THE REPUBLIC OF THE PHILIPPINES

METROPOLITAN CEBU WATER DISTRICT (MCWD)

THE STUDY FOR IMPROVEMENT OF WATER SUPPLY AND SANITATION IN METRO CEBU IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME-I: EXECUTIVE SUMMARY

AUGUST 2010

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NJS CONSULTANTS CO., LTD. (NJS)

NIPPON KOEI CO., LTD. (NK)

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Composition of the Final Report

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Introduction of the Study
Project Formulation on WATSAN Sector
Recommendations

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- Part-B OPEX Estimation (Excel)

Volume-I Executive Summary contains the study results, while Volume-II Main Report includes contents of the action plan with major examinations and recommendations for its realization. Volume-III Supporting Report describes examination methods and study results in water supply sector, and contents of the technical transfer. Volume-IV Data CD installs the electronic files of primary data/ information, presentation materials and cost estimation for effective use in future.

Currency Exchange Rates Adopted for the Study: March 2010

US$1.00 = PHP46.148, PHP1.00 = J¥1.934

Preface

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct the Study for Improvement of Water Supply and Sanitation in Metro Cebu in the Republic of the Philippines and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Norihisa Taoka of NJS Consultants Co., Ltd. and consists of NJS Consultants Co., Ltd. and Nippon Koei Co., Ltd. between January, 2009 and June, 2010.

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

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

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

August 2010

Izumi Takashima,
Vice-President
Japan International Cooperation Agency

Letter of Transmittal

We are pleased to submit herewith the Final Report of the Study for Improvement of Water Supply and Sanitation in Metro Cebu in the Republic of the Philippines. The Report has been prepared for the Government of the Philippines as a guideline for consideration when implementing the improvement projects of water supply and sanitation to meet the socio-economic demand in the future.

The report deals with the formulation of a WATSAN sector plan in Metropolitan Cebu towards the year 2015, which includes the groundwater development and the water supply improvement action plans for the MCWD and sanitation improvement basic plan in Metropolitan Cebu. As the short term strategies, the Study proposes to implement action plans for accelerate the water supply improvement in the fields of water source development, water supply system, customer management and institutional strengthening of the MCWD. The other output of the Study is the supporting of the Initial Environmental Examination (IEE) for smooth promotion of the plans.

The report consists of four (4) volumes: Volume-I for Executive Summary, Volume-II for Main Report, Volume-III for Supporting Report and Volume-IV for Data CD, respectively. The main outputs of the Study are presented in the Executive Summary. The Main Report deals with the study results and conclusions in more detail as well as the improvement and action plans, and the effective recommendations to realize such the plans. The Supporting Report explains the procedures and results of the Study by each of the disciplines including reference drawings and the technical transfer records during the study period. Data CD contains the primary data on socio-economy and hydrogeology, power point files of workshop and seminar, and cost estimate of CAPEX and OPEX, respectively.

All members of the Study Team wish to express grateful acknowledgement to the personnel from your Agency, Ministry of Foreign Affairs, Ministry of Health, Labor and Welfare, Ministry of Land, Infrastructure, Transport and Tourism, and Embassy of Japan in the Philippines, and also to officials and individuals of the Government of the Philippines for their kind assistance and advice extended to the Study Team. The Study Team sincerely hopes that the results of the Study will contribute to the future improvement of WATSAN sector and to the socio-economic demand and well-being of the residents in the Metropolitan Cebu of the Philippines.

August 2010

Yours Sincerely,

Norihisa TAOKA

Study Team Leader

Message

The Metropolitan Cebu Water District (MCWD) is privileged to be the beneficiary of this JICA sponsored study for the Improvement of Water Supply and Sanitation in Metro Cebu, Philippines. The Final Report of the study will be a useful reference for our planning and implementation of water supply and sanitation projects in the future.

During the one and a half years period of the study, the MCWD counterpart staffs were also able to acquire and learn to use relevant tools in such fields as groundwater modeling, hydraulic analysis and leak detection. These are expected to enhance the effectiveness and efficiency of MCWD in its planning, operations and maintenance activities.

In behalf of the Metropolitan Cebu Water District, I would like to thank the Government of Japan through the Japan International Cooperation Agency (JICA) and all its officials, staff and consultants for their support and contribution to this study.

August 2010

Armando H. PAREDES

General Manager
Metropolitan Cebu Water District

Action Plan on Water Supply Improvement

1. **Water Source**
   - Surface Water
     - Improvement: Existing Infiltration Facility at Jaclupan
   - Groundwater
     - Construction: New Well & Pump Station at several Well Fields
     - Rehabilitation: Existing Well at several Well Fields
   - Seawater
     - Construction: New De-salination Plant at Mactan Island
2. **Facility**
   - Reservoir
     - Construction: Additional Reservoirs at Tisa, Talamban, Casili and Mactan Saucer
   - Water Treatment Plant
     - Re-construction: Rapid Sand Filtration at Tisa
   - Booster Pump Station
     - Construction: Mactan 2nd Bridge Crossing
3. **Pipeline**
   - Raw Water Conveyance Pipeline
     - Installation: New Pipeline from New Well to Reservoir
   - Transmission Pipeline
     - Installation: New Pipeline between Reservoir for Water Allocation
     - Installation: New Pipeline from De-salination Plant to Reservoir
   - Distribution Pipeline
     - Improvement: Creation of Distribution Blocks
     - Maintenance: NRW Reduction
     - Replacement: Reducing of Low Water Supply Area
     - Installation: Reducing of Low Water Supply Area

LEGEND

Existing: Well Field; Dam/ Weir; Water Treatment Plant; Ground Reservoir; Elevated Tank; Pipe Network; Bulk Water

Action Plan: New Well Field; Weir Rehabilitation; Water Treatment Plant; Ground Reservoir; Elevated Tank; Improved Pipes; Booster Pump Station; CLC DB; Casili DB; Talamban DB; Tisa DB; Lagtang DB; Mactan DB

Scale 1:125,000 (4km)

LOCATION MAP — Modeling Area

Compostela; Compostela WF; Liloan; San Vicente WF; CAMOTES SEA; Consolacion; Construction; Cebu City; Casili WF; Cansaga Bay; Canduman WF; Construction; Jaclupan WF; Mandaue City; Bulk Water (Abejo North); N; Buhisan Dam; Re-construction; WTP; Construction; Guadalupe WF; Lusaran WF; Construction; CEBU STRAIT; Under-ground Dam; Jaclupan Weir; Improvement; Tisa-Talamban WF; Talisay City; Bulk Water (Abejo South); Mactan WF; Lapu-lapu City; Bulk Water (Foremost); Cordova; Bulk Water (Mactan Rocks); BOHOL STRAIT

Figure A.12
Location Map of Project Components for Water Supply Improvement

Metropolitan Cebu Water District
JICA Study Team
NJS Consultants Co., Ltd.
Nippon Koei Co., Ltd.

Figure A.12
Location Map of Project Components for Water Supply Improvement

Outline of the Study

I Introduction of the Study

I-1 Objectives and Scope of the Study

According to the implementation arrangement (I/A) and minutes of meeting (M/M) signed and exchanged on July 2007, the Study has following objectives:

1) To formulate a plan for sectoral improvement of water supply and sanitation including sustainable development and conservation of groundwater;
2) To carry out the technical transfer to the Philippine counterparts in the courses of the Study.

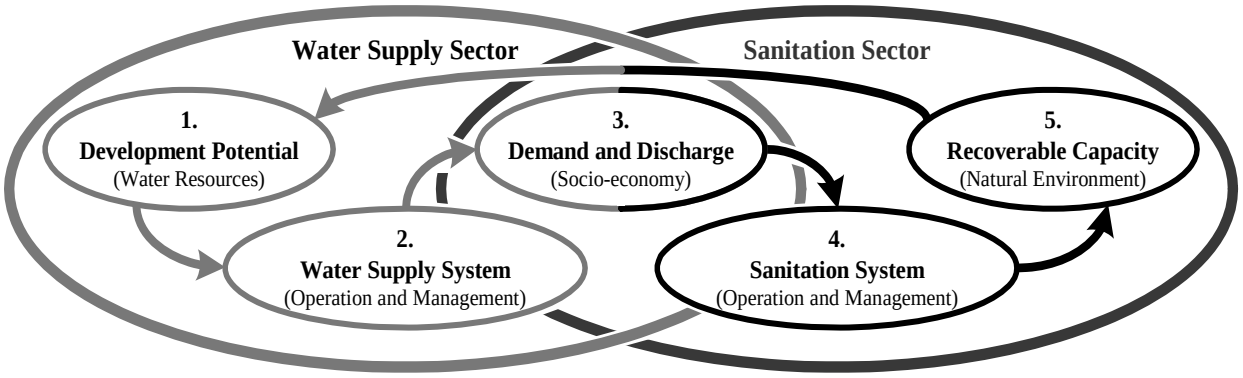
A plan covers the service area of MCWD and its surroundings as indicated below with a target year of 2015.

1) Water Sources Development: water supply service area of MCWD and its surroundings
2) Water Supply and Sanitation: water supply area of MCWD

I-2 Contents of the Study

This study has following categories and the study has put emphasis to water supply sector.

Jurisdiction of MCWD



Major Components in the Study

I-3 Study Schedule

The Study was carried out with the following two phases;

Phase-I:	Basic Study and Groundwater Modeling	January 2009 to October 2009
Phase-II:	WATSAN Planning (action and basic plans)	July 2009 to July 2010

Following workshops and seminars were conducted.

Workshop:

Workshop-I:	Basic Study Results and Brief WATSAN Sectoral Plans	October 2009
Workshop-II:	Improvement Plan of WATSAN Sector	March 2010

Seminar:

V-MODFLOW:	Groundwater Flow (basic and advance courses)	October 2009
WaterCAD:	Pipeline Hydraulic (basic course)	October 2009

II Action Plan on Water Supply

II-1 Water Demand Projection

Total and Niche Water Demand

- Total Demand: Water demand in the whole MCWD franchise area
- Niche Demand: Water demand in the existing service area of MCWD plus that in the un-served areas where residents and enterprises are willing and/ or opt to connect to MCWD

Population Projection of Metropolitan Cebu

- 1.9 million in 2007 (Census as base year) → 2.2 million in 2015 → 3.0 million in 2030

MCWD Service Population

MCWD service population was estimated considering the direct and the indirect water supply users.

Per Capita Consumption

Water consumptions of domestic and communal use were assumed at 150 Lpcd and 25 Lpcd.

Projected Water Demand

	2007 (base year)	2015 (Sort-tem)	2030 (Long-term)
• Domestic:	98,705 m^3/day	151,725 m^3/day	233,443 m^3/day
• Commercial and Industrial:	15,160 m^3/day	34,094 m^3/day	50,494 m^3/day
• Governmental Institutions:	2,300 m^3/day	2,300 m^3/day	2,300 m^3/day

NRW Rate

- 30 % in 2007 actual NRW → 20 % in 2015 → 17 % in 2030

Gross Water Demand Projection

Gross Water Demand Projection: Total (m^3/day)

Category of Demand Projection		2007	2010	2015	2020	2025	2030
MCWD	Revenue Water	116,165	140,774	188,120	214,588	247,630	286,237
	Non-Revenue Water	49,785	46,925	47,030	50,335	54,357	58,626
	Total	165,950	187,699	235,150	264,923	301,987	344,863
Non-MCWD Total		203,639	198,162	186,425	200,031	213,268	225,128
Grand Total		369,589	385,861	421,575	464,954	515,255	569,991

II-2 Water Sources Appraisal and Availability

Measures	Life-cycle Cost (PHP/m^3)	Net Present Value (million PHP)	Benefit Cost Ratio
Surface Water	2.9 to 13.1	298 to 1,904	0.6 to 3.2
Groundwater	2.8 to 2.8	11 to 13	2.7 to 2.8
Seawater	34.8 to 36.6	1,498 to 1,338	0.2 to 0.2

For the action plan up to 2015, water shortage should be covered by de-salination. At the same time, surface water development is recommended to promote immediately for long term measures.

- Groundwater: 176,000 m^3/day Own Wells, however 158,000 m^3/day could be developed by 2015
- Surface Water: 44,700 m^3/day Buhisan and Jaclupan
- Bulk Water: 23,000 m^3/day 3 suppliers with 4 connections

II-3 Water Demand and Supply Balance

Water Balance in 2015 (m^3/day)

Demand		Supply	
Domestic	151,725	Well	158,000
Commercial and Industrial	34,095	Buhisan	4,700
Governmental Institutions	2,300	Jaclupan	40,000
NRW	47,030	Bulk Water	23,000
		De-salination	9,600
Total	235,150	Total	235,300

II-4 Requirements in Technical Improvement

Objectives

- to increase water supply volume to meet water demand in 2015
- to achieve water supply service level under above water supply situation

Design Concepts

- gravity water supply
- distribution block water supply

Design Standard

- MCWD Technical Standards Manual 2003 (TSM-03)
- Philippines National Standard for Drinking Water 2007 (PNSDW-07)
- JWWA (Japan Waterworks Association) Facility Design Guideline 2000

Design Criteria

- Design Flow: DAF: DMF: HMF = 1.0: 1.2: 2.2
- Reservoir Capacity: 6 hours equivalent DAF
- Water Supply Pressure: minimum 0.07 MPa (equivalent to 10 psi or 7 m H_2O)

BOQ of Overall Improvement Plan

Overall Project Component

Item	Description	Unit	Quantity
1-1	Well Intake Facilities Construction	well	63
1-2	Well Intake Facilities Rehabilitation	well	101
1-3	Jaclupan Weir Rehabilitation	site	1
1-4	Tisa WTP Rehabilitation	site	1
1-5	Mactan Desalination Plant	site	1
2-1	Reservoir (V = 10,000 m^3)	site	2
2-2	Reservoir (V = 5,000 m^3)	site	1
2-3	Water Tower Construction (V = 2,000 m^3)	site	2
3-1	Raw Water Pipeline (100mm and 150mm)	m	31,500
3-2	Transmission Pipeline (400mm to 800mm)	m	26,788
3-3	Inter-reservoir Pump Station	site	2
3-4	Main Distribution Pipeline (300mm to 700mm)	m	32,206
3-5	Secondary Distribution Pipeline (75mm to 200mm)	m	37,014
3-6	Flow Meter Installation	site	6
4-1	NRW Reduction	LS.	1

II-5 Requirements in Managerial Improvement

NRW Reduction

Effect of leakage reduction can be improved by control on the recurring rate of leakage reduction when the cycle of working period can be reduced. Target NRW rate in 2015 is 20 %.

II-6 Initial Environmental Examination

Overall, it was confirmed that the environmental and social impacts by the proposed projects were preliminary avoided and mitigated as much as possible.

Environmental and Social Impacts by the Proposed Projects

		Item	Well Development	Desalination Plant	System/ Facility Improvement
Social Environment	1	Involuntary Resettlement	D	D	D
	2	Local Economy	B	B	B
	3	Land Use, Local Resources	B (land use) B (groundwater)	B (land use) B (fishery)	B
	4	Social Institutions	D	D	D
	5	Social Infrastructures/Services	D	D	D
	6	Poor, Indigenous and Ethnic people	C	D	C
	7	Misdistribution of Benefit/Damage	C	C	C
	8	Cultural heritage	C	D	D
	9	Local Conflicts of Interest	C	C	C
	10	Water Usage/ Rights	B	C	D
	11	Sanitation	D	D	D
	12	Hazards (risk), Infectious Diseases	D	D	D
	13	Accident	C	C	C
Natural Environment	14	Topography and Geography	D	D	D
	15	Soil Erosion	D	D	D
	16	Groundwater	B	D	D
	17	Hydrological Situation	D	D	D
	18	Coastal zone	D	B	D
	19	Flora, Fauna and Biodiversity	B	B (terrestrial) B (marine)	B
	20	Meteorology	D	D	D
	21	Landscape	D	D	B
	22	Global Warming	B	B	B
Pollution/ Contamination	23	Air Pollution	B	B	B
	24	Water Pollution	B	B	D
	25	Soil Contamination	D	D	D
	26	Waste	B	B	B
	27	Noise and Vibration	B	B	B
	28	Ground Subsidence	D	D	D
	29	Offensive Odor	D	D	D
	30	Bottom Sediment	D	C	D

II-7 Project Implementation

Overall Project Cost and its Feasibility

Project cost was estimated at 6,055 million PHP with 4,428 million PHP of available loan portion and 1,626 million PHP of own equity portion. There is no MCWD capacity to barrow 4,428 million PHP as maximum loan portion. Even in the case of water rate increase from 2011, the working capital will be lacking when the all project is implemented by 2015. Therefore, the project should be screened.

Financing Capacity of MCWD

Financing institutions are DBP (PWRF) and LWUA.

Financing Capacity of MCWD (million PHP)

Financing Category	Current Water Rate	Water Rate Increase
Potential Loan Portion	1,100	1,500
Own Equity	610 to 1,200	610 to 1,560
Total	1,710 to 2,300	2,110 to 3,060

Prioritization Criteria

- MCWD Benefit: Financing Capacity and Gross Profitability (GP) in the each Distribution Block
- Users Benefits: Additional Demand, Demand Growth Rate and Low Pressure Improvement

Following were nominated as priority projects.

CAPEX (million PHP) and GP (%) of the Priority Projects

Distribution Block		CAPEX	Gross Profitability	Project Contents
Casili		1,020	14 %	All improvement items within Distribution Block
Tisa		606	15 %	Excluding Tisa WTP rehabilitation
Lagtang		36	79 %	All improvement items within Distribution Block
Mactan		863	6 %	Desalination plant with its transmission only
Total		2,525	14 %	-
Breakdown	Loan	1,791	Remarks*: Available loan was estimated at 1,500 million PHP, while	
Cost*	Own Equity	734	MCWD own equity becomes 1,025 million PHP.	

II-8 Financial Feasibility

Project Evaluation

The Financial Internal Rate of Return (FIRR) of the prioritized projects is comparatively low. This is considered to happen because, the investment cost is large compared to the expected gross return from the investment, in its nature the projects. Incremental O/M expenses further lower the profitability, such as the material power cost required for operation of the desalination plant.

Prerequisite for the Implementation of Prioritized Projects

As it is indicated in the preceding analysis, financial feasibility of the prioritized projects assumes that the water rate increase accompanies with their implementation. Not only for securing the loan financing capacity, the prioritized projects are not considered financially feasible unless a sufficient increase in the water rate is made at an appropriate timing.

FIRR of the Prioritized Projects

Without water rate increase	After 10% water rate increase
8.6%	14.7%

III Basic Plan on Urban Sanitation

III-1 Needs Assessment

In order to identify the requirements for achieving change, a needs assessment was carried out. The assessment was split into two distinct but interrelated parts to ensure a holistic approach to change across all levels of intervention.

- The Service Provision and System Performance
- The Institutional Framework Arrangements and Capacity

III-2 Basic Improvement Plan

Facility Improvement Plan

Facility Improvement Plan Options

Options	Proposed Intervention	Target Location
Septage Management	Septage collection, transfer and treatment service	Areas 1, 3, 4, 5 and 6
Septage Management and Environmental Improvements	This Option plus improve raw water quality by: (a) On site systems	Areas 1, 2, 3, 4, 5 and 6
	(b) Hybrid systems	Areas 1, 3, 4, 5 and 6
Centralized Sewerage System and Treatment Facilities	Centralized sewerage system and treatment facility	Area 1 (Areas 3, 4 and 5 in future)

Institutional Improvement Plan

- Technical assistance in institutional capacity building for the preparation of follow-up programs for wastewater and sanitation improvements and
- Carrying out public information campaigns on the benefits of sewerage and sanitation services, and on the best practices of proper disposal of sewage

< Institutional Structure >

A new institutional framework was proposed that could support the delivery of sanitation services. The framework addresses the major weaknesses of the sector by delineating the roles and responsibilities of the main sector stakeholders, and defining the required functions and outputs.

< MCWD Organizational Structure >

It is proposed that MCWD should emphasize its commitment to the new role by renaming its Water Operations group to WATSAN Operations and create the new Department of Wastewater and Septage Management with a Collection and Transfer Division and a Treatment Division.

IV Recommendations

IV-1 Sectoral and Administrative Improvement

Institutional Framework

It is proposed that a national water apex body should be created or NWRB should be strengthened. At the Metropolitan Cebu/ local level, there is a need to unify the development and regulatory functions over groundwater into one single local apex body to function as the local counterpart of NWRB.

Groundwater Regulation

Sound operation of groundwater regulation is basis of future development. MCWD is requested to work with NWRB for field monitoring and evaluation activities.

IV-2 MCWD Technical Improvement

Sustainable Water Supply

Following topics were recommended to improve strongly.

- Supply Systems with Gravity Water and Distribution Block
- SCADA System
- NRW Reduction Work using DMA

Technical Guideline for Groundwater Development

MCWD is required to complete the guideline for groundwater development with additional institutional portions. This material composes of following.

- Water Balance in Well Field: (1) site selection and (2) facility operation
- Performance Indicator: (1) well efficiency and (2) sand contents
- Monitoring and Evaluation: (1) water balance and (2) performance indicator

Improvement of the Cebu-GWM-09

This plan includes following information. Most of assumed information could be replaced by actual data with possibility of sensitivity analysis and post audit.

- Data Accumulation: Well Inventory Survey, Well Monitoring and Hydrogeological Investigation
- Model Improvement: Investigated Data, Observation Data, Data Verification and Performance

IV-3 MCWD Managerial Improvement

MCWD Re-organization

MCWD re-organization with effective MIS works was proposed according to its rationalization.

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Location Map of Project Components for Water Supply Improvement
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Abbreviations

Organization	
ADB	Asian Development Bank
AO	Administrative Order
BDO	Bank de Oro Unibank, Inc.
BMGS	Bureau of Mines and Geological Survey
DA	Department of Agriculture
DBP	Development Bank of the Philippines
DENR	Department of Environment and Natural Resources
DEPW	Department of Engineering and Public Works (LGU)
DILG	Department of Interior and Local Government

DOF .....Department of Finance
DOH .....Department of Health
DOJ.....Department of Justice
DOST .....Department of Science and Technology
DOT.....Department of Tourism
DPS.....Department of Public Services (LGU)
DPWH .....Department of Public Works and Highways
DTI .....Department of Trade and Industry
EMB .....Environmental Management Bureau
ENRO .....Environment and Natural Resources Office
EOJ .....Embassy of Japan
GAs.....Government Agencies
GOJ.....Government of Japan
GOP .....Government of the Philippines
HSBC .....Hongkong Shanghai Banking Corporation
IBRD .....International bank for Re-construction and Development
IUCN .....International Union for Conservation of Nature and Natural Resource
JBIC.....Japan Bank of International Cooperation
JICA .....Japan International Cooperation Agency
LBP.....Land Bank of the Philippines
LGU.....Local Government Unit
LWUA .....Local Water Utility Administration
MCWD .....Metropolitan Cebu Water District
MWSS .....Metro-Manila Waterworks and Sewerage System
NAMRIA.....National Mapping and Resource Information Authority
NEDA.....National Economic and Development Authority
NGO .....None Governmental Organization
NHRC-UP .....National Human Rights Committee - UP
NJS .....NJS Consultants Co., Ltd.
NK .....Nippon Koei Co., Ltd.
NWRB.....National Water Resources Board
NSO.....National Statistics Office
OPS.....Office of Population Studies
SM .....Shoe Mart
UNDP .....United Nations Development Program
UP.....University of the Philippines
USA.....United State of America
USC .....University of San Carlos
WB .....World Bank
WD .....Water District
WHO .....World Health Organization

Personnel/ Department

AGM.....Assistant General Manager
BD .....Billing Department
CD .....Construction Department
C/P .....Counterpart

CPD .....Corporate Planning Department
ENG'D .....Engineering Department
EWRKC .....Environment & Water Resources Knowledge Center
GM .....General Manager
LD.....Legal Department
MSSD.....Maintenance Support Service Department
PDD.....Production Distribution Department
PMD .....Pipe Maintenance Department
PMG .....Pipeline Monitoring Group
PPDC.....Provincial Planning and Development Coordinator
SCID.....Service Connection Installation Department
SRR .....Service Recovery Rate Committee
WASEC .....Water Supply Evaluation Committee

Managerial

BWSA .....Barangay Water Supply and Sanitation Association
CPCD .....Consumption par Capita, Day
CPH .....Census on Population and Housing
CNC.....Certificate of Non-coverage
CRP .....Custom Retention Program
CSD .....Consumption per Service Connection, Day
CWA .....Communal Water Association
CWS .....Communal Water System
DB .....Distribution Block
DMA.....District Meter Area
ECAs .....Environmental Critical Areas
ECC .....Environmental Compliance Certificate
ECPs.....Environmental Critical Projects
EIA .....Environmental Impact Assessment
EIS.....Environmental Impact Statement
EPS.....Electronic Procurement System
EXECOM .....Executive Committee
F/S .....Feasibility Study
FDIs.....Foreign Direct Investors
GFI .....Global Financial Integrity
HRD .....Human Resources Development
IEE.....Initial Environmental Examination
IRA.....Internal Revenue Allotment
IRR .....Implementation Rules and Regulations
IT .....Information Technology
IWRM.....Integrated Water Resources Management
LAN.....Local Area Network
LGC.....Local Government Code
M&E.....Monitoring and Evaluation
MOA.....Memorandum of Agreement
MEPZ .....Mactan Economic Processing Zone
M/P .....Master Plan

MIS	Management Information System
NDPS	No Down Payment System
NIPAS	National Integrated Protected Area System
NRW	None Revenue Water
O/M	Operation and Maintenance
ODA	Official Development Assistance
OJT	On the Job Training
PC	Presidential Decree
PFI	Private Financial Initiative
PIs	Performance Indicators
RWSA	Rural Water Supply and Sanitation Association
SCADA	Supervisory Control and Data Acquisition
SDIP	Supply and Distribution Improvement Program
WAN	Wide Area Networks
WATSAN	Water Supply and Sanitation
WRMU	Water Resources Management Unit
WSP	Water Supply Provider
Technical	
BOD	Bio-chemical Oxygen Demand
Ca	Calcium
CHB	Constant Head Boundary
Cl	Chloride
DHB	Dirichlet Head Boundary
E-Coli	Escherichia Coliform
EC	Electric Conductivity
FEM	Finite Element Method
FDM	Finite Different Method
GHB	General Head Boundary
Log	Logarithm
Mn	Manganese
NFB	No Flow Boundary
NO_2	Nitrate
NO_3	Nitrite
pH	Power Hydrogen
PNSDW	Philippines National Standard for Drinking Water
PWL	Pumping (Production) Water Level
SI	International System of Units (System International d'Unités)
STP	Sewage Treatment Plant
SWL	Static Water Level
Temp	Temperature
TH	Total Hardness
Unit	
cm	Centimeter
cm/s	Centimeter per second
HHs	Households
kgf	Kilogram force

km.....Kilometer
Lpcd.....Litter per capita day
Lps.....Litter per second
m^2 .....Square meter
m^3/day.....Cubic meter per day
m.....Meter
masl .....Meter above sea level
mbgs .....Meter below ground surface
mbsl .....Meter below sea level
mg/L .....Milligram per litter
N.....Newton: N = 1.01972 x 10^{-1} kgf
Pa.....Pascal: Pa = N/m^2
psi .....Pound per square inches
m.mho/cm.....Micro ohm^{-1} per centimeter

.....

Chapter-I Introduction

I-1 Scope of the Study

I-1.1 Authorization

Considering the circumstances of water crisis and water sources availability including water related institutions, the Government of the Philippines (GOP) requested the technical support from the Government of Japan (GOJ).

In response to this request, Japan International Cooperation Agency (JICA) dispatched the Preliminary Study Team, and implementation arrangement (I/A) and minutes of meeting (M/M) were signed and exchanged on July 2007 for implementation of the study for improvement of water supply and sanitation in Metro Cebu (the Study). The original I/A was amended on November 2008.

JICA announced an official notice for this study on the middle of November 2007 and nominated the consortium of NJS Consultants Co., Ltd. (NJS) and Nippon Koei Co., Ltd. (NK) as an official study team on the middle of December 2007. Fieldwork of the study was commenced on the beginning of January 2009 and the final report was submitted to JICA headquarters on the middle of July 2010.

I-1.2 Objectives

The Study had following objectives:

1) To formulate a plan for sectoral improvement of water supply and sanitation including sustainable development and conservation of groundwater;
2) To carry out the technical transfer to the Philippine counterparts in the courses of the Study.

.....

I-2 Frameworks

This study was conducted as a social development scheme with diplomatic recognition from both governments. Implementing agencies of this study are MCWD and JICA.

I-2.1 Contents of the Study

Following contents of the study were confirmed by both parties (MCWD and JICA).

(1) Sector and Field

The study included an official jurisdiction of MCWD in WATSAN sectors. Following Table I-01 shows the brief contents of this study.

Table I-01 Brief Contents of Sub-sectoral Fields in the Study

Field	WATSAN Sector	
	Water Supply	Sanitation
Management	• Institutional Capacity Development and Improvement of System Management • Support to Formalities of Initial Environmental Examination (IEE)	• Basic Plan on Sectoral Improvement • Introduction of Activity Models in other LGUs
Engineering	• Action Plan on Improvement of Water Supply System/ Facility and NRW Reduction • Operationalization of Simulation softwares for groundwater flow and pipeline hydraulic	• Basic Plan on Improvement of Zonal System/ Facility

Note: Items mentioned above table do not include the individual technical transfer.

(2) Study Area

A plan covered the service area of MCWD and its surroundings as shown following.

1) Water Sources Development: water supply service area of MCWD and its surroundings
2) Water Supply and Sanitation: water supply area of MCWD

(3) Planning Target Year

A plan has a target year of 2015.

(4) Study Component

This study had following categories as shown in Figure I-01. The study had put emphasis to water supply sector.

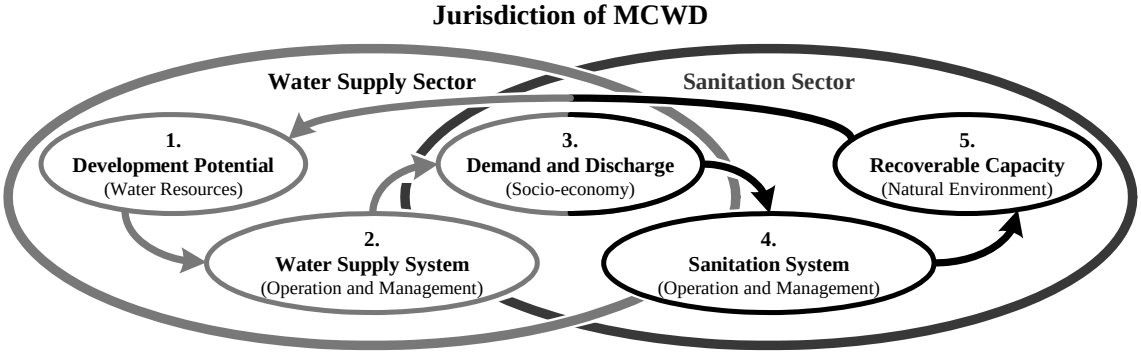

Figure-I.01 Major Components in the Study

I-2.2 Organization and Schedule

Following organization and schedule of the study were confirmed by MCWD and JICA.

(1) Organization of the Study

Figure I-02 shows the study system.

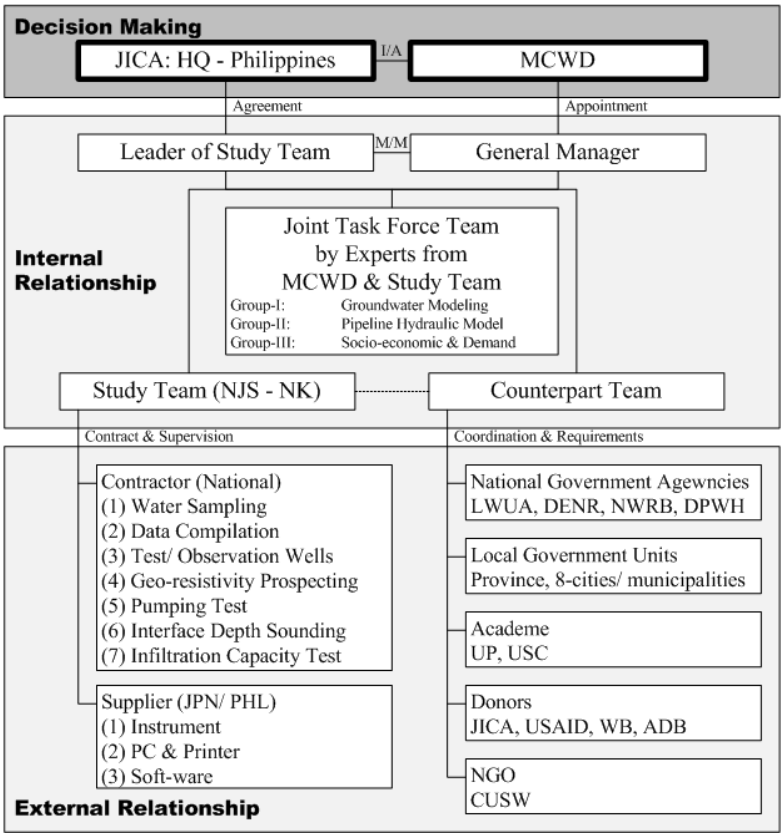

Figure I-02 Study System

(2) Assignment of the Study Team and the Counterparts

MCWD counterparts were nominated according to the study field.

Position	MCWD	the Study Team
Team Leader:	GM Armando Paredes	Mr. Norihisa Taoka
Hydrogeologist:	Mr. Lasaro P. Salvacion	Mr. Nobukatsu Sakiyama
Groundwater Modeler:	Mr. Ronnel Magalso	Mr. Keiji Ishii
Facility Planner:	Mr. Michael M. Balazo	Mr. Satoshi Omoto
Socio-economist:	Ms. Rowan E. Tenedo	Mr. Masahiro Ibayashi
Corporate Management:	Mr. Edgar H. Donoso	Mr. Teruo Maruyama*[1-1]
		Ms. Eleanoa E. Tan*[1-2]
Financial Analyst:	Mr. Edgar H. Donoso	Mr. Teruo Maruyama*[1-1]
		Mr. Hideyuki Takagi*[1-3]
NRW Reduction Planner:	Mr. Noel R. Dalena	Mr. Isao Sakaoka
Urban Sanitation Planner:	Mr. Angelo H. Cabije	Mr. David Beale*[2-1]
		Ms. Georgia Karamituro*[2-2]
Pipeline Designer:	Mr. Jose Eugenio B. Singson	Mr. Takanori Nemoto
IEE Specialist:	Mr. Roel A. Panebio	Mr. Tomoyuki Hosono

Note: Remark of *1-1 was changed by *1-2 and *1-3, while *2-1 was changed by *2-2.

