biodiversity/Philippine Eagle conservation Project)

Remarks

- *: Estimated and/or proposed by project proponent
- Management Area: 10, 14,166 ha of Pantabangan-Carranglan WFR in N. Ecija per MOA with NIA and 55,079 ha of Angat WFR in Bulacan per EO 258 of July 1995
- Actual Area Planted (as of 2008): 90 ha of Pantabangan-Carranglan WFR by PWAT and 130 ha of Angat WFR by AWAT
- Unit cost assumed
  1) 60 pesos/ha for forest protection
  2) 48,000 pesos/ha for reforestation and maintenance of newly established forest
  3) 13,000 pesos/ha for silviculture
  4) 1,250 pesos/ha for maintenance of newly established forests
  5) 13,000 pesos/HH for resettlement and socio-economic survey
  6) 2,635,000 pesos/year for other activities
- Required annual budget is calculated at 7.14 mil. pesos/year.
-

Source of Information

- NPC - PWAT and AWAT, 2009.

Annex-T 9.5.1 (9/16) Project profile for Watershed Management Sector

Project Code	WS-G-09	
Project Title	Integrated Social Forestry (ISF) Projects	
Status of Project	On-going	
Objective Area	1,143ha of the ISF_tenured areas, with initial targets identified in (a) Nueva Ecija: 50 ha of Talavera WS, 50 ha of Aulo-Cabo WS for protection, 200 ha of Carranglan WS for reforestation; (b) Tarlac: 500 ha of O'Donnell WS for reforestation	
Implementing Agency	DENR-CENRO and Local Government Units	
Objectives	Sustainable forest management through granting of 25-year certificates of stewardship contracts (CSC) to individual households forest occupants to sustainably manage, develop, protect and utilize forest resources as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	51 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Internal revenue allotment (IRA) of LGUs and Countrywide Development Funds (CDF) of congressional district*	
Expected Implementation Schedule	1999- Continuing*	

Project Description

The implementation of ISF projects has been devolved to LGUs by virtue of RA 9160 or the Local Government Code of 1991. Through the program, the province of N. Ecjia plans to rehabilitate 200 ha of ISF areas within Carranglan watershed. Tarlac plans to rehabilitate 500 ha of ISF areas in O'Donnell watershed, which is expected to be funded out of the country-wide development fund.
The following activities are included.

1) Forest plantation development and management (nursery establishment, enrichment planting, ANR, silviculture): 381ha
2) Agro-forestry Development (nursery establishment, agro-forestry, crop production): 762ha
3) Protection of old plantations and maintenance of newly established plantations: 1,143ha
4) Relocation survey, mapping & monitoring: 1,143ha
5) Organizational development and stakeholder capability building, Sustenance of livelihood project, Technical support

Remarks

- *: Estimated and/or proposed by project proponent
- Tenured Area: 12,942 ha
- Actual Area Planted (as of 2008): 100 ha in Talavera and Aulo-Cabo Watersheds
- Number of Beneficiaries: 5,590 households
- Unit cost assumed
  1) 13,500 pesos/ha for forest plantation development and management
  2) 28,000 pesos/ha for agro-forestry development
  3) 1,500 pesos/ha for protection of old plantations and maintenance of newly established plantations
  4) 600 pesos/ha for relocation survey, mapping & monitoring
  5) 1,020,000 pesos/year for other activities
- Required annual budget is calculated at 3.40 mil. pesos/year.

Source of Information

- DENR-FMS III-CBFM Office, 2009.

Annex-T 9.5.1 (10/16) Project profile for Watershed Management Sector

Project Code	WS-G-10	
Project Title	Private Sector WM initiatives	
Status of Project	On-going	
Objective Area	Reforestation of 735 ha of denuded protection forests within Pampanga and Bulacan	
Implementing Agency	Private sector	
Objectives	To rehabilitate "adopted" watersheds forest areas through reforestation and protection in partnership with the DENR as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	32 as of 2009
EIRR	(N/A)	
Expected Source of Fund	Private sector*	
Expected Implementation Schedule	1999- Continuing*	

Project Description

The private sector is a potent partner and would be fully harnessed in DENR's "Adopt-a-Watershed Program". Efforts will extend beyond the usual tree planting activities in watersheds supporting domestic water supply sources. The Clark Development Corporation (CDC) and Subic-Clark Alliance for Development (SCAD) have plans to undertake comprehensive watershed management programs in line with the future domestic water supply projects for Clark SEZ. .
Other private companies led by big cement factories like Holcim are active partners in the "Adopt-a-Mountain Program" in Angat-Maasim watersheds. Meanwhile, the DENR-Manila Water Corp.-Maynilad Water Services partnership is now being explored to improve forest cover in the Angat watershed areas in order to sustain the domestic water supply of Metro Manila.
The following activities are included.

1) Forest plantation development (reforestation, nursery establishment and river bank vegetation): 735ha
2) Maintenance of newly established plantations: 735ha
3) Relocation survey, mapping & monitoring: 735ha
4) Organizational development and stakeholder capability building

Remarks

- *: Estimated and/or proposed by project proponent
- The project costs are borne by the private agencies through volunteer work and as part of their social responsibility agenda.
- Unit cost assumed
- 25,000 pesos/ha for forest plantation development
- 1,500 pesos/ha for Maintenance of newly established plantations
- 600 pesos/ha for relocation survey, mapping & monitoring
- 500,000 pesos/year for other activities
- Required annual budget is calculated at 2.12 mil. pesos/year.

Source of Information

- DENR-FMS III, LGUs, 2009.

Annex-T 9.5.1 (11/16) Project profile for Watershed Management Sector

Project Code	WS-G-11	
Project Title	Forest Mgt. Program (FMP)	
Status of Project	On-going	
Objective Area	44,600ha Pantabangan-Carranglan and Talavera Watersheds, with 14,133 ha earmarked for reforestation and agroforestry.	
Implementing Agency	DENR-FASPO	
Objectives	To strengthen forest management in partnership with the LGUs and the communities and to improve the economic conditions of upland dwellers through sustainable resource utilization.	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	5,870.64 as of 2009	996 as of 2009
EIRR	20.9%*	
Expected Source of Fund	JICA Loan*	
Expected Implementation Schedule	2011-2020*	

Project Description

FMP is a 10-year JICA-assisted project in the pipeline and targeted for implementation in 2011. It covers three critical river basins in the country, namely, Upper Magat-Cagayan River Basin in Region II, Jalaur River Basin in Iloilo and Upper Pamapanga River Basin. The latter includes 44,600 ha, all of which are inside the study area.

The project components include: (i) physical survey and mapping and socio-economic baseline profiling; (ii) PO formation and CBFMA acquisition; (iii) PO capacity building; (iv) forest tree plantation, silvi-pasture and agro-forestry with bio-fuel and soil conservation measures; (v) infrastructure support such as farm-to-market roads, bridges, and pipeline irrigation system for agro-forestry; (vi) policy initiative (including establishment of cost sharing mechanism and payment for environmental services); and (vii) monitoring and evaluation.

The total area covered by forest plantation development in Upper Pampamga river basin is 14,133ha. It is assumed that 30% of the area is covered by reforestation and the rest is covered by agro-forestry.

Remarks
- *: Estimated and/or proposed by project proponent
- As of August 2010, the project has been approved by the NEDA-ICC's Technical Board.
- The estimated project cost by project proponent is for entire project.
- The estimated cost by Study Team is only for Upper Pampanga river basin.

Source of Information
- DENR-FASPO, 2009.

Annex-T 9.5.1 (12/16) Project profile for Watershed Management Sector

Project Code	WS-G-12	
Project Title	Pampanga River Basin Rehabilitation Program (PRBRP)	
Status of Project	On-going	
Objective Area	Protection and maintenance of 500ha out of the newly established areas (2,000 ha) in Pampanga, Bulacan, N. Ecija and Tarlac	
Implementing Agency	DENR-FMS 3 - FRCD	
Objectives	Protection and maintenance of remaining newly established reforestation stands as part of the uncompleted works under the PRRB	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	12 as of 2009	12 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	1999- Continuing*	

Project Description

The PRBRP is a special project undertaken by the DENR-FMS 3 from 2004 to 2008 in response to the spate of flood events in the basin. It was temporarily shelved in 2009 due to budget constraints. The accomplishments involved reforestation of 4,900 and maintenance and protection of 2,900ha of newly established plantations within the forestlands in Pampanga, N. Ecija, Bulacan and Tarlac. The PRBP utilized the CBFM beneficiaries who were contracted to undertake the reforestation or planting activities while DENR provides technical and financial assistance.
For the year 2010-2012, the project will be resumed in order to carry out remaining maintenance and protection activities involving a backlog of 500 ha out of 2,000 ha of newly established tree plantations.

Remarks
- *: Estimated and/or proposed by project proponent
- Undertaken through contract reforestation scheme

Source of Information
- DENR-FMS III- FRCD, 2009.

Annex-T 9.5.1 (13/16) Project profile for Watershed Management Sector

Project Code	WS-C-01	
Project Title	Upland Development Program (UDP)	
Status of Project	Conceptual	
Objective Area	10,505 ha of severely eroded areas and areas of watersheds supporting O'Donnell and Porac-Gumain national irrigation systems (NIS) that are not yet covered by any on-going or proposed watershed rehabilitation program	
Implementing Agency	DA-Bureau of Soils and Water Management/NIA/DENR/LGUs	
Objectives	Sustainable upland agricultural production geared at rehabilitating forest cover, arresting soil erosion and improving water conservation through agro-forestry with the introduction of appropriate diversified farming systems and sloping agricultural land technology.	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	980 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

The original model of the Upland Development Program was implemented by the Department of Agriculture (DA) in Mindanao. It aimed to address upland poverty by replacing the widespread practice of slash and burn ("kaingin") system with sustainable alternative farm management systems. The concept of this model UDP is sustainable upland agricultural production using appropriate soil and water conservation strategies such as Sloping Agricultural Technology (SALT) and its variants in integrated or diversified farming systems anchored on agro-forestry. It gained wide acceptance and proved successful among upland farmers in Mindanao.
The UDP is conceived as one of the better options for heavily eroded areas with critical (30% or more) slopes and watershed areas supporting other NIS where any form of management is lacking and where severe soil erosion is a cause for concern.

In the basin, the potential severe erosion areas comprise some 22,114 ha while watershed areas supporting other NIS (O'Donnell and Porac-Gumain WS) which are not under any management scheme comprise some 60,826 ha. Only 20% of the former and 10% of the latter, which is 10,505ha in total, are targeted for this project until 2025.

Remarks
- 93,230pesos/ha is assumed for the cost estimation, referring the project cost of UDP in Southern Mindanao (€18.3million covering 16,000 ha)

Required Action to Upgrade to a Proposed Project for Implementation
- F/S level study would be required.

Source of Information
- DA-UDP. 2004

Annex-T 9.5.1 (14/16) Project profile for Watershed Management Sector

Project Code	WS-C-02	
Project Title	Protected Area Mgt. Program (PAMP)	
Status of Project	Conceptual	
Objective Area	56,147 ha, which comprise the most critical of the initial components of the NIPAS (protected areas) in terms of conservation of biodiversity, unique ecosystem and cultural heritage, namely: (i) Biak Na Bato NP, (ii) Minalungao NP; (iii) LT: DRT-Gen. Tinio WS; (iv) Mt. Arayat NP, and (v) Talavera Watershed Reserve.	
Implementing Agency	DENR-PAWCZMS	
Objectives	To formally declare and manage these areas as NIPAS sites through congressional and executive legislation and establishment of appropriate management mechanisms	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	404 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

The activities will include:

- watershed characterization (basic resource inventory, assessment and mapping; socio-economic surveys);
- designation and ground delineation of management zones;
- policy and institutional support initiation though organization of PAMBs and establishment of IPAF;
- formulation of Protected Area Management Plans and harmonization with ancestral domain plans, forest land use plans and comprehensive land use plans to address conflicting land use issues
- mechanisms to streamline compliance with FPIC requirements in ancestral domain areas
- initial implementation of priority action plans:
  - community-based reforestation through assisted natural regeneration in 5,615ha of degraded forests
  - biodiversity and wildlife conservation
  - alternative livelihood for forest occupant
  - IEC campaigns

Remarks

- It is assumed that 33,000peso/ha is required for community-based reforestation.
- It is estimated that 124mil.pesos is required for other activities.
- It is assumed that 30% of the project cost is required for project management and TA.

Required Action to Upgrade to a Proposed Project for Implementation

- Basic project components as well as TOR for T.A. should be determined.

Source of Information

- DENR-PAWCZMD, 2009.

Annex-T 9.5.1 (15/16) Project profile for Watershed Management Sector

Project Code	WS-C-03	
Project Title	Urban Greening Program	
Status of Project	Conceptual	
Objective Area	Greening of 7,256ha of urban corridors, including 222 km of highways, river banks, community parks, school grounds, public plazas and subdivisions in urban areas	
Implementing Agency	DENR/LGU/Private Sector	
Objectives	To establish urban tree/forest corridors in strategic locations in each LGU	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	264 as of 2009
EIRR	(N/A)	
Expected Source of Fund	IRA*	
Expected Implementation Schedule	(N/A)	

Project Description

Reforestation focusing on strategic urban spaces using appropriate timber and non-timber species to enhance the urban greening initiatives and provide balance to uncontrolled urban sprawl.
It is expected that 7,256ha in total of urban corridors would be covered by forest..

The LGUs' active involvement in watershed management through organized tree planting activities in partnership with the academe, business groups and NGOs will be enhanced. LGUs have the advantage of strong local influence and could therefore mobilize a critical mass of volunteers and resources from both private and public agencies to launch a full-scale greening program in their localities. Moreover, owing to LGU's strong presence in the lowlands rather than the uplands LGUs could be more effective partners in the watershed management by focusing their efforts in urban greening.

Remarks
- *: Estimated and/or proposed by project proponent
- It is assumed that 30,000pesos/ha is required for tree-planting and maintenance.
- 100,000pesos/year is required for organization, monitoring and technical support.

Required Action to Upgrade to a Proposed Project for Implementation
- Basic project components should be determined.

Source of Information
- LGUs, 2009.

Annex-T 9.5.1 (16/16) Project profile for Watershed Management Sector

Project Code	WS-C-04	
Project Title	Community-based Eco-Tourism Program	
Status of Project	Conceptual	
Objective Area	10,984ha within Candaba Sawamp, Pantabangan-Carranglan WFR, and Biak-na-Bato National Park (These areas contain critical habitats and biodiversity that presents a high potential for eco-tourism development.)	
Implementing Agency	Department of Tourism, Local Government Units and private sector	
Objectives	To generate additional income for communities through eco-tourism while contributing resources and sustaining public support for the protection and conservation of critical habitats and natural ecosystems	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	264 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

Candaba Swamp, Pantabangan-Carranglan WFR and Biak-na-Bato National Park are among the emerging and key potential ecotourism sites identified by the National Ecotourism Steering Committee. As such these areas are already enjoying tourist patronage on a limited scale, but there is room for improving the facilities and services to improve tourist traffic. Eco-tourism thrives on the principle of regulated public access during particular seasons of the year, when for example, migratory birds and other important species could be the focus of tourist attraction to support conservation. Eco-tourism will sustain public interest and support to conservation and protection efforts.
There is a huge potential for providing additional income to organized communities through low-impact guided tours, hostel and restaurant management, trekking and camping services, health and wellness services, sale of souvenir items and the like. At the same time, funds generated in part could be used to finance reforestation activities.

About 1,098ha will be reforested in phases out of funds generated.

Remarks
- It is assumed that 30,000pesos/ha is required for initial reforestation.
- It is estimated that 167mil. pesos is required for other activities.
- It is assumed that 30% of the project cost is required for project management.

Required Action to Upgrade to a Proposed Project for Implementation
- F/S level study would be required.

Source of Information
- DOT, NEDA Region III, 2009.

Annex-T 9.6.1 (1/6) Project profile for Water-related Environment Management Sector

Project Code	WQ-G-01	
Project Title	Ecological Solid Waste Management Program (ESWMP)	
Status of Project	On-going	
Objective Area	All LGUs in the basin	
Implementing Agency	Local Government Units	
Objectives	To prevent potential contamination of ground, surface and coastal waters due to improperly disposed domestic solid wastes as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	192 as of 2009
EIRR	(N/A)	
Expected Source of Fund	LGU equity (from 20% Development Fund)*	
Expected Implementation Schedule	Continuing*	

Project Description

The present activities under the LGUs' 10-year Ecological Solid Waste Management Plans will be sustained until 2025 at the very least or improved at best. These activities consist primarily of soft measures, such as segregation at source; waste reduction, recycling and reuse; upgrading of open dumpsites into controlled dumpsites; composting; operation and maintenance of materials recovery facilities (MRFs).

Besides the LGUs in the province of Tarlac, only seven other LGUs of Pampanga and Bulacan are disposing of their residual wastes in the Sanitary Landfill (SLF) in Capas, Tarlac. The two (2) smaller SLFs in SJDM City and Norzagaray are inadequately designed and are therefore operating more as controlled dumpsites until upgraded.

Remarks:

- *: Estimated and/or proposed by project proponent
- The 100-ha sanitary landfill in Sitio Kalangitan in Capas, Tarlac has been operating since 2004 but remains under-utilized. The LGUs plan to establish a common waste transfer station for a cluster of LGUs in order to overcome financial constraints and thereby optimize access to this facility.
- The project cost is estimated based on budget of Pampanga Province as of 2008.

Source of Information

- DENR-EMB III; LGUs, 2008-2009.

Project Code	WQ-G-02	
Project Title	Industrial Pollution Control Program (IPCP)	
Status of Project	On-going	
Objective Area	All industries in the basin that are covered by the Phil. EIS system	
Implementing Agency	DENR-EMB III	
Objectives	To control industrial pollution through compliance with regulatory requirements of the Clean Water Act and the Phil. EIS system and by promoting industrial self-regulation as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	153 as of 2009
EIRR	(N/A)	
Expected Source of Fund	GAA*	
Expected Implementation Schedule	Continuing*	

Project Description

Through the program, the DENR-EMB regulates industrial pollution by way of issuing and monitoring adherence to Environmental Compliance Certificates (ECC), Discharge Permits and Self Monitoring Reports (SMRs) as well as pollution adjudication for non-compliant industries.

The agency promotes environmental self-regulation by industries under its twin programs, namely the Revised Industrial Eco-watch System (RIES) and the Philippine Environmental Partnership Program (PEPP). The former rates industries in color codes-- i.e., Gold, Silver, Green or Blue to indicate compliance and Red or Black to indicate non-compliance with the Clean Water Act. The latter provides incentives and rewards for adopting pollution prevention and cleaner production processes.

Remarks

- *: Estimated and/or proposed by project proponent
- The project cost is estimated based on the budget for EMB Region III in 2009.

Source of Information

- DENR-EMB III, 2009.

Annex-T 9.6.1 (2/6) Project profile for Water-related Environment Management Sector

Project Code	WQ-G-03	
Project Title	Sagip-Ilog Project	
Status of Project	On-going	
Objective Area	San Fernando River, Angat River, Candaba Swamp	
Implementing Agency	Local Government Units	
Objectives	To clean up waterways of solid wastes, pollutive substances, sediments and illegal structures as a regular program	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	11 as of 2009
EIRR	(N/A)	
Expected Source of Fund	IRA of LGUs*	
Expected Implementation Schedule	Continuing*	

Project Description

The “Sagip-Ilog” Program is a river clean-up drive undertaken by the LGUs in coordination with the DENR. On a smaller scale, the “Linis Estero” Program involves clean-up of creeks and small waterways.

The Sagip San Fernando River is one of the flagship environmental projects of the City government of San Fernando. Presently the project involves only clean up activities. Future plans include dredging/desilting, slope protection works, bank re-vegetation and river park development.

The Sagip-Ilog Angat initiative of the municipality of San Rafael, Bulacan involves inventory of industrial polluters and clean up activities in partnership with industries and the private sector. The LGU of Candaba for its part initiated de-silting, clean up activities and advocacy campaigns against waste dumping in Candaba Swamp.

Remarks
- *: Estimated and/or proposed by project proponent
- The project cost is estimated based on budget of Pampanga Province in 2008

Source of Information
- LGUs, 2008-2009.

Annex-T 9.6.1 (3/6) Project profile for Water-related Environment Management Sector

Project Code	WQ-P-01	
Project Title	Clean Development Mechanism (CDM) Projects	
Status of Project	Proposed	
Objective Area	Cluster of six (6) commercial hog farms owned by Star Superior Farms in Bulacan; Metro Clark Waste Management Corp.'s Sanitary Landfill facility in Sitio Kalangitan, Capas, Tarlac, (3) Bulacan Engineered Sanitary Landfill in Bgy. Sto. Crrito, San Jose Del Monte City, Bulacan.	
Implementing Agency	Private Industries	
Objectives	To capture/recovery of carbon and other greenhouse gas emissions in order to generate electricity from wastewater/organic wastes collected from hog farms and from domestic, commercial and industrial sources, respectively. The companies will eventually earn by feeding the electricity generated to the Luzon-Visayas power grid and at the same time trading their carbon credits. The proceeds can be used to refinance their operations. The companies will earn additional revenues by feeding the electricity generated to the Luzon-Visayas power grid and at the same time trading their carbon emission credits. The proceeds can be used to refinance their operations.	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	1,036 as of 2009	1,036 as of 2009
EIRR	For Metro Clark SLF, 4.93%*	
Expected Source of Fund	Private sector: For livestock farms, through BOT scheme. For SLFs, the project implementers will avail of loans through the financing windows of the World Bank/Land Bank of the Philippines Carbon Finance Support Facility *	
Expected Implementation Schedule	2011-2020*	

Project Description

The two projects identified above consist of wastewater and waste collection, treatment and gas-capture facilities capable of sequestering methane (along with other greenhouse gases) to produce electricity in commercial quantities. The three projects have passed DENR's host country approval and are presently being registered with the CDM Executive Board in Bonn, Germany as waste-to-energy (methane sequestration and CO_2 recovery) projects. The Clark SLF facility can generate as much as 6.5 MW of electricity, while the Bulacan SLF can generate as much as 5.0 MW of electricity.

Remarks

- *: Estimated and/or proposed by project proponent
- The CDM was established under the Kyoto Protocol to the United Nations Framework Convention on Climate Change. It is designed to assist developed countries to comply with their quantified greenhouse gas (GHG) emission limitation targets and at the same time help meet developing countries' sustainable development objectives through carbon trading.
- The estimated cost does not include the cost for power generation.
- The estimated annual O&M cost is 63Mil.Peoss/year.

Source of Information

- DENR-EMB. Philippine Bio-Sciences Co., Inc., MCWMC. 2009.

Project Code	WQ-C-01	
Project Title	Capacity Development to Upgrade WQ Monitoring and Data Management Program	
Status of Project	Conceptual	
Objective Area	Nine priority water bodies in PRB: Pampanga R., San Fernando/Abacan R., Angat R./Labangan FW, Quitangil R., Sapang Balen Cr., Pasac R., Candaba Swamp, Mouth of Manila Bay	
Implementing Agency	DENR-EMB III	
Objectives	To build capacity for upgrading of the WQ and effluent monitoring, regulation and data management	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	140 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

This DENR-EMB III will improve the collection and management of data on water quality by way of:

- Rationalizing the system of water quality/effluent monitoring and compliance
- Thorough inventory and estimation of all pollution sources
- Upgrading its staff and laboratory capability
- Capacity building for WQMA Governing Board, private industries and other stakeholders
- Strengthening regulatory and coordination mechanisms among the DENR-EMB, the LGUs, relevant agencies and clientele
- Environmental awareness as part of school curriculum; public IEC utilizing multi-media

Remarks

- The project cost is estimated based on DENR-EBM III regional budget for environmental management, pollution control, research & laboratory as of 2009.

Required Action to Upgrade to a Proposed Project for Implementation

- Basic project components should be determined.

Source of Information

- DENR-EMB III, 2009.

Project Code	WQ-C-02	
Project Title	Capacity Development to Improve Water Quality and Aquaculture Fisheries Management	
Status of Project	Conceptual	
Objective Area	Fishpond areas in Bulacan and Pampanga	
Implementing Agency	Bureau of Fisheries and Aquatic Resources	
Objectives	To protect the waters in and surrounding the fishpond areas from eutrophication	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	48 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

The project will complement the fisheries projects of the DA-BFAR Region III and the F.I.S.H. program of the provinces of Pampanga and Bulacan. The program will include assessment and carrying capacity studies, R&D, advocacy, legislative support, capability building and information management program, which aims to:

- enhance awareness and capability to adopt cleaner aquaculture production technologies
- improve regulatory mechanisms through the issuance of supporting local ordinances pursuant to the Fisheries Code
- develop and pilot new or emerging low water use-low water quality impact technologies and best management practices, such as the use of “pro-biotics” for sustainable fisheries production and disease control, including possible remediation measures for eutrophication, algal bloom and related fish kills and disease infestation
- develop appropriate indicators and institute water and fisheries resources monitoring and evaluation systems

Remarks

Required Action to Upgrade to a Proposed Project for Implementation

- Basic project components should be determined.

Source of Information

- DA-BFAR III.

Annex-T 9.6.1 (5/6) Project profile for Water-related Environment Management Sector

Project Code	WQ-C-03	
Project Title	Capacity Development Project to Improve Industry Adoption of Cleaner Production Options	
Status of Project	Conceptual	
Objective Area	Priority non-compliant SMEs in the basin, by industry type	
Implementing Agency	DTI/DENR/Private industries	
Objectives	To build capacity to adopt new and emerging cleaner production management options and eco-efficient technologies especially among small and medium-scale enterprises.	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	60 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

Participatory assessment, opportunity matching, preparation of industry-specific Action Plans and adoption on pilot scale of the most eco-efficient and appropriate green industry options through:

- Inventory of non-compliant industries and organization of CP team
- Evaluation of participating industries' production and environmental management systems
- Needs assessment and priority setting (e.g., vis-à-vis process flow/input-output analysis)
- Institutional, policy, market-based financial support mechanisms
- Preparation of industry-specific Clean Production Manuals
- Training and technology transfer
- IEC and other promotional activities

Remarks

- Cleaner production technologies and management practices already abound in the basin. Examples include waste-to-energy projects such as bio-gas digesters, "bagasse" as fuels for heating steam turbines, effluent re-use and recycling into cooling waters, distillery effluents into liquid fertilizer, industrial waste material and by-products as alternative fuel or alternative raw material for cement processing. The adoptability of these and other emerging green industry opportunities to non-compliant industries in the basin, particularly SMEs, will be explored.

Required Action to Upgrade to a Proposed Project for Implementation

- TOR for the T.A. should be determined.

Source of Information

- DENR-EMB III. ADB: Clean Energy Applications in Asia and the Pacific, 2006. ADB TA to the Republic of the Philippines for the Promotion of Cleaner Production, 2002.

Annex-T 9.6.1 (6/6) Project profile for Water-related Environment Management Sector

Project Code	WQ-C-04	
Project Title	Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan and Pampanga	
Status of Project	Conceptual	
Objective Area	(1) Nueva Ecija: Gen. Tinio, Palayan City, San Jose City, Munoz City, Sta. Rosa; (2) Bulacan: Baliuag, Calumpit, Hagonoy, Mololos City; (3 Pampanga:) Angeles City, Guagua, Mabalacat, San Fernando City	
Implementing Agency	Local Government Units	
Objectives	To prevent potential contamination of ground, surface and coastal waters due to improperly disposed domestic solid wastes. The cluster transfer station is deemed as a less costly alternative to construction of SLF in each LGU.	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	2,025 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

Construction of five (5) suitably engineered Sanitary Landfills in N. Ecija and four (4) Transfer Station-cum-Materials Recovery Facilities (MRFs) for a cluster of LGUs in Bulacan and Pampanga. The Transfer Stations will have adequate support facilities for sorting, compaction composting, segregation of recyclables and handling of residuals prior to final disposal. Two complete engineered facilities are now presently operating in the basin and could serve as final disposal areas of residual wastes from the proposed Transfer Stations. One is the 100-ha Sanitary Landfill in Sitio Kalangitan, Capas, Tarlac, which started operating in 2006. The other is the newly constructed (2009) 52-ha Bulacan Engineered Sanitary Landfill in San Jose Del Monte City.

The proposed facilities and coverage population are as follows.

1) Construction of five (5) suitably engineered Sanitary Landfills in N. Ecija
   -Provincial sanitary landfill at Gen.Tinio
   -Sanitary landfill: Munoz City, San Jose City, Palayan City and St.Rosa
   -MRFs etc.: 12 municipalities
   -Coverage population: 485,802
2) Construction of four (4) Cluster Transfer Station-cum-Materials Recovery Facilities (MRFs) for a cluster of LGUs in Bulacan and Pampanga
   -Construction of one (1) cluster transfer stations each for: (a) Baliuag and Calumpit, (b) Hagonoy and Malolos City, (c) Angeles City and Guagua, (d) Mabalacat and San Fernando City
   -Coverage population: 2,020,740

Remarks:

- Improved and more efficient segregation, reduction, reuse and recycling at source is prerequisite for these facilities to function and provide benefits at optimum level. Capability of LGUs to implement these at the local level needs to be enhanced. Construction of additional satellite MRFs in the barangay and municipal levels may become necessary over time.

- The LGUs are now assisted by the DENR-EMB in implementing their Ecological Solid Waste Management Plans in compliance with RA 9003. At present, the LGUs are in various stages of implementing these plans but resources are extremely inadequate to enable the complete closure of open dumps and construction of Sanitary Landfills.

- The project cost for SLF in N. Ecija is based on the Province's MTD as of 2009. The annual O&M cost for the SLF in N. Ecija is assumed to be 10.9% of the initial investment cost, referring to similar project, which resulted in estimated per capita cost of 45pesos/person/year.

- The annual O&M cost for the cluster waste transfer stations and final disposal is estimated at 161pesos/person/year.

Required Action to Upgrade to a Proposed Project for Implementation

- F/S level study would be required.

Source of Information

- DENR-EMB III; LGUs, 2009. JICA Master Plan on Solid Waste Management for Boracay Island and Malay Municipality, 2008.

Annex-T 9.7.1 (1/4) Project profile for Inter-Sector for Water Resources Management Sector

Project Code	IS-C-01	
Project Title	Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin	
Status of Project	Conceptual	
Objective Area	Entire Pampanga river basin	
Implementing Agency	NWRB / Others	
Objectives	Establishment of groundwater monitoring system to address sustainable water source for municipal water supply	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	297 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- It is recommended that periodical intensive groundwater monitoring for the municipalities and cities whose groundwater usage is at risk. There is also inferred land subsidence in the lower reach of the study area based on some previous studies, which should be verified in detail. Considering these, the conceptual projects for Establishment of Comprehensive Groundwater Resources Monitoring in Pampanga River Basin is proposed in the present study.
- The projects should include the following activities.
  1) Establishment of monitoring wells and observation
     - Proper locations and density of monitoring wells to capture the lowering of groundwater level and salt-water intrusion in a basin scale, especially for lower reach of Pampanga river basin, should be selected.
     - Monitoring wells for sole use should be installed (1 monitoring well/30km^2 in average).
     - Monitoring network for land subsidence in lower reach of the study area should be installed, utilizing the installed monitoring wells.
     - Database and their management system should be established.
     - Water level and water quality in the monitoring wells should be periodically monitored by WDs, LGUs etc.
     - The monitoring results should be stored in one database and shared by stakeholders.
  2) Groundwater resource management
     - Groundwater resource management by NWRB and/or river basin organization based on the periodically monitored data, which may include the policy establishment for groundwater regulation and so on, should be implemented.
- It is proposed that the installation of monitoring wells would be gradually expanded during 15years. The lower Pampanga area should be firstly covered by the monitoring wells.

Remarks

- The monitoring wells would be installed in strategic location based on geology within the river basin (totally about 5,400km^2 mainly in plain are), which requires about 180 monitoring wells.
- It is assumed that the cost for developing a monitoring well is 1.5 mil pesos/well, which results in 270 mil pesos for installing the monitoring wells. It is further assumed that 10% of the cost for installation of monitoring wells is required for establishing the data management system as well as monitoring network for land subsidence.
- The estimated initial investment cost is 297 mil. pesos.

- Annual maintenance cost for the installed monitoring wells and data management system is assumed to be 0.5% of the initial investment cost.
- The cost for observation by observer is assumed to be 12,000pesos/well/year, which requires 2.2mil. pesos/year for operation of the monitoring.
- The estimated annual O&M cost is 3.7 mil. pesos/year.

Required Action to Upgrade to a Proposed Project for Implementation

- Basic project components should be studied.

Source of Information

Annex-T 9.7.1 (2/4) Project profile for Inter-Sector for Water Resources Management Sector

Project Code	IS-C-02	
Project Title	Project for Recovery of Reliability of Water Supply in Angat-Umiray System	
Status of Project	Conceptual	
Objective Area	Bulacan Province and Metro Manila	
Implementing Agency	NWRB / NIA/ MWSS/ NPC / Bulacan Government	
Objectives	Recovery of reliability of water supply in Angat-Umiray system	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	7,966 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- It is evaluated that the present reliability of water supply in Angat-Umiray system is not enough for both Municipal water supply for MWSS and irrigation water supply for AMRIS. To address this problem, the conceptual project for Recovery of Reliability of Water Supply in Angat-Umiray System is proposed. The project would include both new water resources development and reduction of water demand.
- The preliminary study to discuss the future direction of the project has identified the following alternatives.
  Alternative-1: Upgrading AMRIS + Bayabas dam
  Alternative-2: Upgrading AMRIS + Balintingon dam ($2.9m^3/s$) + Laiban dam ($0.5m^3/s$)
  Alternative-3: Upgrading AMRIS + Laiban dam ($3.1m^3/s$)
  Alternative-4: Laiban dam ($4.0m^3/s$) only
- The study team conditionally recommends Alternative-1, based on the overall evaluation. The technical variability of Alterenative-1 will have to be clarified by further study and proper institutional arrangement should be considered for implementation of this alternative.
-

Remarks

Required Action to Upgrade to a Proposed Project for Implementation

- F/S level study would be required.

Source of Information

-

Annex-T 9.7.1 (3/4) Project profile for Inter-Sector for Water Resources Management Sector

Project Code	IS-C-03	
Project Title	Enhancement of Monitoring System for Surface Water in Pampanga River Basin	
Status of Project	Conceptual	
Objective Area	Entire Pampanga river basin	
Implementing Agency	NWRB / Others	
Objectives	Establishment of Inter-sector surface water monitoring system to prepare for future expected increase of conflict among water users, especially between municipal and irrigation water users	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	10 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- The usage of surface water will increase and become more complicated, because of very complicated water movement by abstraction for irrigation and municipal use and their return flow. To utilize the limited water resources more efficiently and effectively, it is vital to monitor the actual condition of water movement by natural and artificial drainage system. The conceptual project for Enhancement Monitoring System for Surface Water in Pampanga River Basin is proposed to realize the inter-sector surface monitoring system by enhancing the existing monitoring system by each sector and agency.
- The projects should include the following activities.
  1) Establishment of monitoring networks
     - Proper and important monitoring locations for capturing the actual movement of surface water in the basin should be selected. The monitoring points may include the existing hydrometric stations, large storage dams and major intakes.
     - At the selected monitoring stations, the strengthening of monitoring method such as automatic observation and transfer of data should be introduced.
     - Database and their management system should be established.
     - Monitoring results should be stored in one database and shared by stakeholders.
  2) Surface water resource management by NWRB and/or river basin organization based on the monitored data should be conducted. The monitored data may be utilized for controlling water use permit. The accumulated monitoring data will benefit significantly for the preparation of the next river basin management planning so as to grade-up the spiral of IWRM process.
- Recommended measures
  - Establishing main database and data transfer system: 1
  - Establishing local database and data transfer system for storage dams: 2
  - Establishing local database and data transfer system for dam-intake: 6
  - Installation of automatic gauge(water level and rainfall), cable facilities for discharge measurement and establishing data transfer system at HMS: 1
  - Establishing data transfer system with PAGASA flood warning system (optional): 1
  - Software and system development: 1
- It is proposed that the project be implemented firstly in Umiray-Angat system as a pilot project. Then, the remaining area in Pampanga river basin should be covered by the project after getting the lesson and learned from the pilot project.

Remarks

- Unit cost for installation of automatic gauge station and cable facilities for discharge measurement with data transfer facilities = 5.0mil.pesos/st.
- Unit cost for installation of local database and data transfer facilities = 0.25mil.pesos/st.
- Unit cost for installation of main database and data transfer facilities = 0.50mil.pesos/st.
- The cost for software and system development is assumed to be 25% of the installation cost for the facilities.
- The estimated initial investment cost is 10mil. pesos.

- Annual maintenance cost for the installed facilities is assumed to be 0.5% of the initial investment cost.
- Unit cost for data transfer = 0.075mil.pesos/st./year
- Unit cost for observer for HMS = 0.012mil.pesos/st./year
- Unit cost for operator for data input and transfer = 0.12mil.pesos/st./year
- Unit cost for discharge measurement = 0.05mil.pesos/st./year
- The estimated annual O&M cost is 2.0mil. pesos/year.

Required Action to Upgrade to a Proposed Project for Implementation

- Basic project components should be determined.