(3) Study Schedule

The Study was carried out with the following two phases;

Phase-I: Basic Study (Jan-2009 to Oct-2009)
Phase-II: Planning (Jul-2009 to Apr-2010)

(4) Participants in the Workshop and Seminar

Workshop:

Workshop-I:	Basic Study Results and Brief WATSAN Sectoral Plans	53 persons × 2 days
Workshop-II:	Improvement Plan of WATSAN Sector	35 persons × 2 days

Seminar:

V-MODFLOW:	Basic Course 20 man-days and Advance Course 8 man-days
WaterCAD:	Basic Course 9 man-days

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I-3 Acknowledgements

Government of the Philippines has extended its assistance and cooperation to the Team throughout the study period. The Stakeholders' Committee formed by the representatives of the relevant officials from the national governments, LGUs, academe, donors and MCWD, and chaired by Mr. Armando H. Paredes, the General Manager of the MCWD, has guided well the JICA Study Team through the discussion in the Stakeholders' Committee meetings. The Team wishes to acknowledge that all the comments given to the Team from the committee were useful to guide the Study to the proper and effective goals.

Data collection was successfully done although available time to use on it had been so shortened especially for the phase-I study period of groundwater flow simulation. It could not have been achieved without assistance and support extended to the Team by all the concerned agencies of the Philippines. The Team highly appreciates for those personnel and agencies with respect to their cooperation during the field investigation and survey.

Hearty gratitude of the Team is addressed to the MCWD led by Mr. Armando H. Paredes, the General Manager. Activities of MCWD staff, as the counterpart officers, complied sufficiently with requirements. The Team members were impressed by enthusiasm shown by MCWD staff to overcome hectic schedule.

The Team would like to acknowledge supporting received from the Government of Japan as well. Ministry of Foreign Affair concluded an agreement with the Government of the Philippines on the Study through the Embassy of Japan to the Philippines. The ministry assigned its staff to a member of the advisory committee of the Study to guide the Team to proper way.

Among others, special acknowledgement is expressed to the JICA Headquarters in Tokyo and JICA Philippines Office for their good arrangement and support given to the Team in the course of the Study.

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Chapter-II
Profiling of the Study Site

II-1 Background Information

II-1.1 Natural Conditions

(1) Location of the Study Site

Cebu Island with an area of 4,870 km^2 is formed 210 km long and 25 km wide, measuring 35 km in its broadest section near the center. Several islets are dotted between Cebu Island and Bohol Island. Mactan Island is located at nearest to the Cebu Island.

(2) Geomorphology

Cebu Island is mountainous to hilly with high elevation terrains reach up to more than 600 masl. Because of central mountain range with steep slope close to the seashore, coastal plains are quite limited. In comparison with Cebu Island, the topography of Mactan Island is almost flat. The highest elevation is only about 11 masl.

(3) Geology

In general, the geology and stratification of Cebu has the younger sedimentary rocks along the coastline becoming older towards the mountainous inland, with the older sedimentary rocks being metamorphosed in varying degrees and intruded by dioritic and ultra-basic igneous bodies. The geanticlinal evolution of Cebu has formed an elongated narrow shaped island, which abruptly terminates to the sea on the eastern flanks of the island, giving limited catchment basins for fresh groundwater.

Figure II-01 shows the simplified geological map of groundwater study area. Typical geological order is indicated in Table II-01.

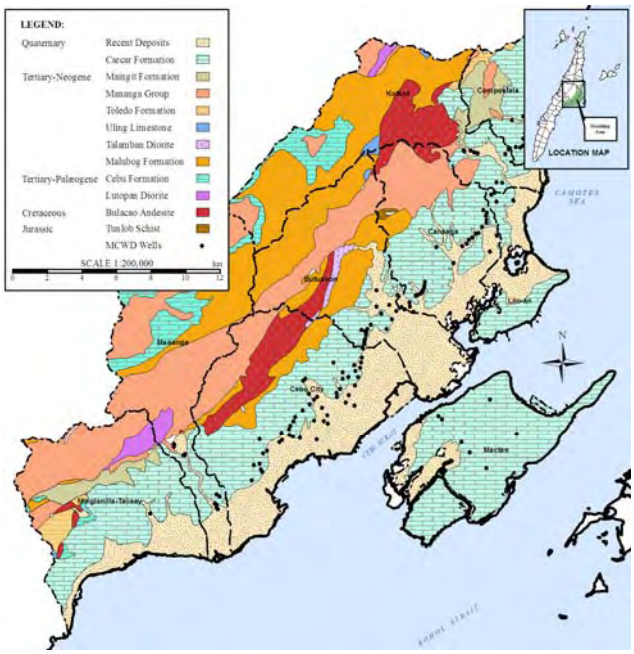


Figure II-01 Geological Map of Groundwater Modeling Area

Table II-01 Typical Geology in Metropolitan Cebu District

Stratigraphy				Geologic Nomenclature in Cebu Area		
Group	System	Series	Time	Southern Part	Central Part	Northern Part
Cenozoic	Quaternary	Holocene	0.011	Recent Formation: Qal		
		Pleistocene	2.000	Carcar Formation (un-conformity): CaF		
	Tertiary Neogene	Pliocene	5.200			
		Miocene			Maingit Formation: MG	
				Toledo Formation	Uling Limestone	Talamban Diorite
			25.000	Malubog Formation: MbF		
	Tertiary Palaeogene	Oligocene			Cebu Formation: CF	
			38.000	Lutak Hill Formation		
		Eocene	55.000	Lutopan Diorite: LD		
		Paleocene	65.000			
Mesozoic	Cretaceous		143.000	Cansi Meta-Volcanic	Pandan Formation	
	Jurassic		212.000	Tunlob Schist		

Time: a time scale ago in million years

(4) Hydrology

The drainage pattern is likewise as diverse as its geology. Box pattern river networks are observed in the older limestone areas. Likewise, dendritic and irregular patterns can be found in the younger limestone formations, as well as those underlain by the older basement rocks. These river systems merge into short major rivers that drain into the Bohol Strait. Figure II-02 show catchment area and relative location of the water resources management units.

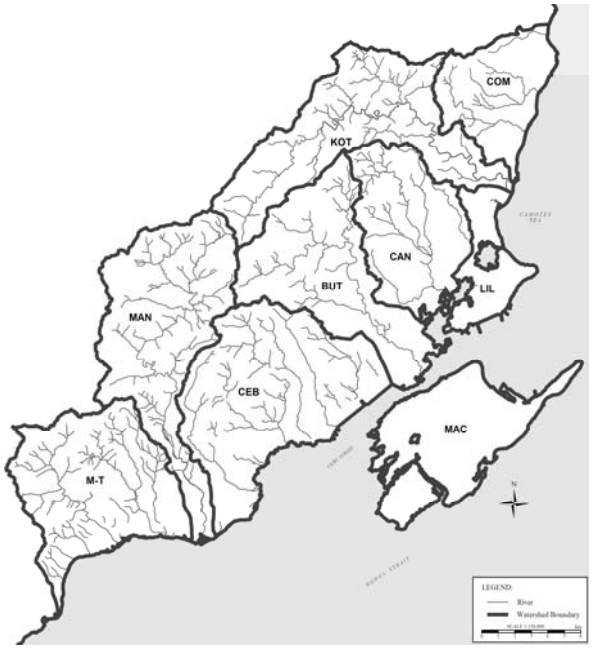


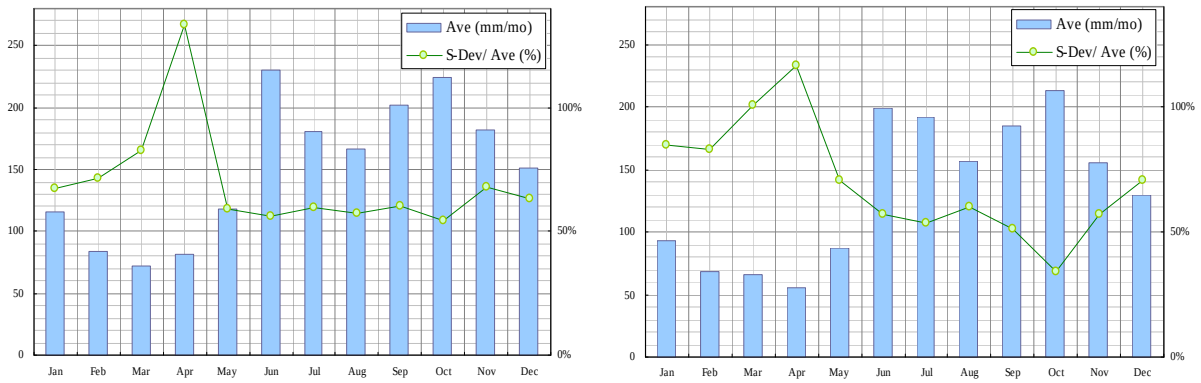
Figure II-02 Major River Network in the Groundwater Study Area

(5) Meteorology

The Philippines Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) uses classification of climates in the Philippines based on the temporal rainfall distribution of the Corona's classification system. Four climate types are recognized in the Philippines. Study area belongs to climate type-III/ IV. Typhoons have a great influence on the climate and weather conditions of the Philippines. A great portion of the rainfall, humidity and cloudiness are due to the influence of typhoons.

Using temperature and rainfall as bases, climate of the country can be divided into two major seasons: (i) the rainy season, from June to November; and (ii) the dry season, from December to May. The dry season may be subdivided further into (ii-1) the cool-dry season, from December to February; and (ii-2) the hot-dry season, from March to May.

Typical 2-stations are picked up for observation of rainfall pattern namely Mac-01; plain and But-08; hilly. Figure II-03 illustrates the precipitation patterns using records from the year 1977 to 2005 at typical 2-stations mentioned above. Coefficient of variation (standard deviation per average) in monthly distribution of 2-stations has similar pattern which means starting period of wet season sometime in April.



RCPI/ Man-12: Mountainous　　Talamban/ But-08: Hilly

Figure II-03　Monthly Distribution and Annual Variation of Rainfall

(6) Vegetation and Land-use

New built-up areas are developed along major road intersections that are accessible to transportation, middle and upper class residential villages, and sprouting shopping malls. Croplands are predominantly planted with coconut, corn and rice as intercrops. Grass and shrub lands are dominant with isolated patches of permanent and temporary crops and secondary forests. Wetlands are natural environments for nipa and mangroves along coastal areas that are shared with fishponds. Bare-land consists of mine and quarry sites, riverbeds, and areas that underlain by hard outcrops of massive rock.

(7) Hydrogeology (Groundwater)

Within the study area, the following main aquifers can be distinguished.

- Alluvial Sandy Sediments: It is located near the coast providing groundwater from shallow private wells for domestic use.
- Alluvial Coarse Sediments: It exists in river valleys providing groundwater from shallow wells, as well as offering possibilities for infiltration schemes such as at Jaclupan on the Mananga River.
- Carcar Limestone: This aquifer is composed of un-consolidated coralline limestone which is the most important groundwater system on the study area and is the main water source for potable water supply.
- Sandstone: Local name is Malubog formation in the Kot-kot valley with a small but not yet fully exploited groundwater potential.
- Cebu Limestone: It can be found at higher altitudes capping less permeable rocks and providing water mainly through springs.

(8) Flora and Fauna

< Red List of International Union for Conservation of Nature and Natural Resource (IUCN) >

The number of extinct, threatened and other species in the Philippines is provided by IUCN as shown in Table II-02.

Table II-02 Number of Extinct, Threatened and Other Species in the Philippines

Category		Plant	Animal
Extinct (EX)		0	0
Extinct in the Wild (EW)		0	0
Threatened	Critically Endangered (CR)	52	42
	Endangered (EN)	34	65
	Vulnerable (VU)	130	318
	Total	216	425
Lower Risk – Conservation Dependent (LR/cd)		3	5
Near Threatened (NT)		24	284
Least Concern (LC)		66	807
Data Deficient (DD)		12	192

Source: IUCN 2008 Red List (http://www.iucnredlist.org/, cited on March 11, 2009)

< National List of Rare, Endangered, Threatened, Vulnerable, Indeterminate and Insufficiently Known Species of the Philippine Wild Bird, Mammals and Reptiles >

In total, 163 species are designated as the species for conservation as shown in Table II-03.

Table II-03 Animal and Plant Species for Conservation in the Philippines

Classification	No. of species
Mammals	27
Birds	125
Reptiles	11
Total	163

Source: DAO 91-48 and DAO 07-01

Category	No. of Species
Critically Endangered	101
Endangered	188
Vulnerable	176
Other Threatened	44
Others	159
Total	668

< Establishing the National Red list of Threatened Philippine Plants and their Categories, and List of Other Wildlife Species >

The plant species of priority concern for conservation in the Philippines are regulated by DENR-AO No.01 of 2007.

II-1.2 Socio-economic Conditions

(1) Population

The total population of the study area as of the 2007 Census of Population has reached 1,853,231. Mandaue City has the highest density of about 10,700 persons per km^2, while the municipality of Compostela is the least densely populated municipality in the study area with about approximately 760 persons per km^2. Population density by barangay level in the study area is shown in Figure II-04.

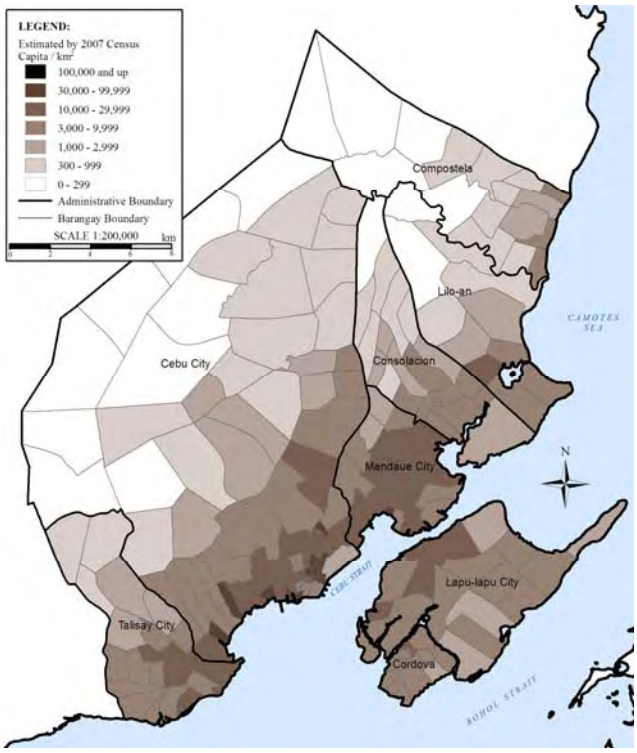


Figure II-04 Barangay Population Density (2007 Census Base)

(2) Poverty Situation and Income Level

Currently, there is no available data on the poverty situation and income level for specific cities and municipalities. Nonetheless, the situation in the study area is shown in Table II-04.

Table II-04 Poverty Situation in the Study Area

Items		Figure
Annual per Capita Poverty Threshold in 2006	Urban Areas of Cebu	14,467 PHP
	Rural Area of Cebu	12,107 PHP
Annual per Capita Food Threshold in 2006	Urban Areas of Cebu	9,917 PHP
	Rural Area of Cebu	8,825 PHP
Poverty Incidence in the Philippine	In 2006	32.9%
	In 2003	30 %
Number of Poor Families in the Philippine	In 2006	26.9%
	In 2003	24.4%
Number of Poor Families in Cebu Province	In 2006	33 %
	In 2003	29.4%

Source: National Statistical Coordination Board

(3) Industry and Economic Activities

Metropolitan Cebu is the center of economic activities in the province. It is also where the majority of the population is concentrated.

On tourism, white sand beaches and diving sites vis-à-vis the dynamic and diverse local culture have attracted foreign tourists who are mostly nationals from Korea, Japan, USA, Hong Kong, and Taiwan. Catering to foreign and domestic tourists are the hotels, inns, and pension houses scattered all over the metropolis. Service industries that support tourism are equally important to Cebu's economy.

In terms of exports, Cebu's top products include electronics, fashion accessories, furniture, garments, machinery parts, metal and steel products, processed foods, gifts, toys, and house-wares. The top markets of these products are USA, Japan, Hongkong, Belgium, Indonesia, China, Netherlands, Korea, Singapore, and Thailand. According to DTI, there were 12,165 new businesses registered in Cebu in 2005.

(4) Water Supply

Table II-05 presents the data on percentage of households by source of drinking water in the eight (8) cities and municipalities within the study area using information taken from the Cebu: A Demographic and Socio-Economic Profile Based on the 2000 Census, a study undertaken by JICA, Cebu SEED (Socio-Economic Empowerment and Development) Project.

Table II-05 Drinking Water Source in the Study Area by Households Rate (%)

	Base Information		Community System		Private System		Wells		Spring,	Vendor,
	LGUs	HHs	Individual	Communal	Individual	Communal	Safe	Un-safe	Lakes	Bottled
City	Cebu	147,600	38.3	28.3	4.5	14.0	1.1	1.8	5.7	6.3
City	Lapu-lapu	44,439	12.6	17.2	6.2	26.3	4.8	14.1	2.1	16.8
City	Mandaue	54,882	28.2	35.6	4.8	19.5	1.6	0.9	0.2	9.2
City	Talisay	28,751	21.0	27.6	11.1	28.9	3.9	1.9	2.3	3.3
Municipality	Compostela	6,296	14.7	30.3	3.9	38.6	2.0	5.7	4.3	0.6
Municipality	Consolacion	12,837	16.8	15.4	4.4	39.3	8.9	3.8	5.3	6.0
Municipality	Cordova	6,520	6.6	14.5	7.8	29.2	9.5	17.6	5.5	9.3
Municipality	Lilo-an	13,381	18.1	25.2	4.9	32.2	6.0	11.2	1.2	1.3
	Total	314,706	28.46	27.04	5.46	20.67	2.68	4.28	3.68	7.74

Source: Cebu: A Demographic and Socioeconomic Profile Based on the 2000 Census, op cit

(5) Sanitation

Status of access to toilet facilities presented is based on the 2000 Population Census. The Census of Population distinguished between sanitary and unsanitary disposal of human wastes. The former included water-sealed toilets with sewer, septic tanks, and other depository, while the latter included the pit, open system, and no toilet facility. Table II-06 shows the percentage of households in the eight cities/ municipalities by type of toilet facility.

Table II-06 Type of Toilet Facility in the Study Area by Households Rate

	Base Information		Sanitary (water sealed)				Un-sanitary			
			Sewer/ Septic Tank		Other Depository		Pit Latrine		Others	None
	LGUs	HHs	Individual	Shared	Individual	Shared	Closed	Opened	(pail, etc.)	
City	Cebu	147,600	51.9	17.4	8.8	6.5	2.9	2.1	2.1	8.4
City	Lapu-lapu	44,439	28.4	9.7	13.1	14.2	2.6	4.3	2.0	25.6
City	Mandaue	54,882	45.6	22.5	7.9	12.6	2.9	2.8	1.7	4.0
City	Talisay	28,751	42.1	13.4	11.3	10.1	6.2	2.0	1.8	13.2
Municipality	Compostela	6,296	32.7	11.5	11.7	7.8	3.6	2.9	0.5	29.2
Municipality	Consolacion	12,837	36.9	13.6	13.5	14.1	1.7	4.5	1.0	14.7
Municipality	Cordova	6,520	20.8	7.8	12.4	14.7	3.2	6.2	2.4	32.4
Municipality	Lilo-an	13,381	35.4	12.6	10.1	8.9	6.5	3.3	1.2	22.1
	Total	314,706	44.2	16.2	9.9	9.6	3.3	2.8	1.9	12.3

Source: Cebu: A Demographic and Socio-Economic Profile Based on the 2000 Census, op cit

(6) Cultural Heritage

The cultural heritages in Metropolitan Cebu identified by Cebu Provincial Tourism and Heritage Council are 20 naturals and 51 builds.

(7) Ramsar Sites and World Heritage

Olango Island Wildlife Sanctuary in Lapu-lapu and Cebu cities is designated as Ramsar site of Convention on Wetlands of International Importance Especially at Waterfowl Habitat.

(8) Briefing of Socio-economic Survey

< Household (HH) >

Household questionnaire survey was conducted with 746 samples. Question items are classified into 3 groups: general information, water supply and sanitation. Following are briefing of survey analysis.

∗ Average No. of HH members:	5.9	
∗ Average monthly HH income:	10,381	PHP
∗ Own Well:	9.9	%
∗ Individual Faucet:	38.2	%
∗ Cost of Bottled Water:	1.59	PHP/L
∗ Cost of MCWD:	0.03	PHP/L
∗ Cost of Private Vendor:	0.07	PHP/L
∗ Cost of Public Well:	0.18	PHP/L
∗ Own Toilet:	79	%

< Establishment >

Establishment questionnaire survey was conducted with 100 samples. Question items are classified as the same groups of HHs survey: general information, water supply and sanitation. Following are briefing of survey analysis.

∗ Has Own Well:	47	%
∗ Has Well Permit:	57	% (yea = 27/ 47)
∗ Water Source from MCWD:	63	%
∗ Monthly Consumption (MCWD):	750	m^3/month
∗ Monthly Cost (MCWD):	35,800	PHP/month

……

II-2 Current Situation of WATSAN Sector

II-2.1 Water Supply

(1) Background

Currently, several types of drinking water supply or fetching can be observed in the Metropolitan Cebu excluding bottled water. Most of residents maintain plural accessibilities depending on required water quality and cost effectiveness. These are categorized as;

- MCWD Water Supply — water supply to 4 cities and 4 municipalities
- Non-MCWD Water Supplies — managed and operated by private company using piped system
- Own Water Sources — several types of wells (electric/ hand-pump or pail) or spring
- Indirect Users — to buy water from concessionaire of above
- Water Vendors — they use the small de-salination system with hand delivery
- Water Supply Associations — mainly for services in their sub-division

(2) Service Coverage of MCWD

MCWD has franchise water supply areas in Metropolitan Cebu including 4 cities and 4 municipalities, jurisdiction area of which are totaled at 682 km^2. Of these franchise areas, existing service area is estimated at 78 km^2 as shown in Figure II-05.

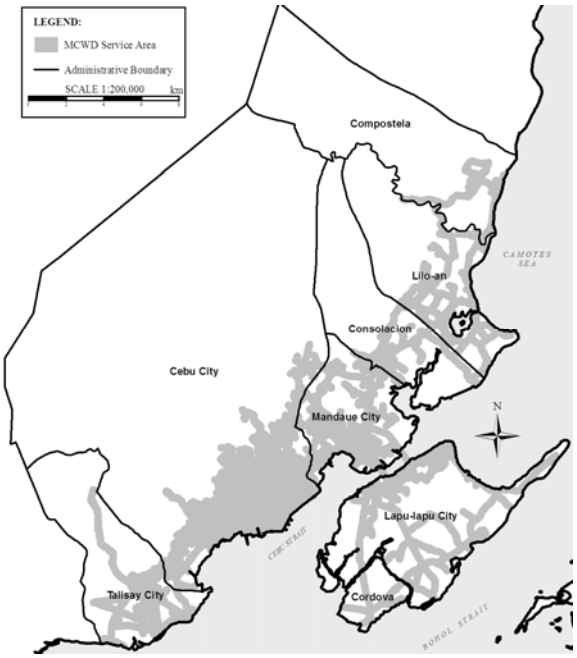


Figure II-05 Service Area of MCWD

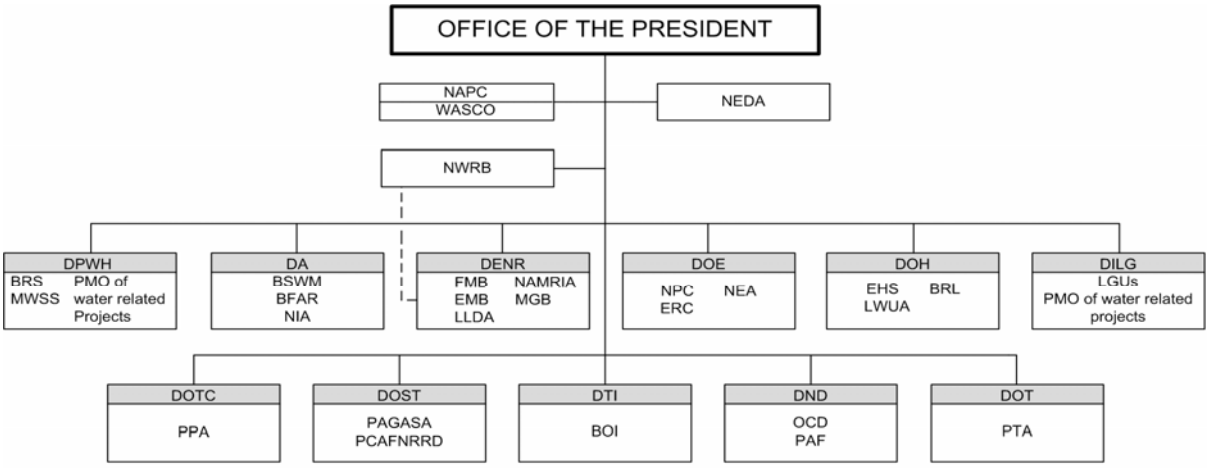
As of December 2008, MCWD record indicates following numbers of concessionaires.

- Individual Connection 114,847
- Communal Connection 199
- Sub-division (3,267 HHs) 47

This number can be converted to 36% of service population coverage equivalent. According to the socio-economic survey (house hold) con ducted in February 2009, about 40% of un-served population is being fall on service population as in-direct concessionaires of MCWD. Thus, coverage in this case goes up to about 62%.

(3) Current Institution

Management of the Philippine water sector is essentially run by about 30 different government agencies with each one responsible for only a limited aspect of water resources development and administration. As shown in Figure II-06, agencies belonging to each sub-sector generally have independent strategies and programs resulting to overlapping projects/ activities.



BFAR	Bureau of Fisheries and Aquatic Resources
BOI	Bureau of Investment
BRL	Bureau of Research and Laboratories
BRS	Bureau of Research and Standards
BSWM	Bureau of Soil and Water Management
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DND	Department of National Defense
DOE	Department of Energy
DOH	Department of Health
DOST	Department of Science and Technology
DOT	Department of Transportation
DOTC	Department of Transportation and Communication
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industries
EHS	Environmental Health Sciences
EMB	Environmental Management Bureau
ERC	Energy Regulatory Commission
FMB	Forest Management Bureau
LGUs	Local Government Units
LLDA	Laguna Lake Development Authority
LWUA	Local Water Utilities Administration
MGB	Mines and Geosciences Bureau
MWSS	Metropolitan Waterworks and Sewerage System
NAMRIA	National Mapping and Resource Information Authority
NAPC	National Anti-Poverty Commission
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NIA	National Irrigation Administration
NPC	National Power Corporation
NWRB	National Water Resources Board
OCD	Office of Civil Defence
PAF	Philippine Air Force
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PCAFNRRD	Philippine Council for Agriculture Forestry, Natural Resources and Resource Research and Development
PMO	Project Management Office
PPA	Philippine Ports Authority
PTA	Philippine Tourism Authority
WASCO	Water Supply Coordinating Office

Source: Updated by the Study Team, as of March 2010

Figure II-06 National Government Agencies relating to Water Sector

To date, no law has been passed creating an independent regulatory body responsible for both resource and economic regulation of water. These lead to the non-resolution of the following issues and concerns in the water sector:

- Non-systematic approach to WRM,
- Deficient coordination and lack of a systematic basic water data collection system for an efficient and effective flow of information,
- Inadequate institutional capacity-building,
- Watershed degradation,
- Inadequate financial support/ resources to the programs/ projects of the sector,
- Unabated extraction of groundwater by illegal users,
- Lack of appreciation of water as an economic good hence, the inability to allow market-based mechanisms to function,
- Need to increase public awareness of the vital role of water resources management in sustainable development,
- Limited private sector participation in water resources development, and
- Unclear definition and delineation of roles and responsibilities, particularly of NWRB.

II-2.2 Sanitation

(1) Background

Sanitation has been historically a low priority in Metropolitan Cebu with priority given to water supply. Lack of awareness at local level results in failure to recognize sanitation needs in present and future. This short-term view means that opportunities to tackle the problem early on are lost, along with all the benefits (financial, environmental, health etc) associated with early intervention. This is typical of a lot of sector practice around the world. The rapid urbanization of the area, especially in Metropolitan Cebu and the increased water supply coverage have resulted in an increase of solid waste and wastewater generation without a corresponding investment in sanitation services and facilities.

(2) Current Service Level

A survey was carried out as part of this study including sanitation conditions. A summary of the existing sanitation situation along with relevant study area conditions obtaining from socioeconomic survey is presented below.

< Toilet Facilities >

- Approximately 80% of the sample population owns a private toilet 10% uses communal and 10% has no toilet facilities at all (study survey).
- Most common toilet type is a wet type with either pour and flash (84%) or cistern flush (11%) and only 5% pit latrines or other

< Waste Collection Systems and Treatment practices >

- About 90% of the population with toilet facilities has septic tanks (on-site treatment). These are usually single chamber, without soak-away or drain-field inadequately constructed and poorly maintained.
- The rest 10% along with the population with no toilet facilities dispose waste untreated in waterways, adjacent land, directly to drains etc.
- No centralized sewerage system or treatment facilities are available.
- Industrial users and commercial/ special economic zones provide typically some form of aeration treatment with on-site or off-site sludge treatment.
- Septic tanks overflow to existing drains or directly into the river discharging in effect untreated effluent.
- Domestic grey water is also discharged to the drainage system and as a result the latter is effectively operating as a combined sewer.
- The city has an extensive drainage system along the main roads and most of the minor roads. The system is under capacity with extensive intrusion of solid wastes (50% of capacity) and domestic discharges (10% of flow).

< Existing Service Provision >

- Service Provision is limited and demand weak for alternatives to septic tanks
- Private companies provide evacuation and transfer of sludge to domestic users but only one sludge treatment facility exists
- 65% of septic tank owners do not de-sludge and approx 60% of those who do, de-sludge infrequently (over 10 years)
- Industrial users and commercial/special economic zones run private facilities

< Solid Waste >

In LGUs jurisdiction, the collection and disposal of solid waste is the responsibility of both LGUs and Barangays. The DPS is responsible for collecting non-domestic waste, e.g. from markets and slaughterhouses. Approximately 350 tons of solid wastes are collected each day. The Barangays are responsible for the collection of solid waste from domestic consumers. All have their own garbage collection vehicles ranging from Compacters to trucks.

(3) Existing Facilities

There are a number of sewage treatment works in Metropolitan Cebu area. These provide treatment only to selected industrial or commercial areas. No centralized sewerage treatment facilities exist for the majority of smaller commercial areas and all of the residential area.

There is one official disposal site for night soil in Cebu City at the Inayawan landfill site. The facility was operated by Phil-Bio, a private contractor. The facility was originally built to produce methane gas for re-use but currently it is evident that is operating as a dumpsite.

Cebu City operates a sanitary landfill site in Inavawan. The site accepts both solid wastes collected by the Barangays and also by the MDPW. Three other landfill sites were inspected: Lapu-lapu Dumpsite, Mandaue City Dumpsite and Consolacion Dumpsite. None of the sites were lined and no provision was made for leachate collection and treatment. Finally there is one site treating industrial waste. The Cebu Central Treatment Facilities (called as CCTFI) is a modern well-run treatment plant purpose built for industrial waste. Figure II-07 shows the locations of the main existing facilities.

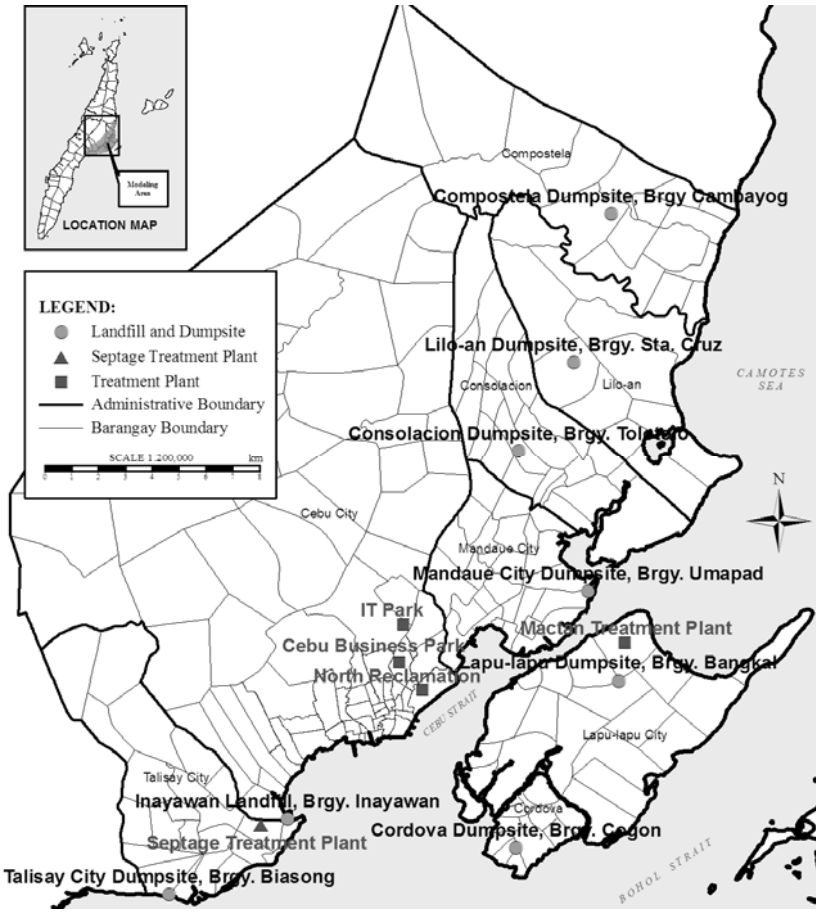


Figure II-07 Existing Treatment Facilities

(4) Current Institutions

Under the decentralized system promoted by the Provincial Water Utility Act 1973 and the Local Government Code 1991, devolution of legislative power and operation and control of water and sanitation systems and services at local level has been favored. Currently the sanitation sector principal stakeholders and institutional arrangements are as follows.