Source of Information

-

Annex-T 9.7.1 (4/4) Project profile for Inter-Sector for Water Resources Management Sector

Project Code	IS-C-04	
Project Title	Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution	
Status of Project	Conceptual	
Objective Area	Angat-Umiray system (1st phase) Entire Pampanga river basin or Nation-wide (2nd phase)	
Implementing Agency	NWRB / Others	
Objectives	Capacity development for water allocation and distribution to prepare for future expected increase of conflict among water users, especially between municipal and irrigation water users	
Project Cost (Million Pesos)	Estimated by Project Proponent	Estimated by Study Team for 2011-2025
	(N/A)	300 as of 2009
EIRR	(N/A)	
Expected Source of Fund	(N/A)	
Expected Implementation Schedule	(N/A)	

Project Description

- To recover the inadequate reliability of water supply in Angat-Umiray system, it is indispensible to improve water allocation including refinement of water use permit. The capacity development of NWRB and Relevant Agencies on Water Allocation and Distribution is proposed as one of conceptual projects, in order to improve the water governance by NWRB.
- The operation of hydropower plant should be well balanced for other functions of the storage dam such as flood control, water use for irrigation and municipal water supply. The proper regulation of operation of hydropower plant is also one of the topics to be dealt with in the project.
- The project is also to prepare for the expected increase of conflict among water users in the entire Pampanga river basin and even in the entire country in long-term on the basis of the experience in Angat-Umiray system.
- The expected outputs of the project are as follows.
    1) Improvement of water permitting system, especially for irrigation water use, in Angat-Umiray system,
    2) Enhanced Capacity of NWRB and relevant agencies on operation of water allocation and its monitoring in Angat-Umiray system,
    3) Identification of critical area for water conflict in the nationwide considering possible future climate change,
    4) Preparation of framework for application of the refined methodology for water allocation and water permitting system to the identified critical areas, and
    5) Recommendation on improvement of institution and legislation, through the activities on the project.

Remarks

- Two phases are considered for implementation for total 5years. In the 1st phase, Angat-Umiray system will be mainly dealt with as a pilot area. Based on the experience in 1st Phase IInd phase will be implemented for the entire Pampanga river basin or nation-wide activity.
- For the project cost, input on technical assistance by foreign expert team (60 mil.pesos/year) for 5years is considered.

Required Action to Upgrade to a Proposed Project for Implementation

- TOR for the T.A. should be determined.

Source of Information

-

Annex-T 11.1.1 (1/2) Grouping of Projects (Group-A Projects)

Project Group	Sector	Serial No.	Project		Implementing Agency	Initial Investment Cost	O&M cost
			Code	Name of Project		(Million Pesos)	(Mil.Pesos/year)
A	Agriculture/ Irrigation and Fishery	1	AI-G-03	Repair, Rehabilitation of Existing Groundwater Irrigation Systems, Establishment of Groundwater Pump Project (REGIP)	NIA	398	None
		2	AI-G-04	Balikatan Sagip Patubig Program (BSPP)	NIA	46	None
		3	AI-G-05	Repair, Rehabilitation, Restoration & Preventive Maintenance of Existing National & Communal Irrigation Facilities	NIA	1,579	None
		4	AI-G-06	Restoration/Rehabilitation of Existing NIA Assisted Irrigation System (RRE-NIAIS)	NIA	8,767	None
		5	AI-G-08	Rehabilitation of Small Water Impounding Projects / Diversion Dams	DA-BSWM	128	None
		6	AI-G-09	Comprehensive Agrarian Reform Program, Irrigation Component	NIA	1,020	None
		7	AF-G-01	Aquaculture Fisheries Development Programs	DA-BFAR	450	None
		8	AF-G-02	Comprehensive Regulatory Services	DA-BFAR		
		9	AF-G-03	Support Projects and Activities	DA-BFAR		
		10	AF-G-04	Fisheries Resources Management for Improved and Sustainable Harvest	DA-BFAR		
		Sub-total				12,388	0.0
A	Municipal Water Supply, Sanitation and Sewerage	11	MW-G-01	Angat Water Utilization and Aquaduct Improvement Project (AWUAIP) Phase 2	MWSS	4,568 *	30.5
		12	MW-P-01	Rehabilitation of Umiray-Macua Facilities	MWSS	454	2.3
		13	MW-P-02	Sumag River Diversion Project	MWSS	540	2.7
		14	MW-P-03	Bulacan Treated Bulk Water Supply Project	MWSS/LGU	11,935	119.3
		15	MW-P-04	Metro Clark Bulk Surface Water Project	CDC	3,527	35.3
		16	MW-C-01	Additional Level 3,2, 1 Facilities towards 2025 in Bulacan	LWUA/WDs/LGUs /Private WSPs	3,839	324.2
		17	MW-C-02	Additional Level 3,2, 1 Facilities towards 2025 in Pampanga	LWUA/WDs/LGUs /Private WSPs	4,914	416.6
		18	MW-C-03	Additional Level 3,2, 1 Facilities towards 2025 in Nueva Ecija	LWUA/WDs/LGUs /Private WSPs	2,903	249.3
		19	MW-C-04	Additional Level 3,2, 1 Facilities towards 2025 in Tarlac	LWUA/WDs/LGUs /Private WSPs	559	46.2
		20	MW-C-05	Extended Bulacan Bulk Water Supply Project	LGU	16,754	167.7
		21	MW-C-06	Pampanga Bulk Water Supply Project	LGU	5,732	57.4
		22	MS-C-01	Additional Sanitary Facilities towards 2025 in Bulacan	LGUs	3,676	18.4
		23	MS-C-02	Additional Sanitary Facilities towards 2025 in Pampanga	LGUs	4,725	23.6
		24	MS-C-03	Additional Sanitary Facilities towards 2025 in Nueva Ecija	LGUs	3,477	17.4
		25	MS-C-04	Additional Sanitary Facilities towards 2025 in Tarlac	LGUs	968	4.8
		Sub-total				68,571	1,515.6
A	Management of Flood and Sediment Disasters	26	FL-G-03	Maintenance and Rehabilitation Works for River Dike and Slope	DPWH	679	None
		27	FL-C-03	Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs	LGUs	3,000	None
		28	FL-C-04	Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula	DE-Region III	8	None
		Sub-total				3,687	0.0
A	Watershed Management	29	WS-G-01	Forest Protection and Law Enforcement Program (FPLEP)	DENR/PENRO/CENRO	39	None
		30	WS-G-02	Community-based Forest Management Program	DENR/RCBFMO	71	None
		31	WS-G-04	Coastal Resource Management Program (CRMP)	DENR/PAWCZMS	37	None
		32	WS-G-05	Protected Area Community-based Resource Management Program (CBFM-PACBRMA)	DENR/PAWCZMS	13	None
		33	WS-G-06	Private Forest Plantation Development Program (PFPDP)	DENR-FRDD	93	None
		34	WS-G-07	NIA-UPRIIS' Watershed Management Program	NIA-UPRIIS	180	None
		35	WS-G-08	NPC's Watershed Management Program	NPC	107	None
		36	WS-G-09	Integrated Social Forestry (ISF) Projects	LGUs/DENR/RCBFMO	51	None
		37	WS-G-10	Private-sector Watershed Management Initiatives	Private Firm/NGOs	32	None
		Sub-total				623	0.0
A	Water-related Environment Management	38	WQ-G-01	Ecological Solid Waste Management Program (ESWMP)	DENR-EMB III	192	None
		39	WQ-G-02	Industrial Pollution Control Program (IPCP)	DENR-EMB III	153	None
		40	WQ-G-03	Sagip-Ilog Project	DENR-EMB/LGUs/Pvt. Sector	11	None
		41	WQ-P-01	Clean Development Mechanism	Private Industries	1,036	63.0
		42	WQ-C-04	Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan and Pampanga	LGUs	2,025	349.0
		Sub-total				3,417	412.0
A	Others	43	IS-C-02	Project for Recovery of Reliability of Water Supply in Angat-Umiray System	NWRB/NIA/MWSS/NPC/LGU	7,966	39.8
		Sub-total				7,966	39.8
	Total for Group A Projects					**96,652**	**1,967.4**

Note: *: The project cost is not total cost, but only for 2011-2025.

Annex-T 11.1.1 (2/2) Grouping of Projects (Group-B Projects)

Project Group	Sector	Serial No.	Project		Implementing Agency	Initial Investment Cost	O&M cost
			Code	Name of Project		(Million Pesos)	(Mil.Pesos/year)
B	Agriculture/ Irrigation and Fishery	1	AI-G-01	Balog-Balog Multipurpose Project Phase 1	NIA	236 *	11.8
		2	AI-G-02	Along-along Creek Irrigation Project (UPRIIS Div3)	NIA	25 *	1.3
		3	AI-G-07	Participatory Irrigation Development Project, APL1-Infrastructure Development	NIA	41 *	0.3
		4	AI-G-10	Upper Tabuating SRIP	NIA	76 *	1.3
		5	AI-P-01	Balintingon Reservoir Multipurpose Project (BRMP)	NIA/G. Trino	13,591	68.0
		6	AI-P-02	Balog-Balog Multipurpose Project Phase 2	NIA	16,095	80.5
		7	AI-P-03	Sector Loan on Rehabilitation of Irrigation Facilities	NIA	222	1.1
		8	AI-P-04	Casecnan Multi-purpose Irrigation & Power Project Irrigation Component Phase 2	NIA	7,000	35.0
		9	AI-P-05	Procurement of Pumps, Drilling Rigs & Related Equipment	NIA	206	1.0
		10	AI-P-06	Irrigation Water Resources Augmentation Pump Establishment Project	NIA	130	0.7
		11	AI-P-07	Appropriate Irrigation Technologies for Enhanced Agricultural Production	NIA	654	3.3
		12	AI-P-08	Central Luzon Groundwater Irrigation Systems Reactivation Project	NIA	1,429	7.1
		13	AI-P-09	Gumain Reservoir Project	NIA	13,729	68.6
		14	AI-P-10	Rehabilitation of AMRIS	NIA	983	4.9
		15	AI-P-11	Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects, Small Diversion Dam Projects	DA Region III/LGUs	169	0.8
		16	AI-C-01	New Construction of Small Scale Irrigation Project under BSWM	BSWM/LGUs	514	2.6
		17	AI-C-02	Introduction of Water Saving Irrigation Technology	NIA	150	None
		18	AI-C-03	Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs	NIA	150	7.5
		Sub-total				55,400	295.8
B	Municipal Water Supply, Sanitation and Sewerage	19	MP-G-01	Cabanatuan Sewerage System	LGU	189	1.9
		20	MP-G-02	Expansion of Clark Sewerage System	Clark Water	456	4.6
		21	MP-C-01	Septage Treatment and Disposal Facility	MCWMC/LGUs/WDs/Private	510	355.0
		Sub-total				1,155	361.5
B	Management of Flood and Sediment Disasters	22	FL-G-01	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part I	DPWH	470 *	23.5
		23	FL-G-02	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part II	DPWH	5 *	0.3
		24	FL-G-04	Flood Forecasting and Warning System Capacity Building Project upon Dam Release in the Philippines	PAGASA	300	None
		25	FL-P-01	Flood Control Measures in Mt. Pinatubo Devastated Area- Focus on Pasac Delta	DPWH	4,320	21.6
		26	FL-P-02	Bacolor Comprehensive Rehabilitation Master Plan	LGU	1,500	7.5
		27	FL-C-01	Flood Mitigation for Pampanga Delta	DPWH	5,468	27.3
		28	FL-C-02	Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and N. Ecija	LGUs	8	0.4
		Sub-total				12,071	80.6
B	Watershed Management	29	WS-G-03	Integrated Agro-Forestry Development Program (CBFM-CARP)	DENR/RCBFMO/DAR	31	None
		30	WS-G-11	Forestlands Management Project (FMP)	DENR-FASPO	996	None
		31	WS-G-12	Pampanga River Basin Rehabilitation Project (PRBRP)	DENR-FRCD	12 *	None
		32	WS-C-01	Upland Development Program	DA/DENR/LGUs	980	None
		33	WS-C-02	Protected Area Management Program (PAMP)	DENR/PAWCZMS	404	None
		34	WS-C-03	Urban Greening Program	DENR/LGUs/Pvt. Sector	264	None
		35	WS-C-04	Community-based Eco-tourism Program	DOT/DENR/LGUs	264	None
		Sub-total				2,951	0.0
B	Water-related Environment Management	36	WQ-C-01	Capacity Development to Upgrade WQ Monitoring and Data Management Program	DENR-EMB	140	None
		37	WQ-C-02	Capacity Development to Improve Water Quality and Aquaculture Fisheries Management	DA-BFAR	48	None
		38	WQ-C-03	Capacity Development Project to Improve Industry Adoption of Cleaner Production Options	DTI/DENR/Private Industries	60	None
		Sub-total				248	0.0
B	Others	39	IS-C-01	Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin	NWRB/Others	297	3.7
		40	IS-C-03	Enhancement of Monitoring System for Surface Water in Pampanga River Basin	NWRB/Others	10	2.0
		41	IS-C-04	Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution	NWRB/Others	300	None
		Sub-total				607	5.7
	Total for Group B Projects					**72,432**	**743.5**
Grand Total						**169,084**	**2,710.9**

Note: *: The project cost is not total cost, but only for 2011-2025.

Annex-T 11.2.1 (1/3) Principal Objectives and Contents of Major Discussions in TWG Meetings, Stakeholder Meeting and Joint SC and TWG Meeting in September and October 2010

TWG Meeting on Sep. 29, 2010

Objectives:

1. To discuss the proposed prioritization order of the projects and development scenario for IWRM of Pampanga River Basin
2. To discuss the proposed IWRM institutional setup.
3. To discuss the interim results of preliminary Initial Environmental Evaluation (IEE) done for the projects

Contents of Major Discussions:

1. The TWG members shall have another meeting for their own validation on the prioritization of the different projects that were identified.

   The TWG Workshop for the validation of the prioritization of project components of the IWRM Plan is scheduled on October 7, 2010 at Sulo Hotel from 9 – 4 pm.

2. The monitoring of water quality and the watershed environment shall not be integrated into one TWG in the organizational structure of the RBC since water quality is with EMB and there is a possibility for either of the sectors to be neglected.

   The proposal of the Study Team was a separate TWG for each. However, it was decided to integrate them under one TWG through FDG since the two sectors are coordinated and both are under the organization of DENR.

3. The Study Team proposed that DILG shall head the TWG for water supply, sanitation and sewerage in the proposed organization setup of RBC. However, the TWG shall be headed by the LWUA or water districts (WDs) while the sanitation and sewerage to be under the DENR-EMB.

   The original idea of the Study Team was for the DOH to chair the TWG for monitoring sanitation and sewerage, while it was modified to DILG in accordance with suggestion by FDG.

TWG Meeting on Oct. 07, 2010

Objectives:

1. To validate and/or improve the evaluation criteria for prioritization of projects as components of the IWRM Plan; and
2. To validate and/or improve the results of prioritization of projects made by the Study Team through Delphi technique

Improvement of Results of Project Evaluations and Prioritization of Projects:

1. The results of project evaluations and prioritization of projects made by the Study Team were revised by 13 TWG Members who represent from NIA, NPC, BSWM, PHILVOLCS, DENR-RBCO, DPWH-FCSEC, PAGASA, DILG-Region III, Tarlac Province, Bulacan Province, NEDA-Region III, MWSS, DENR-PAWB and NWRB.

Contents of Major Discussions:

1. The cost of P75M for the project "FL-C-02: Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and N.E" is deemed to be too costly in comparison with the cost of the similar project completed in Bulacan. Moreover, the Project shall be implemented earlier than its target implementation in 2016 proposed by the Study Team.
2. The benefits by the above Project could be gained for a longer period of time if it can be implemented earlier. Moreover, it is recommended to give the project more functionality by not limiting its use to flood alone but to utilize the data that can be monitored for research development, infrastructure, etc.
3. It was informed that the Provincial Disaster Coordinating Council (PDCC) of Nueva Ecija is now considering the proposal for the community-based flood early warning system which will be discussed with the Governor.
4. After the discussion, the participants replicated the evaluation done by Mr. Otogawa by project sets. Using the Scoring Matrix, the participants revised the scores of the projects for each set, as they see fit. Revised scores were placed in the blank above the scoring made by Mr. Otogawa. The new scores were incorporated and the total scores were collated by the encoders for each project set. The scores for Project Sets 1, 2 and 3 were collated and integrated by the Chief Encoder using geometric mean to arrive at the final scores.

Annex-T 11.2.1 (2/3) Principal Objectives and Contents of Major Discussions in TWG Meetings, Stakeholder Meeting and Joint SC and TWG Meeting in September and October 2010

Stakeholder Meeting on Oct. 13, 2010

Objectives:

1. To present the methodologies for the formulation of the development scenarios, implementation program and investment program of the water-related projects proposed as components of the IWRM Plan for Pampanga River Basin by the JICA Study Team;
2. To discuss the approach and framework for the proposed institutional set-up plan for IWRM for Pampanga River Basin;
3. To present the web-page developed for the Pampanga River Basin Study; and
4. To review and validate the development scenarios, implementation program and investment program targeted for the short-term, mid-term and long-term.

Contents of Major Discussions:

1. The Study Team shall come up with a review of the Medium Term Development Plan (MTDP) of each province within the river basin. The particular consideration shall be given to the following three projects: (1) Cabo Holistic Development Project; (2) Tabuating River Irrigation System and (3) Sierra Madre Watershed Development Program.
   * The Study Team made an attempt to review the MTDP, but it was virtually difficult to take overview of the MTDPs for the whole provinces in the study area. Due to the difficulty, the whole of the MTDP was not incorporated and it was reflected only in the "FL-C-03: the Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs". It is further noted that of the above three projects to be given the particular consideration, the "Tabuating River Irrigation System "has been included as a part of the proposed IWRM Plan (refer to AI-G-10: Upper Tabuating SRIP"), but other two projects were not incorporated due to the invalid old information on them.
2. In accordance with comments given in the meeting, the following revisions were made for the Project of "MW-P-04: Metro Clark Bulk Water Supply Project".
   - The name of Project was renamed from "Development of Water Supply System for Clark Special Economic Zone (2020～2025)
   - The project implementation period is revised from 2020-2025 to 2011-2025.
   - The objective area is expanded from the Clark New Frontier Area to the whole Metro Clark, which covers a part of Tarlac and Pampanga Province.
   - The classification of the Project is revised from the Group-B Project to Group-A Project.
3. In accordance with the comments given in the meeting, the target completion year of the Project of "MP-C-01: Construction/ Provision of Septage Treatment and Disposal Facilities" was revised from 2020 to 2025.
4. In accordance with the comments, the development scenario on "Level 3 Water Supply System" was modified to the development scenario on "Level 3, 2,1 Water Supply System".
5. In accordance with the comments in the meeting, the following two projects were added as the components of the IWRM Plan for Pampanga River Basin.
   - FL-C-03 Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs
   - FL-C-04 Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula
6. In accordance with the comments in the meeting, the following two projects were transferred from Group-B to Group-A:
   - WQ-P-01: Clean Development Mechanism Projects
   - WQ-C-04: Construction of Sanitary Landfills and Support facilities in Nueva Ecija and Cluster Water Transfer Stations in Bulacan

Annex-T 11.2.1 (3/3) Principal Objectives and Contents of Major Discussions in TWG Meetings, Stakeholder Meeting and Joint SC and TWG Meeting in September and October 2010

Joint SC and TWG Meeting on

Objectives:

1. To present the revised prioritization order of the projects and development scenarios as well as the revised institutional setup plan for IWRM of the Pampanga River Basin.

.

Contents of Major Discussions:

1. There shall be a footnote that states that the proposed grouping of the projects into Group A & B is not fixed but the projects can be transferred from one grouping to the other depending on the future situation and necessity for the project
2. The Chairperson for the TWG on Water Supply, Sanitation and Sewerage in the organization setup for RBC should be DILG and DOH instead of DILG and LWUA.
3. E.O. to be drafted should include a provision that will direct National Government Agencies to initially allocate contributions to the operation of the RBC from their respective offices and eventual allocation of specific funds from the national government for its operation.
4. The long-term option of legislative action to institutionalize creation of RBOs/RBCs in the country should be included.
5. Issues/conflicts on arbitration and monitoring of water rights shall be resolved first at the RBC level and only unresolved issues shall be elevated to NWRB. In this regard, the arbitration shall be subject to the guidelines or agreement that will be developed between RBC and NWRB.

Annex-T 11.2.2 (1/2) Development Scenarios and Relevant Projects (Group-A)

Sector	Development Scenario	Term of Implementation	Project Code	Project Name of Project	Implementing Agency	Cost (million pesos) Short-term	Mid-term	Long-term	Total
Agriculture/Irrigation and Fisheries	**(1) Rehabilitation of Existing Irrigation Facilities** The agricultural productivities shall be improved through rehabilitation of the existing irrigation facilities.	Whole Terms	AI-G-03	Repair, Rehabilitation of Existing Groundwater Irrigation Systems, Establishment of Groundwater Pump Project (REGIP)	NIA	216	91	91	398
			AI-G-04	Balikatan Sagip Patubig Program (BSPP)	NIA	46	0	0	46
			AI-G-05	Repair, Rehabilitation, Restoration & Preventive Maintenance of Existing National & Communal Irrigation Facilities	NIA	1,027	276	276	1,579
			AI-G-06	Restoration/Rehabilitation of Existing NIA Assisted Irrigation System (RRE-NIAIS)	NIA	3,437	2,665	2,665	8,767
			AI-G-08	Rehabilitation of Small Water Impounding Projects / Diversion Dams	DA-BSWM	43	43	43	128
			AI-G-09	Comprehensive Agrarian Reform Program, Irrigation Component	NIA	340	340	340	1,020
	(2) Sustainable Fishery Production The fishery productivities shall be sustained through the on-going regular projects.	Whole Terms	AF-G-01	Aquaculture Fisheries Development Programs	DA-BFAR	150	150	150	450
			AF-G-02	Comprehensive Regulatory Services	DA-BFAR				
			AF-G-03	Support Projects and Activities	DA-BFAR				
			AF-G-04	Fisheries Resources Management for Improved and Sustainable Harvest	DA-BFAR				
	Total					**5,259**	**3,565**	**3,565**	**12,388**
Municipal Water Supply, Sanitation and Sewerage	**(1) Short-term Development of Bulk Water Supply System for Bulacan Province** MWSS shall provide the bulk municipal water supply system to Bulacan Province in order to retrieve the deterioration of the groundwater currently used as the source for municipal water use in the Province by 2015. The water supply system shall have the supply capacity of 2.7m^3/s, which could cover the municipal water demand of about one million.	Short-term	MW-P-03	Bulacan Treated Bulk Water Supply Project	MWSS/LGU	11,935	0	0	11,935
	(2) Strengthening of Water Supply Capacity of Angat Umiray System (a) The more sustainable water supply by Angat-Umiray system shall be enhanced through implementaion of MW-G-01, MW-P-01 and MW-P-02 by 2015 so as to mitigate the chronic shortage for the municipal water use in Metro Manila and the irrigation water use in AMRIS. (b) The reliability of water supply in Angat Umiray System shall be fully recovred through implementaion of IS-C-02 by 2020.	Short-term and Mid-term	MW-G-01	Angat Water Utilization and Aquaduct Improvement Project (AWUAIP) Phase 2	MWSS	4,568	0	0	4,568
			MW-P-01	Rehabilitation of Umiray-Macua Facilities	MWSS	454	0	0	454
			MW-P-02	Sumag River Diversion Project	MWSS	540	0	0	540
			IS-C-02	Project for Recovery of Reliability of Water Supply in Angat-Umiray System	NWRB/NIA/ MWSS/NPC/LGU	100	7,866	0	7,966
	(3) Expansion of Level 3, 2, 1 Municipal Supply System (a) The coverage of Level 3, 2, 1 water supply system with safe drinking water supply shall reach 100% by 2025. (b) The coverage ratios of the Level 3 Water Supply System in the urban area shall increase 1% per annum by 2015, and their average ratio shall reach 80% by 2025. At the same time, the lowest coverage ratio in the urban area shall not be below 46.5% in 2025. (c) The present average coverage ratio of Level 3 Water Supply System in the rural area shall be maintained until 2025, notwithstanding the future increment of population. The target coverage ratio to be maintained is 18% in average for the whole study area.	Whole Terms	MW-C-01	Additional Level 3,2, 1 Facilities towards 2025 in Bulacan	LWUA/WDs/LGUs/ Private WSPs	1,404	1,200	1,235	3,839
			MW-C-02	Additional Level 3,2, 1 Facilities towards 2025 in Pampanga	LWUA/WDs/LGUs/ Private WSPs	1,714	1,588	1,612	4,914
			MW-C-03	Additional Level 3,2, 1 Facilities towards 2025 in Nueva Ecija	LWUA/WDs/LGUs/ Private WSPs	973	957	973	2,903
			MW-C-04	Additional Level 3,2, 1 Facilities towards 2025 in Tarlac	LWUA/WDs/LGUs/ Private WSPs	221	169	169	559
	(4) Construction/Provision of Sanitary Toilet The rate of construction/provision of the sanitary toilets in all municipalities and cities shall increase at the rate of 10% per annum by 2015, and the whole households in the study area shall be provided with the sanitary toilet by 2025.	Whole Terms	MS-C-01	Additional Sanitary Facilities towards 2025 in Bulacan	LGUs	1,774	948	954	3,676
			MS-C-02	Additional Sanitary Facilities towards 2025 in Pampanga	LGUs	1,969	1,356	1,400	4,725
			MS-C-03	Additional Sanitary Facilities towards 2025 in Nueva Ecija	LGUs	1,394	1,037	1,046	3,477
			MS-C-04	Additional Sanitary Facilities towards 2025 in Tarlac	LGUs	370	294	304	968
	(5) Development of Bulk Water Supply System for Metro Clark The bulk water supply system (supply capacity of 0.8m^3/s) shall be gradually expanded to the entire Metro Clark by 2025.	Whole Terms	MW-P-04	Metro Clark Bulk Surface Water Project	CDC	1,176	1,176	1,175	3,527
	(6) Long-term Development of Bulk Water Supply System for Bulacan and Pampanga Province The bulk water supply system with the supply capacity of additional 3.8m^3/s for Bulacan and 1.3m^3/s for Pampanga Province shall be developed by 2025 in order to serve the incremental provincial population and cope with deterioration of the groundwater quality.	Long-term	MW-C-05	Extended Bulacan Bulk Water Supply Project	LGU	0	0	16,754	16,754
			MW-C-06	Pampanga Bulk Water Supply Project	LGU	0	0	5,732	5,732
	Total					**28,592**	**16,591**	**31,354**	**76,537**

Annex-T 11.2.2 (2/2) Development Scenarios and Relevant Projects (Group-A)

Sector	Development Scenario	Term of Implementation	Project Code	Name of Project	Implementing Agency	Cost (million pesos) Short-term	Mid-term	Long-term	Total
Management of Flood and Sediment Disasters	**(1) Sustainment of Regular Program for Maintenance and Rehabilitation of River Dike and Slope** Until 2025, the following regular program for maintenance and rehabilitation of the deteriorated river dike and slope of Pampanga, Angat and Pasac river systems of 54km in length, which are under jurisdiction of DPWH, shall be sustained to maintain the original river flow capacities and morphology	Whole Terms	FL-G-03	Maintenance and Rehabilitation Works for River Dike and Slope	DPWH	226	226	227	679
	(2) Sustainment of Regular Program for Maintenance and Rehabilitation of Drainage and Flood Control Facilities for LGUs Until 2025, the following regular program for maintenance and rehabilitation of the drainage and flood control facilities, which are under jurisdiction of the Provincial Governments of Pampanga, Bulacan, Nueva Ecija and Tarlac, shall be sustained to maintain the original design capacity of the facilities.	Whole Terms	FL-C-03	Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs	LGUs	1,000	1,000	1,000	3,000
	(3) Improvement of Public Awarenss on IWRM Toward 2025, public awarness on IWRM shall be improved thorugh the annual regular program on the salient points of IWRM into school curricula for primary and secondary school in the aspect of IWRM for Pampanga river basin.	Whole Terms	FL-C-04	Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula	DE-Region III	2	3	3	8
	Total					**1,228**	**1,229**	**1,230**	**3,687**
Watershed Management	**(1) Susttainment of the On-going Regular Program for Watershed Management** The major on-going nine (9) regular programs for watershed management in Pampanga river basin shall be sustained by 2025, which could lead to the following outcomes: (a) The 285,300has. of tenured and untenured forestlands shall be protected against illegal harvesting, encroachment, forest fires, illegal land use and conversion. (b) The present forest cover of 187,500has shall be expanded through timber forest establishment and agro-forestry by about 10,000has. at the rate of 660has. per annum. Forest expansion will cover an additional 2.63% of the total classified and unclassified forestlands (377,500has.) in Pampanga river basin by 2025. (c) The present agro-forestry cover shall expand by about 29,700has. at the rate of 200has. per annum as the basic strategy to provide additional income source to upland dwellers, particularly the indigenous peoples. (d) Conservation of natural ecosystems and their critical habitats will be sustained in order to protect bio-diversity. The area to be conserved includes: (i) natural forests within the 79,800has. of protected areas of Mt. Arayat NP, Pantabangan-Carranglan WFR and Angat WFR, and (ii) old and re-established mangrove forests within 77,400has. of coastal areas of Pampanga and Bulacan.	Whole Terms	WS-G-01	Forest Protection and Law Enforcement Program (FPLEP)	DENR/PENRO/CENRO	13	13	13	39
			WS-G-02	Community-based Forest Management Program	DENR/RCBFMO	24	24	23	71
			WS-G-04	Coastal Resource Management Program (CRMP)	DENR/PAWCZMS	12	12	13	37
			WS-G-05	Protected Area Community-based Resource Management Program (CBFM-PACBRMA)	DENR/PAWCZMS	4	4	5	13
			WS-G-06	Private Forest Plantation Development Program (PFPDP)	DENR-FRCD	36	29	28	93
			WS-G-07	NIA-UPRIIS' Watershed Management Program	NIA-UPRIIS	100	40	40	180
			WS-G-08	NPC's Watershed Management Program	NPC	51	28	28	107
			WS-G-09	Integrated Social Forestry (ISF) Projects	LGUs/DENR/RCBFMO	17	17	17	51
			WS-G-10	Private-sector Watershed Management Initiatives	Private Firm/NGOs	11	11	10	32
	Total					**268**	**178**	**177**	**623**
Water-related Environment Management	**(1) Dealing with Contamination of Surface, Ground and Coastal Water** The pollution load from various sources shall be reduced by sustaining the ongoing non-strutural measures under three (3) ongoing regular DENR and LGU programs that are intended to protect water quality.	Whole Terms	WQ-G-01	Ecological Solid Waste Management Program (ESWMP)	DENR-EMB III	64	64	64	192
			WQ-G-02	Industrial Pollution Control Program (IPCP)	DENR-EMB III	51	51	51	153
			WQ-G-03	Sagip-Ilog Project	DENR-EMB/ LGU/Pvt. Sector	5	3	3	11
	(2) Reduction of Risk for Contamination in Water Body By 2025, the structural measures will be implemented to reduce the risk of contamination from livestock, domestic and industrial wastes. These include: (a) waste-to-energy CDM projects for livestock farms in Bulacan and the sanitary landfill in Tarlac and Bulacan; and (b) sanitary landfills in N. Ecija and waste transfer stations in Pampanga and Bulacan.	Whole Terms	WQ-P-01	Clean Development Mechanism Projects	Private Industries	518	518	0	1,036
			WQ-C-04	Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan	LGUs	675	675	675	2,025
	Total					**1,313**	**1,311**	**793**	**3,417**
Grand Total						**36,660**	**22,874**	**37,119**	**96,652**

Annex-T 11.2.3 Implementation Schedule for Group-A Projects

Sector	Code	Name of Project	Implementing Agency	Short-term	Mid-term	Long-term
Agriculture/ Irrigation and Fisheries	AI-G-03	Repair, Rehabilitation of Existing Groundwater Irrigation Systems, Establishment of Groundwater Pump Project (REGIP)	NIA			
	AI-G-04	Balikatan Sagip Patubig Program (BSPP)	NIA			
	AI-G-05	Repair, Rehabilitation, Restoration & Preventive Maintenance of Existing National & Communal Irrigation Facilities	NIA			
	AI-G-06	Restoration/Rehabilitation of Existing NIA Assisted Irrigation System (RRE-NIAIS)	NIA			
	AI-G-08	Rehabilitation of Small Water Impounding Projects / Diversion Dams	DA-BSWM			
	AI-G-09	Comprehensive Agrarian Reform Program, Irrigation Component	NIA			
	AF-G-01	Aquaculture Fisheries Development Programs	DA-BFAR			
	AF-G-02	Comprehensive Regulatory Services	DA-BFAR			
	AF-G-03	Support Projects and Activities	DA-BFAR			
	AF-G-04	Fisheries Resources Management for Improved and Sustainable Harvest	DA-BFAR			
Municipal Water Supply, Sanitation and Sewerage	MW-P-03	Bulacan Treated Bulk Water Supply Project	MWSS/LGU			
	MW-G-01	Angat Water Utilization and Aquaduct Improvement Project (AWUAIP) Phase 2	MWSS			
	MW-P-01	Rehabilitation of Umiray-Macua Facilities	MWSS			
	MW-P-02	Sumag River Diversion Project	MWSS			
	IS-C-02	Project for Recovery of Reliability of Water Supply in Angat-Umiray System	NWRB/NIA/MWSS/NPC/LGU			
	MW-C-01	Additional Level 3,2, 1 Facilities towards 2025 in Bulacan	LWUA/WDs/LGUs/Private WSPs			
	MW-C-02	Additional Level 3,2, 1 Facilities towards 2025 in Pampanga	LWUA/WDs/LGUs/Private WSPs			
	MW-C-03	Additional Level 3,2, 1 Facilities towards 2025 in Nueva Ecija	LWUA/WDs/LGUs/Private WSPs			
	MW-C-04	Additional Level 3,2, 1 Facilities towards 2025 in Tarlac	LWUA/WDs/LGUs/Private WSPs			
	MS-C-01	Additional Sanitary Facilities towards 2025 in Bulacan	LGUs			
	MS-C-02	Additional Sanitary Facilities towards 2025 in Pampanga	LGUs			
	MS-C-03	Additional Sanitary Facilities towards 2025 in Nueva Ecija	LGUs			
	MS-C-04	Additional Sanitary Facilities towards 2025 in Tarlac	LGUs			
	MW-P-04	Metro Clark Bulk Surface Water Project	CDC			
	MW-C-05	Extended Bulacan Bulk Water Supply Project	LGU			
	MW-C-06	Pampanga Bulk Water Supply Project	LGU			
Management of Flood and Sediment Disasters	FL-G-03	Maintenance and Rehabilitation Works for River Dike and Slope	DPWH			
	FL-C-03	Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs	LGUs			
	FL-C-04	Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula	DE-Region III			
Watershed Management	WS-G-01	Forest Protection and Law Enforcement Program (FPLEP)	DENR/PENRO/CENRO			
	WS-G-02	Community-based Forest Management Program	DENR/RCBFMO			
	WS-G-04	Coastal Resource Management Program (CRMP)	DENR/PAWCZMS			
	WS-G-05	Protected Area Community-based Resource Management Program (CBFM-PACBRMA)	DENR/PAWCZMS			
	WS-G-06	Private Forest Plantation Development Program (PFPDP)	DENR-FRCD			
	WS-G-07	NIA-UPRIIS' Watershed Management Program	NIA-UPRIIS			
	WS-G-08	NPC's Watershed Management Program	NPC			
	WS-G-09	Integrated Social Forestry (ISF) Projects	LGUs/DENR/RCBFMO			
	WS-G-10	Private-sector Watershed Management Initiatives	Private Firm/NGOs			
Water-related Environment Management	WQ-G-01	Ecological Solid Waste Management Program (ESWMP)	DENR-EMB III			
	WQ-G-02	Industrial Pollution Control Program (IPCP)	DENR-EMB III			
	WQ-G-03	Sagip-Ilog Project	DENR-EMB/LGU/Pvt. Sector			
	WQ-P-01	Clean Development Mechanism Projects	Private Industries			
	WQ-C-04	Construction of Sanitary Landfills & Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan & Pampanga	LGUs			