- LGUs The 8 LGUs within Metropolitan Cebu including DEPW, DPS and Barangays have the legislative power to translate policy at local level and create, through ordinances, the legal and regulatory framework for the set up and operation of sanitation facilities.
- DENR In relation to sanitation activities, DENR is the central regulatory body for the control of water, air and land pollution.
- DOH DOH is the National Agency responsible for all health maters pertaining to the population. There is a strong link between health and sanitation and as such DOH plays an important role in the sanitation sector.
- MCWD MCWD recognizes its responsibilities under PD 198 Local Water Districts Law and envisages becoming a full service utility that provides not only water supply, but also effective sanitation for its customers.
- Others A series of other inter-sectoral comities, associations such as the Philippine Pollution Control Association, NGOs and International donors (JICA, USAID, ADB, World Bank, etc.) operate within the Philippine sanitation sector.

II-2.3 Environment

(1) Water Bodies

There are a number of rivers and creaks traversing the study area, generally in a southeasterly direction, draining into Cebu Strait. It was not possible to gather sufficient information on current water quality in this study (e.g. no monitoring is undertaken at Guadalupe River at the moment).

Past studies and anecdotal evidence indicate that BOD levels at some locations can exceed 200 mg/L and even reach 400 mg/L in dry weather. Typical BOD concentration of raw sewage is 200 mg/L. This is indicative of a serious water quality problem and a reduced capacity of water bodies to assimilate receiving pollution loads. Site walks along the major rivers within Cebu city confirmed that river channels are heavily polluted with a distinct open sewer smell and heavily silted with a lot of rubbish especially plastics. The conditions get progressively worst from upstream to downstream culminating at highly polluted outfalls into the Cebu strait.

(2) Groundwater

From the date thereon, nitrate is among the closely monitored parameters by the MCWD. Nitrate contamination was:

- 11 MCWD well had reached or exceeded the 10 mg/L nitrate (maximum desirable level of the Philippines National Standard for Drinking Water 2007: PNSDW-07)
- Only 1 well K3 .2 showed a significant upward trend.
- Some wells in Cebu city and Mactan Island among MCWD wells (totaled at 104 wells) showed consistent upward trend of nitrate.

II-2.4 Health Status

Health information regarding Water Related Diseases (WRDs) within the study area indicates that there is an increasing trend in incident occurrence. Data from Cebu City Hospital Surveillance Program provided by CHD show that approximately 95% of the diseases registered are WRDs. Of these the majority are waterborne in nature with diarrhoea the most common registered cases. Diarrhoea cases in general increased from 2,186 in 2001 to 3,277 in 2007 while amoebiasis almost doubled in the same period. Other water borne diseases such as Leptospirosis, Typhoid Fever and Hepatitis A are fluctuating through out the period with an increasing trend after 2005.

The next most common WRDs are water related vectoral diseases, with minimal Malaria incidents but a large number of Dengue fever cases registered. Dengue fever reaches almost epidemic proportions during the rainy months of August through to October. The Dengue fever mortality rate between January and August in 2008 was 4.2% (please note that this figure does not cover the high risk period).

.....

II-3 Metropolitan Cebu Water District

II-3.1 Organization and Finance

(1) History

MCWD was established on July 1974 pursuant to Presidential Decree (PD) No.198 also called the Provincial Water Utilities Act of 1973. It took over the assets and operations of the Osmeña Waterworks System, after the latter's financial collapse, and the responsibility for water supply and sewerage in the Metropolitan Cebu area. MCWD service areas include the cities of Cebu, Lapu-lapu, Mandaue, and Talisay and the municipalities of Compostela, Consolacion, Cordova, and Lilo-an.

(2) Organization

MCWD belongs to the very large water district category. As of December 31, 2009, it has a total personnel complement of 922 composed of 509 regular employees, 79 casuals, 299 contractual personnel and 57 job orders.

They are distributed in the following six groups: general manager's (GM) office, administrative group, finance group, operations group, technical services group, and pipelines maintenance group. The GM heads one group composed of the internal audit, legal, corporate planning, and management information systems (MIS) departments. The GM is assisted by five assistant general managers in charge of each of the other groups. Figure II-08 shows the organization of MCWD.

(3) Financial Statement

The value of all existing water facilities of Osmena Waterworks System transferred to MCWD served as the latter's initial capital. In addition, Cebu city council further resolved the authority to encumber other city properties or assets placed as security or collateral with the DBP in connection with the loan in order to turn-over those assets to MCWD so that MCWD should not be encumbered by indebtedness incurred prior to its formation.

On 5 July 1991 certain properties of MCWD with a book value of PHP119 million were appraised by the Asian Appraisal Co. Inc., an independent appraiser, and revaluated to PHP694 million resulting to incremental capital of PHP576 million. Table II-07 shows changes in MCWD equity and capitalization.

Balance sheet is presented in Table II-08. The initial loans with LWUA were credit lines that were obtained to finance the various projects of MCWD. On March 17, 2006, a contract of loan was entered with DBP in order to refinance the existing long term loans from LWUA. Salient terms and conditions of the contract are the following:

- Term 15 years to commence on the month following the release of the loan
- Interest rate 9.5% per annum
- Loan to be secured by a real estate mortgage

DBP outstanding loan: Long term loan PHP1,133 million and Current portion of long term loan PHP47 million. Documentary stamp tax amounting to PHP2.5 million was paid on March 14, 2006. Amount set up as reserve for retirement benefits is based on the existing MCWD Retirement Plan with respect to those who are already entitled thereto. This is intended for the employees who were hired prior to April 1993.

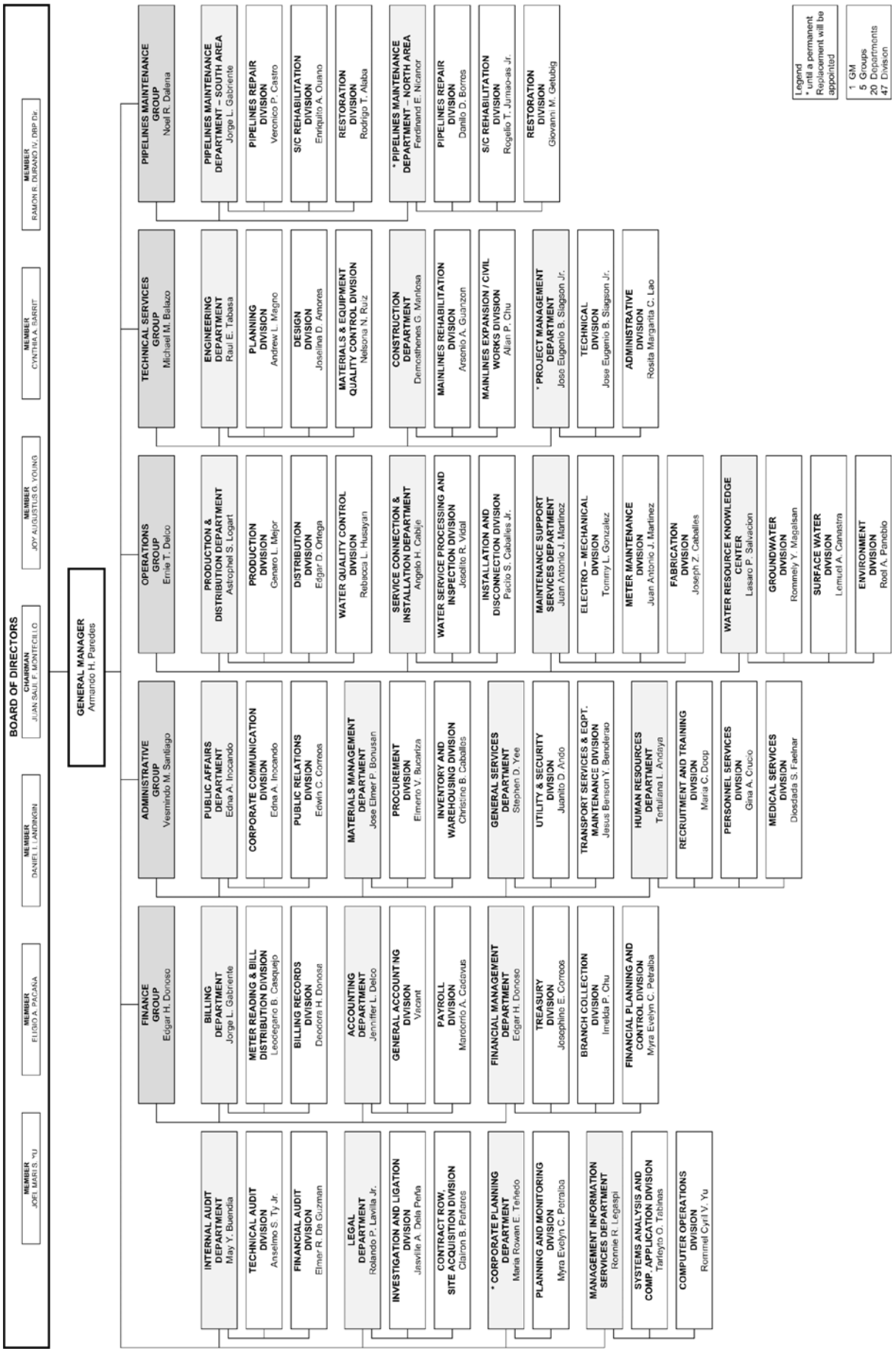


Figure II-08 Current Organization Chart of MCWD (Nov-2008)

Table II-07 Capital Formation (thousand PHP)

Statement of Change in Equity	Equity	Revaluation Surplus	Retained Earnings	Total
Balance at December 31, 2003	**11,312**	**575,535**	**127,708**	**714,555**
Net income for the year			75,707	75,707
Prior year's adjustment			-52,196	-52,196
Balance at December 31, 2004	**11,312**	**575,535**	**151,219**	**738,066**
Net income for the year			50,032	50,032
Transfer of revaluation surplus to retained earnings		-390,458	390,458	0
Prior year's adjustment			-49,071	-49,071
Balance at December 31, 2005	**11,312**	**185,078**	**542,637**	**739,027**
Net income for the year			164,804	164,804
Transfer of assets from Netherlands	1,576			1,576
Transfer of revaluation surplus to retained earnings		-1,080	1,080	0
Prior year's adjustment			-30,437	-30,437
Balance at December 31, 2006	**12,888**	**183,998**	**678,084**	**874,970**
Net income for the year			229,055	229,055
Prior year's adjustment			-22,928	-22,928
Balance at December 31, 2007	**12,888**	**183,998**	**884,211**	**1,081,097**

Source: MCWD Audited financial statement

Table II-08 Balance Sheet (thousand PHP)

Category			2003	2004	2005	2006	2007
Assets	Current	Cash and cash equivalents	24,374	40,113	53,451	66,468	71,113
		Temporary investment	135,205	103,827	55,318	130,175	278,662
		Receivables	100,736	110,294	152,690	173,173	185,414
		Inventories	45,561	41,040	52,228	65,253	52,052
		Prepayments and other current assets	154	20,124	14,170	10,469	13,727
		Total of Current Assets	306,030	315,398	327,857	445,538	600,968
	Non-current	Utility plant in service-net	2,009,718	2,020,712	1,974,460	1,949,533	1,928,337
		Investment property-net	0	0	40,883	38,544	37,352
		Other financial assets	171,281	147,122	134,515	148,564	179,092
		Total of non-current Assets	2,180,999	2,167,834	2,149,858	2,136,641	2,144,781
		Total of Assets	2,487,029	2,483,232	2,477,715	2,582,179	2,745,749
Li-Capitalization/abilities	Current	Account payables and accrued expenses	32,577	31,202	71,245	70,603	65,682
		Customers' deposit	86,460	96,601	106,159	114,718	122,751
		Current portion of long-term loans	29,353	31,840	35,493	42,554	46,777
		Total of Current Liabilities	148,390	159,643	212,897	227,875	235,210
	Non	Long Term Loans	1,288,607	1,255,444	1,218,181	1,179,991	1,133,215
		Deferred liabilities	66,760	70,500	72,036	72,807	77,372
		Total of Non-current Liabilities	1,355,367	1,325,944	1,290,217	1,252,798	1,210,587
		Reserve for Retirement	268,717	259,580	235,574	226,537	218,856
Capital	Equity		11,312	11,312	11,312	12,889	12,889
	Revaluation Surplus		575,535	575,535	185,078	183,997	183,997
	Retained Earnings		127,708	151,218	542,637	678,083	884,210
	Capital Total		714,555	738,065	739,027	874,969	1,081,096
Capital and Liabilities Total			2,487,029	2,483,232	2,477,715	2,582,179	2,745,749

Source: Audited Financial Statement

Table II-09 shows the statement of profit and loss. Cash flow statement is shown in Table II-10.

Table II-09 Profit and Loss Statement (thousand PHP)

Profit and Loss Category			2003	2004	2005	2006	2007
Operating	Income	Water Sales	731,810	763,338	804,538	959,543	1,054,489
		Penalties and service Charge	16,408	20,397	22,758	19,981	23,395
		Total	748,218	783,735	827,296	979,524	1,077,884
	Expenses	Operation	442,046	470,292	533,393	561,872	586,626
		Maintenance	95,445	89,792	99,175	148,920	157,024
		Total	537,491	560,084	632,568	710,792	743,650
	Income		210,727	223,651	194,728	268,732	334,234
Others	Income	Others	5,243	9,142	11,397	13,870	4,628
		Dividend		10	10	10	10
		Interest	5,390			5,200	6,771
	Expense	Interest	-167,980	-157,058	-155,416	-122,273	-115,463
		Exchange Loss	0	-38	-687	-735	-1,125
	Income		-157,347	-147,944	-144,696	-103,928	-105,179
Net Income			53,380	75,707	50,032	164,804	229,055

Table II-10 Cash Flow Statement (thousand PHP)

Cash Flow Category		2003	2004	2005	2006	2007
Operating Activities	Net income for the year	53,380	75,707	50,032	164,804	229,055
	Depreciation	126,155	119,366	128,159	130,145	128,453
	Amortization of deferred charges	-	199	491	52	-
	Provision for un-collective accounts	-	184	462	388	241
	Prior year's adjustment	23,909	-52,196	-49,071	-30,437	-22,928
	Provision for retirement	8,986	8,733	12,390	9,225	7,263
	Interest expense	-	164,334	160,374	122,273	115,463
	Unrealized foreign exchange loss	-	38	687	735	1,125
	Investment income	-	-7,286	-4,968	-5,210	-6,780
	Operating income before working capital change	212,430	309,079	298,556	391,975	451,892
	Increase in assets	-11,789	21,868	411	-104,664	-150,785
	Increase in liabilities	8,221	11,253	53,254	14,978	7,335
	Sub-Total	208,862	342,200	352,221	302,289	308,442
Investment Activities	Utility plant in service	-170,590	-130,360	-81,906	-105,710	-114,761
	Investment property	-	0	-40,883	2,339	1,192
	Other financial assets	-	-4,077	-269	-23,170	-30,528
	Interest received	-	7,275	4,957	5,200	6,771
	Dividend received	0	10	10	10	10
	Sub-Total	-170,590	-127,152	-118,091	-121,331	-137,316
Financing Activities	Equity	0	0	0	1,577	0
	Long term loans	-31,400	-33,163	-37,263	-38,190	-46,776
	Deferred liability	0	-72	3,895	771	4,565
	Operating reserves	-	-5,514	-24,005	-9,038	-7,681
	Other deferred credit	-	3,813	-2,358	-	-
	Interest paid	0	-164,333	-160,374	-122,273	-115,463
	Sub-Total	-31,400	-199,269	-220,105	-167,153	-165,355
Effect of Foreign exchange		-	-38	-687	-788	-1,125
Net increase in cash		6,872	15,741	13,338	13,017	4,646
Cash and cash equivalents at beginning of year		17,500	24,372	40,113	53,451	66,468
Cash and cash equivalents at end of year		24,372	40,113	53,451	66,468	71,114

Source: Audited Financial Statement

II-3.2 Corporate Management

MWCD is the first water district in the Philippines to become ISO 9001 certified. To date, MCWD has managed to maintain its ISO accreditation.

(1) Management Information

Management Information system: GIS for leak repairs, has already completed the study and design phase of the database, both geo-data and its attribute data. The next phase of the project is its implementation through integration of the GIS procedure in the existing operations.

(2) Customer Service Management

As one of marketing strategies, No Down Payment Scheme (NDPS) were developed for new service connection. The NDPS shall be implemented on the months of March, June, September and December covering different strategic areas under the MCWD franchise area. Under the NDPS, applicants need not to pay the down-payment for installation of new service connections. The total cost of installation shall be paid through monthly billing within 12 months.

(3) Accounting System

The financial statements and accounting records are prepared in accordance with the uniform and standard accounting system with double entry bookkeeping method prescribed by LWUA.

Collecting banks accept only current water bills with no service charge. Collection Centers and Sub Offices accept payment for water bills with disconnection notices but payment must be made on or before the due date. Consumers who pay on time can avail of 5% discount. Collection Centers collect PHP3.00 as service charge for every water bill.

(4) Water Tariff Structure

< Water Tariff Table >

The water rate structure is defined by “Manual on Water Rates” issued by LWUA. The water rate is structured to apportion the revenue requirements from customers. The apportionment is based on a socialized pricing scheme where the unit cost of water increases with increased consumption. The structure specifies a minimum consumption of 10 m^3 of water per month. MCWD provides 5% discount for prompt payment and exacts a 2% surcharge equivalent to the cost of money which shall be applied to the payments received 15 days after its due date. Computation of the surcharge shall retroactive to the day after the due date.

MCWD raised water tariff in 2001, 2005 and 2008. In 2009, communal service tariff and bracket has been changed. Water tariff table is shown in Table II-11.

The price of raw water is unrealistically low and does not reflect its true scarcity. In an identified critical area like Central Cebu, cheap raw water actually encourages indiscriminate water withdrawal, and only serves to deepen the problem of water scarcity, under conditions of critical supply, the price of raw water should be set at high enough levels to allocate raw water into more efficient sectors, and thus avoid waste of scarce resources.

Apart from its apparent scarcity, the price of raw water in Central Cebu, must also consider the cost of monitoring water quality, monitoring of water withdrawal and the cost of watershed protection to ensure availability raw water for the sectors who can be expected to utilize it more efficiently.

Table II-11 MCWD Water Tariff (unit: PHP/ m^3)

Classification			Jul-01 to Aug-05	Sep-05 to Jun-06	Jul-06 to Sep-08	Oct-08 to Dec-08	Jan-09 to Present
Regular Connection	First 10 m^3 (pipe size in inch)	1/2"	108.51	122.00		136.00	
		3/4"	175.97	195.20		217.60	
		1"	344.60	390.40		435.20	
		1 1/2"	879.83	976.00		1,088.00	
		2"	2,184.92	2,440.00		2,720.00	
		3"	3,929.92	4,392.00		4,896.00	
		4"	7,859.84	8,784.00		9,792.00	
		6"	11,782.42	14,640.00		16,320.00	
		8"	15,697.66	23,424.00		26,112.00	
	Excess of 10 m^3	11 – 20	11.97	13.40		15.00	
		21 – 30	14.07	15.75		17.65	
		31 – up	38.41	43.20		48.40	
Communal Faucets	First 10 m^3 (pipe size in inch)	1/2"	73.28	76.50	85.68	100.93	118.90
		3/4"	117.23	122.39	137.08	161.48	190.22
		1"	234.46	244.78	274.15	322.95	380.43
	Excess of 10 m^3	11 - 20	7.99	8.34	9.34	10.09	
		21 - 30	9.44	9.86	11.04	11.89	
		31 - 40	10.99	11.47	12.85		
		41 - 172	12.95	13.52	15.14		
		173 - up	41.43	43.25	48.44		
		31 - 120				18.13	21.36
		121 - up				24.22	38.76

Source: Corporate Planning Department

< Communal Water System >

MCWD's Communal Water Association (CWA) was introduced and established in 1980 to provide potable water to low income families. On July 21, 2008, the CWA operational concept was revised. CWAs were converted to and renamed Communal Water Systems (CWS) to operate under a franchising agreement. As of September 2009, 192 CWSs are active. Special water rates are applied to the consumption of communal water consumers up to 120m^3 per month per connection.

II-3.3 Water Supply System/ Facilities and Its Operation/ Management

(1) Water Production and Consumption

< Water Production >

Water is produced from three types of water source, namely ground water, surface water and bulk supply, location of these facilities are referred to the open page. Of the surface water, Manangan River surface water is dammed at Jaclupan weir and infiltrated into aquifer and then pumped up to the reservoir. Each volume as of December 2008 is summarized below.

* Groundwater (own 109 wells): 118,532 m^3/day 71.7 %
* Groundwater (bulk water supply): 16,025 m^3/day 9.6 %
* Surface Water (own Buhisan and Jaclupan): 30,847 m^3/day 18.7 %

< Water Consumption >

Number of service connection as of December 2008 was totaled at 120,989 while water consumption was counted at 3,781,117 m^3/month. Accordingly, per capita consumption was 166 Lpcd.

< Service Connection >

Type of service connection is divided into five categories in accordance with connection pipe size and purpose of use. Actually, connection diameter of 3/8" to 1/2" is categorized as residential use, on the other hand 3/4"and larger diameter is categorized as commercial use.

As mentioned before, served households are reported to provide water to the non-served households. Its rate is nearly 30% of un-served household. This population makes lpcd analysis difficult. Detailed survey on service population is also required.

(2) Water Supply System

MCWD has three types of water source; ground water, surface water and bulk water. System diagram is shown in Figure II-09.

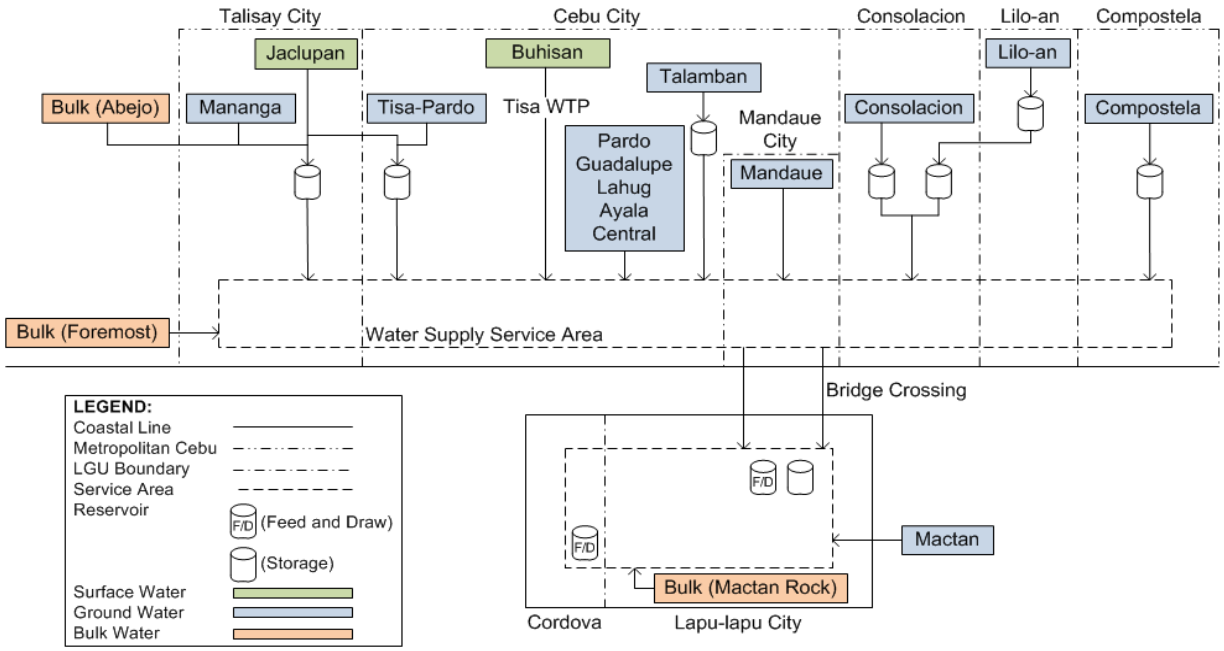


Figure II-09 System Diagram

Historical groundwater intake records are shown in Figure II-10. As of December 2008, intake amount was estimated at 118,500 m^3/day.

At present, MCWD has entered into bulk water supply contract with 3 companies, namely Mactan Rock Industries Inc., Foremost and Abejo. Contracted volume is 5,000 m^3/day for each company, totally 15,000 m^3/day.

Mactan Rock has its own desalination plant with production capacity of 7,000 m^3/day. They use Sand Filter and RO (Reverse Osmosis) system to desalinate blackish water. They are supplying water mainly to Cordova municipality and also cover part of Lap-lap City. Sample of treated water is delivered to Talamban MCWD laboratory every day and water quality is checked whether it fit to the drinking water. Cross checking is done by them.

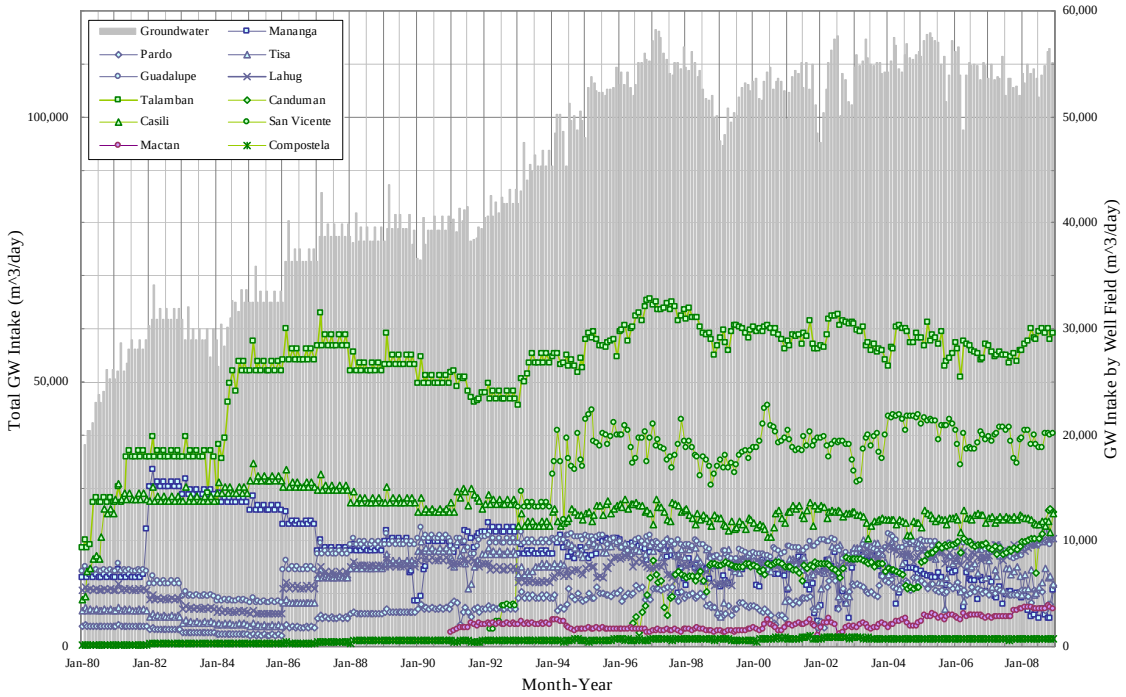


Figure II-10 Historical Records of Groundwater Intake

Tisa Filter Plant was constructed in 1911. Approximate area is nearly 2.5 ha. Source water is delivered by gravity from Buhisan Dam, 2 km away from the plant.

There are 10 reservoirs in MCWD jurisdiction area. Total Capacity is 32,670 m^3, which is equivalent of 4.7 hours of existing production volume 166,000 m^3/day and 6.7 hours of consumption volume 117,000 m^3/day.

Totality, rate of direct supply was estimated at 38% of intake amount. Remaining 62% of water sources were supplied through reservoirs by gravity.

Total pipe line length as of December 2008 is nearly 770 km including small size pipe. The pipe with diameter less than 250 mm is mainly distribution pipe called lateral pipe, while larger pipe with diameter more than 300 mm is mainly transmission pipe which transmits water from the well to the reservoir or from reservoir to the main distributing points.

(3) Water System Management

< SCADA System >

SCADA is the not yet actually in use. Only limited data is transmitted from W-13B well to the Management Information Services Division experimentally. The conceptual design and technology has already been identified by SCADA group and shall be presented to the EXECOM in the first quarter of 2009.

< DMA System >

- Since the past, the District Metering Areas has been primary diagnostic tool for monitoring systems losses. This has been put in place due to loop system, limited main transmission lines, and limited water supply. To date, MCWD already have 56 DMA's with an average of 4 flow meters each.
- The DMA, however, has its own flaws that pose some operational problems. The DMA system has too many flow meters to monitor and maintain. There are flow meter inaccuracies

due to low flow, and too many entry points to handle. Having encountered these problems, MCWD decided to gradually convert the DMA system into a leaf system.

- The Leaf System is a water supply distribution system that minimizes the number of water source entry/ exit points per monitored area for a more effective monitoring system. Most ideal is a one-entry water source, literally.
- As of October 2008, the Engineering Division was able to convert 10 DMA's and expects to complete 6 more before the end of the year.

< Pipeline Network Analysis >

Pipe network analysis using EPANET is on-going. Condition and input data of the analysis is based on GIS data. At present, analysis is proceeding under these conditions. EPANET data are transported to WaterCAD data, and pipeline network analysis is conducted.

No. of Junctions: 2,851
No. of Reservoirs: 124
No. of Tanks: 10
No. of Pipes: 3,551 diameter between 50 mm and 1,000 mm

Appling flow rate of DAF: DMF: HMF = 1.0: 1.2: 2.2, present situation of pipeline network was analyzed using WaterCAD as shown in Figure II-11.

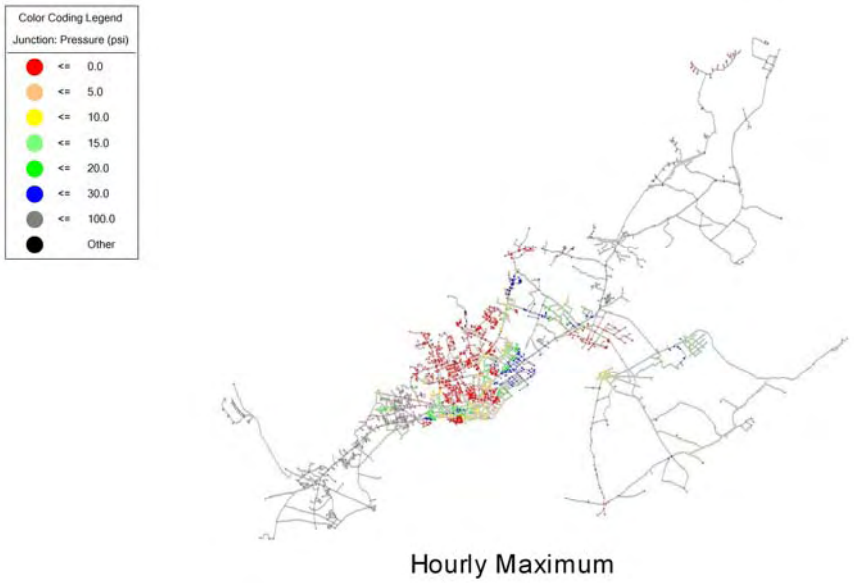


Figure II-11 Result of Pipeline Network Analysis in Current Situation

(4) Facility O/M Works

< Pressure Control >

The PDD is checking water pressure at around 80 points regularly and pressure stabilization project has been conducted by introducing PRV at the neck of high pressure zone to increase 24 hour service area. Of the proposed 17 valves, 14 have already been installed.

< Quality Control >

MCWD has its own standards for drinking water quality, based on Philippine National Standard for Drinking Water 2007 (PNSDW-07) as mentioned in MCWD Technical Standards Manual 2003. At present, MCWD laboratory performs much more than PNSDW-07 requirements.

II-3.4 On-going Activities of NRW Reduction

(1) Organization

SRR Committee (see Figure II-12) has been set up to oversee the NRW reduction efforts, and the committee meeting is regularly held once a month. Chairperson of Committee is AGM of Pipeline Maintenance Group.

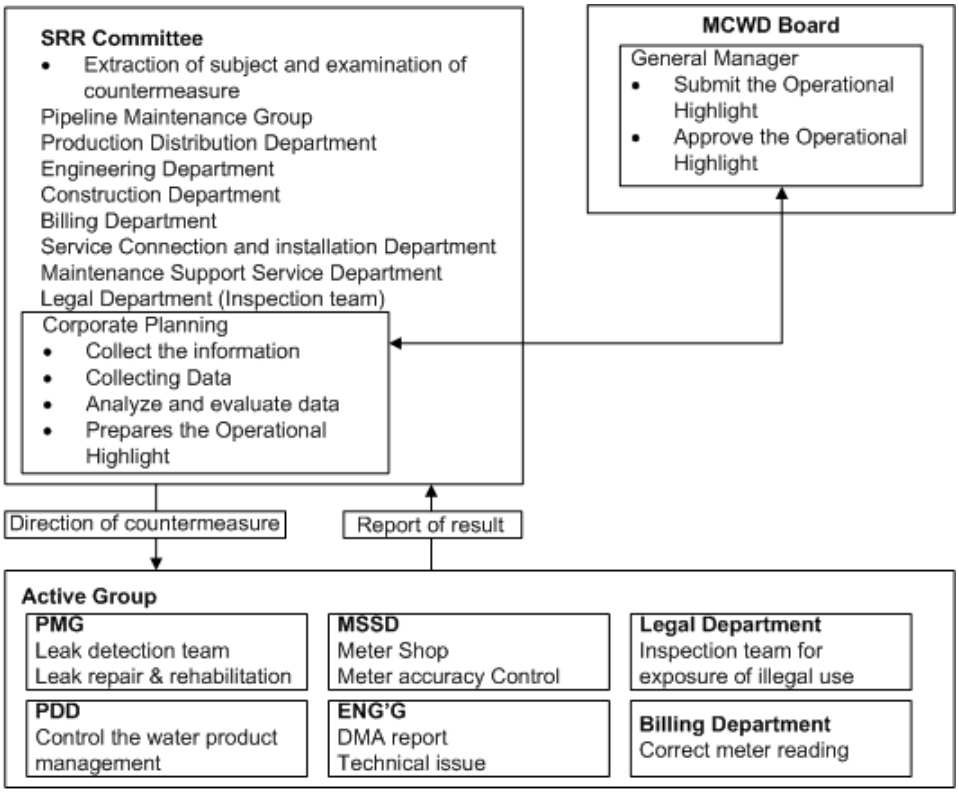


Figure II-12 Organization of SRR Committee

The CPD analyzes the data that were contributed by the members and reports the results to the Committee every month. The analyzed information includes the following. All problems analyzed and suggestions for improvement are reported to the committee on the next month. If the situation is very serious, relevant department deals with the NRW problem as a priority issue setting a time-limit.

- Water balance,
- NRW rate of each area,
- The performance of NRW achievement of each area, and
- The collation of service connection managed GIS and the issue of the bill, etc.