Annex-T 11.2.4 Results of Evaluation (Scoring) of Group-B Projects by Study Team

Sector	Project Code	Viability of the Project						Enhanced Livelihood					Improved Quality of Life					Decentralized Development					Sustained Ecosystem					Empowered People					Grand Total	Rank
		1	2	3	4	5	T	1	2	3	4	T	1	2	3	4	T	1	2	3	4	T	1	2	3	4	T	1	2	3	4	T		
Agriculture / Irrigation and Fishery	AI-P-01	3.0	3.0	2.0	2.0	1.0	11.0	3.0	3.0	2.0	3.0	11.0	1.0	1.0	1.0	2.0	5.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	3.0	2.0	9.0	**49.0**	**15**
	AI-P-02	3.0	3.0	3.0	2.0	1.0	12.0	3.0	3.0	2.0	3.0	11.0	1.0	1.0	1.0	2.0	5.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	3.0	2.0	9.0	**50.0**	**12**
	AI-P-03	3.0	3.0	3.0	3.0	2.0	14.0	2.0	3.0	2.0	3.0	10.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	2.0	4.0	10.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	2.0	2.0	8.0	**50.0**	**12**
	AI-P-04	3.0	3.0	2.0	3.0	1.0	12.0	3.0	3.0	2.0	3.0	11.0	1.0	1.0	1.0	1.0	4.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	3.0	2.0	9.0	**49.0**	**15**
	AI-P-05	2.0	2.0	2.0	3.0	1.0	10.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	1.0	2.0	2.0	1.0	6.0	**40.0**	**28**
	AI-P-06	2.0	3.0	2.0	2.0	2.0	11.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	1.0	3.0	1.0	1.0	6.0	1.0	1.0	1.0	1.0	4.0	1.0	2.0	2.0	2.0	7.0	**40.0**	**28**
	AI-P-07	2.0	2.0	3.0	3.0	2.0	12.0	2.0	3.0	3.0	3.0	11.0	2.0	2.0	1.0	2.0	7.0	1.0	2.0	2.0	2.0	7.0	1.0	1.0	2.0	1.0	5.0	3.0	3.0	3.0	3.0	12.0	**54.0**	**4**
	AI-P-08	2.0	2.0	2.0	2.0	2.0	10.0	2.0	3.0	2.0	3.0	10.0	1.0	1.0	1.0	1.0	4.0	1.0	3.0	1.0	2.0	7.0	1.0	1.0	2.0	1.0	5.0	2.0	2.0	2.0	2.0	8.0	**44.0**	**24**
	AI-P-09	2.0	2.0	2.0	2.0	1.0	9.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	1.0	1.0	2.0	1.0	5.0	**38.0**	**30**
	AI-P-10	2.0	2.0	3.0	2.0	1.0	10.0	3.0	3.0	2.0	3.0	11.0	3.0	3.0	2.0	1.0	9.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	2.0	1.0	5.0	2.0	2.0	2.0	3.0	9.0	**53.0**	**7**
	AI-P-11	2.0	2.0	2.0	2.0	3.0	11.0	3.0	3.0	2.0	3.0	11.0	1.0	1.0	1.0	1.0	4.0	1.0	3.0	2.0	3.0	9.0	1.0	1.0	2.0	1.0	5.0	3.0	2.0	3.0	2.0	10.0	**50.0**	**12**
	AI-C-01	2.0	2.0	1.0	2.0	3.0	10.0	3.0	3.0	2.0	3.0	11.0	1.0	1.0	1.0	1.0	4.0	1.0	3.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	3.0	2.0	9.0	**46.0**	**20**
	AI-C-02	2.0	2.0	2.0	2.0	3.0	11.0	3.0	3.0	3.0	3.0	12.0	2.0	1.0	1.0	1.0	5.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	2.0	1.0	5.0	3.0	3.0	3.0	3.0	12.0	**54.0**	**4**
	AI-C-03	2.0	2.0	2.0	2.0	2.0	10.0	2.0	3.0	3.0	3.0	11.0	1.0	2.0	2.0	1.0	6.0	1.0	2.0	2.0	2.0	7.0	2.0	2.0	2.0	2.0	8.0	3.0	3.0	3.0	3.0	12.0	**54.0**	**4**
Municipal Water Supply, Sanitation and Sewerage	MW-P-04	2.0	2.0	2.0	2.0	1.0	9.0	2.0	2.0	1.0	1.0	6.0	2.0	3.0	2.0	1.0	8.0	2.0	2.0	2.0	1.0	7.0	1.0	1.0	1.0	1.0	4.0	1.0	1.0	1.0	1.0	4.0	**38.0**	**30**
	MP-C-01	2.0	2.0	2.0	2.0	1.0	9.0	1.0	1.0	1.0	1.0	4.0	3.0	1.0	3.0	1.0	8.0	2.0	1.0	2.0	2.0	7.0	1.0	3.0	2.0	3.0	9.0	2.0	2.0	2.0	1.0	7.0	**44.0**	**24**
Management of Flood and Sediment Disasters	FL-P-01	3.0	3.0	3.0	2.0	1.0	12.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	3.0	3.0	8.0	3.0	3.0	3.0	2.0	11.0	1.0	2.0	1.0	2.0	6.0	3.0	2.0	3.0	2.0	10.0	**56.0**	**2**
	FL-P-02	1.0	1.0	1.0	2.0	1.0	6.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	2.0	3.0	7.0	2.0	2.0	2.0	1.0	7.0	1.0	1.0	1.0	1.0	4.0	2.0	1.0	2.0	1.0	6.0	**38.0**	**30**
	FL-C-01	2.0	2.0	2.0	2.0	2.0	10.0	2.0	3.0	3.0	2.0	10.0	1.0	2.0	2.0	3.0	8.0	3.0	3.0	3.0	2.0	11.0	2.0	1.0	1.0	1.0	5.0	3.0	3.0	3.0	2.0	11.0	**55.0**	**3**
	FL-C-02	2.0	2.0	1.0	3.0	3.0	11.0	2.0	2.0	2.0	3.0	9.0	1.0	1.0	2.0	3.0	7.0	2.0	1.0	2.0	1.0	6.0	1.0	1.0	1.0	1.0	4.0	3.0	3.0	3.0	2.0	11.0	**48.0**	**17**
Watershed Management	WS-C-01	2.0	2.0	2.0	3.0	3.0	12.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	3.0	6.0	1.0	2.0	2.0	3.0	8.0	1.0	3.0	3.0	2.0	9.0	3.0	2.0	3.0	2.0	10.0	**53.0**	**7**
	WS-C-02	2.0	2.0	2.0	3.0	3.0	12.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	3.0	6.0	1.0	2.0	2.0	3.0	8.0	1.0	3.0	3.0	2.0	9.0	3.0	2.0	3.0	2.0	10.0	**53.0**	**7**
	WS-C-03	2.0	3.0	2.0	3.0	1.0	11.0	1.0	1.0	1.0	1.0	4.0	1.0	1.0	2.0	2.0	6.0	1.0	1.0	2.0	1.0	5.0	2.0	3.0	3.0	2.0	10.0	3.0	2.0	3.0	2.0	10.0	**46.0**	**20**
	WS-C-04	2.0	2.0	2.0	3.0	1.0	10.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	2.0	1.0	5.0	2.0	2.0	1.0	2.0	7.0	2.0	2.0	2.0	2.0	8.0	2.0	1.0	2.0	2.0	7.0	**45.0**	**23**
Water-related Environment Management	WQ-P-01	2.0	2.0	2.0	3.0	3.0	12.0	1.0	3.0	1.0	1.0	6.0	1.0	1.0	2.0	1.0	5.0	2.0	1.0	2.0	1.0	6.0	1.0	2.0	3.0	2.0	8.0	2.0	2.0	3.0	3.0	10.0	**47.0**	**19**
	WQ-C-01	2.0	3.0	2.0	3.0	1.0	11.0	1.0	1.0	1.0	1.0	4.0	3.0	2.0	3.0	1.0	9.0	2.0	1.0	2.0	1.0	6.0	3.0	2.0	2.0	2.0	9.0	2.0	2.0	2.0	1.0	7.0	**46.0**	**20**
	WQ-C-02	2.0	2.0	2.0	3.0	1.0	10.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	2.0	1.0	5.0	1.0	3.0	2.0	2.0	8.0	3.0	3.0	1.0	2.0	9.0	2.0	2.0	2.0	2.0	8.0	**48.0**	**17**
	WQ-C-03	2.0	2.0	2.0	2.0	2.0	10.0	1.0	1.0	1.0	1.0	4.0	2.0	1.0	3.0	1.0	7.0	1.0	1.0	2.0	1.0	5.0	3.0	2.0	1.0	3.0	9.0	2.0	2.0	2.0	2.0	8.0	**43.0**	**27**
	WQ-C-04	2.0	2.0	2.0	2.0	1.0	9.0	1.0	1.0	1.0	1.0	4.0	3.0	1.0	3.0	1.0	8.0	2.0	1.0	2.0	1.0	6.0	1.0	3.0	2.0	3.0	9.0	2.0	2.0	2.0	2.0	8.0	**44.0**	**24**
Others	IS-C-01	2.0	3.0	2.0	3.0	2.0	12.0	1.0	1.0	1.0	1.0	4.0	3.0	3.0	3.0	1.0	10.0	1.0	2.0	2.0	1.0	6.0	3.0	3.0	1.0	2.0	9.0	3.0	3.0	2.0	2.0	10.0	**51.0**	**10**
	IS-C-03	2.0	3.0	2.0	3.0	2.0	12.0	1.0	1.0	1.0	1.0	4.0	3.0	3.0	3.0	1.0	10.0	1.0	2.0	2.0	1.0	6.0	3.0	2.0	1.0	2.0	8.0	3.0	3.0	3.0	2.0	11.0	**51.0**	**10**
	IS-C-04	2.0	2.0	2.0	3.0	2.0	11.0	2.0	3.0	2.0	2.0	9.0	3.0	3.0	3.0	1.0	10.0	2.0	3.0	3.0	3.0	11.0	2.0	2.0	2.0	1.0	7.0	3.0	3.0	3.0	3.0	12.0	**60.0**	**1**

Annex-T 11.2.5 Results of Evaluation (Scoring) of Group-B Projects by TWG Members

Sector	Project Code	Viability of the Project						Enhanced Livelihood					Improved Quality of Life					Decentralized Development					Sustained Ecosystem					Empowered People					Grand Total	Rank
		1	2	3	4	5	T	1	2	3	4	T	1	2	3	4	T	1	2	3	4	T	1	2	3	4	T	1	2	3	4	T		
Agriculture / Irrigation and Fishery	AI-P-01	2.9	2.7	1.9	1.8	1.1	10.4	2.9	2.9	2.0	2.8	10.7	1.0	1.0	1.0	1.9	4.9	2.0	3.0	2.0	2.0	9.0	1.0	1.0	1.0	1.0	4.0	2.0	1.9	2.8	1.9	8.6	**47.6**	**18**
	AI-P-02	3.0	3.0	3.0	2.0	1.0	12.0	3.0	3.0	2.0	2.8	10.8	1.0	1.0	1.0	2.0	5.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	3.0	2.0	9.0	**49.8**	**13**
	AI-P-03	3.0	2.9	3.0	2.9	2.0	13.8	2.0	2.9	2.1	2.8	9.8	1.0	1.0	1.0	1.1	4.1	1.9	2.1	1.9	2.7	8.6	1.0	1.0	1.0	1.0	4.0	1.9	1.9	1.9	1.9	7.6	**47.8**	**17**
	AI-P-04	3.0	3.0	2.0	3.0	1.1	12.1	2.9	2.9	2.0	2.8	10.7	1.0	1.0	1.0	1.0	4.0	2.0	3.0	2.0	2.0	9.0	1.0	1.0	1.1	1.0	4.1	2.0	2.0	3.0	2.0	9.0	**48.8**	**14**
	AI-P-05	2.0	2.0	2.0	3.0	1.0	10.0	1.9	1.9	2.0	1.9	7.7	1.0	1.0	1.0	1.0	4.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	1.0	2.0	2.0	1.0	6.0	**39.7**	**29**
	AI-P-06	2.0	3.0	2.0	2.0	2.0	11.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	1.0	3.0	1.0	1.0	6.0	1.0	1.0	1.0	1.0	4.0	1.0	2.0	2.0	2.0	7.0	**40.0**	**28**
	AI-P-07	2.0	2.0	3.0	3.0	2.0	12.0	2.0	3.0	3.0	3.0	11.0	2.0	2.0	1.0	2.0	7.0	1.0	2.0	2.0	2.0	7.0	1.0	1.0	2.0	1.0	5.0	3.0	3.0	3.0	3.0	12.0	**54.0**	**4**
	AI-P-08	2.0	2.0	2.0	2.0	2.0	10.0	2.0	3.0	2.0	3.0	10.0	1.0	1.0	1.0	1.0	4.0	1.0	3.0	1.0	2.0	7.0	1.0	1.0	2.0	1.0	5.0	2.0	2.0	2.0	2.0	8.0	**44.0**	**24**
	AI-P-09	2.0	2.0	2.0	2.0	1.0	9.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	1.0	4.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.1	1.0	4.1	1.0	1.0	2.0	1.0	5.0	**38.1**	**30**
	AI-P-10	2.1	2.0	2.9	2.1	1.1	10.1	2.9	3.0	1.9	2.9	10.7	2.9	2.9	1.9	1.1	8.8	1.9	3.0	1.9	1.9	8.7	1.0	1.0	2.1	1.0	5.1	1.9	1.9	1.9	2.8	8.5	**51.9**	**8**
	AI-P-11	2.1	2.1	1.9	2.1	2.9	11.1	3.0	3.0	2.1	3.0	11.1	1.1	1.1	1.1	1.1	4.2	1.1	3.0	2.0	2.9	8.9	1.1	1.1	2.1	1.1	5.2	2.9	2.0	3.0	2.1	9.9	**50.4**	**12**
	AI-C-01	2.0	1.9	1.0	2.1	2.9	9.8	3.0	3.0	2.1	3.0	11.1	1.1	1.1	1.1	1.1	4.2	1.1	3.0	2.0	2.0	8.0	1.1	1.1	1.1	1.1	4.3	2.0	2.0	2.8	1.9	8.6	**46.0**	**21**
	AI-C-02	2.1	2.1	2.1	2.0	2.8	11.0	2.7	2.8	2.8	2.8	11.1	1.8	1.0	1.0	1.0	4.8	1.8	2.7	1.8	2.0	8.3	1.0	1.0	1.8	1.0	4.8	2.6	2.7	2.7	2.7	10.7	**50.7**	**10**
	AI-C-03	2.0	2.0	2.0	2.0	2.0	10.0	2.0	3.0	2.9	2.9	10.8	1.0	2.0	2.0	1.0	6.0	1.0	2.0	2.0	2.0	7.0	2.0	2.0	2.0	2.0	8.0	3.0	3.0	3.0	3.0	12.0	**53.8**	**5**
Municipal Water Supply, Sanitation and Sewerage	MW-P-04	1.9	1.9	1.9	1.9	1.0	8.6	1.9	2.0	1.0	1.0	5.9	2.1	2.9	1.9	1.0	7.9	2.0	2.0	2.1	1.1	7.1	1.0	1.1	1.0	1.1	4.1	1.0	1.0	1.0	1.0	4.0	**37.6**	**32**
	MP-C-01	2.0	2.0	2.0	1.9	1.0	8.9	1.0	1.0	1.0	1.0	4.0	2.5	1.1	2.9	1.0	7.5	1.9	1.0	1.9	2.0	6.8	1.0	2.9	1.9	2.9	8.7	2.0	2.0	2.0	1.0	7.0	**42.9**	**27**
Management of Flood and Sediment Disasters	FL-P-01	3.0	3.0	3.0	2.0	1.1	12.1	1.9	2.9	2.0	1.9	8.7	1.0	1.0	2.9	3.0	7.9	2.9	2.9	2.9	2.0	10.7	1.0	2.0	1.0	2.0	6.0	3.0	2.0	3.0	2.0	10.0	**55.4**	**2**
	FL-P-02	1.0	1.0	1.0	2.0	1.1	6.1	1.9	2.0	2.0	2.0	7.9	1.0	1.0	2.0	3.0	7.0	2.0	2.0	2.0	1.0	7.0	1.0	1.0	1.0	1.0	4.0	2.0	1.0	2.0	1.0	6.0	**38.0**	**31**
	FL-C-01	2.0	2.0	2.0	2.0	2.0	10.0	1.9	3.0	3.0	2.0	9.9	1.0	2.0	2.0	3.0	8.0	2.8	2.8	3.0	2.0	10.5	2.0	1.0	1.0	1.0	5.0	3.0	3.0	3.0	2.0	11.0	**54.5**	**3**
	FL-C-02	2.0	2.0	1.0	3.0	3.0	11.0	1.9	2.0	2.0	3.0	8.9	1.0	1.0	2.0	3.0	7.0	2.0	1.0	2.0	1.0	6.0	1.1	1.1	1.1	1.1	4.2	3.0	3.0	3.0	2.0	11.0	**48.1**	**15**
Watershed Management	WS-C-01	1.9	1.9	2.0	3.0	3.0	11.8	2.0	2.0	2.0	2.0	8.0	1.0	1.0	1.0	2.9	5.9	1.0	2.0	2.0	3.0	8.0	1.1	3.0	3.0	2.0	9.1	3.0	2.1	3.0	2.1	10.1	**52.9**	**7**
	WS-C-02	2.0	2.0	2.0	3.0	3.0	12.0	2.0	2.0	2.0	1.9	7.9	1.1	1.1	1.0	3.0	6.2	1.0	2.0	2.0	3.0	8.0	1.1	3.0	3.0	2.0	9.1	3.0	2.0	2.9	2.0	9.9	**53.1**	**6**
	WS-C-03	2.0	3.0	2.0	3.0	1.0	11.0	1.0	1.0	1.0	1.0	4.0	1.0	1.0	2.0	2.0	6.0	1.0	1.0	2.0	1.0	5.0	2.0	3.0	3.0	2.0	10.0	3.0	2.0	3.0	2.0	10.0	**46.0**	**20**
	WS-C-04	2.0	2.0	2.0	3.0	1.0	10.0	2.0	2.0	2.0	2.0	8.0	1.0	1.0	2.0	1.0	5.0	2.0	2.0	1.0	2.0	7.0	2.0	2.0	2.0	2.0	8.0	2.0	1.1	2.0	2.0	7.1	**45.1**	**23**
Water-related Environment Management	WQ-P-01	1.9	2.0	2.0	3.0	3.0	11.9	1.0	2.9	1.1	1.0	6.0	1.0	1.0	2.0	1.0	5.0	2.0	1.0	2.0	1.1	6.1	1.0	2.0	3.0	2.0	8.0	2.0	2.0	3.0	3.0	10.0	**46.9**	**19**
	WQ-C-01	2.0	2.9	2.0	3.0	1.0	10.9	1.0	1.0	1.0	1.0	4.0	3.0	1.9	3.0	1.0	8.9	2.0	1.0	2.0	1.0	6.0	2.9	2.0	2.0	2.0	8.9	2.0	2.0	2.0	1.0	7.0	**45.7**	**22**
	WQ-C-02	2.0	2.0	2.0	3.0	1.0	10.0	1.9	2.0	2.0	2.0	7.9	1.0	1.0	2.0	1.0	5.0	1.0	3.0	2.0	2.0	8.0	3.0	3.0	1.0	1.9	8.9	2.0	2.0	2.0	2.0	8.0	**47.8**	**16**
	WQ-C-03	2.0	2.0	2.0	2.1	2.0	10.1	1.0	1.0	1.0	1.0	4.0	2.0	1.0	3.0	1.0	7.0	1.0	1.0	2.0	1.0	5.0	3.0	2.0	1.0	3.0	9.0	2.0	2.0	2.1	2.0	8.1	**43.1**	**26**
	WQ-C-04	2.0	2.0	2.0	2.1	1.1	9.1	1.1	1.0	1.1	1.0	4.1	2.6	1.0	3.0	1.0	7.6	2.0	1.1	2.0	1.1	6.1	1.0	2.9	2.0	3.0	8.9	2.0	2.0	2.0	2.0	8.0	**43.8**	**25**
Others	IS-C-01	2.0	3.0	2.0	3.0	2.0	12.0	1.0	1.0	1.0	1.0	4.0	2.9	2.9	3.0	1.0	9.8	1.0	2.0	2.0	1.0	6.0	3.0	3.0	1.0	2.1	9.1	2.8	2.8	1.9	2.0	9.6	**50.5**	**11**
	IS-C-03	2.0	3.0	2.0	3.0	2.0	12.0	1.0	1.0	1.0	1.0	4.0	2.9	2.9	3.0	1.1	9.9	1.0	2.0	2.0	1.0	6.0	3.0	2.1	1.0	2.0	8.1	2.9	2.9	3.0	2.0	10.8	**50.8**	**9**
	IS-C-04	2.0	2.0	2.0	3.0	2.0	11.0	1.9	2.8	2.1	2.0	8.8	2.8	2.8	2.8	1.0	9.5	2.0	2.9	2.9	2.9	10.7	2.0	2.0	2.0	1.0	7.0	2.9	2.9	2.9	2.8	11.6	**58.6**	**1**