The priority issue includes not only the rate of NRW but also the magnitude of water losses. As a result of these activities, an efficient NRW reduction has been performed, achieving a current NWR rate of 29%. Principal NRW reduction method is Leakage countermeasure and Water Meter Accuracy Control.

(2) On-going Activities

< Leakage Countermeasure >

NRW reduction has mainly been implemented through actual leak detection. The Leak Detection Team has been organized and it consists of the selected staff from the Pipe Maintenance

Department. The leak countermeasure plan is designed to inspect the whole pipelines with a length of 800 km in 4 years.

Leak detection is carried out in two ways: (i) listening for leak noise on the stub-outs and (ii) listening for leak noise on the road surface. This method was suggested during the leak detection training that was conducted by a German technician 13 years ago. This technique is sufficient for finding largest leaks, but a more precise, detailed, and organized approach is required for smaller leaks. The result of investigation of the past eight years is shown in Table II-12.

Table II-12 Results of NRW Investigation

Indicator		2001	2002	2003	2004	2005	2006	2007	2008
Detected Length in km		127.2	110.2	127.0	134.8	178.2	208.7	222.8	319.1
Leak Found	Visible	52	145	127	50	42	67	41	52
	Under ground	113	114	105	113	100	94	136	161
Found Rate by point/km		1.30	2.35	1.83	1.21	0.80	0.77	0.79	0.67

Currently, leakage detection equipments available in the teams are following:

- ✓ Leak Noise Correlator 1 unit
- ✓ Leak Detector 4 units
- ✓ Metal Pipe Locator 1 unit
- ✓ Non Metal Pipe Locator 1 unit
- ✓ Service Vehicle 2 cars
- ✓ VHF Wireless Radio 1 unit
- ✓ Accessories 1 set (Reflector red vest, Warning traffic corn, Flash right, etc.)

< Water Meter Control >

Control of Illegal Use

As for the reduction of un-authorized consumption, the legal department reacts to the problem actively. The two main problems are:

- ✓ The function of water meter is spoiled (i.e. the water meter is manipulated to stop it from registering) and
- ✓ Illegal connections are exposed as the way of stealing water in the component of un-authorized consumption.

Control of Water Meter Accuracy

Maintenance Support Service Department control customer meter accuracy for newly installed meters and existing meters. The number of staff members of meter shops is 18.

< GIS for Leak Repair Work >

For leak repairs, GIS has already completed the study and design phase of the database, both geo-data and its attribute data. The next phase of the project is its implementation through integration of the GIS procedure in the existing operations. This project has already started early November this year through an orientation. It will be fully operational by March 2009

(3) Analysis of NRW

Table II-13 shows the water balance (IWWA) in 2008.

Table II-13 Water Balance (2008)

System Input **60,738,859**m³ Error margin ±1.7% (100.0%)	Authorized Consumption **43,268,912**m³ Error margin ±0% (71.2%)	Billed Authorized Consumption **43,161,251**m³ (71.0%)	Billed Metered Consumption **43,161,251**m³ (71.0%)	Revenue Water **43,161,251**m³ (71.0%)
			Billed Un-metered Consumption **0**m³ (0.0%)	
		Unbilled Authorized Consumption **107,661**m³ Error margin±1.7% (0.2%)	Un-billed Metered Consumption **35,581**m³ (0.1%)	NRW **17,577,608**m³ Error margin±6% (29.0%)
			Un billed un metered Consumption **72,080**m³ (Error margin±26.2%) (0.1%)	
	Water Losses **17,469.947**m³ Error margin ±6% (28.8%)	Commercial Losses **506,126**m³ Error margin±8.1% (0.8%)	Un authorized Consumption **69,428**m³ (Error margin±50.7%) (0.1%)	
			Customer Meter In-accuracy and Data Handling error **436,698**m³ (Error margin±5%) (0.7%)	
		Physical Losses (Error margin±6.2%) **16,963,821**m³ (27.9%)		

Source: Corporate Planning Department

Note[1)] The System input volume: production volume of Tisa Filtration Plant plus the pump discharge of 109 wells are summed up.

Note[2)] Billed Consumption: Total volume of billing by meter reading.

II-3.5 Existing Development Plan

(1) Investment Plan

Investment plan is shown in Table II-14.

Table II-14 Investment Plan (million PHP)

Project	2008	2009	2010	2011	2012	2013	2014	2015	Total
Rehabilitation	19	73	46	78	83	88	93	99	579
Expansion	0	244	74	40	0	0	0	0	358
Water Source	2	101	44	0	0	0	0	0	147
Special Project	25	23	0	0	0	0	0	0	48
Massive Rehab.	8	8	9	9	9	10	10	11	74
Transportation	0	25	13	14	15	15	16	17	115
Pump Replace	6	6	8	9	9	10	10	11	69
Meter Replace	6	24	27	31	35	40	45	50	258
Other CAPEX	34	36	37	40	42	45	48	50	332
Total	100	541	259	221	193	207	222	238	1,982

Source: Corporate Planning Department

MCWD plans to invest around PHP200 million every year, and most of them are for rehabilitation/ replacement projects for the existing pipelines, service connections and meters. The budget of expansion and water source planned in 2009 is the investment for developing new groundwater sources, but its implementation is expected to be delayed.

(2) Water Demand Projection

MCWD classifies the water demand in the territory area of 4 cities and 4 municipalities into two categories namely “Total Demand” and “Niche Demand”. The definition of the two categories is as follows:

- Total Demand: Water demand in the whole administrative area of 4 cities and 4 municipalities.
- Niche Demand: Water demand in the existing service area of MCWD plus that in the un-served areas where residents and enterprises are willing and/ or opt to connect the MCWD system.

The total demand does not have any important meaning for MCWD because there exist a lot of private water venders and water supply facilities in addition to MCWD in Metropolitan Cebu and a significant part of households and commercial entities rely on water from these vendors/ facilities. It is of an important challenge for MCWD to correctly project the niche water demand and to develop water resources in accordance with the niche demand projection. Table II-15 shows the water demand and supply projection in coming 5 years prepared by MCWD as of now.

Table II-15 Supply and Demand Projections (2007-2014)

		Categories	2007	2008	2009	2010	2011	2012	2013	2014
Niche Demand	A: Domestic	Cebu City	7,874	8,058	8,245	8,435	8,626	8,820	9,017	9,217
		Lapu-lapu City	3,230	3,280	3,332	3,384	3,436	3,490	3,544	3,598
		Mandaue City	3,283	3,345	3,408	3,471	3,535	3,601	3,666	3,733
		Compostela	55	58	60	63	66	69	72	76
		Consolacion	809	823	838	853	868	884	900	915
		Cordova	478	486	494	502	511	519	527	536
		Lilo-an	217	240	265	290	316	343	372	402
		Talisay	2,179	2,214	2,249	2,285	2,321	2,357	2,394	2,432
		Total	18,125	18,505	18,891	19,282	19,680	20,083	20,493	20,909
	B: Commercial/ Industrial		77,011	79,474	82,018	84,647	87,363	90,170	93,072	96,072
	C: Demand Adjustments		73,427	75,725	78,057	80,425	82,829	85,270	87,748	90,265
	Total (A+B+C)		168,563	173,704	178,966	184,354	189,872	195,523	201,313	207,246
MCWD Supply		Production Capacity	114,043	117,494	180,272	180,272	205,392	224,392	237,892	251,892
		Additional Supply				25,120	19,000	13,500	14,000	54,795
		Total Supply	114,043	117,494	180,272	205,392	224,392	237,892	251,892	306,687
		SRR		70.8%	70.8%	70.8%	70.8%	70.8%	70.8%	70.8%
		Total	114,043	83,211	127,672	145,462	158,918	168,479	178,394	217,201
Niche Demand Served			67.7%	47.9%	71.3%	78.9%	83.7%	86.2%	88.6%	104.8%
Niche Demand to Total Demand			61.3%	62.0%	62.7%	63.4%	64.1%	64.7%	65.4%	66.0%

(3) Water Source Development Plan

Generally, "Water REMIND, Netherlands ODA, 2006" is a bible of the water source development plan. However, MCWD has modified this plan according to the demand required from the users who are residents in nearby existing service area.

Up to date, formalities of surface water development are still postponed due to environment aspects and residential movements with many governmental agencies concerned. Groundwater development plan has been on-going. MCWD application of the water permits at several wells in Cebu, Mandaue and Lapu-lapu are on-processed.

(4) Facility Plan

So far, many plans and reports have proposed a variety of water importation schemes from outside catchments to deal with the chronic shortfall of water sources in Metro Cebu, however, none

of them has been confirmed to be implemented. At present, thus, there is no remarkable concrete water facility plan such as a large scale expansion of service areas.

However, in the investment plan of MCWD, pipe network expansion/ rehabilitation projects are on-going up to year 2010. They are composed of (A) Rehabilitation Project, (B) Expansion project, (C) Water source development and (E) Special Projects, as shown in Table II-16.

Table II-16 On-going Projects

Project	Contents
A. Rehabilitation	15 administration projects and 3 contract projects Total length of pipeline is 6,919 m.
B. Expansion	7 expansion projects Total length of pipeline is 6,846 m.
C. Water Source Development	Additional drilling projects and Pipeline Civil, Electro/ Mechanical works.
E. Special	Warehouse, Laboratory, Pump Station Projects

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II-4 Relevant Legal System and Regulations

II-4.1 De-centralization

(1) Provincial Water Utility Act (1973)

This is Presidential Decree No.198 May 25, 1973 known as the "Provincial Water Utility Act of 1973", declaring a national policy favoring local operation and control of water systems, authorizing the formation of local water districts and providing for the government and administration of such districts, chartering a national administration to facilitate improvement of local water utilities, granting said administration such powers as are necessary to optimize public service from water utility operations, and for other purposes.

(2) Local Government Act (1991)

Republic Act No.7160 is known as Local Government Code of 1991, declared the policy of the State that the territorial and political subdivisions of the State shall enjoy genuine and meaningful local autonomy to enable them to attain their fullest development as self-reliant communities and make them more effective partners in the attainment of national goals. Toward this end, the State shall provide for a more responsive and accountable local government structure instituted through a system of decentralization whereby local government units shall be given more powers, authority, responsibilities, and resources. The process of decentralization shall proceed from the national government to the local government units.

(3) NEDA Board Resolution No.4 (1994)

It approved the following recommendations of the Infrastructure Committee (INFRACOM):

a. Registration with the National Water Resources Board (NWRB) of all well drilling and the extraction of water there from, irrespective of the use of extracted water and ownership of the land where the well is to be drilled.

b. Strengthening of the NWRB Staff in order to effectively cope with the planning, monitoring and implementation activities of the water resources sector. NWRB shall submit an action plan to this effect to INFRACOM for review and endorsement to the President and the NEDA Board.

c. Reorientation of the Local Water Utilities Administration (LWUA) to its original corporate mission as a "specialized lending institution" financing only viable water supply projects with tariff levels formulated towards full costs recovery. LWUA shall therefore upgrade its banking and finance expertise and immediately complete its financial restructuring.

d. Privatization of all existing Water Districts (WDs) should be vigorously pursued whenever feasible and large commercially viable water services areas like Metropolitan Manila, Cebu, Zamboanga, and Davao should be formed or converted into SEC-style private water corporations, independent of LWUA and other government funding institutions but subject to regulation by NWRB.

e. Procurement needs of WDs should be provided based on a competitive basis and not centrally imposed on them.

f. LWUA shall submit an action plan to INFRACOM to effect the recommended reforms for review and endorsement.

g. With respect to the delineation of responsibilities in the sector, NEDA Board Resolution No.5 (1989) is proposed to be amended to allow local government units (LGUs) to implement all levels of water supply projects consistent with government's decentralization and devolution process, mandating LWUA to implement only financially viable projects and further defining the roles of the agencies in the sector.

(4) NEDA Board Resolution No.6 (1996)

It approved the recommendation of the Infrastructure Committee (INFRACOM) on the executing agency arrangement for assistance to Local Government Units (LGUs) in the implementation of devolved infrastructure activities/facilities under the Local Government Code in support of national priority programs in order to ensure efficiency, effectively and more focused implementation consistent with the government's decentralization and devolution objectives.

II-4.2 Private Sector Participation

(1) Republic Act No.6957/ No.7718 (1994)

Republic Act No.6957 is an act authorizing the financing, construction, operation and maintenance of infrastructure projects by the private sector, and for the other purposes.

It is the declared policy of the State to recognize the indispensable role of the private sector as the main engine for national growth and development and provide the most appropriate favorable incentives to mobilize private resources for the purpose.

(2) Executive Order 279 (2004)

It provided institutional reform order in the financing policies for the water supply and sewerage sector and water service providers, and provided for the rationalization of LWUA's organizational structure and operations.

II-4.3 Environment Conservation

(1) National Integrated Protected Area System Act of Republic Act No.7586 (1992)

National Integrated Protected Area System (NIPAS) Act of 1992 was established by the government of the Philippines, to maintain the natural biological and physical diversities of the environment notably on areas with biologically unique features.

The Act designates "protected areas", which identify portion of land and water set aside by reason of their unique physical and biological significance, managed to ensure sustainable use of resources found therein, and to maintain their natural conditions to the greatest extent possible. The categories of protected areas were established as follows:

- Strict nature reserve;
- Natural park;
- Natural monument;
- Wildlife sanctuary;
- Protected landscapes and seascapes;
- Resource reserve;
- Natural biotic areas and
- Other categories established by law, conventions or international agreements which the Philippine Government is a signatory.

(2) Philippine Clean Water Act No.9275 (2004)

This act focuses on the prevention of pollution of water bodies. As part of the act measures to avoid the discharge of septic tank effluent, sewage affluent, operation of sewerage systems, sludge, waste and wastewater. The act makes provision for Water Quality Management Areas be set up with a governing board of local authority members.

Each local government unit shall, through its Environment and Natural Resources Office (ENRO) established in Republic Act No.7160, have the following powers and functions:

a) Monitoring of water quality;
b) Emergency response;
c) Compliance with the framework of the Water Quality Management Action Plan;
d) To take active participation in all efforts concerning water quality protection and rehabilitation; and
e) To coordinate with other government agencies and civil society and the concerned sectors in the implementation of measures to prevent and control water pollution

(3) NWRB Resolution No.002-1106/ No.004-0507 (2006/ 2007)

In this regulation, criteria in following Table II-17 were adopted. Additionally, following conditions are included into the regulatory operation.

- De-salination of brackish water and sea water for domestic use may be processed.
- Water re-use and re-cycle shall be promoted as a groundwater conservation measure.

Table II-17 Water Policies for Metropolitan Cebu

Critical Area (5 LGUs)	With Existing Permits	Adequate Water Supply Service	Users shall reduce the extraction volume to keep Cl concentration below 210 mg/L. Well shall be closed and plugged when Cl concentration exceeds 250 mg/L.
		In-adequate Water Supply Service	
	New/ Pending Permit	Adequate Water Supply Service	Only back-up users of Hospital can be processed.
		In-adequate Water Supply Service	Applications may be processed until commercial connection becomes available.
None Critical Area (2 LGUs)	With Existing Permits	Adequate Water Supply Service	Existing permit shall be revoked when trend of Cl concentration indicates increasing.
		In-adequate Water Supply Service	Applications may be processed but permit shall be revoked when Cl exceeds 250 mg/L.
	New/ Pending Permit	Adequate Water Supply Service	Only back-up users of Hospital can be processed.
		In-adequate Water Supply Service	Applications may be processed until commercial connection becomes available.

Note: Cordova is not included in the regulatory operation area.

Guideline for groundwater regulation (No.004-0507) was established, features of that guideline are summarized below.

- Critical area was restricted by topographical conditions (below 70 masl).
- Applicants of water permit shall report the groundwater quality with parameters of Cl and NO_3.
- Reduction rate of groundwater abstraction was mentioned clearly according to the said report.
- MCWD shall inform NWRB his service area using map for correspondence to new applicants.

(4) Ecological Solid Waste Management Act (2000)

The Ecological Solid Waste Management Act of 2000 was enacted to adopt a systematic, comprehensive and ecological solid waste management program throughout the Philippines. As part of the act the National Solid Waste Management Commission was set up to oversea implementation of the act.

(5) Implementing Rules and Regulations of Republic Act 9003 (2002)

Based on the RA 9003 the Department of Environment and Natural Resources produced a document clarifying the act and providing specific advice for the LGUs and regional waste management committees. The makeup of each committee is given in detail. Together with detailed recommendations for waste collection and separation, and design of sanitary landfills.

(6) Republic Act No.9486 (2007)

This Act is kwon as The Central Cebu Protection Landscape Law (CCPL Law). The CCPL covers the Central Cebu National Park, including Buhisan Dam, Mananga Watershed Forest Reserve, Kot-kot Lusuran Watershed Forest Reserve, and the Sudlon National Park. The protected area spans 290.62 km^2 of adjoining forestlands and watersheds located in the middle of the province.

II-4.4 Framework of Environmental and Social Consideration

(1) Legislations

The list of major relevant legislations on environmental and social consideration in Philippine are shown in Table II-18.

Table II-18 List of Relevant Legislations

Category	Title	Code
General Environment	Philippine Environment Policy (1977)	PD 1151
	Philippine Environment Code (1977)	PD 1152
Noise level	DENR Ambient Noise Quality Standards	-
Water Quality	Philippine Clean Water Act (2004)	RA 9275
	Revised Water Usage and Classification/Water Quality Criteria, Revised Effluent Regulations, Revising and Amending the Effluent regulation of 1982 (1990)	DAO 90-34/ 35
Biodiversity Conservation	Central Cebu Protection Landscape (CCPL) Act (2007), Establishing the National Red list of Threatened Philippine Plants and their Categories, and List of Other Wildlife Species (2007)	RA 9486 DAO 07-01
	Wildlife Resource Conservation and Protection Act (2001), National List of Rare, Endangered, Threatened, Vulnerable, Indeterminate and Insufficiently Known Species of the Philippine Wild Bird, Mammals and Reptiles	RA 9147 DAO 91-48
	An Act Providing for the Establishment and Management of National Integrated Protected Areas System (NIPAS), Defining its Scope and Coverage, and for Other Purposes (1992)	RA 7586
Solid Waste	Implementing Rules and Regulations of RA 9003 (2001)	DAO 01-34
	Ecological Solid Waste Management Act (2000)	RA 9003
Environmental Impact Assessment	Revised Procedural Manual for DENR-AO No. 30, Series of 2003 (2007)	-
	Implementing Rules and Regulations for the Philippine Environmental Impact Statement System (2003)	DAO 03-30
	Establishing an Environmental Impact Statement System, Including Other Environmental Management Related Measures and for other purposes (1978)	PD 1586
Resettlement	An Act to Facilitate the Acquisition of Right-Of-Way, Site or Location for National Government Infrastructure Projects and for other Purposes (2000)	RA 8974
	An Act to Provide for a Comprehensive and Continuing Urban Development and Housing Program, Establish the Mechanism for its Implementation (1992)	RA 7279

(2) Environmental Impact Assessment

< Outline of the Philippine's Environmental Impact Assessment (EIA) System >

Philippines' statutory framework requiring EIA for all projects that will affect environmental quality is embodied in Presidential Decree (PD) No.1151 of 1977 (Philippine Environmental Policy). The Philippine Environmental Impact Statement System, established through PD No.1586 of 1978, sets a systematic EIA system. In the Department of Environment and Natural Resources (DENR) Administrative Order (AO) 21 of 1992, the Environmental Management Bureau (EMB) of DENR is mandated as the lead agency in the implementation of EIA system.

< EIA process in relation to Project Cycle >

The EIA study shall determine the environmental impacts of the project and shall provide recommendations/guidance at various stages of the project cycle. It is during the F/S stage when a proponent defines its range of actions and consider project alternatives, thus, it is the most ideal stage in the project cycle wherein the EIA study will have most added value.

< Screening for Project's EIA Coverage >

According to ECP and ECA criteria, each single project is classified into three (3) major groups as follows:

* Group 1: ECPs in either ECAs or Non-ECAs
  Projects classified in this group are required to submit Environmental Impact Statement (EIS) and to be granted Environmental Compliance Certificate (ECC).
* Group 2: Non-ECPs in ECAs
  Projects classified in this group are required to submit EIS, Initial Environmental Examination (IEE) report/ checklist or Project Description (PD), in accordance with the project size/ thresholds, and to be granted ECC or Certificate of Non-Coverage (CNC) respectively.
* Group 3: Non-ECPs in Non-ECAs
  Projects classified in this group are required to submit Project Description (PD) to be granted CNC.

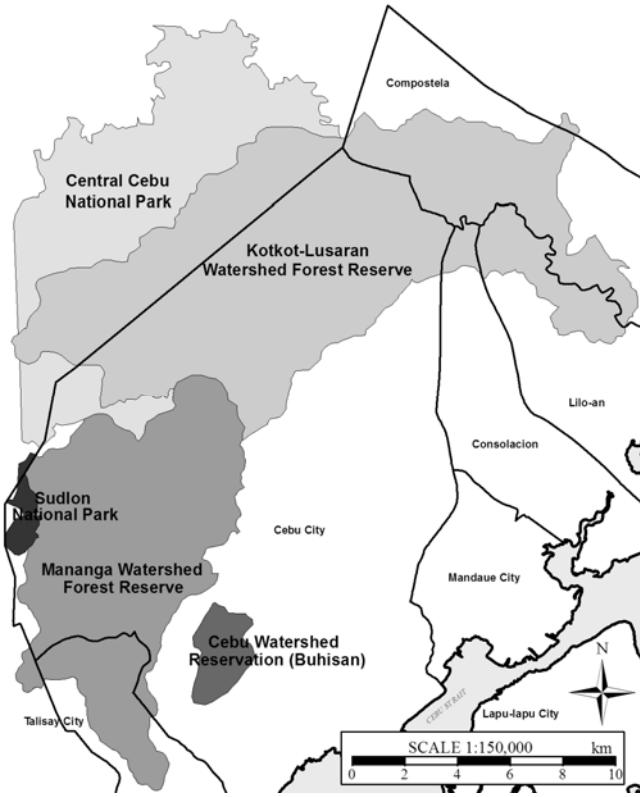
< ECAs in Metropolitan Cebu >

It is desirable for the proponent to understand the location of ECAs to confirm which EIA procedure is required for its project. According to DENR/ EMB Region 7, there was a proponent who tried to certify its project site was Non-ECA but it failed. As a part of ECAs in Metro Cebu, the protected landscape in Central Cebu by virtue of the NIPAS Act is shown in Table II-19 and Figure II-13.

Table II-19 List of Protected Areas in Metropolitan Cebu

No.	Designation	Classification	Area
1	Buhisan Watershed Forest Reserve	Protected Landscape	about 29,062 ha
2	Mananga Watershed Forest Reserve		
3	Sudlon National Park		
4	Central Cebu National Park		
5	Kotkot-Lusaran Watershed Forest Reserve		
6	Olango Island Wildlife Sanctuary	Wildlife Sanctuary	1,030 ha

Note: Olango Island Wildlife Sanctuary is identified by actual survey though it was identified as 920 ha by PP 903.



Note: Olango Island Wildlife Sanctuary is located outside the map. Source: MCWD

Figure II-13 Protected Landscape in Central Cebu

(3) Public Participation and Information Disclosure in EIA Process

Public participation and information disclosure are demonstrated through the EIA process as follows:

- Social preparation process at pre-scoping is required for EIS based projects and serves as a basis for preliminary identification of stakeholders and related issues in preparation for proper scoping;
- Public scoping for EIS based projects plays an important role to acquire community inputs and is formally considered before signing off the scoping checklist;
- Local stakeholders participate in EIA study, i.e. data collection interviews, etc. and EIA scoping and report allocate specific section for a presentation and discussion of public participation process and outcome;
- Public hearing/ consultation is required for EIS based projects and public consultation is required for IEE based projects if EMB considers it is necessary, and it provides explicit instruction on registration, access to EIA report, etc.;
- Once an ECC/ CNC is issued, EIA recommendation are transmitted by EMB to the concerned GAs and LGUs, and it results to more integrated, coordinated and participative safeguarding of environmental concerns;
- Multi-partite monitoring team is organized to encourage public participation, to promote greater stakeholder vigilance and to provide appropriate check and balance mechanism in the post-ECC monitoring of project implementation.
- Any party aggrieved by ECC/ CNC application can file an appeal to EMB within 15 days from receipt of such decision;
- Administrative procedure is set for addressing complaints or findings on alleged violation of proponents to ECC, environmental monitoring plan or other requirements.

(4) Relative Agencies & Institution

DENR has not only central office but also 6 bureaus, 5 attached agencies and 16 regional offices. EMB of DENR Region 7, of which jurisdiction covers the central part of the Visayas, is the responsible organization for implementation of EIA system in Metropolitan Cebu.

(5) Land Acquisition and Resettlement

The Philippine Constitution Article 3 (Bill of Rights) stipulates overall objectives of resettlement and land acquisition policy as follows:

- No person shall be deprived of life, liberty, or property without due process of law, nor shall any person be denied the equal protection of the laws. (Section 1)
- Private property shall not be taken for public use without just compensation. (Section 9)

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Chapter-III
Action Plan on Water Supply

Improvement target of MCWD water utility is to achieve the management of water supply system meeting with service standards providing in terms of water quality and quantity. Improvement items are proposed as the action plan which can solve the gap between the present situations and what MCWD should be in the target year 2015. This plan was composed of following sections.

Section 1: Planning Fundamentals
Section 2: Requirements in Technical Improvement
Section 3: Requirements in Managerial Improvement
Section 4: Initial Environmental Examination
Section 5: Project Implementation
Section 6: Financial Feasibility

III-1 Planning Fundamentals

III-1.1 Water Demand Projection

(1) General Background

Water demand projection is a fundamental factor for determining the scale of a water supply system in the target year. While the target year for the improvement plan of water supply and sanitation in Metropolitan Cebu is set at 2015, the water demand projection for the further 15 years (i.e. until 2030) is also carried out in order to view the long-term water supply and sanitation situations in the project area.

In general, existing consumption data of the water users are served as a baseline of the demand projection. MCWD classifies the water users into three main categories, namely, domestic, commercial and industrial, and government institutions. Therefore, water demand in these three categories is projected separately, and summing up the respective demand, the total demand is estimated.

In addition, both the total and niche water demand are projected in accordance with the following definition (referred to Figure III-01).

- Total Demand: Water demand in the whole MCWD franchise area of 4 cities and 4 municipalities
- Niche Demand: Water demand in the existing service area of MCWD plus that in the un-served areas where residents and enterprises are willing and/or opt to connect to MCWD

The total demand is not directly related to the MCWD's business because there are a lot of private water venders and water supply facilities in addition to MCWD in Metropolitan Cebu and a considerable number of households and commercial establishments rely on water from such vendors and or facilities. On the other hand, the niche demand will give the basis of the future scale of MCWD's water supply systems.

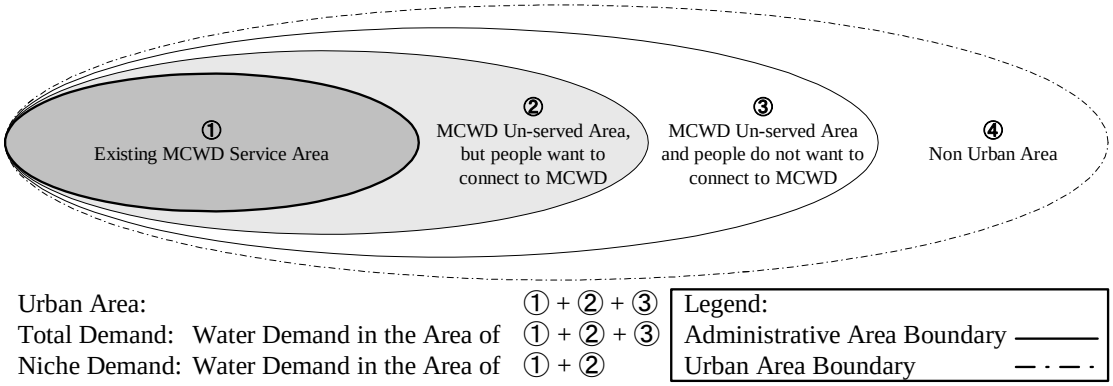


Figure III-01 Definition Image of Total and Niche Water Demand

The methodology of demand projection is summarized as presented in Figure III-02.

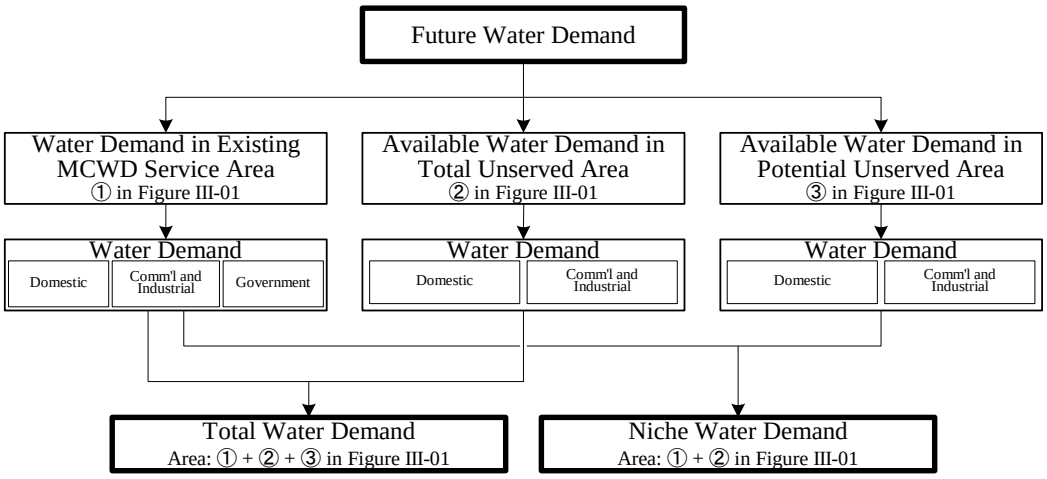


Figure III-02 Methodology of Water Demand Projection

(2) Domestic Water Demand

< Population Projection >

- Total Population

The population of Metropolitan Cebu has increased from 1.30 million in 1995 to 1.85 million in 2007, which gives an average annual growth rate of 3.0%.

The population in Metropolitan Cebu will increase from 1.8 million in 2007 to 2.2 million in 2015, and to 3.0 million in 2030. Cebu City will be the most populated area, followed by the cities of Lapu-lapu and Mandaue. Figure III-03 shows the visual comparison on population growth of the study area in past and projection.

- Service Population

According to MCWD data, the number of domestic concessionaires in 2007 is 111,898 including communal and subdivision connections. Assuming that every residential connection has an average household member of 5.1, and every communal connection has an average of 52 household users with an average household size of 5.1, the service population in 2007 is estimated at 646,406. This gives a service ratio of 35% against the total population.

The MCWD service population is estimated at 947 thousand in 2015 and 1,563 thousand in 2030 indicating a MCWD service ratio of 43% and 51%, respectively, as shown in Table III-01.

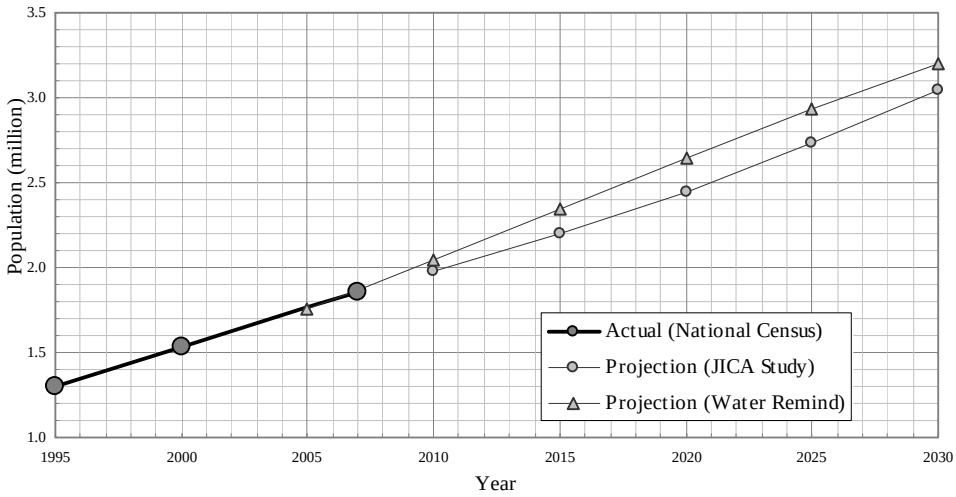


Figure III-03 Population Projection of Metropolitan Cebu

Table III-01 Projection of MCWD Service Population

LGUs	2007 Existing	2010	2015	2020	2025	2030
Cebu City	385,499	385,499	432,174	518,489	566,116	622,609
Lapu-lapu City	45,585	74,239	131,285	168,112	215,396	275,514
Mandaue City	109,186	133,638	182,536	214,241	254,136	304,005
Compostela	4,299	5,343	7,892	10,114	13,278	17,753
Consolacion	25,061	32,002	44,415	50,844	58,418	67,218
Cordova	8,314	12,400	19,672	23,473	27,929	33,185
Lilo-an	30,115	33,317	42,756	52,476	72,370	83,149
Talisay City	38,347	54,545	85,941	105,194	129,293	159,175
Metropolitan Cebu	646,406	730,982	946,671	1,142,944	1,336,936	1,562,609
Total Population	1,853,231	1,974,600	2,196,800	2,446,700	2,728,000	3,045,000
Service Coverage	34.9 %	37.0 %	43.1 %	46.7 %	49.0 %	51.3 %

In addition, the Household Survey shows that about 40% households of MCWD non-served area are receiving water from neighboring MCWD water consumers. According to the survey, such households are distributed in every area surveyed although the distribution is concentrated in Cebu City and Mandaue City.

This means there exist further 427 thousand people who use MCWD water indirectly as shown in Table III-02, and accounting this population to be a beneficiary, the virtual MCWD service ratio in 2007 is estimated at 58%.

Table III-02 Estimated No. of HHs and Population of Indirect MCWD Users

①, No. of residential connections in 2007	Neighbouring Barangays of MCWD Service Area in 2007			
	②, Total No. of HHs in Barangays	③=②-①, No. of HHs un-served	④=③×40%, 40% of un-served HHs	⑤=④×5.1, 40% of un-served Population
111,631	320,867	209,236	83,694	426,839

< Per Capita Consumption >

Regarding the future per capita consumption, its growth would not be expected because the people's water use is considered saturated under the strained situation of developing water resources in Metropolitan Cebu.

In summary, the per capita consumption presented in Table III-03 is adopted for the available domestic water demand.

Table III-03 Adopted Per Capita Consumption for Domestic Demand Projection

Category of Users	Per Capita Consumption	Remarks
Residential	150 Lpcd	90% of available service population
Communal	25 Lpcd	10% of available service population

< Domestic Water Demand Projection >

The available domestic water demand is projected based on the established per capita consumption and available un-served population of MCWD. Adding the water consumption in the existing MCWD service area, the domestic water demand is estimated. Table III-04 shows the result of the niche domestic water demand projection.

Table III-04 Niche Domestic Water Demand (m^3/day)

LGUs	2007	2010	2015	2020	2025	2030
Cebu City	0	6,418	18,286	24,835	32,603	41,722
Lapu-lapu City	0	3,940	11,784	16,847	23,349	31,615
Mandaue City	0	3,343	10,027	14,361	19,815	26,632
Compostela	0	143	491	795	1,227	1,839
Consolacion	0	949	2,646	3,525	4,560	5,763
Cordova	0	559	1,553	2,072	2,681	3,400
Lilo-an	0	438	1,728	3,057	5,776	7,250
Talisay City	0	2,214	6,506	9,138	12,432	16,517
Metropolitan Cebu	0	18,002	53,020	74,630	102,444	134,738
Existing MCWD	98,705	98,705	98,705	98,705	98,705	98,705
Niche Demand	98,705	116,707	151,725	173,335	201,149	233,443

(3) Commercial and Industrial Water Demand

According to the Establishment Survey conducted in February 2009, 12.8% of the non-MCWD water users want to connect to MCWD. Furthermore, 80% of non-MCWD water users are using water from private wells but 40% of the private wells were drilled without permission. NWRB will strictly regulate such illegal groundwater abstraction in the future. Assuming that the private well users without permission will eventually be served by MCWD, the following percentage of non-MCWD users are expected to be transferred to MCWD consumers.

- 12.8% + 87.2% × 80% × 40% = 40% (in 2015)

Regarding the water demand, even if these water users connect to MCWD, they would keep having the other sources. According to the Establishment Survey, the average daily consumption of MCWD users was as follows:

- MCWD plus other sources: 25.0 m^3/day
- MCWD only: 17.2 m^3/day (68.8 % of the above)

Therefore, 70% of water demand in such users is assumed to be transferred to MCWD. Together with this assumption, the commercial and industrial water demand is estimated utilizing the conditions assumed by the Water Remind Project as presented in Table III-05.

In Table III-06, the niche estimated water demand of commercial and industrial activities is presented.

(4) Government Institutions Water Demand

Although the water consumption tends to increase slightly, the number of connections is decreasing. Basically, MCWD serves water to all the institutions. Therefore, the demand is regarded as constant, at 2,300 m^3/day.

Table III-05 Assumptions for Commercial and Industrial Demand Projection

Descriptions	Assumptions
Total commercial area in 2005	370 ha
Total industrial area in 2005	350 ha
Commercial demand density in 2005	29.26 m^3/ha/day
Industrial demand density in 2005	129.37 m^3/ha/day
Annual Demand Growth Rate during 2005-2030	
• Commercial Demand	3.20 %
• Industrial Demand	0.69 %
Percentage of available commercial/ industrial demand within non-MCWD users for Niche Demand	2007: 0.0 % 2015: 40.0 % × 0.7 = 28 % 2030: 60.0 % × 0.7 = 42 %

Table III-06 Niche Commercial and Industrial Water Demand (m^3/day)

LGUs	2007	2010	2015	2020	2025	2030
Cebu City	8,475	10,189	13,551	15,034	16,710	18,747
Lapu-lapu City	3,416	5,183	8,420	9,638	10,915	12,453
Mandaue City	1,831	3,946	7,705	9,007	10,305	11,855
Compostela	118	189	334	404	491	598
Consolacion	31	85	195	246	309	386
Cordova	150	238	415	497	597	720
Lilo-an	120	326	735	919	1,138	1,404
Talisay City	1,019	1,611	2,740	3,208	3,716	4,331
Metropolitan Cebu	15,160	21,767	34,094	38,953	44,181	50,494
% of Total Demand	20.0 %	27.9 %	41.2 %	44.5 %	47.3 %	50.9 %

(5) Results of Water Demand Projection

< Niche Water Demand Projection >

Table III-07 summarizes the result of niche water demand projection.

< Comparison of Demand Projection >

Table III-08 shows the comparison of demand projection results between the JICA Study and MCWD existing projection.

(6) Non-Revenue Water

MCWD aims to reduce system losses by 10% over the next 8 years. In line with this target, the NRW rate will be reduced to 20% in 2015. After 2015, the NRW rate is assumed to be reduced by 0.2% per year and reach to 17% in 2030 as shown in Table III-09.

Table III-07 Result of Niche Water Demand Projection (m^3/day)

Niche Demand		2007	2010	2015	2020	2025	2030
Cebu City	Residential, Communal	0	6,418	18,286	24,835	32,603	41,722
	Commercial and Industrial	8,475	10,189	13,551	15,034	16,710	18,747
	Total	8,475	16,607	31,837	39,869	49,313	60,469
Lapu-lapu	Residential, Communal	0	3,940	11,784	16,847	23,349	31,615
	Commercial and Industrial	3,416	5,183	8,420	9,638	10,915	12,453
	Total	3,416	9,123	20,204	26,485	34,264	44,068
Mandaue	Residential, Communal	0	3,343	10,027	14,361	19,815	26,632
	Commercial and Industrial	1,831	3,946	7,705	9,007	10,305	11,855
	Total	1,831	7,289	17,732	23,368	30,120	38,487
Compostela	Residential, Communal	0	143	491	795	1,227	1,839
	Commercial and Industrial	118	189	334	404	491	598
	Total	118	332	825	1,199	1,718	2,437
Consolacion	Residential, Communal	0	949	2,646	3,525	4,560	5,763
	Commercial and Industrial	31	85	195	246	309	386
	Total	31	1,034	2,841	3,771	4,869	6,149
Cordova	Residential, Communal	0	559	1,553	2,072	2,681	3,400
	Commercial and Industrial	150	238	415	497	597	720
	Total	150	797	1,968	2,569	3,278	4,120
Lilo-an	Residential, Communal	0	438	1,728	3,057	5,776	7,250
	Commercial and Industrial	120	326	735	919	1,138	1,404
	Total	120	764	2,463	3,976	6,914	8,654
Talisay City	Residential, Communal	0	2,214	6,506	9,138	12,432	16,517
	Commercial and Industrial	1,019	1,611	2,740	3,208	3,716	4,331
	Total	1,019	3,825	9,246	12,346	16,148	20,848
Total	Residential, Communal	0	18,002	53,020	74,630	102,444	134,738
	Commercial and Industrial	15,160	21,767	34,095	38,953	44,181	50,494
	Total	15,160	39,769	87,115	113,583	146,625	185,232
Demand Adjustment	Residential, Commercial	98,705	98,705	98,705	98,705	98,705	98,705
	Government	2,300	2,300	2,300	2,300	2,300	2,300
Niche Demand		116,165	140,774	188,120	214,588	247,630	286,237

Table III-08 Comparison of Demand Projection (m^3/day)

Projects		2007	2010	2015	2020	2025	2030
Niche Demand MCWD	Residential, Communal	18,125	19,282	21,331	23,540	26,162	28,713
	Commercial	77,011	84,647	99,173	116,348	136,415	160,128
	Adjustment	71,839	71,839	71,839	71,839	71,840	71,839
	Total	166,975	175,768	192,343	211,727	234,417	260,680
Niche Demand JICA 2009	Residential, Communal	0	18,002	53,020	74,630	102,444	134,738
	Commercial	15,160	21,767	34,095	38,953	44,181	50,494
	Adjustment	101,005	101,005	101,005	101,005	101,005	101,005
	Total	116,165	140,774	188,120	214,588	247,630	286,237

Table III-09 NRW Rate Assumption

Rate of NRW (%)	2007	2008	2010	2015	2020	2025	2030
	30.0	29.0	25.0	20.0	19.0	18.0	17.0

(7) Gross Water Demand Projection

Table III-10 shows a result of the gross water demand projection. The MCWD gross demand will increase from 166,000 m^3/day in 2007 to 235,000 m^3/day in 2015, and to 345,000 m^3/day in 2030. On the contrary, the future gross demand of non-MCWD area will be leveling off or only slightly increase from 204,000 m^3/day in 2007 due to the expansion of MCWD service area.

Table III-10 Gross Water Demand Projection: Total (m^3/day)

Category of Demand Projection			2007	2010	2015	2020	2025	2030
MCWD	Revenue Water	Domestic	98,705	116,707	151,725	173,335	201,149	233,443
		Commercial & Industrial	15,160	21,767	34,095	38,953	44,181	50,494
		Government	2,300	2,300	2,300	2,300	2,300	2,300
		Sub-total	116,165	140,774	188,120	214,588	247,630	286,237
	Non-Revenue Water		49,785	46,925	47,030	50,335	54,357	58,626
	MCWD Total		165,950	187,699	235,150	264,923	301,987	344,863
Non MCWD	Domestic		143,083	141,845	137,740	151,505	164,066	176,333
	Commercial & Industrial		60,556	56,317	48,685	48,526	49,202	48,795
	Non-MCWD Total		203,639	198,162	186,425	200,031	213,268	225,128
Grand Total			369,589	385,861	421,575	464,954	515,255	569,991

III-1.2 Water Sources Appraisal and Availability

(1) Water Sources Appraisal

Several plans of water source development had been prepared as measure for improvement of water supply services in Metropolitan Cebu since water supply utility was turned over to MCWD from Osmena in 1974. The life-cycle cost estimation of different water source development scheme was briefly reviewed as it was, using source of the Water Remind. Three kinds of measure were compared such as; surface water, groundwater and seawater.

All measures were contrasted on the basis of their cost/m^3. The life-cycle cost including all costs over 25-years project life were divided by the total production volume of water. This cost ignores escalation of average delivery charges and its timing. Preliminary estimates had been made of additional two indicators namely; (1) Net Present Value - NPV and (2) Benefit Cost Ratio - BCR. Table III-11 shows these three (3) indicators.

Table III-11 LCC Cost and Benefit Estimation

Measures		Life-cycle Cost (PHP/m^3)		NPV (Net Present Value)	BCR (Benefit Cost Ratio)
Water Source	Intake	minimum	maximum	PHP millions	Ratio
Surface Water	Mananga Dam	5.2	6.9	344 to 554	1.2 to 1.4
	Lusaran Dam	2.9	3.0	1,891 to 1,904	2.8 to 3.2
	Kot-kot Dam	5.4	6.1	298 to 425	1.3 to 1.4
	Luyang Dam	7.8	13.1	482 to 75	0.6 to 0.9
Groundwater	Deep Well	2.8	2.8	11 to 13	2.7 to 2.8
Seawater	Desalination	34.8	36.6	1,498 to 1,338	0.2

Source: Financial Report, Water Remind Project, December 2005

Note: Unit costs for surface water development were estimated without regulatory approvals and residential removal. NPV of deep well development is depending on the number of well to be included.

Development priority shall be given in due order of groundwater, surface water and seawater. On the premises of above, groundwater should be developed as much as possible at the first. For the short term strategy, water shortage should be covered by de-salination even it is not fundamental measures. At the same time, surface water development is recommended to promote immediately for long term measures.

(2) Concept of Water Sources Development

MCWD will improve its water supply services with best effort and compliance. Availability of water sources development was studied with following concepts.

- Groundwater:
  Potential will be estimated using groundwater modeling (predictive simulation) under the condition of current groundwater regulation. Feasible well development was examined within the groundwater potential for the action plan. Potential groundwater will be developed by the prospect of long-term horizon.
- Surface Water:
  Existing surface source availability will be estimated by historical intake amount and feasible measure with due consideration of the 5-year return period. New surface water source is not included into the action plan, because of non-suitability expected. MCWD is recommended to promote the dam development plan depending on the progress of bulk water supply scheme.
- Bulk Water:
  Importation amount of existing bulk water source will be adopted for the action plan with due consideration of status contract quo and current supplying record. New bulk water supply plan (Carmen for instance) is depending on progress of the third party; therefore it will not be included in this action plan.

(3) Water Sources Availability

Availability of MCWD water sources is estimated according to existing conditions and expertise standpoints. Following are development target of each water source.

< Groundwater >

Groundwater potential was studied applying predicted simulation using groundwater model, namely the Cebu-GWM-09. As a result of this modeling study, groundwater potential in MCWD franchise area was estimated at 176,000 m^3/day.

< Surface Water >

Buhisan Dam

Production capacity of Buhisan Dam is assumed at 4,700 m^3/day as status quo.

Jaclupan Infiltration Galleries

Production capacity from Jaclupan Infiltration Galleries is adopted at 40,000 m^3/day with precise improvement of the intake facility. Following rehabilitation plan is proposed with phased progress. The baffle sheet pile measure is adopted in this action plan.

* riverbed seepage under the weir
  - ✓ study: riverbed flow (construction of observation 2 wells with pumping test)
  - ✓ measure: baffle sheet pile (tentatively 30 m in depth × 60 m wide)

* siltation on the filtration surface
  - ✓ study: water level sounding during well production
  - ✓ measure: air back-washing, additional flash-out waterway
* physical clogging at well surrounding
  - ✓ study: step drawdown test at production well, water quality examination
  - ✓ measure: well rehabilitation (physical, chemical or combination method)

< Bulk Water Source >

Expected intake amount is set up at merely 23,000 m^3/day. To date, MCWD has four (4) contracts of water purchase with tree (3) bulk suppliers.

Amounts of water sources availability in Table III-12 are adopted for the action plan. It is noted that groundwater potential is estimated at 176,000 m^3/day, however up to 158,000 m^3/day would be developed by the year 2015.

Table III-12 Water Sources Availability in Action Plan

Surface Water		Groundwater (Brackish)		Total
Buhisan Dam	Jaclupan Infiltration	Own Wells	Bulk Water	
4,700 m^3/day	40,000 m^3/day	158,000 m^3/day	23,000 m^3/day	225,700 m^3/day
2 %	17 %	74 %	7 %	100 %

III-1.3 Groundwater Potential

(1) Criteria on Groundwater Potential

Compliance of regulation is most important criterion, on the other hand, review of such regulation shall be held in the public hearing for social acceptance. Additionally, groundwater potential was studied on the particular occasion of "without artificial protection". It means that measures using under ground fence or well injection (see Figure III-04) are not considered in this study.

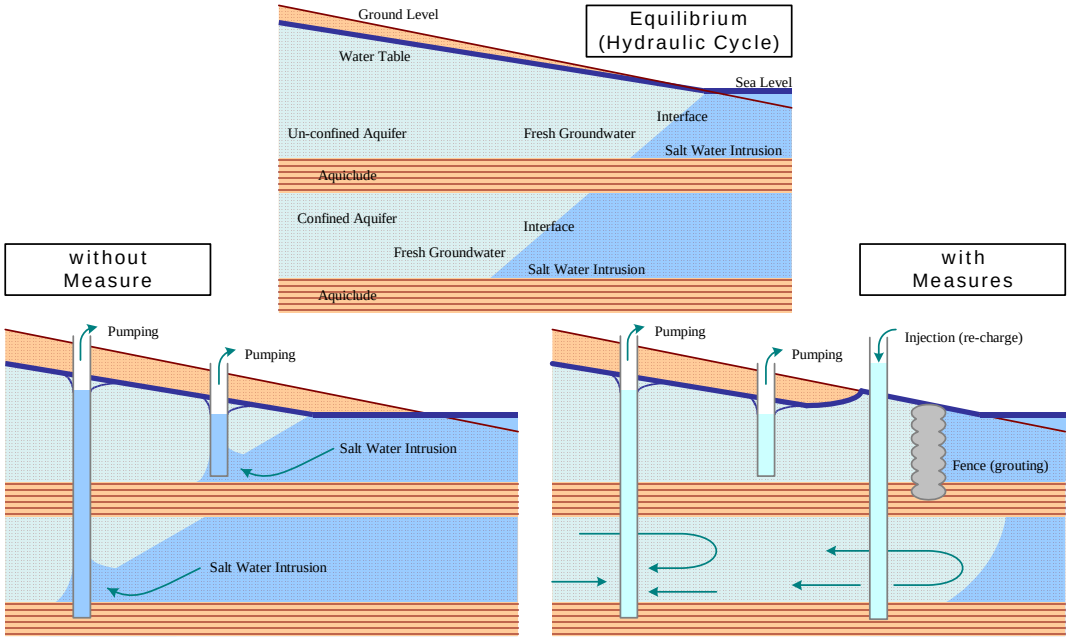


Figure III-04 Image of Groundwater Potential Study

(2) Predictive Simulation

Groundwater potential was predicted by the Cebu-GWM-09 simulation. Applied scenarios are;

Scenario-1: MCWD wells and Non-MCWD wells will extract groundwater amount according to population growth rate continuously until year 2030.

Scenario-2: MCWD wells will extract groundwater according to population growth rate continuously until year 2030. However, Non-MCWD wells will be regulated after 2011 with constant extraction rate.

Scenario-3: Non-MCWD wells will be regulated after 2011. Optimal MCWD wells will extract potential extraction amount starting from Jan-2011 until Dec-2030 with compliance of groundwater regulation.

Following Table III-13 indicates groundwater potential by the present compliance.

Table III-13 Groundwater Potential in MCWD Franchise LGUs

Model			Predict Simulation as Potential				Development Plan			
District	WRMUs	Q-07	Exist.	Q-add	Q-30	Location	Additional Q		Total Q	
Northern	Compostela	799	0	14,800	14,800	-	14,001	-8,163	32,600	175,840
	Kot-kot	4,042	0	0	0	-	**-4,042**			
	Lilo-an	6,076	0	3,000	3,000	-	**-3,076**			
	Cansaga	29,846	0	3,700	14,800	North	**-15,046**			
			0	11,100		South				
Central	Butuanon	28,986	0	17,000	30,600	North	1,614	41,451	109,800	
			0	13,600		South				
	Cebu	39,363	0	24,000	79,200	Cebu River	39,837			
			0	55,200		Others				
Southern	Mananga	5,528	0	12,000	12,000	-	6,472	24,672	30,200	
	M-Talisay	0	0	18,200	18,200	-	18,200			
Mactan	Mactan	3,671	1,080	2,160	3,240	-	**-431**	**-431**	3,240	

Note: Unit of Q (discharge amount in 2007 and 2030) is m^3/day. Mapping information is referred to the Section-III, Part-B of Chapter-I in the Volume-III Supporting Report.
Remarks: Following are meaning of abbreviations.

Q-07: Intake amount from the MCWD production wells in 2007.
Exist: Production amount from existing MCWD wells which was diverted for predictive simulation.
Q-add: Intake amount of optimal well fields other than existing MCWD wells for predictive simulation.
Q-30: Intake amount for predictive simulation continuously extracted from 2011 until 2030.
Additional-Q: Available additional intake amount based on the existing well intake in 2007.
Total-Q: Groundwater development potential for MCWD portion.

III-1.4 Water Demand and Supply Balance

(1) Present Water Balance in MCWD Service Area

The water balances in 2007 are estimated as presented in Table III-14.

(2) Water Balance in MCWD Service Area in 2015

The water balances in 2015 are thus proposed as presented in Table III-15.

(3) Water Balance in MCWD Service Area in Long-Term Horizon

In 2030, the amount of additional water sources that is required to be imported from outside MCWD area is estimated at 91,600 m^3/day. In addition, an amount of 50,000 m^3/day needs to be exported from Cebu main island to Mactan area as shown in Table III-16. This export amount of 50,000 m^3/day is exceeded the design capacity of bridge crossing pipelines.

Table III-14 Water Balance in 2007 (m^3/day)

Area	Demand		Supply	
Cebu Area	Domestic	90,367	Well	114,800
	Commercial & Industrial	11,594	Buhisan	4,700
	Government	2,300	Jaclupan	27,000
	NRW	44,683	Bulk Water	11,000
			Export to Mactan	-8,500
	Total	148,944	Total	149,000
Mactan Area	Domestic	8,338	Well	3,500
	Commercial & Industrial	3,566	Bulk Water	5,000
	Government	--	Import from Cebu	8,500
	NRW	5,102		
	Total	17,006	Total	17,000
MCWD Total	Domestic	98,705	Well	118,300
	Commercial & Industrial	15,160	Buhisan	4,700
	Government	2,300	Jaclupan	27,000
	NRW	49,785	Bulk Water	16,000
	Total	165,950	Total	166,000

Note: New bulk water was contracted from June 2009 with importing amount of 7,000 m^3/day.

Table III-15 Water Balance in 2015 (m^3/day)

Area	Demand		Supply	
Cebu Area	Domestic	130,051	Well	154,500
	Commercial & Industrial	25,260	Buhisan	4,700
	Government	2,300	Jaclupan	40,000
	NRW	39,403	Bulk Water	18,000
			Export to Mactan	-20,100
	Total	197,014	Total	197,100
Mactan Area	Domestic	21,674	Well	3,500
	Commercial & Industrial	8,835	Bulk Water	5,000
	Government	--	Import from Cebu	20,100
	NRW	7,628	De-salination	9,600
	Total	38,137	Total	38,200
MCWD Total	Domestic	151,725	Well	158,000
	Commercial & Industrial	34,095	Buhisan	4,700
	Government	2,300	Jaclupan	40,000
	NRW	47,030	Bulk Water	23,000
			De-salination	9,600
	Total	235,150	Total	235,300

Table III-16 Water Balance in 2030 (m^3/day)

Area	Demand		Supply	
Cebu Area	Domestic	190,089	Well	172,500
	Commercial & Industrial	37,321	Buhisan	4,700
	Government	2,300	Jaclupan	40,000
	NRW	47,050	Bulk Water	18,000
			Export to Mactan	-50,000
			Outside MCWD Area	91,600
	Total	276,760	Total	276,800
Mactan Area	Domestic	43,353	Well	3,500
	Commercial & Industrial	13,173	Bulk Water	5,000
	Government	--	Import from Cebu	50,000
	NRW	11,578	De-salination	9,600
	Total	68,104	Total	68,100
MCWD Total	Domestic	223,443	Well	*1**176,000**
	Commercial & Industrial	50,494	Buhisan	4,700
	Government	2,300	Jaclupan	40,000
	NRW	58,626	Bulk Water	23,000
			De-salination	9,600
			Sub-total	*2**253,300**
			Outside MCWD Area	*3**91,600**
	Total	344,863	Total	344,900

Note *1: Maximum of available groundwater within MCWD Area

*2: Maximum of available water sources within MCWD Area

*3: Additional water of 91,600 m^3/day will be required to be imported from outside MCWD Area.

.....

III-2 Requirements in Technical Improvement

III-2.1 Design Concept and Criteria

The aims of improvement plan on water supply system and facility are;

- to increase water supply volume to meet water demand in 2015 and
- to achieve water supply service level under above water supply situation.

(1) Design Concept of Water Supply System

Following concepts are maintained to the system design as shown in Figure III-05.

* gravity water supply and
* distribution block water supply.

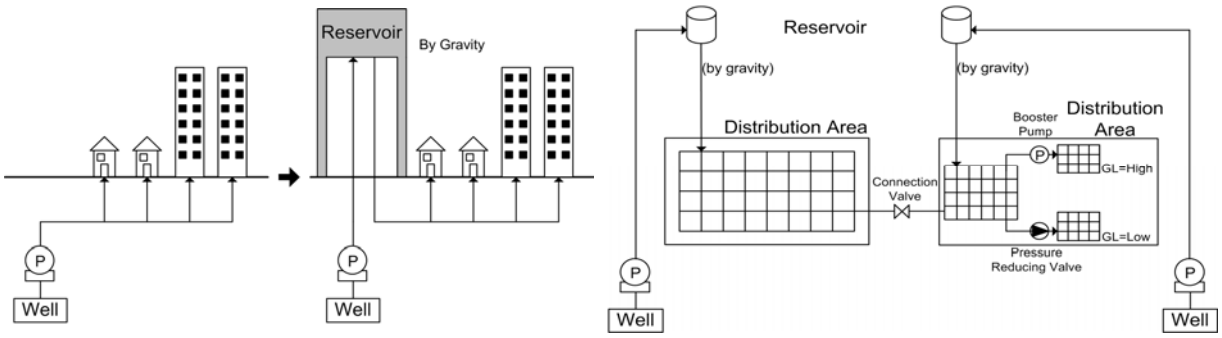


Figure III-05 Design Concepts: Gravity (left) **and Distribution Block** (right)

(2) Design Criteria of Water Supply Facility

Design standards for water supply system, facility and service level were referred to following materials.

* MCWD Technical Standards Manual 2003 (TSM-03),
* Philippines National Standard for Drinking Water 2007 (PNSDW-07),
* NWRB Groundwater Regulation (BO-No.002-1106/ 2006 and No.004-0507/ 2007), and
* JWWA (Japan Waterworks Association) Facility Design Guideline 2000.

Major criteria obtaining from the TSM-03 are described below, which were adopted for facility designing.

< Design Flow>

There are three types of design flow;

- ✓ Daily Average Flow (DAF),
- ✓ Daily Maximum Flow (DMF), and
- ✓ Hourly Maximum Flow (HMF).

As a result, following peak factors between DAF, DMF and HMF (= DMF 1.2 × 1.8 ≅ 2.2) are adopted for facility design.

- ✓ DAF: DMF: HMF= 1.0: 1.2: 2.2

< Reservoir Capacity >

In this improvement plan, design concepts of the water supply system are (1) gravity water

supply and (2) distribution block water supply system. Therefore, reservoir should have performances of;

(a) water buffer from the daily supply fluctuation, and
(b) risk reduction of suspended water supply when power source is cut-off.

Reservoir volume can be calculated by daily fluctuation curve for buffer capacity estimate. The TSM does not include the typical daily fluctuation. Accordingly, such data obtaining from LWUA design standard was adopted for estimate. In Figure III-06, HMF/DAF ratio (daily fluctuation) and storage (water level equivalent to hour DAF) are put together.

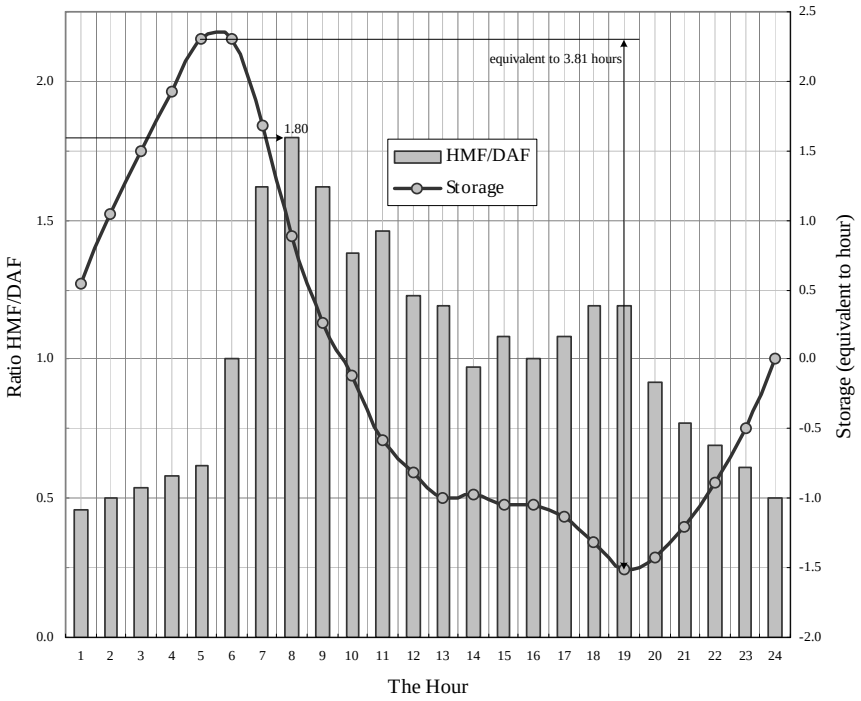


Figure III-06 Reservoir Capacity Calculation using LWUA Standard (Served Pop. > 20,000)

Based on the daily fluctuation and storage displacement, design volume can be estimated at 3.81 hour DAF. Standing on the safe side, surplus 1-hour at both sides (low and high water level in the reservoir) was added to the designed capacity of 3.81 hours-equivalent. Therefore, design volume of 6 hour equivalent DAF is adopted.

< Water Supply Pressure >

The TSM mentions following requirements of line pressure head for design purpose during the HMF condition (exceptional case of firefighting).

Area	Minimum	Maximum
✓ Urbanized:	0.14 MPa (20 psi or 14 m H_2O)	0.69 MPa (100 psi or 70 m H_2O)
✓ Less-urbanized:	0.07 MPa (10 psi or 7 m H_2O)	0.69 MPa (100 psi or 70 m H_2O)

< Water Treatment >

Since design criteria for water treatment plant (WTP) and de-salination plant are not guided in the Philippine (both LWUA and MCWD), facility of WTP and de-salination plant were mainly designed applying standards of the JWWA guideline.

III-2.2 Allocation for Water Sources and Water Supply

(1) Formation of Distribution Block

With due consideration of following localities, 6 distribution blocks is proposed as shown in Figure III-07, names of which are CLC (LGUs' capital figure of Consolacion, Lilo-an and Compostela), Casili (Mandaue), Talamban (northern Cebu), Tisa (southern Cebu), Lagtang (Talisay) and Mactan (Lapu-lapu and Cordova), respectively.

- local demand density in 2015,
- location and volume of existing reservoirs,
- present hydraulic capacity of distribution pipeline network, and
- LGU boundaries (for sector monitoring).

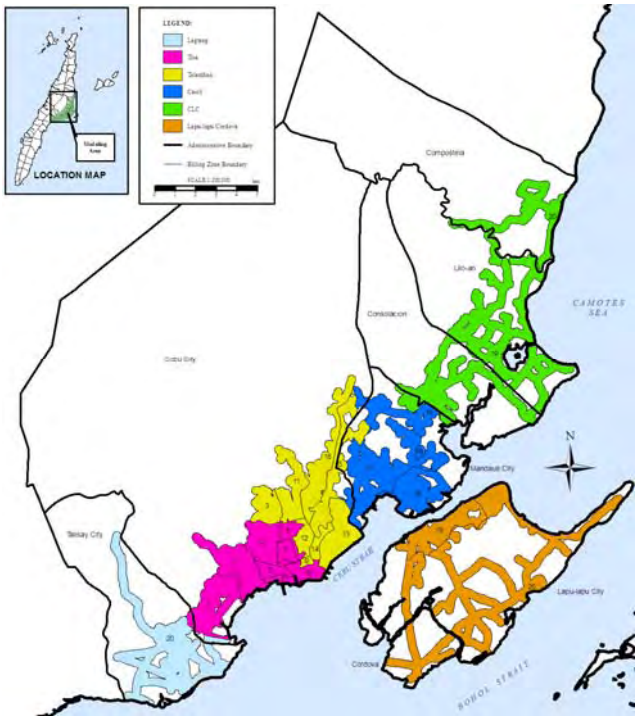


Figure III-07 Formation of 6 Distribution Blocks

(2) Water Demand of each Distribution Block in 2015

Since water demand is consumption base volume, NRW has to be added to the figure. As it was mentioned in previous section, 20% of NRW in 2015 and 17% in 2030 are projected. Finally, water demand (supply volume) is calculated as shown in Table III-17.

Table III-17 Distribution Block Demand (m^3/day)

Area / Distribution	Dec-2008		2015		2030	
	w/o NRW	with NRW (30%)	w/o NRW	with NRW (20%)	w/o NRW	with NRW (17%)
CLC	9,590	13,701	15,409	19,261	26,513	31,943
Casili	16,444	23,491	32,258	40,323	53,002	63,858
Talamban	35,108	50,154	46,539	58,173	61,022	73,521
Tisa	37,099	52,986	48,764	60,956	62,940	75,831
Lagtang	6,453	9,219	14,641	18,301	26,234	31,607
Mactan	13,186	18,836	30,509	38,136	56,526	68,104
Total	117,871	168,387	188,120	235,150	286,237	344,864

(3) Allocation for Water Source and Water Supply

Within the 6 distribution blocks, water allocation is required to meet the balance of demand and supply in 2015 as shown in Figure III-08. Examination result of water sources connection and inter-reservoir transmission was provided in Figure III-09 as the water flow diagram in 2015.