Annex-T 11.2.6 Group-B Projects to be Implemented in Short, Mid and Long Term

Priority Order	Project Code		Implementing Agency	Initial Investment Cost (Million Pesos)				Implementaion Period (years)				Score
				Short-tem	Mid-term	Long-term	Total	Short-tem	Mid-term	Long-term	Total	
Group-A Project for Maintenance and Rehabilitation of Existing Facilities				5,485	3,791	3,792	13,067					
On-going Group-B Projects				2,339	498	0	2,837					
IS-C-04	Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution		NWRB/Others	300			300	Less than 5				**58.6**
FL-P-01	Flood Control Measures in Mt. Pinatubo Devastated Area- Focus on Pasac Delta		DPWH	4,320			4,320	Less than 5				**55.4**
FL-C-01	Flood Mitigation for Pampanga Delta		DPWH	100	5,368		5,468	5	5		10	**54.5**
AI-P-07	Appropriate Irrigation Technologies for Enhanced Agricultural Production		NIA	654			654	Less than 5				**54.0**
AI-C-03	Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs		NIA	150			150	Less than 5				**53.8**
WS-C-02	Protected Area Management Program (PAMP)		DENR/ PAWCZMS	202	202		404	5	5		10	**53.1**
WS-C-01	Upland Development Program		DA/DENR/ LGUs	490	490		980	5	5		10	**52.9**
AI-P-10	Rehabilitation of AMRIS		NIA	983			983	Less than 5				**51.9**
IS-C-03	Enhancement of Monitoring System for Surface Water in Pampanga River Basin		NWRB/ Others	10			10	Less than 5				**50.8**
AI-C-02	Introduction of Water Saving Irrigation Technology		NIA	150			150	Less than 5				**50.7**
IS-C-01	Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin		NWRB/ Others	99	99	99	297	5	5	5	15	**50.5**
AI-P-11	Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects, Small Diversion Dam Projects		DA Region III/ LGUs	169			169	Less than 5				**50.4**
AI-P-02	Balog-Balog Multipurpose Project Phase 2		NIA	8,942	7,153		16,095	5	4		9	**49.8**
AI-P-04	Casecnan Multi-purpose Irrigation & Power Project Irrigation Component Phase 2		NIA	5,000	2,000		7,000	5	2		7	**48.8**
FL-C-02	Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and N. Ecija		LGUs	8			8	Less than 5				**48.1**
WQ-C-02	Capacity Development to Improve Water Quality and Aquaculture Fisheries Management		DA-BFAR	48			48	Less than 5				**47.8**
AI-P-03	Sector Loan on Rehabilitation of Irrigation Facilities		NIA	222			222	Less than 5				**47.8**
WS-C-03	Urban Greening Program		LGUs	88	88	88	264	5	5	5	15	**46.0**
AI-C-01	New Construction of Small Scale Irrigation Project under BSWM		BSWM/ LGUs	257	257		514	5	5		10	**46.0**
WQ-C-01	Capacity Development to Upgrade WQ Monitoring and Data Management Program		DENR-EMB	140			140	Less than 5				**45.7**
WS-C-04	Community-based Eco-tourism Program		DOT/DENR/ LGUs	132	132		264	5	5		10	**45.1**
AI-P-01	Balintingon Reservoir Multipurpose Project (BRMP)		NIA/ G. Trino		9,708	3,883	13,591		5	2	7	**44.6**
AI-P-08	Central Luzon Groundwater Irrigation Systems Reactivation Project		NIA		1,429		1,429		Less than 5			**44.0**
WQ-C-03	Capacity Development Project to Improve Industry Adoption of Cleaner Production Options		DTI/DENR/ Private Industries		60		60		Less than 5			**43.1**
MP-C-01	Septage Treatment and Disposal Facility		MCWMC/ LGUs/WDs/ Private		255	255	510		5	5	10	**42.9**
AI-P-06	Irrigation Water Resources Augmentation Pump Establishment Project		NIA		130		130		Less than 5			**40.0**
AI-P-05	Procurement of Pumps, Drilling Rigs & Related Equipment		NIA		206		206		Less than 5			**39.7**
AI-P-09	Gumain Reservoir Project		NIA		1,716	12,013	13,729		1	7	8	**38.1**
FL-P-02	Bacolor Comprehensive Rehabilitation Master Plan		LGU			1,500	1,500				Less than 5	**38.0**
Total				30,287	33,582	21,630	85,499					

Annex-T 11.2.7 Implementation Schedule for Group-B Projects

Sector	Code	Name of Project	Implementing Agency	Short-term	Mid-term	Long-term
Agriculture/Irrigation and Fisheries	AI-P-07	Appropriate Irrigation Technologies for Enhanced Agricultural Production	NIA			
	AI-C-02	Introduction of Water Saving Irrigation Technology	NIA			
	AI-C-03	Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs	NIA			
	AI-G-01	Balog-Balog Multipurpose Project Phase 1	NIA			
	AI-G-02	Along-along Creek Irrigation Project (UPRIIS Div3)	NIA			
	AI-G-10	Upper Tabuating SRIP	NIA			
	AI-G-07	Participatory Irrigation Development Project, APL1-Infrastructure Development	NIA			
	AI-P-10	Rehabilitation of AMRIS	NIA			
	AI-P-03	Sector Loan on Rehabilitation of Irrigation Facilities	NIA			
	AI-P-11	Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects, Small Diversion Dam Projects	DA Region III/LGUs			
	AI-P-02	Balog-Balog Multipurpose Project Phase 2	NIA			
	AI-P-04	Casecnan Multi-purpose Irrigation & Power Project Irrigation Component Phase 2	NIA			
	AI-C-01	New Construction of Small Scale Irrigation Project under BSWM	BSWM/LGUs			
	AI-P-08	Central Luzon Groundwater Irrigation Systems Reactivation Project	NIA			
	AI-P-06	Irrigation Water Resources Augmentation Pump Establishment Project	NIA			
	AI-P-05	Procurement of Pumps, Drilling Rigs & Related Equipment	NIA			
	AI-P-01	Balintingon Reservoir Multipurpose Project (BRMP)	NIA/G. Trino			
	AI-P-09	Gumain Reservoir Project	NIA			
Municipal Water Supply, Sanitation and Sewerage	MP-G-01	Cabanatuan Sewerage System	LGU			
	MP-G-02	Expansion of Clark Sewerage System	Clark Water			
	MP-C-01	Septage Treatment and Disposal Facility	LWUA/WDs/LGUs/Private WSPs			
Management of Flood and Sediment Disasters	FL-G-01	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part I	DPWH			
	FL-G-02	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part II	DPWH			
	FL-P-01	Flood Control Measures in Mt. Pinatubo Devastated Area- Focus on Pasac Delta	DPWH			
	FL-C-01	Flood Mitigation for Pampanga Delta	DPWH			
	FL-G-04	Flood Forecasting and Warning System Capacity Building Project upon Dam Release in the Philippines	PAGASA			
	FL-C-02	Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and N. Ecija	LGUs			
	FL-P-02	Bacolor Comprehensive Rehabilitation Master Plan	LGU			
Watershed Management	WS-G-03	Integrated Agro-Forestry Development Program (CBFM-CARP)	DENR/RCBFMO/DAR			
	WS-G-11	Forestlands Management Project (FMP)	DENR-FASPO			
	WS-G-12	Pampanga River Basin Rehabilitation Project (PRBRP)	DENR-FRCD			
	WS-C-01	Upland Development Program (UDP)	DA/DENR/LGUs			
	WS-C-02	Protected Area Management Program (PAMP)	DENR-PAWZCMS			
	WS-C-03	Urban Greening Program	DENR/LGUs/Pvt. Sector			
	WS-C-04	Community-based Eco-tourism Program	DOT/DENR/LGUs			
Water-related Environment Management	WQ-C-01	Capacity Development to Upgrade WQ Monitoring and Data Management Program	DENR-EMB			
	WQ-C-02	Capacity Development to Improve Water Quality and Aquaculture Fisheries Management	DA-BFAR			
	WQ-C-03	Capacity Development Project to Improve Industry Adoption of Cleaner Production Options	DTI/DENR/Private Industries			
Others	IS-C-01	Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin	NWRB/Others			
	IS-C-03	Enhancement of Monitoring System for Surface Water in Pampanga River	NWRB/Others			
	IS-C-04	Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution	NWRB/Others			

Annex-T 11.2.8 (1/3) Development Scenarios and Relevant Projects (Group-B)

Sector	Development Scenario	Target Completion Period	Project		Implementing Agency	Cost (Million)			
						Short-term (2011-2015)	Mid-term (2016-2020)	Long-term (2021-2025)	Total (2011-2025)
Agriculture/Irrigation and Fisheries	**(1) Improvement of Irrigation Technologies** The innovative irrigation technologies shall be developed and the capacity building on usage of the technologies shall be made so as to increase the irrigation efficiency and save the irrigation water by 2015.	Short-term	AI-P-07	Appropriate Irrigation Technologies for Enhanced Agricultural Production	NIA	654			654
			AI-C-02	Introduction of Water Saving Irrigation Technology	NIA	150			150
			AI-C-03	Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs	NIA	150			150
	(2) Short-term Development of Irrigation Systems The agricultural productivity shall be increased through the seven (7) irrigation development projects, which contribute to the beneficial area (newly developed) of 5,880ha, the beneficial area (rehabilitated) of 37,046 ha and beneficiaries of 56,640 farm-families in total, by 2015.	Short-term	AI-G-01	Balog-Balog Multipurpose Project Phase 1	NIA	236			236
			AI-G-02	Along-along Creek Irrigation Project (UPRIIS Div3)	NIA	25			25
			AI-G-10	Upper Tabuating SRIP	NIA	76			76
			AI-G-07	Participatory Irrigation Development Project, APL1-Infrastructure Development	NIA	41			41
			AI-P-10	Rehabilitation of AMRIS	NIA	983			983
			AI-P-03	Sector Loan on Rehabilitation of Irrigation Facilities	NIA	222			222
			AI-P-11	Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects, Small Diversion Dam Projects	DA Region III/ LGUs	169			169
	(3) Mid-term Development of Irrigation Systems The agricultural projects shall be increased through the six (6) irrigation development projects, which contribute to the beneficial area (newly developed) of 58,443 ha, the beneficial area (rehabilitated) of 50,904 ha and the beneficiaries of 101,893 farm-families in total by 2020.	Short-term/Mid-term	AI-P-02	Balog-Balog Multipurpose Project Phase 2	NIA	8,942	7,153		16,095
			AI-P-04	Casecnan Multi-purpose Irrigation & Power Project Irrigation Component Phase 2	NIA	5,000	2,000		7,000
			AI-C-01	New Construction of Small Scale Irrigation Project under BSWM	BSWM/LGUs	257	257		514
			AI-P-08	Central Luzon Groundwater Irrigation Systems Reactivation Project	NIA		1,429		1,429
			AI-P-06	Irrigation Water Resources Augmentation Pump Establishment Project	NIA		130		130
			AI-P-05	Procurement of Pumps, Drilling Rigs & Related Equipment	NIA		206		206
	(4) Long-term Development of Irrigation Systems The agricultural projects shall be increased through the two (2) irrigation development projects, which contribute to the beneficial area (newly developed) of 31,100 ha and the beneficiaries of 9,152 farm-families in total by 2025.	Mid-term/Long-term	AI-P-01	Balintingon Reservoir Multipurpose Project (BRMP)	NIA/G. Trino		9,708	3,883	13,591
			AI-P-09	Gumain Reservoir Project	NIA		1,716	12,013	13,729
	Total					**16,905**	**22,599**	**15,896**	**55,400**
Municipal Water Supply, Sanitation and Sewerage	**(1) Development of Sewerage Systems** The on-going development for the sewerage systems for Cabanatuan City in Nueva Ecija and Clark City in Tarlac shall be completed by 2015. Upon completion of the projects, about 12 % of the population in Cabanatuan City and 100% in Clark would be served by the public sewerage system.	Short-term	MP-G-01	Cabanatuan Sewerage System	LGU	189			189
			MP-G-02	Expansion of Clark Sewerage System	Clark Water	456			456
	(2) Construction/Provision of Septage Treatment and Disposal Facilities The services of the septage treatment and disposal facilities shall be provided to about 80% of the urban area in the following ten cities/municipalities by 2025: (1) Angeles, (2) San Fernado, (3) Guagua and (4) Mabalacat, (5) Baliuag, (6) Calumpit, (7) Hagonoy and (8) Malolos, (9) Cabanatuan and (10) Tarlac.	Mid-term/Long-term	MP-C-01	Septage Treatment and Disposal Facility	LWUA/WDs/LGUs /Private WSPs		255	255	510
	Total					**645**	**255**	**255**	**1,155**

Annex-T 11.2.8 (2/3) Development Scenarios and Relevant Projects (Group-B)

Sector	Development Scenario	Target Completion Period	Project		Implementing Agency	Cost (Million) Short-term (2011-2015)	Mid-term (2016-2020)	Long-term (2021-2025)	Total (2011-2025)
Management of Flood and Sediment Disasters	**(1) Flood Mitigation for Pasac River Basin (Eastern Pinatubo Area)** All on-going, proposed and conceptual flood mitigation projects for Pasac river basin shall be completed by 2015. Upon completion of the projects, the chronic flood damage in the area of about 57,300 ha would be mitigated, and about 309,000 people would be benefitted.	Short-term	FL-G-01	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part I	DPWH	470			470
			FL-G-02	Pinatubo Hazard Urgent Project (PHUMP) Phase III Part II	DPWH	5			5
			FL-P-01	Flood Control Measures in Mt. Pinatubo Devastated Area- Focus on Pasac Delta	DPWH	4,320			4,320
	(2) Flood Mitigation for Pampanga Delta The flood mitigation plan for Pampanga Delta **shall be completed by 2020. Upon completion of the projects, the chronic flood damage in Pampanga Delta of about 32,400 ha would be mitigated, and about 175,000 people would be benefitted.**	Short-term and Mid-term	FL-C-01	Flood Mitigation for Pampanga Delta	DPWH	100	5,368		5,468
	(3) Capacity Building on the Appropriate Dam Reservoir Operation against Flood The capacity building on the appropriate reservoir operation against flood for Pantabangan Dam and Angat Dam shall be made through the technical cooperation by JICA by 2015.	Short-term	FL-G-04	Flood Forecasting and Warning System Capacity Building Project upon Dam Release in the Philippines	PAGASA	300			300
	(4) Establishment of Community-based Flood Forecasting and Warning System for Provinces of Pampanga, Tarlac and Nueva Ecija Succeeding to Bulacan Province, Pampanga, Tarlac and Nueva Ecija shall be provided with the community-based flood forecasting and waning system by 2015.	Short-term	FL-C-02	Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and N. Ecija	LGUs	8			8
	(5) Flood Mitigation for Bacolor Municipality The current potential flood damage in Bacolor Municipality shall be reduced through river channel improvement of Gugu River, drainage improvement by 2025.	Long-term	FL-P-02	Bacolor Comprehensive Rehabilitation Master Plan	LGU			1,500	1,500
	Total					**5,203**	**5,368**	**1,500**	**12,071**
Watershed Management	**(1) Strengthening of the On-going Reforestation Efforts** The seven (7) special projects shall be implemented in order to strengthen the on-going reforestation efforts. The target outcomes by the special projects are as below: (a) The forest cover shall expand by 39,900has. at the rate of 2,660has./yr by 2025 through implementation of WS-G-03, WS-G-11, WS-G-12, WS-C-01, WS-C-02 and WS-C-04. (b) Agro-forestry cover shall expand by 21,500has. at the rate of 1,430has./yr through implementation of WS-G-11, WS-G-12 and WS-C-01. The expansion of agro-forestry could enhance access to the livelihood and economic opportunities for upland occupants, particularly the indigenous communities. (c) The degraded and severely eroded uplands/untenured watersheds of 10,500has. in particular shall be restored through implementation of WS-C-01. (d) Urban greening (WS-C-03) shall cover 7,300has. of open spaces and 222 linear km of roads and riverbanks. (e) The objective forest protection area of 56,100has. under WS-C-02 shall be officially included into the NIPAS areas and provided with the formal management in order to conserve the biodiversity in critical habitats and natural ecosystems. (f) The facilities and services for eco-tourism to the natural integrated protected areas and/or the critical habitats in the study area shall be improved through WS-C-04 so as to increase the income levels for the communities and to enhance the present natural conditions of the important habitats and ecosystems in these areas.	Whole Period	WS-G-03	Integrated Agro-Forestry Development Program (CBFM-CARP)	DENR/ RCBFMO/DAR	31			31
			WS-G-11	Forestlands Management Project (FMP)	DENR-FASPO	498	498		996
			WS-G-12	Pampanga River Basin Rehabilitation Project (PRBRP)	DENR-FRCD	12			12
			WS-C-01	Upland Development Program (UDP)	DA/DENR/ LGUs	490	490		980
			WS-C-02	Protected Area Management Program (PAMP)	DENR-PAWZCMS	202	202		404
			WS-C-03	Urban Greening Program	DENR/LGUs/ Pvt. Sector	88	88	88	264
			WS-C-04	Community-based Eco-tourism Program	DOT/DENR/LGUs	132	132		264
	Total					**1,453**	**1,410**	**88**	**2,951**

Annex-T 11.2.8 (3/3) Development Scenarios and Relevant Projects (Group-B)

Sector	Development Scenario	Target Completion Period	Project		Implementing Agency	Cost (Million)			
						Short-term (2011-2015)	Mid-term (2016-2020)	Long-term (2021-2025)	Total (2011-2025)
Water-related Environment Management	**(1) Improvement of Monitoring and Processing System for the Water Quality Data** DENR shall improve the monitoring and processing system for the water quality data taking the following measures: (a) Rationalize water quality monitoring and pollution regulatory compliance, (b) Compile inventory of pollution sources, (c) Upgrade management capability of DENR Staffs and other stakeholders and (d) Upgrade the data management system	Short-term	WQ-C-01	Capacity Development to Upgrade WQ Monitoring and Data Management Program	DENR-EMB	140			140
	(2) Capacity Development to Reduce Pollution Load The capability of fishpond operators and non-compliant industries will be improved over the mid-term towards adopting cleaner production options in order to reduce their impacts on water quality.	Short-term and Mid-term	WQ-C-02	Capacity Development to Improve Water Quality and Aquaculture Fisheries Management	DA-BFAR	48			48
			WQ-C-03	Capacity Development Project to Improve Industry Adoption of Cleaner Production Options	DTI/DENR/ Private Industries		60		60
	Total					**188**	**60**	**0**	**248**
Others	**(1) Enhancement of Monitoring of Groundwater and Surface Water** The monitoring of the groundwater and surface water shall be enhanced in order to apprehend the actual status of the water resources in Pampanga river basin	Whole Terms	IS-C-01	Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin	NWRB/Others	99	99	99	297
			IS-C-03	Enhancement of Monitoring System for Surface Water in Pampanga River	NWRB/Others	10			10
	(2) Capacity Development on Water Allocation and Distribution The appropriate methodologies on the water allocation and distribution for municipal water use, irrigation, hydropower generation and other various water uses shall be introduced to NWRB and other relevant agencies	Short-term	IS-C-04	Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution	NWRB/Others	300			300
	Total					**409**	**99**	**99**	**607**
Grand Total						**24,803**	**29,791**	**17,838**	**72,432**