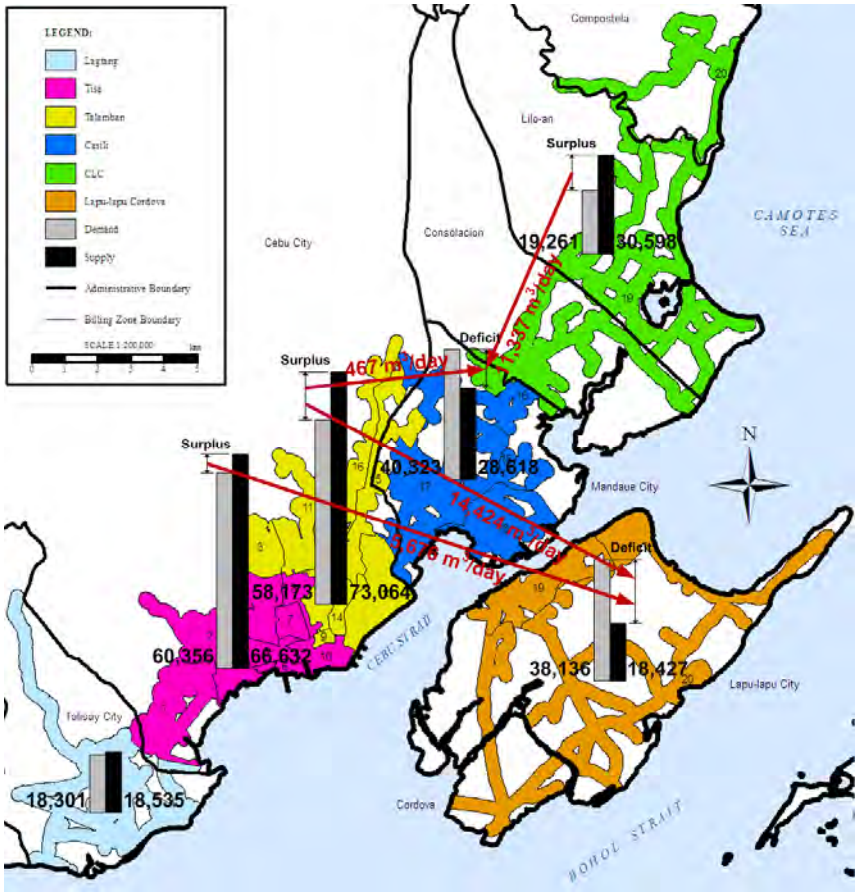


Figure III-08 Allocation for Water Source and Water Supply

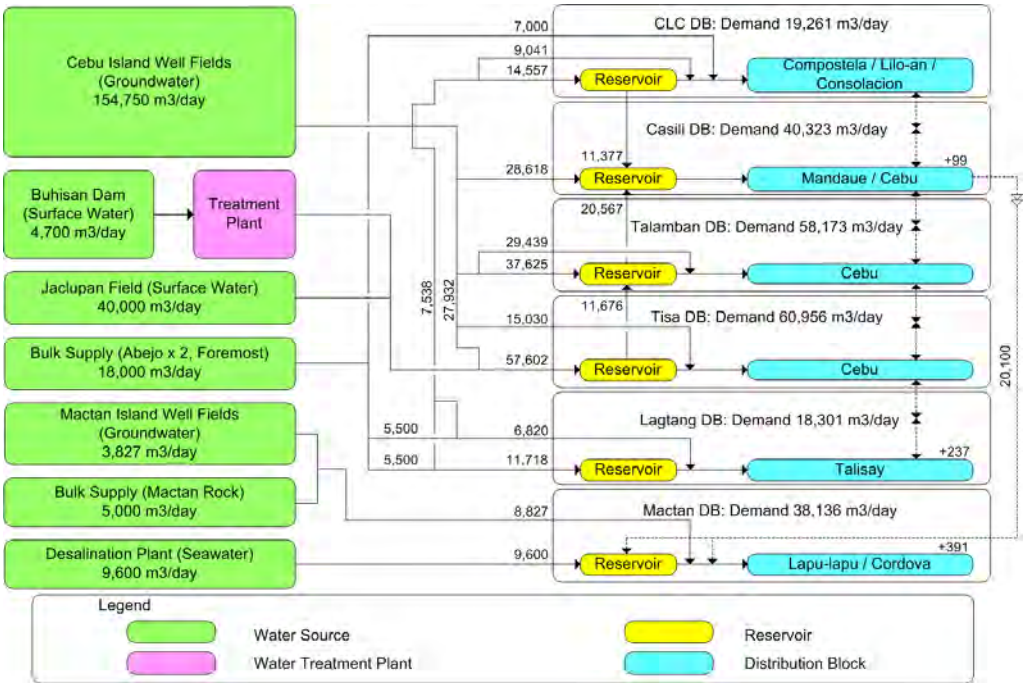


Figure III-09 Water Source and Demand Balance in 2015

III-2.3 Improvement of Water Supply Facilities

(1) Well Development

< Scope of Work >

Scope of groundwater development work is described in Table III-18.

Table III-18 Scope of Groundwater Development Work

Well		Development		Intake Facility		
Type	Statement in 2010 and 2015	Rehab.	Const.	House	M/E	Pipe
Production	Construction by 2015	-	Yes	Yes	Yes	Yes
	Existing in 2010 up to 2015	Yes	-	Excluded		
	Existing by 2015 from Stand-by in 2010	Yes	-			
Stand-by	Existing in 2010 up to 2015	Not Applicable				
Monitoring	Existing in 2010 up to 2015	Conservation Plan		Not Applicable		
	Existing by 2015 from Production in 2010					

Note: M/E means that mechanical and electrical works.

< New Well Development >

Location of new well development is shown in Figure III-10 together with the standard well design.

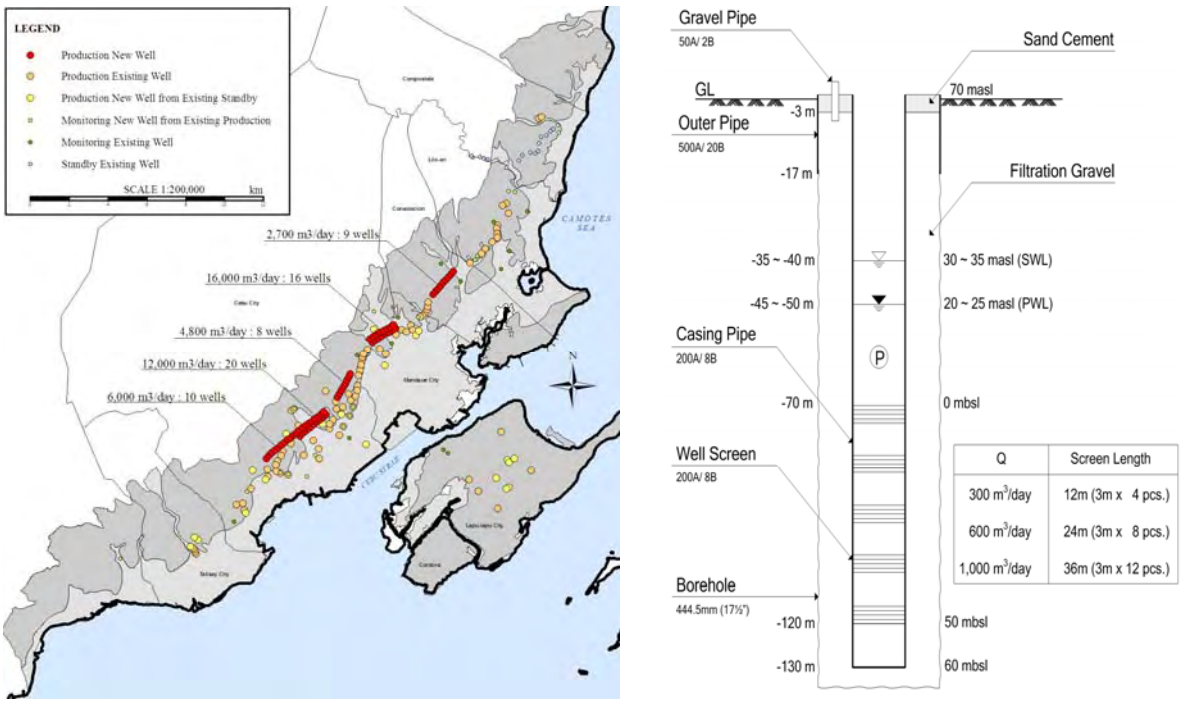


Figure III-10 Location Map and Standard Design for New Well Development

< Existing Well Rehabilitation >

Number of existing well rehabilitation is counted at 101.

(2) Jaclupan Improvement

Improvement purpose of Jaclupan Infiltration Facility is to restore its design capacity of 40,000 m^3/day. Phasing investigation and improvement is recommended (referred to Chapter III-3.1). As an initial improvement, underground baffle wall is designed to reduce the riverbed water

seepage for maintaining its water level as constant as possible if the amount of riverbed water flow is confirmed as additional potential.

Figure III-11 indicates the location of sheet pile. Detailed structures shall be design after soil investigation to confirm actual depth to the base rock of limestone.

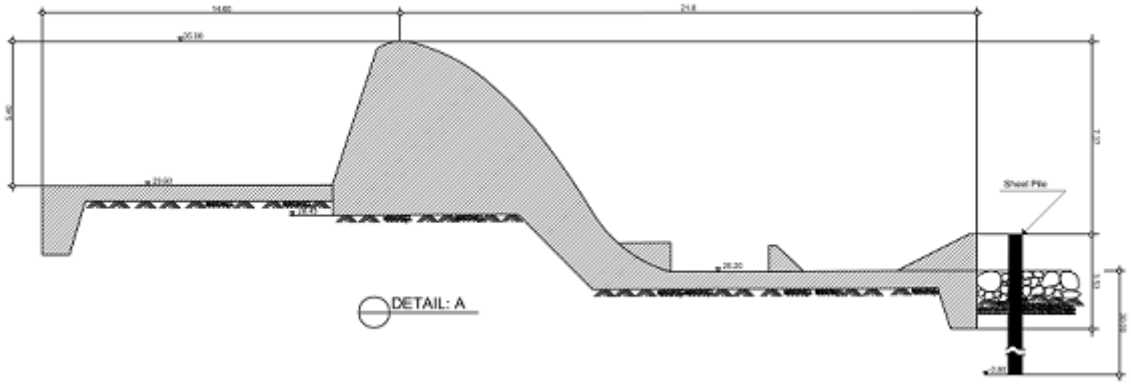


Figure III-11 Jaclupan Improvement

(3) Desalination Plant Development

In the year 2015, desalination plant in Mactan Island should produce and supply 9,600 m^3/day of membrane filtered water. Proposed treatment process is drawn in Figure III-12.

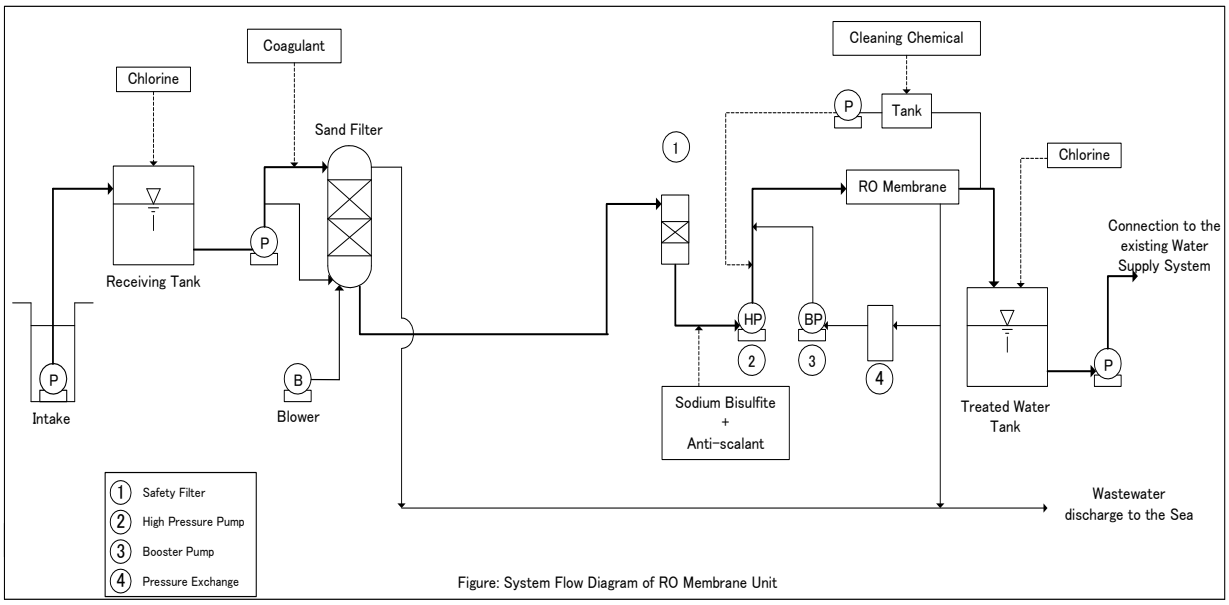


Figure III-12 Proposed Treatment Process of Mactan Desalination Plant

(4) Tisa WTP Improvement

Existing Tisa Filter Plant was constructed almost one century ago and its facilities are already deteriorated. Design flow for the new treatment plant is 10,000 m^3/day based on the past operation data.

(5) Reservoir Development

Required volume of reservoir, existing capacity and additional volume are calculated in Table III-19;

Table III-19 Proposed Reservoir Volume

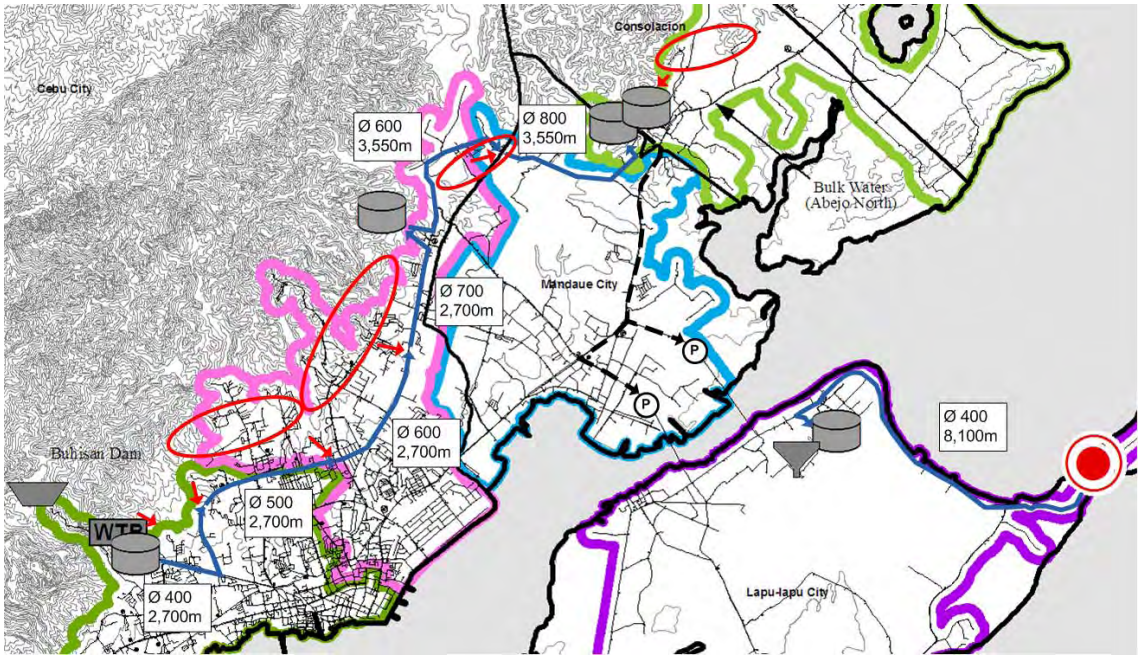
Distribution Block	DAF in 2015 (m^3/day)	Volume Estimation (m^3)			
		Estimated	Existing	Additional	Proposed
CLC	19,261	4,815	5,000	-	
Casili	40,323	10,081	5,000	5,081	5,000
Talamban	58,173	14,543	5,000	9.543	10,000
Tisa	60,956	15,239	5,000	10,239	10,000
Lagtang	18,301	4,575	5,000	-	
Mactan	38,136	9,534	*[1]5,200	4,334	4,000

Note*[1]: Volumes of reservoir at MEPZ is 3,200m^3 and Pusok is 2,000m^3.

(6) Transmission Pipe

< Inter-Reservoir >

Flow diagrams are shown in the Figure III-13 with direct cost estimated by well, desalination and inter-reservoir pipeline.



Option-1 (1,076 million PHP): Groundwater should be collected at Casili and be transferred to Mactan reservoir.

Figure III-13 Optional Plan on the Route of Inter-reservoir Transmission

< Desalination Plant >

Treated water from Mactan desalination plant is transmitted to the new reservoir next to the existing Pusok reservoir as shown in Figure III-14.

(7) Distribution Pipelines

< Fabrication of Distribution Blocks >

Proposed 6 distribution blocks can be separated by shutting the valves as shown in Figure III-14. Since existing Pusok reservoir in Mactan Island was designed as fill and draw type, it is desirable to replace by the gravity distribution reservoir with direct connection of transmission from Cebu Island.

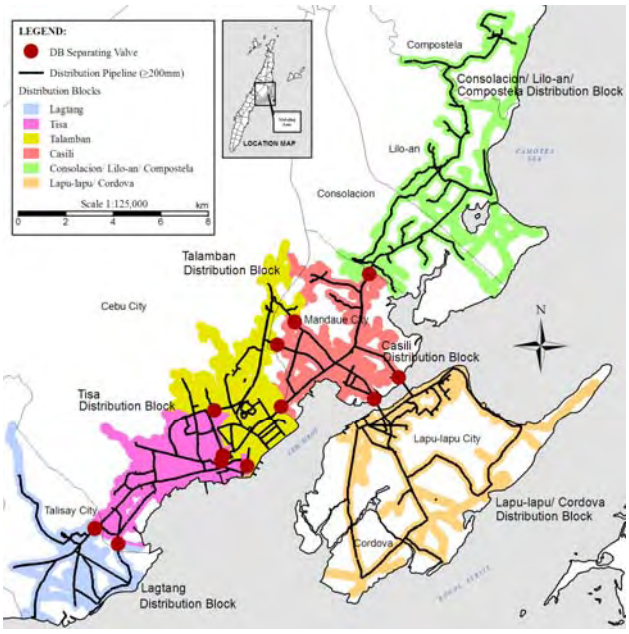


Figure III-14 Location of Major Shut Valves to fabricate Distribution Blocks

< Distribution Pipeline Network Analysis >

Proposed networks was simulated using the software of hydraulic analysis namely WaterCAD. Result of hydraulic analysis by planned pipeline (2015) using input condition of HMF is illustrated in Figure III-15. Basic information of planned pipeline in 2015 including MCWD plan in 2010 and Action Plan until 2015 are;

- No. of nodes: 2,890 (2,851 in Dec-2008)
- No. of pipes: 4,164 (3,551 in Dec-2008)

According to the figures mentioned above, most of pipes were planned as replacement and addition (the same node number with different pipe numbers). New expansion pipelines are limited. It can be seen that following node numbers which indicates below minimum water supply pressure.

- HMF: 92 nodes (< 0.07 MPa) with 9 negative nodes (red points in Figure III-15).

As results of this hydraulic analysis, this plan proposed the booster pump station at two (2) points. The on-going project of fill and draw reservoir with booster pump station was suggested by MCWD engineering department. In this regard, action plan for the said booster pump station was dropped off.

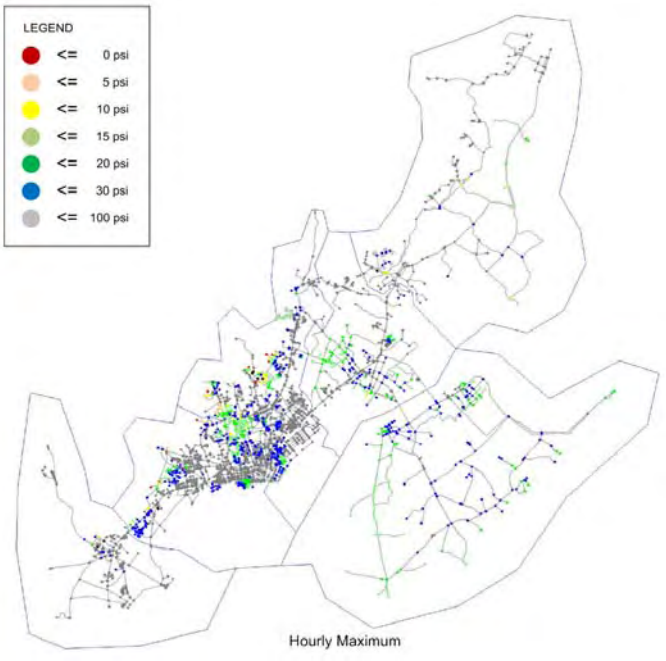


Figure III-15 Predictive Simulation of Improved Pipeline Network in 2015

III-2.4 Bill of Quantity by each Distribution Block

Table III-20 presents the overall project component (bill of quantity).

Table III-20 Overall Project Component

Item	Description	Unit	Quantity
1-1	Well Intake Facilities Construction	well	63
1-2	Well Intake Facilities Rehabilitation	well	101
1-3	Jaclupan Weir Rehabilitation	site	1
1-4	Tisa WTP Rehabilitation	site	1
1-5	Mactan Desalination Plant	site	1
2-1	Reservoir (V = 10,000 m^3)	site	2
2-2	Reservoir (V = 5,000 m^3)	site	1
2-3	Water Tower Construction (V = 2,000 m^3)	site	2
3-1	Raw Water Pipeline (100mm and 150mm)	m	31,500
3-2	Transmission Pipeline (400mm to 800mm)	m	26,788
3-3	Inter-reservoir Pump Station	site	2
3-4	Main Distribution Pipeline (300mm to 700mm)	m	32,206
3-5	Secondary Distribution Pipeline (75mm to 200mm)	m	37,014
3-6	Flow Meter Installation	site	6
4-1	NRW Reduction (referred to Chapter III-3)	LS.	1

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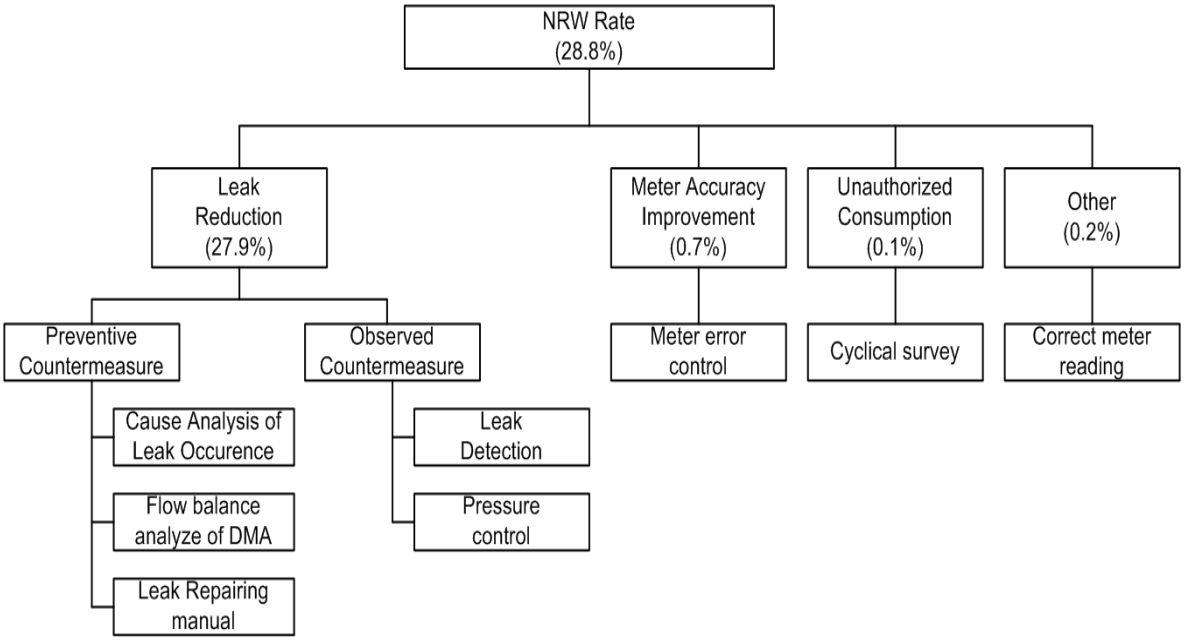
III-3 Requirements in Managerial Improvement

III-3.1 NRW Reduction

(1) Planning Concept

Currently, the rate of NRW has a share of 28.8% in total production. Based on the water balance performed in 2008, leakage itself, is at 27.9% of total production (i.e. leakage makes up 96.8% of total NRW). Water meter error was 0.7% (2.4% of total NRW), and others were about 0.3% (1% of total NRW). It is clear that the reduction of leakage is critically important to reduce NRW effectively.

Therefore, it is the most important subject to reduce the leakage and this should be raised as the action plan. Countermeasures of leakage reduction are made up of two components as shown in Figure III-16, preventive and re-active countermeasures, respectively.



Source: NRW rate is based on operational highlight of 2008, MCWD.

Figure III-16 Objective Tree Analysis

(2) Action Plan

Leakage amount has been recurred as the same amount of leakage reduction according to fluctuation of NRW rate since 2006. Work cycle of leak detection and pipe repair within entire pipeline system was estimated at 2-years using record until 2008.

Therefore, effect of leakage reduction can be improved by control on the recurring rate of leakage reduction when the cycle of working period can be reduced. Current cycle of field work is 2-years. Accordingly, 75% of leak reduction would be effective since the fieldwork cycle can be reduced to 6-months (25% of current cycle: 25% of recurring rate).

Based on the analysis on leakage detection survey in the study period, it can be judged that 2.5% of NRW reduction would be achieved during the first 6-months period. Target of 25% reduction in following 6-months period can be anticipated. Finally, NRW rate will be reduced at 19.8% in 2015 as shown in Table III-21.

Table III-21 NRW Reduction Plan in Short Term

Year	NRW Rate	Progress Point	Reduced Volume (m^3/day)
Dec-2009	29.4%	Not Applicable	Not Applicable
Jul-2010	26.9%	2.5%	1,223
Jan-2011	25.0%	1.9%	917
Jul-2011	23.6%	1.4%	688
Jan-2012	22.5%	1.0%	516
Jul-2012	21.8%	0.8%	387
Jan-2013	21.2%	0.6%	290
Jul-2013	20.7%	0.4%	218
Jan-2014	20.4%	0.3%	163
Jul-2014	20.1%	0.2%	122
Jan-2015	19.9%	0.2%	92
Jul-2015	19.8%	0.1%	69
Total			4,686

< Preventive Countermeasure >

A preventive countermeasure does not directly contribute to the reduction of latent leaks. Rather it contributes to prevent the leak from recurring by properly repairing existing leakage points. This will significantly reduce the volume of leakage. The preventive countermeasures include preparation of a leak repairing manual, analysis of the leak cause and water balance analysis of DMA.

* Leak Repairing Manual
* Analysis of Flow Balance of DMA
* Analysis of the Cause of Leak Occurrence

< Re-active Countermeasure >

Re-active countermeasures reduce the leak volume directly by (a) the repair of existing leaks, and (b) the intentional control of water pressure. Since these countermeasures are of high priority over others, an action plan shall deal with these matters preparing periodically.

III-3.2 Water Saving Measures

(1) Outline

In the Metropolitan Cebu, there are many problems in developing new water resource. Such problems include acquisition of the water rights and the production cost, and the execution of the water-saving countermeasure is necessary for the continuation of the steady water supply for MCWD to catch up with the future population growth and increase in the water demand.

(2) Water-saving Equipment

Even many Japanese waterworks authorities encourage adoption of the water-saving type product. For example the effect on saving water by the water-saving utensils is;

- In a rest room of toilet bowl 16 to 10 liter/ flash
- In a rest room of urinal 10 to 5 litter/ flash

III-3.3 Poverty Stratum Measures

(1) Water Usage of Poor Households

In terms of unit price for usage, the most expensive one (0.061 peso/litter) is the one for households below 5,000 pesos of their monthly household income. This shows that the poorest households use the most expensive water.

While regarding average daily consumption per person, poor households daily consume only 41.7 litters per person, which is a half or one third of richer households.

In terms of unit price of each water source, the unit price of communal faucet water is 5.7 times of one of MCWD individual faucet water. While the unit price of MCWD water buy from neighbor is 10 times of one of MCWD individual faucet water.

As a result, poor household, that have monthly income blow 5,000 pesos, have to spend 12.3% of monthly income for water, which is equivalent to 372.45 peso. It is almost two (2) times or more of households in richer ranges.

(2) MCWD's Approach to Poor

< Previous and New Policies >

1. Who may apply
   - Previous Communal Water Associations (CWA) only
   - New Anybody
2. Qualifications
   - Previous Poor families belonging to the low income class. No clear-cut definition as to who are poor families.
   - New The communal service connection must be located in the depressed areas as determined by MCWD.
3. Requirements for Application
   - Previous Formal petition only
   - New Consent of the owner of the lot where the communal service connection will be installed. Board resolution for NGO and Cooperative. Articles of incorporation for NGO and Cooperative. Resolution authorizing the organization's representative to transact with MCWD.
4. Membership Requirement
   - Previous At least 30 members per communal association
   - New None
5. Number of Communal Faucets
   - Previous Maximum of 3 faucets per CWA (regardless of the number of members)
   - New Maximum of 2 faucets (1 faucet per 15 members)
6. Communal Water Management
   - Previous CWA elects the following officers to operate the communal faucet but with close and direct supervision by MCWD. CWA funds in excess of MCWD payments shall be spent for projects.
     President: responsible for the management of the CWA
     Secretary: keeps the minutes of all CWA meetings
     Treasurer: takes charge of the CWA funds and prepares the financial statement of the CWA

Auditor: audits all financial transactions of the CWA

* New The undertaking shall be that of franchising; franchisor-franchisee relationship between MCWD and NGO, Cooperative, and private contractor. Communal water management is completely delegated to the franchisee. Subcontracting of the management and operation of the communal water system is totally prohibited. MCWD shall act as a regulatory body in the creation and overall management of the communal water system. Projects out of the communal water funds are no longer required.

7. Selling Prices of Communal Water
   * Previous The following standard selling prices are set but not compulsory:
     2 gallon (about 7.5 litters) PHP 0.25
     1 kerosene (about 20 litters) PHP 0.65
     1 container (about 22 litters) PHP 0.75
   * New The following ceiling prices are set for strict compliance (selling prices shall be posted on the communal faucets as notice to the communal consumers):
     1 gallon (about 3.8 litters) PHP 0.25
     1 pail (about 8.5 litters) PHP 0.75
     1 container (about 22 litters) PHP 1.50
8. Income Statement and Audit
   * Previous The CWA's are required to submit their income statement to MCWD. The CWA and its funds may be subject to audit by MCWD.
   * New MCWD shall conduct a spot audit of franchisee's operations and finances.
9. Penalty Clause
   * Previous Disconnection or cancellation of the CWA status in case of non-compliance with any or all of the implementing rules.
   * New Application of regular water rates in case of non-compliance with any or all of the revised implementing rules.
10. Communal Water Rates
    * Previous None.
    * New Existing communal water rates shall be adjusted to break-even.

< Case Study >

Due to several problems/ issues encountered by MCWD on the communal water system, case studies have been conducted to:

1. Look into the background of communal water associations/ systems with a brief description of the barangays that host them, including the CWA/ CWS histories and the rationale behind their formation,
2. Assess the current status of CWA/ CWS operations in line with the MCWD requirements for communal faucets,
3. Identify problems and concerns that pose as major challenges affecting CWA/ CWS operations, and
4. Ascertain CWA/ CWS future plans that will significantly make impact on their management directions.

At the time of the case studies as of April 2009, MCWD listed 192 communal water associations/ systems with 87 already under the franchise system in its service area. The case studies selected three (3) typical cases, which are;

(i) existing CWA,
(ii) non-operational CWA, and
(iii) converted in to a franchise system.

As of September 2009, all CWAs have been converted into franchised CWS. The case studies were conducted for the following CWA/ CWS as shown in Table III-22.

Table III-22 CWA/ CWS for Case Study

Status	Name of CWA/ CWS	LGU
Existing CWA	The Communal Water Associations in San Vicente, Lilo-an – the Sitios Ibabao and Tabaylawom CWAs	Mandaue City
	The Communal Water Associations in Catarman, Cordova particularly the Catarman II B CWA	Cordova
	The Villamanga Communal Water Association in Opao, Mandaue City	Mandaue City
Non-operational	The Non-Existing Communal Water Associations in Guizo, Mandaue City	Mandaue City
	ATU Carbon Market Multi-Purpose Cooperative in Cebu City	Cebu City
Converted into a franchise system	Saac Seaside Community Association, Inc. in Mactan, Lapu-lapu City	Lapu-lapu City
	Alvin Flores/ Cantila Communal Water System 4 in Poblacion Occidental, Consolacion	Consolacion

< Issues to be addressed >

The summary of the case studies' results is as follows:

1. Selection of CWA/ CWS beneficiaries
   No clear cut definition of "low income families." No definite cut-off point when an economic status is no longer considered "low income" that merits the dissolution of a CWA/ CWS. Presence of beneficiaries is not limited to families but vendors.

2. Institutional support
   Absence of support activities that strengthen the institutional capability of associations/ organizations. Inability of MCWD to provide institutional support due to the nature of the program and the limited number staff assigned to communal water systems; Absence of mechanisms to thwart conflicting interests; Effectively managed associations (e.g., Saac Seaside Community Association, Inc. in Mactan, Lapu-lapu City) have better communal water supply management; they were provided with institutional support by government agencies and NGOs

3. Water prices
   Differences in water prices due to limited monitoring; It is unclear whether consumers are being interviewed regarding how much they pay for water or monitored regarding their knowledge on and satisfaction of the water rates; CWA/ CWS lacks the knowledge and skills in calculating system loss

4. Salaries of watchers
   Differences in the salary/ honorarium of watchers from one CWS/ CWA to another; Absence of policy with regard to salary/ honorarium of watchers; Inequality of salary rates

could be a potential irritant between watchers and CWAs/ franchisees

5. Direct connection from main communal faucet and pilferage
   Revised Implementing Rules on CWS dated July 21, 2008 is silent about the direct water connection issue; No mechanism in place that protects the franchisee from being the victim of pilferage

6. Use of income for CWA projects
   Different interpretations of use of income for CWA projects from one CWA to another; the clause that "income should be used to improve the social condition of members" is subject to many interpretations; Absence of specific guidelines on the utilization of income/ savings resulting in the "abuse" of income leading to conflict within the association

7. CWA conversion to franchise system
   Advent of the franchise system, as approved through MCWD Resolution No. 072-2008, has created anxiety among existing CWAs; NGOs or cooperatives of good standing are the preferred franchisees of the CWS but several CWAs have not been prepared to take on the role of a cooperative in good standing; there is not enough time or support provided to CWAs to prepare themselves for the eventual conversion

8. Income sharing in the CWS franchise
   Anxiety over income sharing in the franchise system; there may be no problem if the franchisee is the NGO or cooperative since income can be shared among or plowed back through projects to its members; if the franchised CWS happens to be a transition from CWA, income sharing could be a volatile source of conflict

< Conclusion in the Action Plan >

It is proposed that MCWD should facilitate to install communal faucets under the franchise system and monitor their operation at the same time. Based on the monitoring data, the franchise system should be reviewed at the appropriate timing.

III-3.4 Institutional Strengthening

The overall MCWD corporate performance from 2005 to 2009 has been good as evidenced by it accomplishments in the monitored key result areas for water utility as shown below. However, the on-time collection efficiency (item 7 in Table III-23) has declined over the same time period. More importantly and a cause of great concern was the deterioration of NRW. Thus, the need to take a closer look at the whole organization to find ways and means to keep the NRW level to at most 20% by 2015.