Annex-T 12.4.1 Institutional Structure of Watershed and Forest Management

National Agencies	DENR					PAMB	Office of the President		DPWH		DA		DE
							NCIP	NDCC	PMO-MFC	FCSEC	BSWM	NIA	NPC
	FMB, FMS			RBCO	PAWD								
	PENRO/CENRO				PASU								
Local Government	LGUs, WDs												
Type of Service	Municipality	Province	City	RBO									
WATERSHED MANAGEMENT				◎									
・ Watershed Project				Rationalize									
・ Protection of Soil and Water											⊙		
・ Control of Illegal Logging, Kaingin Farming, Unsustainable Practices													
・ Flood Control				National M/P	O			◎	⊙	Planning			
・ Protection of Project Area												O	O
FOREST MANAGEMENT (CBFM)		⊙		Rationalize									
・ Social Forestry	O		O										
・ Community-based Forestry Project	O		O										
・ Integrated Social Forestry Program	O	O	O										
・ Community Forestry	O		O										
・ Forest Fire Protection	O		O										
・ Conservation of Mangrove	O		O		⊙/O	O							
PROTECTED AREA MANAGEMENT						⊙							
・ Management of Conservation Areas							O						
TECHNICAL ASSISTANCE	DENR-FMS												
・ Policies, Plans, Programs													
・ Forest Protection and Maintenance													
・ Community Involvement													

Notes: ⊙ Main national agency; ◎ Regulatory function; O responsible organization

Source: JICA Study Team

Annex-T 13.3.1 (1/7) Outlines of Proposed and Conceptual Projects and Programs of IWRM Plan

Sector	Proposed/Conceptual Program/Project	Outline/Scope of the Program/Project	Groups under PEISS	Possible Documents Required For ECC/CNC Application
1. Agriculture/ Irrigation and Fisheries	AI-P-01: Balintingon Reservoir Multipurpose Project (BRMP)	Major activities are the construction of the facilities: · Rock-fill center-core dam (H=140m) and its appurtenant structures with an aim to have the reservoir with 572 MCM storage capacity. · Open-type powerhouse equipped with 2 Francis type turbines with the capacity of 15 MW · Diversion weir (L=140m) · Irrigation facilities: main canal (L=109km), laterals(L=168km) and sub-laterals, main and supplementary farm ditches, drainage channels (L=210km), and access roads	Group I	EIS
	AI-P-02: Balog-Balog Multipurpose Project Phase 2	Major activities are construction of the facilities: · High earth and rock fill dam (H=113.5m) with the storage capacity of 625 MCM (effective storage: 525 MCM) · Hydropower plant with the capacity of 43.5MW · 150 to 200 deep production wells to develop ground water for supplementation of the irrigation water supply · Fishery component consisting of the construction and production of tilapia species in fixed floating cages of at least 150 ha within the Balog-Balog reservoir area. Estimated fishery production per cage is 6,300 kg/year*cage.	Group I	EIS
	AI-P-03: Sector Loan on Rehabilitation of Irrigation Facilities	Major activity is rehabilitation of diversion works, canal system, drainage system, road, and O&M facilities.	Group V	App. for APS
	AI-P-04: Casecnan Multi-purpose Power & Irrigation Project Irrigation Component Phase 2	Major activities are: · New construction of extension of Super Diversion Canal, construction of lateral, and sub-lateral canals, drainage canals and related structures · Rehabilitation/Improvement of UPRIS, such as rehabilitation of PENRIS main and lateral canals, and related structures	Group II/III	EIS/App. for APS
	AI-P-05: Procurement of Pumps, Drilling Rigs & Related Equipment	Major activity is procurement of the following materials: · 1,000 units of centrifugal pumps · 1 units of trailer mounted rotary/percussion type drilling rings · 2 units of resistively machines & electric logger	Group V	App. for APS
	AI-P-06: Irrigation Water Resources Augmentation Pump Establishment Project	Major activities are: · Procurement of 1,330 units of pumps including diesel engines · Installation of 301 units of shallow tube wells · Installation of 1,029 units of surface water pump irrigation to cover the entire target area	-	-
	AI-P-07: Appropriate Irrigation Technologies for Enhanced Agricultural Production	Major activity is installation of the irrigation system with drip sprinkler and flood irrigation operated by the solar power	-	-

Annex-T 13.3.1 (2/7) Outlines of Proposed and Conceptual Projects and Programs of IWRM Plan

Sector	Proposed/Conceptual Program/Project	Outline/Scope of the Program/Project	Groups under PEISS	Possible Documents Required For ECC/CNC Application
1. Agriculture/ Irrigation and Fisheries	AI-P-08: Central Luzon Groundwater Irrigation Systems Reactivation Project	Major activities are: · Construction of 100 deep well pump systems covering 5,000 ha · Provision of rural water supply in the selected barrangays · Procurement of equipment	-	-
	AI-P-09: Gumain Reservoir Project	Major activity is construction of 108m high, zoned embankment dam to store irrigation water which covers 11,000 ha of paddy field and 5,200 ha of sugarcane plantation and to increase the water supply in 7,900 ha of Porac-Gumain & Caulaman RIS.	Group I	EIS
	AI-P-10: Rehabilitation of AMRIS	Major activity is rehabilitation of Bustos, Lower & Upper Maasim Dam.	-	-
	AI-P-11: Construction of Priority Small Scale Irrigation Systems/Small Water Impounding Projects (SWIP), Small Diversion Dam Projects (SDD)	Major activities are: · Construction of SWIP and SDD in the above-mentioned provinces · Rehabilitation of SDD and SWIP in Nueva Ecija	Group II/III	IEE checklist/ App. for APS
	AI-C-01: New Construction of Small Scale Irrigation Project under BSWM	Major activity is construction of small scale irrigation systems which are not covered by on-going and planned projects under BSWM such as: · Diversion Dam (18 nos in 959 ha) · Small Water Impounding Projects (24 nos in 1,635 ha) · Small Farm Reservoir (4 nos in 112 ha) · Shallow Tube Well (STW) and others	Group II/III	IEE checklist/ App. for APS
	AI-C-02: Introduction of Water Saving Irrigation Technology	Major activities are: · Trial and research on water saving irrigation technology · Operation of demonstration farms on water saving irrigation technology · Training to trainers and technical campaign to Irrigator's Associations · Monitoring with close coordination among related agencies, such as DA, NIA, PhilRice, IRRI, and JICA technical cooperation project, etc. · Capacity development of IAs	-	-
	AI-C-03: Improvement of Monitoring System and Capacity Development for Proper Water Management in NISs and CISs	Major activities are: · Installation of additional discharge measurement device · Improvement of discharge monitoring system · Review of calibration of conversion tables · Establishment of communication system · Capacity development	-	-

Annex-T 13.3.1 (3/7) Outlines of Proposed and Conceptual Projects and Programs of IWRM Plan

Sector	Proposed/Conceptual Program/Project	Outline/Scope of the Program/Project	Groups under PEISS	Possible Documents Required For ECC/CNC Application
2. Municipal Water Supply, Sanitation and Sewerage	MW-P-01: Rehabilitation of Umiray-Macua Facilities	Major activities is permanent rehabilitation works which includes: ・ Complete restoration of the access road to tunnel outlet ・ Construction of permanent RCDG bridge for tunnel outlet ・ Widening of ox-bow channel at the tunnel outlet ・ Intake structures such as various mechanical gates; trash rack, waterway protection works, retaining wall, ogee dam, etc. ・ Rehabilitation of mini-hydro plant ・ Construction of log arresters ・ Installation of power/communication cables inside the tunnel ・ Village/Housing relocation	-	-
	MW-P-02: Sumag River Diversion Project	Major activity is construction works such as: ・ Intake facilities ・ Connection canal to the tunnel	Group II/III	IEE/App. for APS
	MW-P-03: Bulacan Treated Bulk Water Supply Project	Major activity is construction works such as: water supply facilities, including a raw aqueduct, a treatment plant, reservoirs, pumping station and primary lines which cover 10 municipalities of Bulacan.	-	-
	MW-P-04: Metro Clark Bulk Surface Water Project	Major activity is installation of the water system with possible construction of storage dams at some of the potential sites such as Marimula, Sacobia and Bangut.	Group I	EIS (Possible amendment for existing ECC)
	MW-C-01: Additional Level 3,2,1 facilities towards 2025 in Bulacan MW-C-02: Additional Level 3,2,1 facilities towards 2025 in Pampanga MW-C-03: Additional Level 3,2,1 facilities towards 2025 in Nueva Ecija MW-C-04: Additional Level 3,2,1 facilities towards 2025 in Tarlac	Major activities are: ・ Development of water supply systems: 1) Installation of new water system 2) Expansion and rehabilitation of the existing water system ・ Soft components: 1) Utilization of high technology equipment in development of water system 2) Immediate water repairs 3) Provision of water meters	Group II/III	IEE/App. for APS
	MW-C-05: Extended Bulacan Bulk Water Supply Project	There are four (4) options proposed: ・ Bayabas Storage Dam ・ Balintingon Storage Dam (same as AI-P-01) ・ Upgrading and improvement of irrigation facilities and water management of AMRIS, consisting of installation of the water pipes/aqueducts ・ Excess water for MWSS from the dams such as Ipo dam which can be constructed outside the Pampanga river basin	Group I	EIS

Annex-T 13.3.1 (4/7) Outlines of Proposed and Conceptual Projects and Programs of IWRM Plan

Sector	Proposed/Conceptual Program/Project	Outline/Scope of the Program/Project	Groups under PEISS	Possible Documents Required For ECC/CNC Application
2. Municipal Water Supply, Sanitation and Sewerage	MW-C-06: Pampanga Bulk Water Supply Project	There are three (3) options proposed: ・ Residual groundwater at surrounding cities/municipalities ・ Pampanga river at Cong Dadong dam ・ Gumain storage dam, same as AI-P-09	Group I	EIS
	MS-C-01: Additional sanitary facilities towards 2025 in Bulacan	Major activities are: ・ Installation of conventional toilets and ecosan toilets ・ Capacity development of the implementing agencies for social preparation for users	-	-
	MS-C-02: Additional sanitary facilities towards 2025 in Pampanga			
	MS-C-03: Additional sanitary facilities towards 2025 in Nueva Ecija			
	MS-C-04: Additional sanitary facilities towards 2025 in Tarlac			
	MP-C-01: Septage Treatment and Disposal Facility	Major activity is purchase of trucks for transportation of septage to the septage treatment and disposal facilities, such as the existing sanitary landfill in Kalangitan, Capas, Tarlac.	-	-
3. Management of Flood and Sediment Disasters	FL-P-01: Flood Control Measures in Mt. Pinatubo Devastated Area-Focus on Pasac Delta	Major activities are: ・ Widening of the existing “pilot third river channel” (22.6 km in length from the confluence with Abacan river/San Fernando river) from the existing bottom width of 30 to 60 m ・ Excavation of the Pasac river as an eastern alignment of the pilot third river channel ・ Local drainage improvement connecting the San Fernando river to the Third river and the excavation of San Fernando river (total length:29.6m) ・ Key road raising to ensure that the transportation routes can be maintained during floods	Group II/III	The type of the document for ECC shall require further discussion with EMB
	FL-P-02: Bacolor Comprehensive Rehabilitation Master Plan	Major activities are: ・ Construction of Gugu ring dike (7.8 km in length) ・ Completion of the unfinished portion of Gugu Dike (1.0 km in length) ・ Channel excavation of Gugu creek and other various creeks (20 km in length) ・ Slope protection of various creeks in Bacolor municipality (11.0 km in length) ・ Construction of new drainage canals (47.5 km in length) ・ Installation of floodwater pumps in the southern part of Bacolor (2 units) ・ Construction of diversion channel for Pasig-Potrero river	Group II/III	The type of the document for ECC shall require further discussion with EMB
	FL-C-01: Flood Mitigation for Pampanga Delta	The options proposed are: ・ Construction of riverbank and channel dredgeing/excavation at the downstream of Pampanga river ・ Development of the flood retarding basin through construction of the dike	Group I	EIS

Annex-T 13.3.1 (5/7) Outlines of Proposed and Conceptual Projects and Programs of IWRM Plan

Sector	Proposed/Conceptual Program/Project	Outline/Scope of the Program/Project	Groups under PEISS	Possible Documents Required For ECC/CNC Application
3. Management of Flood and Sediment Disasters	FL-C-02: Community Based Flood Early Warning System for Provinces of Pampanga, Tarlac and N. Ecija	Major activities are: ・ Establishment of the simple monitoring and communication system managed by the community for flood warning ・ Capacity building for the municipal and barangay personnel for operation, maintenance and management of the flood warning system ・ Information, Education and Communication (IEC) for the residents on the eligible flood evacuation routes/evacuation centers	-	-
	FL-C-03: Maintenance, Rehabilitation and Improvement for Drainage and Flood Control Facilities under Jurisdiction of LGUs	Major activity is implementation of the maintenance, rehabilitation and improvement works for drainage and flood control facilities.	-	-
	FL-C-04: Integration of Salient Points of IWRM for Pampanga River Basin into School Curricula	Major activity is awareness raising activities targeting the students.	-	-
4. Watershed Management	WS-C-01: Upland Development Program	Possible component of the project is capacity development of upland farmers through the trainings, such as FFS with provision of the necessary equipments.	-	-
	WS-C-02: Protected Area Management Program	Major activities are: ・ Characterization of watershed (basic resource inventory, assessment and mapping, and socio-economy survey) ・ Designation and ground delineation of the management zones ・ Organization of PAMBs and establishment of IPAF ・ Formulation of Protected Area Management Plans and harmonization with ancestral domain plans, forest land use plans and comprehensive landuse plans to address conflicting land use issues ・ Setting up of the mechanism to streamline compliance with FPIC requirements in ancestral domain areas ・ Initial implementation of priority action plans: - Community-based reforestation through assisted natural regeneration in 5,615 ha of degraded forests - Biodiversity and wildlife conservation - Alternative livelihood for forest occupants - IEC campaigns	-	-
	WS-C-03: Urban Greening Program	Major activities are: ・ Community/volunteers organization ・ Planting of timber and non-timber species	-	-

Annex-T 13.3.1 (6/7) Outlines of Proposed and Conceptual Projects and Programs of IWRM Plan

Sector	Proposed/Conceptual Program/Project	Outline/Scope of the Program/Project	Groups under PEISS	Possible Documents Required For ECC/CNC Application
4. Watershed Management	WS-C-04: Eco-tourism Program	Major activities are: · Capacity development of the communities on guiding tours and relevant business management · Installation/renovation of the relevant facilities	-	-
5. Water-related Environment Management	WQ-P-01: Clean Development Mechanism	Major activities are: · Installation of facilities for wastewater and waste collection · Installation of treatment facilities to capture and convert methane gas, and to produce electricity	Group II/III	IEE/App. for APS
	WQ-C-01: Capacity Development to Upgrade Water Quality monitoring and Data Management Program	Major activities are: · Revision and rationalization of the existing monitoring system of water quality/effluent · Preparation of inventory and identification of the pollution sources · Capacity development of the staffs on laboratory management with the provision of appropriate facilities and equipments · Capacity development of WQMA governing board, private industries and other stakeholders · Strength the regulatory and coordination mechanism among the DENR-EMB, the LGUs and relevant agencies · IEC	-	-
	WQ-C-02: Capacity Development to Improve Water Quality and Aquaculture Fisheries Management	Major activities are: · Assessment of carrying capacity studies · Capacity building of relevant agencies · Setup the information management systems	-	-
	WQ-C-03: Capacity Development Project to Improve Industry Adoption of Cleaner Production Options	Major activities are: · Organization of the counterpart team · Preparation of inventory of non-compliant industries · Evaluation of production and environmental management system of the participating industries · Needs assessment and priority setting · Setting up of institutional, policy, market-based financial support mechanisms · Preparation of the industry-specific clean production manuals · Trainings · IEC	-	-

Annex-T 13.3.1 (7/7) Outlines of Proposed and Conceptual Projects and Programs of IWRM Plan

Sector	Proposed/Conceptual Program/Project	Outline/Scope of the Program/Project	Groups under PEISS	Possible Documents Required For ECC/CNC Application
5. Water-related Environment Management	WQ-C-04: Construction of Sanitary Landfills and Support Facilities in Nueva Ecija and Cluster Waste Transfer Stations in Bulacan and Pampanga	Major activities are: ・Construction of 5 sanitary landfills in Nueva Ecija, with the capacity for the 485,802 populations: 1) Provincial sanitary landfill at Gen.Tino 2) Sanitary landfills at Munoz City, San Jose City, Palayan City and St. Rosa 3) Materials Recovery Facilities : 12 municipalities ・Construction of 4 cluster transfer station-cum-materials recovery facilities for a cluter of LGUs in Bulacan and Pampanga, with the capacity for 2,020, 740 populations 1) Construction of 1 cluster transfer station each for a) Baliuag and Calumpit, b) Hagonoy and Malolos City, c) Angeles City and Guagua, d) Mabalacat and San Fernando City	Group II/III	IEE-checklist/ App. for APS
6. Inter-sector for Water Resources Management	IS-C-01: Establishment of Comprehensive Groundwater Monitoring in Pampanga River Basin	Major activities are: ・Installation of monitoring wells ・Setting up of the monitoring network with the database management system ・Capacity development of NWRB in ground water resource monitoring, which may include policy setting up for the groundwater regulation.	-	-
	IS-C-02: Project for Recovery of Reliability of Water Supply in Angat-Umiray System	There are four (4) options proposed which could be combined depending on the results of the following studies : ・Bayabas Storage Dam ・Balintingon Storage Dam (same as AI-P-01) ・Upgrading and improvement of irrigation facilities and water management of AMRIS, consisting of installation of the water pipes/aqueducts ・Excess water for MWSS from the dams such as Ipo dam which can be constructed outside the Pampanga river basin	Group I	EIS
	IS-C-03: Enhancement of Monitoring System for Surface Water in Pampanga River Basin	Major activities are: ・Establishment of monitoring networks with proper database management ・Capacity development of NWRB/RBO in monitoring of surface water to obtain the necessary data for control of water permits	-	-
	IS-C-04: Capacity Development of NWRB and Relevant Agencies on Water Allocation and Distribution	Major activities are: ・ Capacity development of NWRB and relevant agencies on 1) improvement of water permit system, especially irrigation water use in Angat-Umiray system, and 2) operation of water allocation and its monitoring in Angat-Umiray system ・ Identification of potential/existing critical area for water	-	-

Annex-T 13.3.2 (1/4) Summary of Environmental Scoping for Projects and Programs of IWRM Plan