MCWD is, on its own, currently undertaking a thorough review of its present organization to address the key issues of improving customer service and business efficiency. This means having an organizational structure tailored fit to provide more efficient delivery of services to customers, deal with an expanding customer base, and improve the financial performance of the business. In 2008, earnest efforts to address improvements in MCWD's operation and water contamination were started and resulted to the identification of areas for improvement. As a result, the reorganization of MCWD was put forward guided by the following principles:

(a) to streamline functions of various units and group the same mind-sets within the organization;
(b) to establish/ institutionalize as regular functions important tasks currently carried out by ad-hoc

bodies/ committees, e.g. NRW reduction and consumer marketing;

(c) to consider outsourcing of non-core activities/ processes;

(d) to equally distribute workloads among groups, departments and divisions; and

(e) to, at most, maintain the same number of groups and departments under the proposed organizational structure

Table III-23 MCWD Key Result Areas, 2005 – 2009

Key Result Area	2005[1]	2006[1]	2007[1]	2008[1]	2009[2]
1. Systems Recovery Rate[2] (%)	72.57	72.15	70.66	70.78	70.10
Non-Revenue Water[2] in (%[3])	27.73	29.04	29.55	29.40	30.30
2. Water Production (000 m³)	53,009	56,564	59,178	60,739	62,647
3. Water Sales (000 m³)	38,179	39,912	41,626	43,003	43,591
4. Net Revenue (PHP'000)	806,941	955,386	1,052,652	1,090,400	1,092,003
5. Collections (PHP'000)	750,822	890,062	985,607	1,007,874	1,025,776
6. Collection Ratio (%)	93	93	94	92	94
7. On-time Collection Efficiency (%)	66	65	63	55	60
8. Service Connections Installed	6,945	5,758	7,455	5,445	6,514
9. Total No. of Service Connections	105,532	110,361	116,417	120,390	126,935
10. Service Connection Repair	18,146	18,155	18,956	18,395	14,010
SCR Reaction Time (hour)	6.87	7.28	7.65	5.50	5.10
11. Mainline Repairs (site)	491	602	535	530	502
MR Reaction Time (hour)	10.47	8.63	9.40	6.78	7.10
12. Service Conn. Reactive Rehabilitation	8,150	9,099	9,940	5,272	6,381
13. Corrective Meter Job Orders	13,768	10,898	9,564	10,616	not applicable
14. Manpower Level (Regular/ Casual)	582	568	572	568	588
15. Employee per '000 Service Connection	5.75	5.31	4.98	4.72	4.63
16. Water Sales per Employee (PHP'000)	146.16	131.17	199.87	206.27	205.19

The reorganization/rationalization of MCWD was spearheaded by the CPD. Core and non-core functions as well as gaps in business functions and possible areas for outsourcing were identified. The CPD-proposed organizational structure shown in Figure III-17 was based on analysis done by the CPD.

It has the same numbers of Groups and Departments, but reduced the total number of divisions. Group names were changed to reflect the core functions. The reorganization plan was approved in principle by the Board of Directors (BOD) who has been fully informed and updated on the progress of the reorganization efforts. It is to be implemented in 3-phases starting in 2010. First phase will focus on financial and customer services functions.

The reorganization of MCWD is bound by the provisions of EO 366 as well as related rules and regulations issued by the DBM and CSC. As a LWD, MCWD organizational structure should likewise be consistent with the LWUA organizational and institutional criteria in accordance with Sec.62 of PD198. The first phase of the reorganization is planned for implementation in 2010. However, this may not be feasible since, the rationalization law calls for specific processes like the creation of change management team/s and substantial consultations which apparently had not been followed in the case of MCWD. Furthermore, EO 366 calls for the full implementation of reorganizations. As such, the issuance of an EO to authorize MCWD to undertake a phased implementation would be necessary.

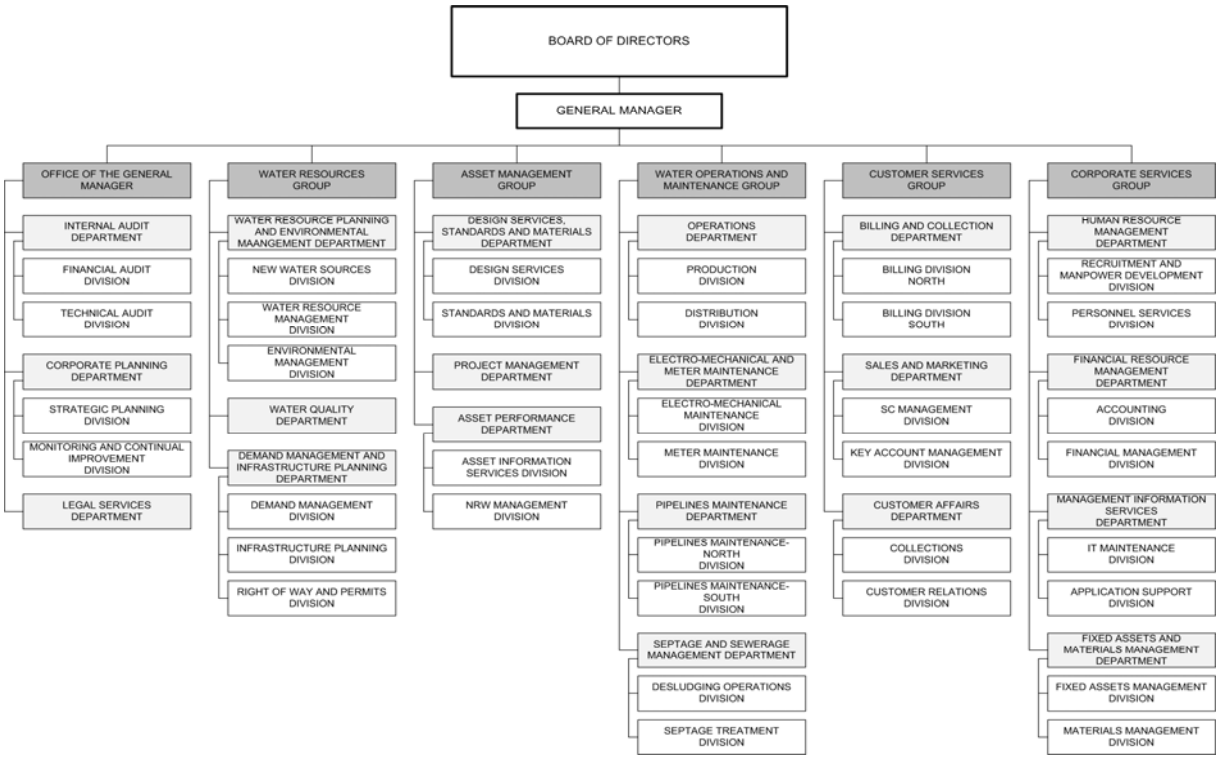


Figure III-17 MCWD CPD-Proposed Organizational Structure

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III-4 Initial Environmental Examination

III-4.1 Preliminary Scoping of Environmental and Social Impact

(1) Alternatives Study

Alternative for water source development in Figure III-18 was examined from the viewpoint of environmental and social consideration as shown in Table III-24.

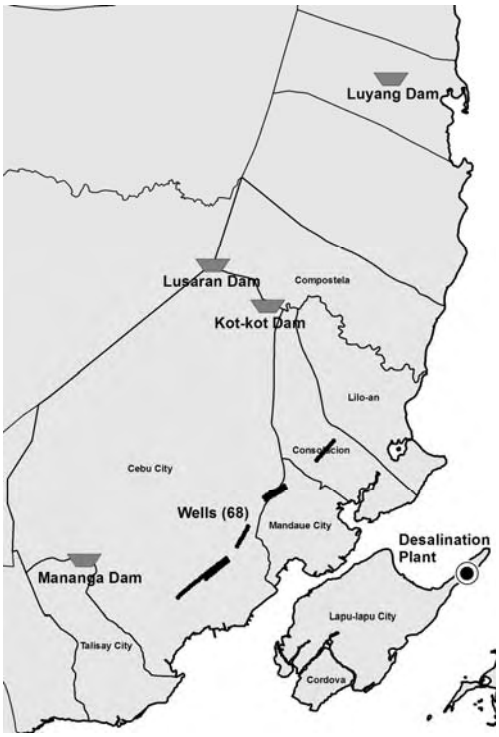

Figure III-18 Map of Water Source Development Sites

Table III-24 Comparison of Major Conceivable Environmental and Social Impacts

Alternatives	Surface Water (dam)	Groundwater (well)	Seawater (desalination)
Land Acquisition or Conversion	Mananga Dam: 69 km^2 Lusaran Dam: 55 km^2 Kot-kot Dam: 33 km^2 Luyang Dam: 37 km^2 Resettlement is necessary.	12,600 m^2 in total[*1] No settlement is required.	6,050 m^2 No settlement is required.
	Negative	Positive	Positive
Protected Area	Candidate sites are located in CCPL except for Luyang dam.	None.	None.
	Negative	Positive	Positive
Conceivable Major Environmental and Social Impacts	Land conversion by the project will affect on terrestrial ecosystem in and around project site. Water quality such as SS, BOD, and DO will be deteriorated, and change of water temperature will be caused by the project, and ecosystem in river will be affected.	Drawing groundwater from constructed wells will cause decline of groundwater level and salt water intrusion.	Intake of seawater and discharge of concentrated seawater by the project will affect on marine ecosystem and will cause water pollution.
LCC	2.9~13.1 PHP/m^3	2.8 PHP/m^3	34.8~36.6 PHP/m^3
BCR	0.6~3.2	2.7~2.8	0.2

Note: LCC and BCR were referred to Chapter III-1. Remark*[1]: Land area is estimated by 63 wells times 200 m^2/well in average. Source: Water Remind Project and JICA Study Team

As the result, groundwater development (deep well) and seawater development (desalination plant) were identified as proposed projects. Besides, the reservoirs and pipelines shall be installed in water supply system/ facility improvement project. Overall, it was confirmed that the environmental and social impacts by the proposed projects were preliminary avoided and mitigated as much as possible.

(2) Preliminary Scoping of Environmental and Social Impact

The conceivable environmental and social impacts by the proposed "well development," "desalination plant" and "system/ facility improvement" were preliminary examined as shown in Table III-25.

Table III-25 Environmental and Social Impacts by the Proposed Projects

		Item	Well Development	Desalination Plant	System/Facility Improvement
Social Environment	1	Involuntary Resettlement	D	D	D
	2	Local Economy	B	B	B
	3	Land Use, Local Resources	B (landuse) B (groundwater)	B (landuse) B (fishery)	B
	4	Social Institutions	D	D	D
	5	Social Infrastructures/Services	D	D	D
	6	Poor, Indigenous and Ethnic people	C	D	C
	7	Misdistribution of Benefit/Damage	C	C	C
	8	Cultural heritage	C	D	D
	9	Local Conflicts of Interest	C	C	C
	10	Water Usage/Rights	B	C	D
	11	Sanitation	D	D	D
	12	Hazards (risk), Infectious Diseases	D	D	D
	13	Accident	C	C	C
Natural Environment	14	Topography and Geography	D	D	D
	15	Soil Erosion	D	D	D
	16	Groundwater	B	D	D
	17	Hydrological Situation	D	D	D
	18	Coastal zone	D	B	D
	19	Flora, Fauna and Biodiversity	B	B (terrestrial) B (marine)	B
	20	Meteorology	D	D	D
	21	Landscape	D	D	B
	22	Global Warming	B	B	B
Pollution/ Contamination	23	Air Pollution	B	B	B
	24	Water Pollution	B	B	D
	25	Soil Contamination	D	D	D
	26	Waste	B	B	B
	27	Noise and Vibration	B	B	B
	28	Ground Subsidence	D	D	D
	29	Offensive Odor	D	D	D
	30	Bottom Sediment	D	C	D

Rating: A: Serious impact is expected, B: Some impact is expected, C: Extent of impact is unknown, D: No impact is expected. IEE/EIA is not necessary. Source: JICA Study Team

III-4.2 Requirements to the IEE Activities

Based on the conceivable adverse environmental and social impacts identified in preliminary scoping matrix, general mitigation measures and monitoring plan for the proposed projects were examined at this stage.

The mitigation measures and monitoring plan shall be detailed in the course of the environmental impact assessment (EIA) as well as preparation of the land acquisition and resettlement plan (LARAP), which will be conducted in parallel with the feasibility study stage of the proposed projects.

The required report types for the proposed projects can be summarized as shown in Table III-26.

Table III-26 Proposed Projects and their Required EIA Report Types

Proposed Categories		Quantity	Required EIA Report
Well Development		63 wells	EIS
Desalination Plant		1 desalination plant	Unclassified. Subject to DENR-EMB review of project description.
System/ Facility	Reservoir	4 reservoirs	
	Pipeline	130 km pipelines in total	EIS

Source: JICA Study Team

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III-5 Project Implementation

Execution of the project should provide significant benefits for both of users and MCWD. These benefits are solutions to acquisition limits of new customers, suspended water supply and low water supply pressure, and also that should be connected to MCWD financial sustainability. Workflow of project implementation indicates in Figure III-19.

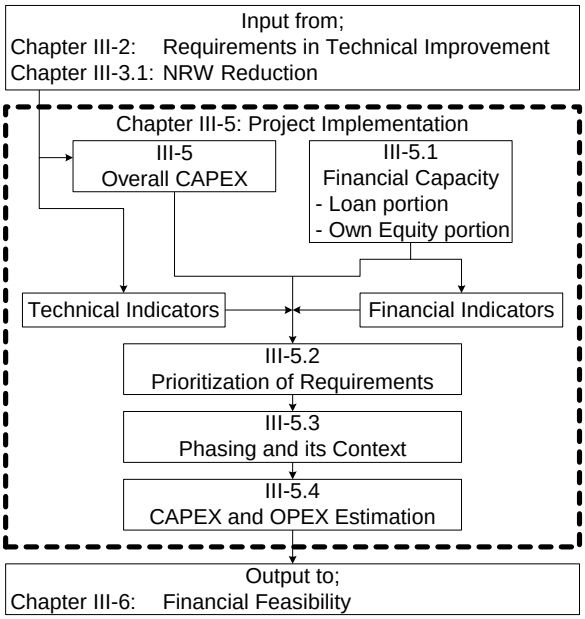

Figure III-19 Workflow of Project Implementation

At the first, Table III-27 shows the overall CAPEX cost of technical requirements including NRW reduction. Detailed conditions of the said cost estimation are referred to Chapter III-5.4.

Table III-27 Overall CAPEX Estimation (million PHP)

Category	2011	2012	2013	2014	2015	Sum	Remarks
A Construction	636	599	841	511	1,081	3,668	
B Procurement	11	0	0	0	0	11	
C Land Acquisition	91	150	0	0	0	241	
D Engineering Services (D/D)	124	84	51	108	0	367	A × 10 %
E Engineering Services (S/V)	32	30	42	26	54	183	A × 5 %
F Government's Formality	16	15	21	13	27	92	A × 2.5 %
G Physical Contingency	45	44	48	33	58	228	(ΣA to F) × 5 %
H Price Contingency	143	138	150	103	183	718	(ΣA to F) × 15.73 %
I Value Added Tax	109	105	115	79	139	547	(ΣA to F) × 12 %
Total of Annual Disbursement	1,207	1,166	1,268	872	1,542	6,055	> 250 million PHP/year
Breakdown Portion	Available from Loan					4,428	A + A × (G + H)
	Should be Self-financing					1,626	Others

Note: Rate of H; Price Contingency was assumed at 15.73 % with annually 6 % and base year of 2013.

According to annual investments of MCWD from 2008 (actual) up to 2015 (plan), it can be seen that the minimum 100 (actual in 2008) and the maximum 541 (actual in 2009) million PHP have been invested, respectively. Average investment including plan was estimated at 250 million PHP annually. Based on the financial analysis, it was found that the case with implementation of the all improvement projects is not feasible due to the predicted shortage of the funds surplus, even under an assumption

about the water rate increase (referred to Chapter III-6.1). Table III-28 shows the projected financial conditions of MCWD, assuming that the all projects are implemented by 2015. In this regard, improvement project should be screened with priority according to conceptual criteria.

Table III-28 Net Income and Cash Flows: All Projects (million PHP)

Financial Indicator		Projection					
		2010	2011	2012	2013	2014	2015
Case-I: without water rate increase	Net Income	251	196	148	53	**-1**	**-103**
	Funds Surplus	194	**-319**	**-382**	**-236**	**-389**	**-329**
	Balance	936	617	236	**-8**	**-389**	**-718**
Case-II: 10% water rate increase in 2011	Net Income	251	315	274	184	134	91
	Funds Surplus	194	**-199**	**-256**	**-105**	**-255**	**-135**
	Balance	936	737	481	376	122	**-14**

Note: Total annual cash flow amount of cash and cash equivalent, and temporary investments is used in this study as the funds surplus definition.

III-5.1 Financing Capacity

(1) Objectives and Methodology

The aim of this study is to estimate the financing capacity of MCWD, which will be ascertained as project cost limitation.

For this purpose mentioned above, gross profitability (GP) in each DB is estimated and compared using the indicator of the gross return on the investment cost. It is noted that overall project cost was divided into the DB with due basic consideration of following.

- purposeful breakdown costs (water source with conveyance pipeline, water treatment/ desalination plant, reservoir and distribution pipeline) were fallen on the DB where the subject water is used, and
- common breakdown costs (transmission pipeline) were allotted to the DB according to the rate of water volume to be supplied.

(2) Finance Institutions

The Development Bank of the Philippines (DBP) and LWUA provide long-term loans to water supply service providers. In the case of DBP, loans are provided through Philippine Water Revolving Fund (PWRF); in the case of LWUA, loans are provided either from its own funds or as a joint funding together with international cooperation agencies (ADB, WB or JICA). DBP is the current creditor of the MCWD for 1,000 million PHP of long-term loans.

(3) Financing Capacity

Financing capacity of MCWD is evaluated by the portions of loan and self-financing.

< Loan Financing Capacity >

Considering the size of the investment required for the projects and the supposed profitability of the project water facilities, certain financial improvements are needed. This study therefore further analyzes the debt service capacity under the assumption that the effective water rate (the average water rate calculated as the water sales revenue/ the water sales volume) will be increased by 10% from 2011. Under this assumption, the financing capacity increases up to 1,500 million PHP.

Table III-29 shows the relation between the financial indicators used for analysis and the financing capacity of MCWD.

Table III-29 Indicators and Loan Capacity during Project period (million PHP)

Indicator	Current Water Rate	Water Rate Increase
Average Net Income	217	282
Average Annual Debt Service Capacity	120	163
Loan Financing Capacity during Project period	1,100	1,500

< Self-financing Capacity >

The current amount of the funds surplus is 740 million PHP, and the projected amount in 2015 is 1,800 million PHP under the assumption that no major water facility projects will be implemented during the period. In the case of a 10% water rate increase, the projected amount in 2015 increases up to 2,400 million PHP.

Table III-30 summarizes the financing capacity of MCWD from 2010 through to 2015, both at the current water rate and at the increased water rate.

Table III-30 Financing Capacity of MCWD (million PHP)

Financing Category	Current Water Rate	Water Rate Increase
Loan financing	1,100	1,500
Self-financing	610 to 1,200	610 to 1,560
Total	1,710 to 2,300	2,110 to 3,060

Note: The Self-financing amounts for each case were calculated under the assumption that the loans are made in 2011, and payments for the annual due amounts (principal and interest) and commission fees are excluded from the self-financing amounts.

III-5.2 Prioritization of Requirements

As described for implementation concept, execution of the improvement project should provide significant benefits for both of MCWD as sustainable operation and users as social service. The proposed improvement projects include achievement of water supply services in terms of water quality and supply quantity. However, water quality improvement is related to the Tisa WTP rehabilitation and that has not large impact to the present situation. Therefore, the project priority shall be given to the quantitative improvement.

On the viewpoints mentioned above, following criteria are conceptualized to select the priority projects comprehensively.

< For MCWD Benefit: Financial Indicator >

- Financing Capacity as project cost limitation
- Profitability in the DB (GP based on the Overall Projects excluding Tisa WTP rehabilitation)

< For Users Benefits: Service Indicators (basic human needs and service sustainability) >

- Additional Demand (2015 - 2007) and Demand Growth Rate (2015/ 2007) by the DB
- Node Rate and Demand Rate of Low Water Supply Pressure in 2015 by the DB

(1) Estimation of Indicators

< MCWD Financial Indicators >

Financing capacity of MCWD was estimated at minimum 2,060 and maximum 2,900 million PHP as shown in Table III-30 (previous page) when water rate can be increased. Among this MCWD financing capacity, loan portion was calculated at 1,500 million PHP. Table III-31 summarizes the relation between the cost (5,676 million PHP excluding Tisa WTP rehabilitation) and gross profitability of each DB.

Table III-31 Gross Profitability of the Projects in Distribution Block (million PHP)

DB	Cost of All Projects (w/o Tisa)	GP of All Projects (w/o Tisa)	
CLC	361	13 %	Middle
Casili	645	20 %	
Talamban	865	11 %	
Tisa	606	15 %	
Lagtang	36	79 %	High
Mactan	3,162	3 %	Low
Total	5,676	10 %	

< Users Service Indicators >

Additional demand and demand growth rate are indicated in Table III-32.

Table III-32 Water Demand and Indicator in Distribution Block

DB	Demand (m^3/day)		Indicator		
	2007: A	2015: B	B - A (m^3/day),	Occupancy %	B/ A (%)
CLC	9,384	15,409	6,025	8 %	164 %
Casili	16,682	32,258	15,577	22 %	193 %
Talamban	35,449	46,538	11,090	15 %	131 %
Tisa	36,491	48,765	12,274	17 %	134 %
Lagtang	6,256	14,641	8,385	12 %	234 %
Mactan	11,904	30,509	18,605	26 %	256 %
Total	116,165	188,120	71,955	100 %	162 %

Note: NRW (30% in 2007 and 20% in 2015) is not included into the water demand.

Regarding the water supply pressure improvement, rates of low-pressure node (pipe connection) and demand in 2015 were compared within the DBs as shown in Table III-33.

(2) Comparison of Indicators

Indicators with their impact according to the conceptual criteria are shown in Table III-34.

(3) Selection of Priority Project

Initially, Lagtang DB with small investment (36 million PHP) and Mactan DB with huge investment (3,162 million PHP) were selected as priority projects. Since financing capacity of MCWD was estimated at 2,060 up to 2,900 million PHP, unwillingly the entire Mactan DB project has no choice to be given up. It means that water importation from Cebu main island to Mactan island should be considered when the remaining project is proceeded or the scheme of surface water development comes true. Therefore, desalination plant with its transmission pipeline was selected as priority in 2015.

Table III-33 Low Water Supply Pressure in 2015 without Improvement Projects

DB	Pressure* (psi)	Low-pressure Node		Low-pressure Demand* (incl. NRW)	
		No.	Rate (%)	m^3/day	Rate (%)
CLC	≤ 10	51	57 %	27,287	64 %
	all	89		42,381	
Casili	≤ 10	88	26 %	30,501	34 %
	all	345		88,691	
Talamban	≤ 10	865	90 %	115,512	90 %
	all	966		127,989	
Tisa	≤ 10	879	94 %	129,129	96 %
	all	931		134,072	
Lagtang	≤ 10	7	5 %	5,245	13 %
	all	141		40,300	
Mactan	≤ 10	103	50 %	41,102	49 %
	all	208		83,897	
MCWD	≤ 10	1,993	74 %	348,776	67 %
	all	2,680		517,330	

Note: Pressure* and demand* without project in 2015 mentioned above were simulated by the WaterCAD model.

Table III-34 Screening Indicators in the DBs

DB	Financial	Service			Impact
	GP: %	Rate (B-A): %	Growth B/A: %	L-P Demand: %	(scoring)
CLC	(M) 13	(L) 8	(M) 164	(M) 64	H×0+M×3+L×1
Casili	(M) 20	(H) 22	(M) 193	(L) 34	H×1+M×2+L×1
Talamban	(M) 11	(M) 15	(L) 131	(H) 90	H×1+M×2+L×1
Tisa	(M) 15	(M) 17	(L) 134	(H) 96	H×1+M×2+L×1
Lagtang	(H) 79	(M) 12	(H) 234	(L) 13	H×2+M×1+L×1
Mactan	(L) 3	(H) 26	(H) 256	(M) 49	H×2+M×1+L×1
MCWD	10	100	162	67	

Note: Tisa WTP rehabilitation is not included. H; high, M; medium and L; low comparatively.

Secondary, priority projects will be nominated among the DBs of Casili, Talamban and Tisa. MCWD needs financial source for continuous project of service improvement using self-financing and or loan. The Casili DB would have a priority because of the higher gross IRR, larger additional demand and demand growth.

Finally, the last choice is given to the Tisa DBs with due consideration of indicator values comparing to Talamban DB.

(4) Contents of Priority Projects

Table III-35 shows the CAPEX and GP of proposed projects. Table III-36 indicates the BOQ of priority projects.

Table III-35 CAPEX (million PHP) **and GP** (%) **of the Priority Projects**

DB		CAPEX	GP	Project Contents
Casili		1,020	14 %	All improvement items
Tisa		606	15 %	Excluding Tisa WTP rehabilitation
Lagtang		36	79 %	All improvement items
Mactan		863	6 %	Desalination plant with its transmission
Total		2,525	14 %	-
Breakdown Cost*	Loan	1,791	Remarks*: Available loan was estimated at 1,500 million PHP, while MCWD funds surplus becomes 1,025 million PHP.	
	Self-financing	734		

Note: GP indicates return on the investment cost. This indicator differs from FIRR, as it does not include incremental OPEX in its calculation. Loan Terms used for the calculation are 20 years of tenor and 9.3% of annual interest rate. No water rate increase is included in its calculation.

Table III-36 BOQ of the Priority Projects

Description		Distribution Block				Total
		Casili	Tisa	Lagtang	Mactan	
Intake	Well: new	26 wells				26 wells
	Well: rehabilitation	6 wells	22 wells	7 wells		35 wells
	Jaclupan		1 site			1 site
	Desalination				1 plant	1 plant
Reservoir	Site	5,000 m^3 × 1	10,000 m^3 × 1			2 sites
Pipeline	Raw Water	17.7 km				17.7 km
	Transmission	5.2 km			8.9 km	14.1 km
	Distribution Main	3.1 km	4.2 km			7.3 km
	Distribution Secondary	8.2 km	4.0 km	2.0 km		14.2 km
	Flow Meter	1 site	1 site	1 site		3 sites
NRW	Reduction	1 LS	1 LS	1 LS		3 lots

III-5.3 Phasing and its Context

(1) Phasing

Priority projects were divided into 3-phases from commencement in 2011 and for work completion by 2015, which are;

Phase-1 Preparatory Work including planning review, detailed design and contract
Phase-2 Construction including construction supervision
Phase-3 Operation and Maintenance including turnover inspection within warranty period

(2) Construction Schedule

Construction schedule is referred to Table III-37.

III-5.4 CAPEX and OPEX Estimation

Capital expenditure (CAPEX) of the priority projects and operating expenditure (OPEX) upon completion of the priority projects were estimated. Following descriptions include detailed estimation methods and conditions. The data CD contains the estimation results in details.

(1) CAPEX Estimation

Composition of CAPEX was referred to the LWUA standard for cost estimation, which is shown in Figure III-20.

Table III-37 Construction Schedule

Description			2011	2012	2013	2014	2015
Water Source	1-1	Well: Construction					
	1-2	Well: Rehabilitation					
	1-3	Jaclupan: Rehabilitation					
	1-4	Desalination: Construction					
Reservoir	2-1	Tisa: Construction					
	2-2	Casili: Construction					
Pipeline	3-1	Raw Water: Installation					
	3-2	Transmission: Installation					
	3-3	Main Distribution: Installation					
	3-4	Secondary Distribution: Installation					
	3-5	Flow Meter: Installation					
Others	4-1	NRW Reduction: Pipe Repairing					

Legend:
- Phase-1: Preparatory Work
- Phase-2: Construction
- Phase-3: Operation and Maintenance

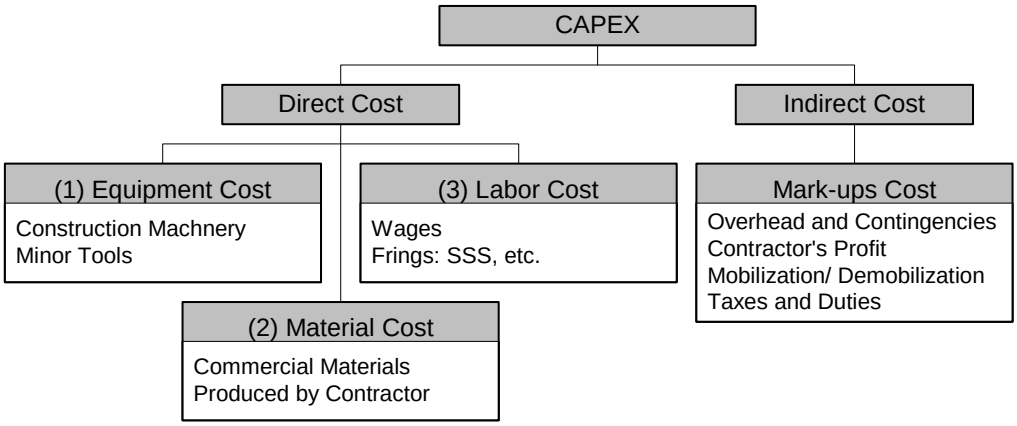

Figure II-20 LWUA Component of CAPEX Estimation

Basically, CAPEX was estimated by: (1) quotations, (2) past price schedules from MCWD contract or (3) past MCWD contract price. According to IMF, annual percentage change of gross domestic product was issued at 6.4%-2004, 4.9%-2005, 5.4%-2006, 6.3%-2007, 5.8%-2008 and average 5.8%. Therefore, merely 6% is given to this study.

CAPEX composition was re-classified into 9-categories to understand the portions of loan and self-financing. Table III-38 indicates cost of the priority projects.

(2) OPEX Estimation

Table III-39 indicates summary of OPEX.

Table III-38 CAPEX Estimation of the Priority Projects (million PHP)

Category		2011	2012	2013	2014	2015	Sum		Remarks
A	**Construction**	477	159	256	271	320	1,483	58.8 %	
B	Procurement	6	0	0	0	0	6	0.2 %	
C	Land Acquisition	91	62	0	0	0	153	6.1 %	MCWD estimation
D	Engineering Services (D/D)	64	26	27	32	0	149	5.9 %	A × 10 %
E	Engineering Services (S/V)	24	8	13	14	16	75	3.0 %	A × 5 %
F	Government's Formality	12	4	6	7	8	37	1.5 %	A × 2.5 %
G	**Physical Contingency**	34	13	15	16	17	95	3.8 %	(∑A to F) × 5 %
H	**Price Contingency**	106	41	48	51	54	300	11.9 %	(∑A to F) × 15.73 %
I	Value Added Tax	81	31	36	39	41	228	9.0 %	(∑A to F) × 12 %
Total of Annual Disbursement		894	344	402	429	456	2,525	100.0 %	
Breakdown Portion		Available from Loan					1,791	71.0 %	A + A × (G + H)
		Should be self-financing					734	29.0 %	Others

Note: Rate of H; Price Contingency was assumed at 15.73 % with annually 6 % and base year of 2013.

Table III-39 OPEX Estimation after the Priority Projects (million PHP)

Category		2007		2015		Remarks*
A	Human Cost	323	64.8 %	450	40.7 %	+ NRW staffs
B	Chemical Cost	5	1.1 %	12	1.1 %	+ chloride for new wells
C	Power Cost	60	12.1 %	133	12.1 %	+ desalination plant and wells
D	O/M Cost	28	5.7 %	75	6.8 %	+ NRW works
E	Other Cost	82	16.4 %	253	22.8 %	Training Cost, etc
Total		499		923		

Note: Comments on remarks are described other than price escalation.

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III-6 Financial Feasibility

III-6.1 Financial Improvement

In implementation of the suggested projects, an increase of the water rate is a necessary condition, in terms of both the financing capacity for the project cost and the financial feasibility of the project operation. As a result of the financial analysis of the prioritized projects, without water rate increase, financial conditions of MCWD are expected to worsen; therefore, financial improvements need to be taken simultaneously in implementation of the major water projects.

An implementable measure of water rate increase is considered, together with the restructuring of water rate. One approach for this revision is to reduce the gap of the cost coverage between the large-volume users and the small-volume users by referring the WDs' average water rate. As the effect, the water sales revenue would increase as a whole.

Following Table III-40 shows the expected effect of the water rate increase in the suggested cases: in case of at current water rate without projects (baseline), in case of water rate increase without projects, and in case of water rate increase with prioritized projects.

Table III-40 Effect of Water Rate Increase on Net Operating Income (million PHP)

Category	Projection					
	2010	2011	2012	2013	2014	2015
Baseline	1,116	1,116	1,116	1,116	1,116	1,116
- Without Projects	1,116	1,228	1,228	1,228	1,228	1,228
- Prioritized Projects	1,149	1,293	1,332	1,352	1,364	1,744

III-6.2 Cost Recovery

It is observed that without the water rate increase net income and cash flows are considered to decrease gradually as the projects proceed. In contrast, if the water rate increase accompanies implementation of the projects, the investment costs seem to be covered by the increased profitability of the projects and the water rate increase. As the effect, the financial stability would be considered to stabilize after 2015 if the water rate is increased.

(1) Projected Financial Conditions

Following figures in Table III-41 are the projected financial conditions of MCWD, assuming that it implements prioritized projects from 2011 through to 2015.

Table III-41 Net Income and Cash Flows: Prioritized Projects (million PHP)

Net Income and Cash Flow		Projection					
		2010	2011	2012	2013	2014	2015
Baseline	Net Income	248	217	225	209	189	173
	Increase in Funds Surplus	191	**-262**	**-21**	**-17**	**-59**	40
	Balance of Funds Surplus	933	670	649	632	574	614
Water Rate Increase	Net Income	248	336	350	339	322	344
	Increase in Funds Surplus	191	**-144**	104	113	75	211
	Balance of Funds Surplus	933	789	893	1,005	1,080	1,291

(2) Financial Ratio Analysis

Financial ratios for the baseline and the prioritized projects with/without water rate increase are also analyzed. Profitability of MCWD would largely be impaired if the prioritized projects are implemented without accompanying water rate increase, which would then negatively affects the solvency and financial stability of the entity as shown in Table III-42.

Table III-42 Financial Ratios: Prioritized Projects

Financial Ratios		Projection					
		2010	2011	2012	2013	2014	2015
Without water rate increase:	Solvency	0.59	0.74	0.69	0.70	0.71	0.75
	Financial Stability	0.53	0.50	0.52	0.53	0.53	0.52
	Profitability	0.22	0.18	0.19	0.17	0.15	0.11
After 10% water rate increase:	Solvency	0.59	0.75	0.73	0.68	0.64	0.60
	Financial Stability	0.53	0.50	0.52	0.54	0.56	0.58
	Profitability	0.22	0.26	0.26	0.25	0.24	0.20

(3) Simulation of Implementing Rest of the All Projects

Results of the simulation indicate that implantation of the rest of projects would worsen financial condition of MCWD due to the burden of debt service. Even if the water rate increase accompanies the projects, the increased expenses such as depreciation and interest lower the net income.

Based on the financial projection at the present, the longer project period of 10 years is considered better between these two cases. In the implementation of the rest of all projects, drawing up of an action plan with a new target after 2015 should be considered.