		Sector	Agriculture/Irrigation and Fishery													
		Project Code*/ Impact Items	AI-P-01	AI-P-02	AI-P-03	AI-P-04	AI-P-05	AI-P-06	AI-P-07	AI-P-08	AI-P-09	AI-P-10	AI-P-11	AI-C-01	AI-C-02	AI-C-03
Social Environment	1	Involuntary resettlement	**A-**	**A-**	C-	C-	-	-	-	-	C-	C-	C-	C-	-	-
	2	Local Economy such as Employment & Livelihood, etc.	B+/C-	B+/C-	B+	B+	B+	B+	B+	B+	B+/C-	B+	B+	B+	B+	C+
	3	Land use & Utilization of Local Resources	B+/C-	B+/C-	B+	B+/ C-	B+	B+	B+	B+	B+/C-	C+/C-	B+	B+	B+	C+
	4	Regional severance	C-	C-	-	C-	-	-	-	-	C-	-	C-	C-	-	-
	5	Existing social infrastructure & Services such as Traffic/Existing Public Facilities	C+/C-	B+ /C-	B+	C-	-	-	C+	-	B+	B+	-	-	B+	-
	6	Social vulnerable groups such as the poverty and ethnic minority	C+/**A-**	C+/**A-**	C+/C-	C+/C-	C+/C-	C+/C-	-	C+/C-	C+/C-	C+/C-	C+/C-	C+/C-	-	-
	7	Inequality between beneficiaries and project-affected peoples	**B-**	**B-**	-	-	-	-	-	-	C-	C-	C-	C-	-	-
	8	Cultural heritage	C-	C-	-	-	-	-	-	-	C-	-	C-	C-	-	-
	9	Conflict of interests	C-	C-	C-	C-	C-	C-	-	C-	C-	C-	C-	C-	-	-
	10	Water use right and common land use right	**B-**	**B-**	C-	C-	C-	C-	-	C-	**B-**	C-	C-	C-	C+	-
	11	Sanitation	C-	C-	C-	C-	C-	C-	-	C-	C-	C-	C-	C-	-	-
Natural Environment	12	Disaster (natural risk) and epidemic as HIV	B+ /C-	B+ /C-	C-	C-	C-	C-	-	C-	B+ /C-	C-	C-	C-	-	-
	13	Topography and geology	**B-**	**B-**	-	-	C-	C-	-	-	**B-**	-	-	-	-	-
	14	Soil erosion	C-	C-	-	C-	-	-	-	-	C-	C-	C-	C-	-	-
	15	Ground water	C+/C-	C+/C-	-	-	C-	C-	-	C-	C+/C-	C-	C+/C-	C+/C-	-	-
	16	Flow regime of lake and river	**B-**	**B-**	C-	**B-**	C-	C-	-	-	**B-**	C-	C-	C-	-	-
	17	National Park or equivalent area in terms of its ecological importance	C-	**B-**	C-	C-	-	C-	C-	C-	C-	C-	C-	C-	-	-
	18	Coastal and sea area	C-	C-	C-	C-	C-	C-	-	C-	-	C-	C-	C-	-	-
	19	Flora and fauna	**B-**	**B-**	C-	C-	C-	-	-	C-	**B-**	C-	C-	C-	-	-
	20	Climate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	21	Landscape	**B-**	**B-**	-	-	-	-	-	-	**B-**	-	C-	C-	-	-
Pollution	22	Global warming	-	-	-	-	-	-	C+	-	-	-	-	-	-	-
	23	Air pollution	C-	C-	C-	C-	C-	C-	-	C-	C-	C-	C-	C-	-	-
	24	Water pollution	**B-**	**B-**	C+/C-	C+/C-	C+/C-	C+/C-	C+/C-	C+/C-	**B-**	C+/C-	C+/C-	C+/C-	-	-
	25	Soil pollution	C-	C-	C+/C-	C+/C-	C+/C-	C+/C-	C+/C-	C+/C-	C-	-	C+/C-	C+/C-	-	-
	26	Waste	**B-**	**B-**	C-	C-	C-	C-	-	C-	**B-**	C-	C-	C-	-	-
	27	Noise and vibration	**B-**	**B-**	C-	C-	-	-	-	-	C-	C-	C-	C-	-	-
	28	Ground subsidence	-	-	-	-	C-	C-	-	C-	-	-	C-	C-	-	-
	29	Offensive odor	C-	C-	C-	C-	C-	C-	-	C-	C-	C-	C-	C-	-	-
	30	Bottom sediment	**B-**	**B-**	-	-	-	-	-	-	**B-**	-	C-	C-	-	-
	31	Accident	C-	C-	C-	C-	C-	C-	-	C-	C-	C-	C-	C-	-	-

Note:Evaluation categories are as follows;

A+/-: Significant positive/negative impact is expected.

B+/-: Some positive/negative impact is expected to some extent.

C+/-: Positive/negative impact is unknown in the scoping stage (Further study was required.).

-: No negative impact is expected. Therefore, the item under this category is not subject to the EIA/IEE

* The project codes correspond to the project titles as shown in Annex-T 13.3.1.

Annex-T 13.3.2 (2/4) Summary of Environmental Scoping for Projects and Programs of IWRM Plan

		Sector	Municipal Water Supply, Sanitation and Sewerage														
		Project Code*/ Impact Items	MW-P- 01	MW-P- 02	MW-P- 03	MW-P- 04	MW-C - 01	MW-C - 02	MW-C - 03	MW-C - 04	MW-C - 05				MW-C – 06		
											Opt.1	Opt.2	Opt.3	Opt.4	Opt.1	Opt.2	Opt.3
Social Environment	1	Involuntary resettlement	C-	C-	C-	C-	C-	C-	C-	C-	C-	**A-**	C-	**A-**	C-	C-	C-
	2	Local Economy such as Employment & Livelihood, etc.	C+	C+	C+	C+	C+	C+	C+	C+	B+/C-	B+/C-	B+	B+/C-	B+	C+/C-	B+/C-
	3	Land use & Utilization of Local Resources	B+	B+	B+	B+	C+	C+	C+	C+	C+/C-	B+/C-	B+	C+/C-	B+	B+	B+/C-
	4	Regional severance	-	-	-	-	C-	C-	C-	C-	B+/C-	C-	-	B+/C-	C-	C-	C-
	5	Existing social infrastructure & Services such as Traffic/Existing Public Facilities	B+	-	-	-	-	-	-	-	C-	B+/C-	B+	B+/C-	-	-	B+
	6	Social vulnerable groups such as the poverty and ethnic minority	C-	C-	C-	C-	C-	C-	C-	C-	C+/C-	C+/**A-**	C+/C-	C+/**A-**	C+/C-	C+/C-	C+/C-
	7	Inequality between beneficiaries and project-affected peoples	C-	C-	C-	C-	C-	C-	C-	C-	C-	**B-**	-	**B-**	C-	-	C-
	8	Cultural heritage	-	-	-	C-	C-	C-	C-	C-	C-	C-	-	C-	C-	C-	C-
	9	Conflict of interests	-	-	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	**B-**	C-	C-
	10	Water use right and common land use right	-	C-	C-	**B-**	C-	C-	C-	C-	**B-**	**B-**	C-	C-	C-	C-	**B-**
	11	Sanitation	-	C+	B+	C-	C+	C+	C+	C+	C-	C-	C-	C-	C-	C+/C-	C-
Natural Environment	12	Disaster (natural risk) and epidemic as HIV	-	C+	B+	B+ C-	C-	C-	C-	C-	C-	B+ /C-	C-	C-	C-	C-	B+ /C-
	13	Topography and geology	-	-	-	**B-**	-	-	-	-	**B-**	**B-**	-	**B-**	-	-	**B-**
	14	Soil erosion	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	-	C-	C-	-	C-
	15	Ground water	-	-	-	C+/C-	-	-	-	-	C+/C-	C+/C-	-	C+/C-	C+/C-	C-	C+/C-
	16	Flow regime of lake and river	**B-**	**B-**	C-	**B-**	C-	C-	C-	C-	**B-**	**B-**	C-	**B-**	C-	**B-**	**B-**
	17	National Park or equivalent area in terms of its ecological importance	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	-	-	C-	C-	C-
	18	Coastal and sea area	-	-	-	-	C+/C-	C+/C-	C+/C-	C+/C-	-	C-	C-	-	-	C-	-
	19	Flora and fauna	C-	C-	C-	C-	C-	C-	C-	C-	**B-**	**B-**	C-	**B-**	C-	-	**B-**
	20	Climate	-	-	-	-	-	-	-	-	-	-	-	-	-	C-	-
	21	Landscape	C-	C-	C-	**B-**	C-	C-	C-	C-	**B-**	**B-**	-	**B-**	C-	-	**B-**
Pollution	22	Global warming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	23	Air pollution	-	-	-	C-	-	-	-	-	C-	C-	C-	C-	C-	C-	C-
	24	Water pollution	C+/C-	C+/C-	B+/C-	**B-**	C+/C-	C+/C-	C+/C-	C+/C-	**B-**	**B-**	C+/C-	**B-**	C+/C-	-	**B-**
	25	Soil pollution	-	-	-	C-	-	-	-	-	C-	C-	C+/C-	C-	C+/C-	-	C-
	26	Waste	-	-	-	**B-**	-	-	-	-	**B-**	**B-**	C-	**B-**	C-	-	**B-**
	27	Noise and vibration	C-	C-	C-	C-	C-	C-	C-	C-	C-	**B-**	C-	**B-**	C-	B+	C-
	28	Ground subsidence	-	C+	B+	-	B+	B+	B+	B+	-	-	-	-	C-	-	-
	29	Offensive odor	-	-	-	C-	-	-	-	-	C-	C-	C-	C-	C-	-	C-
	30	Bottom sediment	-	-	C-	**B-**	C-	C-	C-	C-	**B-**	**B-**	-	**B-**	C-	C-	**B-**
	31	Accident	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-	C-

Note:Evaluation categories are as follows;

A+/-: Significant positive/negative impact is expected.

B+/-: Some positive/negative impact is expected to some extent.

C+/-: Positive/negative impact is unknown in the scoping stage (Further study was required.).

-: No negative impact is expected. Therefore, the item under this category is not subject to the EIA/IEE

* The project codes correspond to the project titles as shown in Annex-T 13.3.1.

Annex-T 13.3.2 (3/4) Summary of Environmental Scoping for Projects and Programs of IWRM Plan

		Sector	Municipal Water Supply, Sanitation and Sewerage					Flood and Sediment Disaster Management							Watershed Management			
		Project Code*/ Impact Items	MS-C- 01	MS-C- 02	MS-C- 03	MS-C- 04	MP-C- 01	FL-P- 01	FL-P- 02	FL-C- 01		FL-C- 02	FL-C- 03	FL-C- 04	WS-C - 01	WS-C - 02	WS-C - 03	WS-C - 04
										Opt.1	Opt.2							
Social Environment	1	Involuntary resettlement	-	-	-	-	-	C-	C-	**A-**	-	-	-	-	-	-	-	-
	2	Local Economy such as Employment & Livelihood, etc.	C+	C+	C+	C+	C+	B+	B+	B+	B+	-	B+	-	C+	B+	C+	C+
	3	Land use & Utilization of Local Resources	-	-	-	-	-	B+	B+	B+	**A-**	-	-	-	C+	C+	C+	C+
	4	Regional severance	-	-	-	-	-	C-	-	C-	C-	-	C+/C-	-	-	-	-	-
	5	Existing social infrastructure & Services such as Traffic/Existing Public Facilities	-	-	-	-	C+	B+	-	-	**B-**	-	B+	-	-	-	-	C+
	6	Social vulnerable groups such as the poverty and ethnic minority	-	-	-	-	-	C-	C-	C-	C-	C+	C+	-	C+	C+	C+	C+
	7	Inequality between beneficiaries and project-affected peoples	-	-	-	-	-	C-	C-	**B-**	C-	-	C+/C-	-	C-	C-	-	C-
	8	Cultural heritage	C-	C-	C-	C-	-	-	-	-	-	-	C-	-	-	-	C-	-
	9	Conflict of interests	-	-	-	-	-	-	-	C-	**B-**	-	C-	-	C-	C-	C-	C-
	10	Water use right and common land use right	-	-	-	-	-	-	-	-	-	-	C-	C+	C-	C-	C-	C-
	11	Sanitation	B+	B+	B+	B+	B+	-	-	-	-	-	-	-	-	-	-	-
Natural Environment	12	Disaster (natural risk) and epidemic as HIV	C+	C+	C+	C+	B+	B+	B+	B+	B+/**B-**	B+	C+	-	-	-	-	-
	13	Topography and geology	-	-	-	-	-	C-	C-	C-	C-	-	-	-	-	-	-	-
	14	Soil erosion	-	-	-	-	-	C-	C-	C-	C+/C-	-	C+	-	C+	C+	C+	C+
	15	Ground water	C+/C-	C+/C-	C+/C-	C+/C-	-	C-	C-	C-	C-	-	-	-	-	-	-	-
	16	Flow regime of lake and river	-	-	-	-	-	C-	C-	C+/C-	**B-**	-	C-	-	-	-	-	-
	17	National Park or equivalent area in terms of its ecological importance	C+/C-	C+/C-	C+/C-	C+/C-	C+	C+/C-	C+/C-	C-	**B-**	-	C+/C-	C+	C+	B+	C+	B+
	18	Coastal and sea area	C+/C-	C+/C-	C+/C-	C+/C-	-	C-	C-	C-	C-	-	-	C+	-	-	-	-
	19	Flora and fauna	C+/C-	C+/C-	C+/C-	C+/C-	-	C+/C-	C+/C-	-	**B-**	-	C+/C-	C+	B+	B+	B+	B+
	20	Climate	-	-	-	-	-	-	-	C-	-	-	-	-	-	-	-	-
	21	Landscape	-	-	-	-	-	C-	C-	C-	C-	-	-	-	C+	C+	C+	C+
Pollution	22	Global warming	-	-	-	-	-	-	-	C-	C-	-	-	C+	C+	C+	C+	C+
	23	Air pollution	-	-	-	-	-	-	-	C-	C-	-	-	C+	-	-	-	-
	24	Water pollution	C+/C-	C+/C-	C+/C-	C+/C-	C+	C-	C-	**B-**	**B-**	-	C-	C+	-	-	-	-
	25	Soil pollution	C+/C-	C+/C-	C+/C-	C+/C-	C+	C-	C-	C-	-	-	C-	C+	-	-	-	-
	26	Waste	C+/C-	C+/C-	C+/C-	C+/C-	C+-	C-	C-	**B-**	C-	-	C-	C+	-	-	-	-
	27	Noise and vibration	-	-	-	-	-	C-	C-	**B-**	C-	-	C-	-	-	-	-	-
	28	Ground subsidence	-	-	-	-	-	-	-	--	-	-	-	-	-	-	-	-
	29	Offensive odor	C+/C-	C+/C-	C+/C-	C+/C-	-	-	-	-	-	-	C-	-	-	-	-	-
	30	Bottom sediment	-	-	-	-	-	C-	C-	C-	-	-	-	-	-	-	-	-
	31	Accident	C-	C-	C-	C-	-	C-	C-	C-	C-	-	C-	-	-	-	-	-

Note:Evaluation categories are as follows;

A+/-: Significant positive/negative impact is expected.

B+/-: Some positive/negative impact is expected to some extent.

C+/-: Positive/negative impact is unknown in the scoping stage (Further study was required.).

-: No negative impact is expected. Therefore, the item under this category is not subject to the EIA/IEE

* The project codes correspond to the project titles as shown in Annex-T 13.3.1.

Annex-T 13.3.2 (4/4) Summary of Environmental Scoping for Projects and Programs of IWRM Plan

		Sector	Water-related Environment Management					Inter-sector for Water Resources Management						
		Project Code*/ Impact Items	WQ-P-01	WQ-C-01	WQ-C-02	WQ-C-03	WQ-C-04	IS-C- 01	IS-C- 02				IS-C- 03	IS-C- 04
									Opt.1	Opt.2	Opt.3	Opt.4		
Social Environment	1	Involuntary resettlement	-	-	-	-	C-	-	C-	**A-**	C-	**A-**	-	-
	2	Local Economy such as Employment & Livelihood, etc.	C+	-	C+	-	C+	C+	B+/C-	B+/C-	B+	B+/C-	C+	C+
	3	Land use & Utilization of Local Resources	C+	C+	C+	C+	C+	C+	C+/C-	B+/C-	B+	C+/C-	C+	C+
	4	Regional severance	-	-	-	-	-	-	B+/C-	C-	-	B+/C-	-	-
	5	Existing social infrastructure & Services such as Traffic/Existing Public Facilities	-	-	-	-	-	-	C-	B+/C-	B+	B+/C-	-	-
	6	Social vulnerable groups such as the poverty and ethnic minority	-	-	-	-	-	-	C+/C-	C+/**A-**	C+/C-	C+/**A-**	-	-
	7	Inequality between beneficiaries and project-affected peoples	-	-	-	-	-	-	C-	**B-**	-	**B-**	-	-
	8	Cultural heritage	-	-	-	-	C-	-	C-	C-	-	C-	-	-
	9	Conflict of interests	-	-	-	-	C-	-	C-	C-	C-	C-	-	B+
	10	Water use right and common land use right	-	-	-	-	C-	-	**B-**	**B-**	C-	C-	-	-
	11	Sanitation	C+	-	-	-	B+	-	C-	C-	C-	C-	-	-
Natural Environment	12	Disaster (natural risk) and epidemic as HIV	-	-	-	-	-	-	C-	B+ /C-	C-	C-	-	-
	13	Topography and geology	-	-	-	-	C-	-	**B-**	**B-**	-	**B-**	-	-
	14	Soil erosion	-	-	-	-	C-	-	C-	C-	-	C-	-	-
	15	Ground water	-	-	-	-	C+	B+	C+/C-	C+/C-	-	C+/C-	C+	C+
	16	Flow regime of lake and river	-	-	-	-	-	-	**B-**	**B-**	C-	**B-**	-	-
	17	National Park or equivalent area in terms of its ecological importance	C+	C+	C+	C+	C+	-	C-	C-	-	-	-	-
	18	Coastal and sea area	-	C+	C+	C+	C+	-	-	C-	C-	-	-	-
	19	Flora and fauna	C+	C+-	C+-	C+-	C+-	-	**B-**	**B-**	C-	**B-**	-	-
	20	Climate	-	-	-	-	-	-	-	-	-	-	-	-
	21	Landscape	-	-	-	-	-	-	**B-**	**B-**	-	**B-**	-	-
Pollution	22	Global warming	C+	-	-	C+	-	-	-	-	-	-	-	-
	23	Air pollution	C+	-	-	C+	C+	-	C-	C-	C-	C-	-	-
	24	Water pollution	B+	B+	B+	C+	C+	C+	**B-**	**B-**	C+/C-	**B-**	B+	C+
	25	Soil pollution	B+	C+	C+	C+	C+	-	C-	C-	C+/C-	C-	-	-
	26	Waste	B+	-	-	C+	B+	-	**B-**	**B-**	C-	**B-**	-	-
	27	Noise and vibration	-	-	-	-	C-	-	C-	**B-**	C-	**B-**	-	-
	28	Ground subsidence	-	-	-	-	-	-	-	-	-	-	-	C+
	29	Offensive odor	C+/ C-	-	-	C+	C+/ C-	-	C-	C-	C-	C-	-	-
	30	Bottom sediment	-	-	-	-	-	-	**B-**	**B-**	-	**B-**	-	-
	31	Accident	C-	-	-	-	C-	-	C-	C-	C-	C-	-	-

Note:Evaluation categories are as follows;

A+/-: Significant positive/negative impact is expected.

B+/-: Some positive/negative impact is expected to some extent.

C+/-: Positive/negative impact is unknown in the scoping stage (Further study was required.).

-: No negative impact is expected. Therefore, the item under this category is not subject to the EIA/IEE

* The project codes correspond to the project titles as shown in Annex-T 13.3.1.