III-6.3 Project Evaluation

(1) Priority Project

The Financial Internal Rate of Return (FIRR) of the prioritized projects is comparatively low as shown in Table III-43. This is considered to happen because, the investment cost is large compared to the expected gross return from the investment, in its nature the projects. Incremental O/M expenses further lower the profitability, such as the material power cost required for operation of the desalination plant.

Table III-43 FIRR of the Prioritized Projects

Base Case	Without water rate increase	After 10% water rate increase
	8.6%	14.7%

(2) Sensitivity Analysis

Following Table III-44 shows the relation between the conceivable risk factors of the projects and their effects on the FIRR.

Table III-44 Sensitivity Analysis of the FIRR

Description	Without water rate increase	After 10 % water rate increase
Delay in completions of projects facilities -- 1 year	8.0 %	13.7 %
Delay in completions of projects facilities -- 2 years	7.2 %	12.2 %
Decrease in revenue due to competition with -- 1% decrease	7.9 %	14.1 %
Decrease in revenue due to competition with -- 2% decrease	7.2 %	13.5 %

(3) Prerequisite for the Implementation of Prioritized Projects

As it is indicated in the preceding analysis, financial feasibility of the prioritized projects assumes that the water rate increase accompanies with their implementation. Not only for securing the loan financing capacity, the prioritized projects are not considered financially feasible unless a sufficient increase in the water rate is made at an appropriate timing.

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Chapter-IV
Basic Plan on Urban Sanitation

IV-1 Needs Assessment

It is apparent that there are major problems with the current sanitation situation relating to;

- Limited infrastructure and access to services outside special economic zones and industrial areas,
- Low priority in the financing of the sector rendering unlikely achieving both national and international targets in the current scenario,
- Gaps in the planning and execution of strategies to increase coverage, and
- Overlapping of roles and responsibilities and weak sector coordination capacity to promote, implement and monitor sustainable solutions.

This has resulted in;

- Environmental Impacts related to degradation of water resources above and below ground level
- Health Impacts related to proliferation of water related diseases
- Socio-Economic Impacts

The resulting adverse impacts indicate that there is an urgent need for change in the provision of sanitation services and the sector.

In order to identify the requirements for achieving change, a needs assessment was carried out. The assessment was split into two distinct but interrelated parts to ensure a holistic approach to change across all levels of intervention.

- The Service Provision and System Performance
- The Institutional Framework Arrangements and Capacity

A Gap Analysis methodology was employed to identify the gaps or weaknesses of each part and provide recommendations. The results indicate that both areas lack the necessary capacity to support the provision of sanitation services in the project area. Weak institutional support and absence of existing facilities demand a coordinated intervention.

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IV-2 Basic Improvement Plan

The needs assessment indicates that two basic improvement plans must be developed in parallel to address both infrastructure and institutional needs and ensure the long term development of the sector and services.

(1) Facility Improvement Plan

In this plan, the available urban sanitation technologies are examined and high level strategic options for the project area are proposed. Critical factors such as existing sanitation practices, environmental and health conditions, land usage and service coverage were used to identify the most viable options.

The options developed are summarized in Table IV-01.

Table IV-01 Facility Improvement Plan Options

Options	Proposed Intervention	Target Location
Option-1: Septage Management	Implement Septage collection, transfer and treatment service	Areas 1, 3, 4, 5 and 6
Option-2: Septage Management and Environmental Improvements	As Option 2 plus improve raw water quality by: (a) On site systems	Areas 1, 2, 3, 4, 5 and 6
	(b) Hybrid systems	Areas 1, 3, 4, 5 and 6
Option-3: Centralized Sewerage System and Treatment Facilities	Install centralized sewerage system and treatment facility	Area 1 (Possibility for expansion to other areas 3, 4 and 5 in future)

Best international practice in this field indicates that not one solution, “one size fits all”, is appropriate for locations such as Metro Cebu. As such a combination of projects from all options will be prioritized based on the target location requirements.

(2) Institutional Improvement Plan

< Institutional Structure >

In this plan, a new institutional framework was proposed that could support the delivery of sanitation services of any nature. The framework addresses the major weaknesses of the sector by delineating the roles and responsibilities of the main sector stakeholders, and defining the required functions and outputs throughout the project lifecycle. The framework is presented in the flow chart shown in Figure IV-01.

< MCWD Organizational Structure >

Central to the delivery of the plan is the institutional strengthening of the sector as a whole and particularly the organizational restructuring and capacity development of MCWD to take on the role of service provider.

It is proposed that MCWD should emphasize its commitment to the new role by renaming its Water Operations group to WATSAN Operations and create the new Department of Wastewater and Septage Management with a Collection and Transfer Division and a Treatment Division.

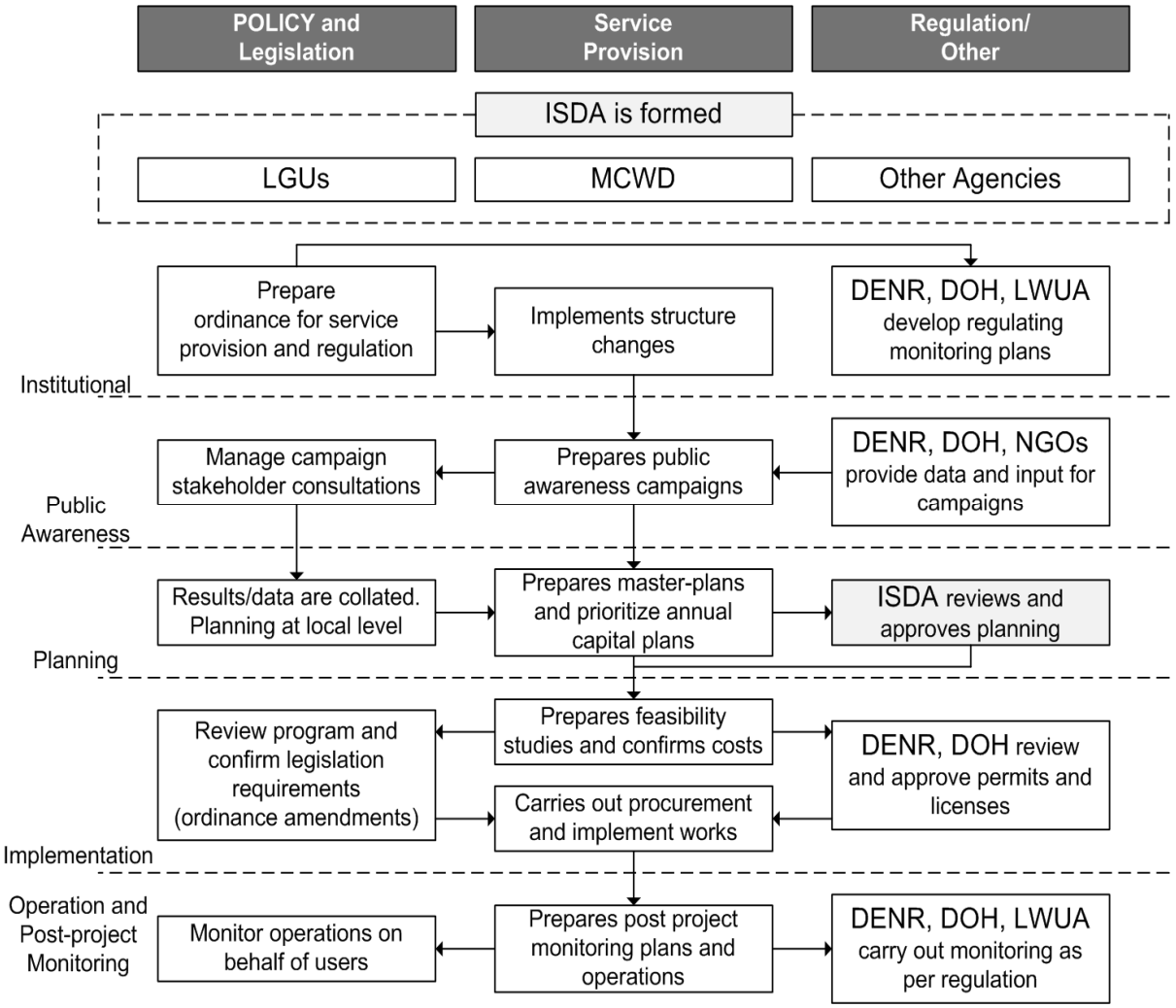

Figure IV-01 Institutional Framework Flow Chart

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IV-3 Prioritization on the Sanitation Projects

In order to realize the Basic Sanitation Plan and improve sanitation conditions in Metropolitan Cebu, specific interventions are proposed for implementation. In line with the methodology, the interventions are split into two components:

1) Zonal Project Requirements

This component includes

- Wastewater Management and
- Septage Management

2) Institutional Capacity Development

This component incorporates

- Technical assistance in institutional capacity building for the preparation of follow-up programs for wastewater and sanitation improvements and
- Carrying out public information campaigns on the benefits of sewerage and sanitation services, and on the best practices of proper disposal of sewage

This two level approach will ensure that projects for both infrastructure and institutional improvements are implemented to achieve effective, efficient and sustainable sanitation services. It is recommended that all projects identified under the Institutional Development component be implemented as a priority within the short term design horizon. These are critical to the development of the sector and the successful implementation and sustainable operation of the proposed infrastructure projects.

Implementation of the proposed priority projects must be carefully monitored and evaluated to ensure that not only the project outputs i.e. the physical works/programs have been completed but also the desired outcomes/ benefits have been achieved and the projects have a long lasting positive impact by improving the lives of the beneficiaries. Indicators must be established at the planning stages of any intervention to measure the value achieved and confirm alignment with the project objectives.

Table IV-02 presents the proposed priority projects and their locations are indicated in Figure IV-02, a summary of corresponding activities and an outline monitoring framework highlighting the short and long term benefits to be achieved.

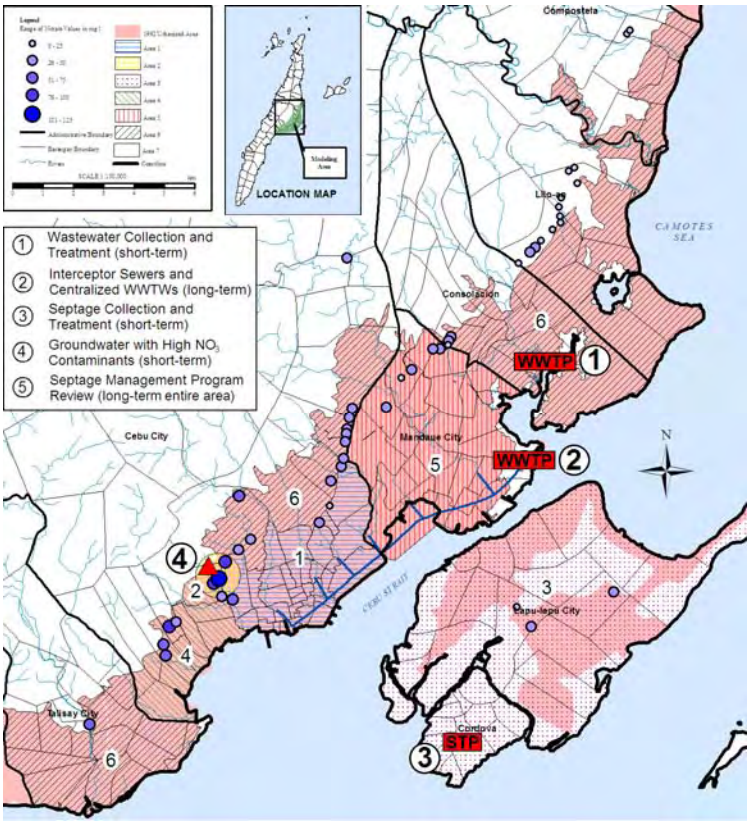

Figure IV-02 Location Map of Priority Projects

Table IV-02 Proposed Sanitation Priority Projects & Monitoring Framework

Inputs/ Priority Projects and Activities				Outputs	Outcome	Impact
Zonal Project Requirements	Wastewater Management	Pilot Project; Wastewater Collection and Treatment	• Shallow/small bore collection system • Anaerobic Baffle Reactor • Serving a municipal market with possible expansion for domestic and commercial coverage	Facilities designed, constructed and operated **Indicators:** 1) No of WWTP built 2) Achieving acceptable treated effluent standards in all new WWTP 3) Km of conventional and shallow sewers installed and/or drains rehabilitated	Increased access to sanitation infrastructure and coverage levels for MC **Indicators:** 1) % increase of population serviced 2) No of HHs connected to treatment facility 3) % increase of sanitation capital investment	Improved Environmental, Health and Economic Conditions of people living in Metropolitan Cebu **Indicators:** 1) % Reduction in BOD in receiving watercourses and Nitrate concentration in groundwater resources 2) Reduction in WRDs 3) No of low-income underserved settlements reduced
		Interceptor Sewers and Centralized WWTP	• Intercept DWF from main outfalls • Construct deep coastal interceptor to transfer effluent away from location • Construct WWTP			
	Septage Management	Septage Collection and Treatment	• Continue with existing plans for Pilot Septage Project in Cordova • Incorporate a septic tank improvement program			
		Improve groundwater quality in locations with High Nitrate concentrations	• Construct shallow sewers to carry effluent away from location (and provide decentralized treatment) • Develop well protection plans and strengthen relevant regulation			
		Septage Management Program Review	• Review Phase 2 of the proposed Septage Management Project in line with wastewater management plans	Long Term Septage Management program updated in line with wastewater management plans	Implementation of reviewed strategy	
Institutional Capacity Development	Technical Assistance	Institutional Strengthening; Sector Wide	• Policy and Strategy • Regulation and Legislation • Manuals and Guidelines • Pro poor Sanitation Services	Efficient, effective urban sanitation sector developed. **Indicators:** 1) Restructuring completed by Dec 20XX 2) All capacity building activities proposed under project achieved by Dec 20XX	Improved, affordable and sustainable sanitation services in MC **Indicators:** 1) % reduction in annualized cost/HH 2) Sustainable and socially acceptable tariff levels and collection mechanisms (set standards) 3) No of new connections per year 4) % improvement in operational performance.	
		Institutional and organizational capacity development; MCWD	• Support organizational restructuring • Planning and Asset Management • Business Financial and Accounting • Training Programs	Governance, institutional and operational capacity strengthened for MCWD **Indicators:** 1) Detailed sector capacity development program and assessment of training needs completed by Dec 20XX 2) All activities proposed under project completed by Dec 20XX		
	Public Awareness	Public Awareness Campaigns	• Support the development of a short and long term strategy for Public Awareness • Carry out campaigns	Improved awareness of health and sanitation and increased willingness to connect **Indicators:** 1) Septage Management campaign completed and household survey results confirm output 2) Long term strategy developed by Dec 20XX 3) CPM detailed training assessment completed by Dec 20XX		
		Training on Community Participatory Methods (CPM)	• FGDs • Stakeholder Consultations • Stakeholder and Activity mapping exercises • Field friendly manuals and information posters • Other			

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IV-4 Introduction of Progressive Activities by LGUs

Two case studies of Septage and Wastewater Management Service Provision were reviewed as part of this study;

- Dumaguete LGU and WD: Septage Management Project and
- MWSS and MWCI: The Metropolitan Manila (MM) Experience.

Experts carried out field visits to review institutional and implementation arrangements and identify lessons learned that could be applicable to future projects in Metropolitan Cebu. The findings are summarized as follows:

(1) Dumaguete LGU and WD: Septage Management Project Lessons Learned

- Public Awareness Campaigns and Community Participation
  - Over 50 Public Hearings required
  - Implementation of Pilot Project to raise awareness and increase technical/ operation capacity
  - 6 years of campaigning and continuing…
- Political Commitment and Legislation
  - Continuous lobbying of Local Government is required to raise profile of sanitation
  - Ordinance approval is a time consuming process (3-years)
- 1-LGU and 1-WD in Dumaguete vs 8-LGUs and 1-WD in Metropolitan Cebu
  - Clustering of LGUs increases the challenge
  - Formation of JVs could be complicated
  - Larger coverage area and needs
- Comprehensive Sanitation solution
  - Septage Management and
  - Raw water quality improvement (Pilot, Septic Tank improvement)

(2) MWSS/ MWCI: The Metro Manila (MM) Experience Lessons Learned

- Legislation and Institutional Arrangements
  - Strengthen legislative support for most competent service provider (outside MM)
  - Establish clears roles and lines of responsibilities (avoid overlapping)
  - Strengthen coordination of stakeholders
- Regulation
  - Clear delineation of service performance, environmental and health standards and regulatory responsibilities
  - Adequate monitoring and enforcement of the above standards
- Planning
  - Development of Master Plans with long term horizon and inbuilt flexibility
  - Development of capital investment plans based on Master Plans
- Financing and Cost Recovery
  - Access to low cost capital, intelligent financial arrangements (public private, pain-gain, cross-subsidization other)
  - Appropriate tariff structure aligned with long term strategy

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Chapter-V Recommendations

V-1 Sectoral and Administrative Improvement

V-1.1 Legal and Regulation

(1) Water Code

There is a need to conduct a comprehensive review of all existing water-related laws/ legal issuances for the purpose of updating the IRR or amending the Water Code. The former could be done through an EO while the latter will need an act of Congress. Should the latter option be adopted, the creation of an apex body that will serve as a strong regulatory body for IWRM should already be incorporated therein.

(2) Island Water Resources Management

It is recommended zealously that groundwater development outside of MCWD franchise area shall be promoted to meet the projected demand as a most feasible choice. Stakeholders including developers and regulators are anticipated to make decisions urgently for the creation of the system of Island Water Resources Management. It will be the first case in the Philippines, when improvement of groundwater resources management in a water crisis area is achieved well. The system should be part of the harmonized Provincial Resource Development Plan to be prepared by the Provincial Water Resource Authority of the Province of Cebu.

V-1.2 Proposed Institutional Framework

The Philippine Government should provide the enabling environment to pursue IWRM which is at present a worldwide recognized process of promoting coordinated development and management of water, land and related resources in river basins, to maximize the economic benefits and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. At the national level, this includes an effective water policy, updated legislation, and conducive financing and incentive structures. At the river basin level, the following are needed:

(a) a capable river basin organization,
(b) clear institutional roles and participation, and
(c) river basin planning and monitoring system involving all the stakeholders.

An institutional structure with the capacity – legal, technical and administrative, to effectively address important water issues would be necessary. These are;

(a) cost sharing and recovery;
(b) water use rights; and,
(c) clear definition of responsibilities

It should have the competence to implement IWRM as planned under the Medium-Term Philippine Development Plan.

It is proposed that a national water apex body with the following functions be created:

- Preparation of the Master Plan on IWRM consistent with and in support of the MTPDP,
- Formulation and adoption of corresponding policies and guidelines as well as enforcement of rules and regulations to implement the Master Plan,
- Regulation and coordination of all water development activities in the country,
- Coordination and monitoring of water-related functions, plans, programs, projects and activities of government agencies including local water district to ensure consistency with the Master Plan,
- Collection of water data and maintenance of the National Water Information System, and
- Arbitration and resolution of conflicts in the water sector.

The national apex body should be sufficiently clothed with clear legal regulatory authority and the supporting organizational structure, manpower and financial and other logistics to perform its functions, implement policies and enforce rules and regulations in the water sector.

(1) The Short-term

NWRB may be considered as the most logical candidate to be the national water apex body invoking its mandate as "the government coordinating and regulating body for all water resources related development." Immediate actions would be possible with only the use of the administrative power and prerogative of the DENR Secretary.

The prescribed Water Resources Regional Councils and the Water Operations Offices should immediately be established in all DENR regional offices utilizing the existing manpower complement and resources of DENR. This is provided for by EO 123 Section-5. The WAOs shall serve as NWRB regional units. Trainings and capability building of these regional units should immediately follow for the decentralization of NWRB regulatory functions, (including regulation of water tariffs of water districts), to pursue IWRM.

(2) The Medium-term

In the medium- and long-terms, further study will be needed to effectively transform NWRB into the national water apex body (or create an entirely new organization or a Department of Water). What is important is to give this apex body the stature and authority to enjoin cooperation from the various water stakeholders. A new law would have to be passed consolidating into one body the fragmented functions, authorities and responsibilities on water management and development while at the same time updating the provisions of the old ones.

At the Metropolitan Cebu/ local level, there is a need to unify the development and regulatory functions over groundwater into one single local apex body to function as the local counterpart of NWRB. This body should likewise be responsible for monitoring and evaluation of the groundwater environment.

It should have as wide representations as possible from identified stakeholders of groundwater: national government agencies like DOH, LWUA, DENR, NWRB, DPWH, DTI, NIA, etc.; provincial, city and municipal LGUs; MCWD and other water providers; sub-division developers and homeowners; business and industries; service providers to the water and sanitation sector; academe; and, NGOs and NPOs.

The PWRA may be considered a good candidate to serve as the local apex body. However, for the PWRA to function effectively as such, it should have financial, personnel and other logistical support for its operations. These may come from regular appropriations from Cebu provincial government and contributions from cooperating LGUs and other stakeholders.

V-1.3 Groundwater Conservation Plan

The most dissolved ingredients in raw water excluding some organic matters can not be removed by the general treatment process of slow or rapid sand filtration. Accordingly, the normal treated water with dissolved substances is supplied to users directly, notwithstanding its effects on human health. Therefore, it is imperative to conserve potable water sources should advanced treatment process is not feasible to apply.

From this point of view, security and conservation of safe water resources are required as important responsibility of the water utility company. The following major issues for groundwater conservation are identified.

- Water Quality: Contamination/ Pollution
- Water Quantity: Saltwater Intrusion (subsidence is unknown because of none observation)

(1) Water Quality Issue

As a stop-gap measure of user side, the following design standard of well structures is proposed.

- ✓ protection seal using permanent conductor pipes with cement milk around well point shall be installed, and
- ✓ well screen portion shall be located below sea level.

(2) Water Quantity Issue

The promotion of inlet (recharge) and the control of outlet (extraction) will be examined.

< Promotion of Groundwater Recharge >

Effective measures to increase recharge rate are:

- ✓ Re-forestation
- ✓ Permeable Paving
- ✓ Infiltration Box

< Control of Groundwater Extraction >

The aim of the groundwater regulation is to maintain the groundwater environment with recovery of aggravated saltwater intrusion. Subject of regulation shall be limited to the mass of well intake for industrial users even though with or without water rights, because location of such wells can not be removed easily.

On the other hand, groundwater use of water supply providers including MCWD shall be regulated its extraction with due consideration of groundwater environment using the Cebu-GWM-09 model and of water supply responsibility to industrial users.

Private well users for domestic purpose are not included in the subject regulation. Complicated formalities may be repealed. Instead of this process change, regulator places users or constrictors under obligation to submit the initial reporting (need penalty).

Administration and regulator shall improve the present institutions with detailed IRR. The action plan shall be prepared with participation of stakeholders related to this problem.

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V-2 MCWD Technical Improvement

V-2.1 Comprehensive Measures for Sustainable Water Supply

(1) Gravity Water Supply System

Presently, about 38% of water sources volume has been fed to the distribution pipeline directory. One of system improvement concepts is to convert the gravity water supply system. Essentially, gravity water supply system with reservoir has following roles among the entire system. Upon completion of the requirements in this improvement plan, the volume ratio of direct feeding water becomes 22% of total production amount.

- water buffer from the daily supply fluctuation, and
- reduce the risk of suspended water supply when power source is cut-off.

Several advantages can be expected when gravity system is applied.

- the water supply pressure at any terminal can be maintained within designed range,
- the contamination risk in distribution can be reduced because of non-negative pressure,
- the life of pipeline will longer because of non-pressure fluctuation, and
- the calcium incrustation can be reduced because of slow flow velocity in the distribution.

(2) Distribution Block Supply System

Presently, complex water supply system disturbs the operating of water utility. Most serious problem is none availability of water balance, especially flow information for NRW reduction. DMAs are established currently. However such system does not cover the entire service area and vales and meters for the said system become the factor of flow obstruction. Flow measurement in each DMA can be done when NRW reduction work is planned.

Initially, water balance shall be monitored by each distribution block. Inflow volume into each network block can be measured using the flow meter to be installed at the outlet point of the main reservoirs and direct-feeding pump outlet points for the meantime. Proposed block boundary is almost the same to administrative boundaries except for Cebu city and each LGU area is divided into the billing zones.

In the future, water intake, transmission, storage, distribution, meter reading, billing and tariff collecting should be the same line of water quantity within the same basic unit for GIS and MIS establishment. For the sector monitoring and planning purposes, LGUs boundaries shall be used for the distribution block supply system because the population statistics are available.

(3) SCADA System

As to the data control, mini-SCADA system is on going between groundwater abstraction wells and feeding reservoirs at Lagtang and Tisa site. After enlarging this system to the entire 5 reservoir sites (Lagtang, Tisa, Talamban, Casili and Mactan) which are called as the local control center (LCC). These data is to be transmitted to the central control center (CCC) at Talamban site. Additionally, the information of water quality from laboratory and maintenance record from repair work is easily accessible. Figure V-01 shows the basic concept of flow control.

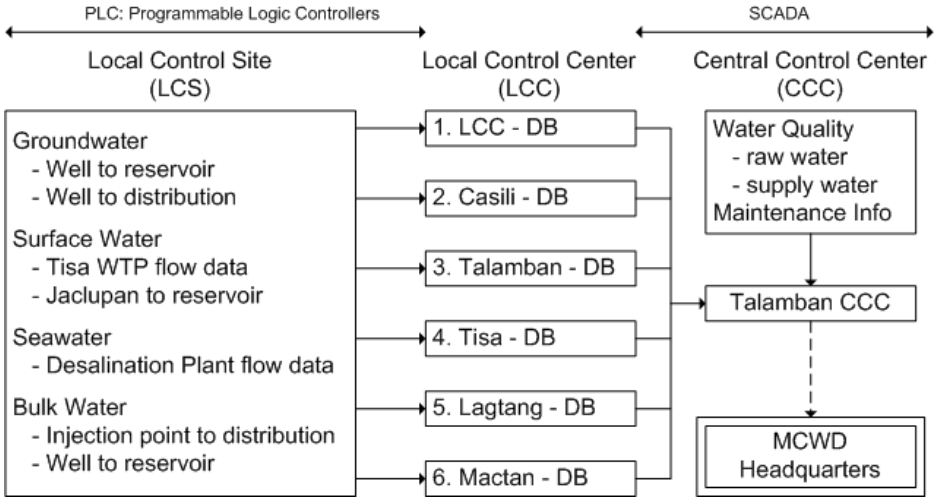


Figure V-01 Data Acquisition Flow

(4) NRW Reduction Work using DMA

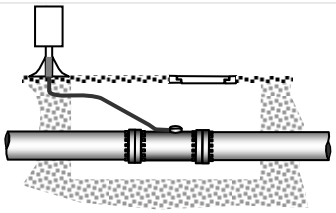
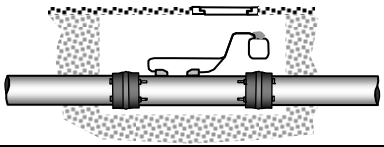
Main issues of the existing DMA are as follows.

- Construction of entire DMA system is too costly. Especially electro magnetic flow meter is expensive.
- Closed valve to make DMA or to convert to leaf system may be the obstacles to interrupt water pressure equalization.
- Covering area of one DMA is small and many DMAs are left to be constructed.

For the future development, cheaper and simpler DMA is required. One proposal is the development of temporal DMA with only chambers at inflow and outflow point of one DMA, in which pipe is exposed to be measured its flow with portable ultrasonic flow meter at convenience occasion without any fixed meter installation.

Although total flow in accordance with consumed volume for one month of billing period is not measured, daily fluctuation is surveyed for the detection and estimation of leakage volume. Table V-01 indicates their advantage and disadvantage.

Table V-01 Comparison of DMA System

Items	On-going Leaf System	Proposed System
Outline	Fixed System: Fixed flow meter (electro magnetic) at inlet point and stop valve at end point.	Loose System: Only the chamber is installed at the inlet and outlet point of the DMA, where flow is measured anytime necessary with portable meter (ultrasonic).
		
Advantage and Disadvantage	• Not only daily fluctuation but monthly and yearly accumulative flow can be measured. NRW can be estimated easily. • Initial cost is expensive.	• Leakage volume can be estimated by measuring only nighttime flow. • Due to the number of staff and portable meter, number of DMA to be measured is limited.

V-2.2 Technical Guideline for Groundwater Development

The guideline for groundwater development should be composed of technical and institutional portions. However, this guideline is concentrated to technical portion and contains following parts.

- Water Balance in Well Field: (1) site selection and (2) facility operation
- Performance Indicator: (1) well efficiency and (2) sand contents
- Monitoring and Evaluation: (1) water balance and (2) performance indicator

(1) Water Balance in Well Field

< Site Selection >

Optimal well arrangement for groundwater potential study was concluded in the model depending on the location as shown in Table V-02.

Table V-02 Input Criteria on Optimal Wells in the Cebu-GWM-09

Island	Particularity (well field)	Interval (m)	Elevation (masl)	SWL (masl)	Intake Portion (mbsl)
Cebu	Well fields are formed by two rows lineally along hilly side.	200	70	30 to 35 (Sep-09)	0 to 50
Mactan	Well field is located in the central portion of island (southern part of Mactan International Airport).	200 to 500	10	3 to 5 (Jun-09)	0 to 3

< Facility Operation >

Following operation standards are guided for adequate groundwater development.

* Cebu Island: water level at 20 masl or higher (10 m drawdown)

(2) Performance Indicator

Functional diagnosis has been conducted mostly for deterioration of well yield. Safety yield shall be evaluated by following three viewpoints.

* Drawdown shall be controlled at maximum 10m with due consideration of less incrustation.
* Inlet velocity from well screen shall not exceed 1 cm/sec because of filtration design.
* Intake amount shall not affect hydraulic balance for avoidance of groundwater level depreciation.

< Well Efficiency >

Following solutions of simultaneous equations are well coefficients B and C.

- ✓ $\Sigma(sw) = B\Sigma(Q) + C\Sigma(Q^2)$
- ✓ $\Sigma(sw/Q) = B\Sigma(N) + C\Sigma(Q)$

< Sand Contents >

Excessive sand contents make the life of well and pump shorter. But it is impossible to make zero while groundwater pumping from the tube well. This test will normally be conducted every 5 years. Design criteria on the solid contents are:

- ✓ Permissive: 50 mg/L pump damage limitation
- ✓ Allowable: 5 mg/L pump abrasion limitation

(3) Monitoring and Evaluation

Groundwater monitoring shall be referred to groundwater regulatory operation. In this section, water balance and performance indicators are the subjects.

< Water Balance >

Monitoring results of MCWD wells will be used for groundwater development and conservation. Water sources availability of MCWD still depends on groundwater development. Therefore, observation records in Table V-03 shall be accumulated and analyzed annually.

Table V-03 Monitoring Well and Parameters

Description		Monitoring or Stand-by Wells	Production Well
Location		11 wells	∗ All Production Well
Parameter	Monthly	∗ SWL (atmospheric pressure) by elevation	∗ Water Quality Cl, NO_3, Ca by pumping water sampling ∗ Discharge Record (monthly average, daily maximum) ∗ PWL (atmospheric pressure) by elevation
	Quarterly	∗ Water Quality EC, Cl, NO_3, TDS/ TH (interface of freshwater and saltwater) by different depths	∗ SWL (atmospheric pressure) by elevation: it shall be measured after 8 hours pump stopped
	Annually	∗ Water Quality NO_3 (Mactan only) by depth	∗ none

Note: Monitoring plan shall be reviewed every 5 years.

< Individual Well >

PIs at individual wells will be accumulated from now on. Following are judgment criteria on planning of well rehabilitation.

- ✓ Well Efficiency < 50 %
- ✓ Sand Contents > 50 mg/L

V-2.3 The Cebu-GWM-09 Improvement Plan

Following are recommended activities of data accumulation and model improvement in future.

(1) Data Accumulation

- ∗ Well Inventory: Database on abstraction and water quality from Non-MCWD wells
  Hydrogeological information in outside of MCWD franchise area
- ∗ Monitoring Wells: 11 sites are nominated as fixed monitoring among MCWD wells
  water quality of Cl, NO_3 and interface freshwater and seawater
  water level of SWL and PWL (well loss)
- ∗ Investigation: Fluid Density (PHP95,000) and Borehole Logger (PHP2,925,000)
  to be procured, the cost is quoted without exporting and tax fee
  Seismic Prospecting for conduit flow (PHP6,500,000)
  to be contracted out (surveyor is available in the Philippines)

(2) Model Improvement

- ∗ Investigated Data: Abstraction and Water Quality from Non-MCWD Wells
  Fluid Densities of Fresh to Sea Water with TDS

Geological Boundary by Gamma Log at existing wells
Confining Layer by Gamma Log at existing wells
Conduit Flow by Seismic Prospecting at San Vicente Well Field

* Observation Data: SWL/ PWL and Cl at MCWD Wells
Interface Depth at MCWD Monitoring Wells
* Data Verification: Application of Regional Model
Review the Water Budgets (both Water Remind and JICA Study)
* Performance: Sensitivity Analysis and Post Audit (2011 until 2015)

Parameters shown in Table V-04 will be replaced for re-calibration of the Cebu-GWM-09.

Table V-04 Comparison of Input Data

Initial Model			Improved Model
Parameter of Weak Points		Applied Method	
Non-MCWD Wells		Assumed	Amount being identified
Fluid Density		Assumed	Actual densities
Aquifer Assignment	Geological Boundary	Supposed with its dips	Truth boundaries of geology and confining layers
	Confining Layer	Supposed below 20 mbsl	
	Conduit Flow	As porous media	identified Fracture zones
Observation Data	SWL-PWL	Not verified yet.	Monitoring with pumping rate.
	Interface Depth	7 test wells by JICA	Interface depth in Butuanon and Cebu river plains
	Chloride	Trend in fixed well was reflected.	

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V-3 MCWD Managerial Improvement

V-3.1 Rationalization and Reorganization

It is recommended that MCWD follows the rationalization parameters and processes prescribed by EO-366. It should start with the creation of the change management team (CMT) who will be responsible for the change management within the organization. The engagement of a change management expert to guide and advise the CMT should also be considered.

An agreement to a more sensible time-frame to implement the MCWD reorganization has to be forged among all the stakeholders of the change. Quick change may prevent proper consultation and involvement and may eventually lead to difficulties that take time to resolve. Consultations will give both management and staff better understanding of the implications and feasibility of the proposed reorganization.

The proposed MCWD organizational structure and recommended general functions of the groups are shown in Figure V-02 and Table V-05.

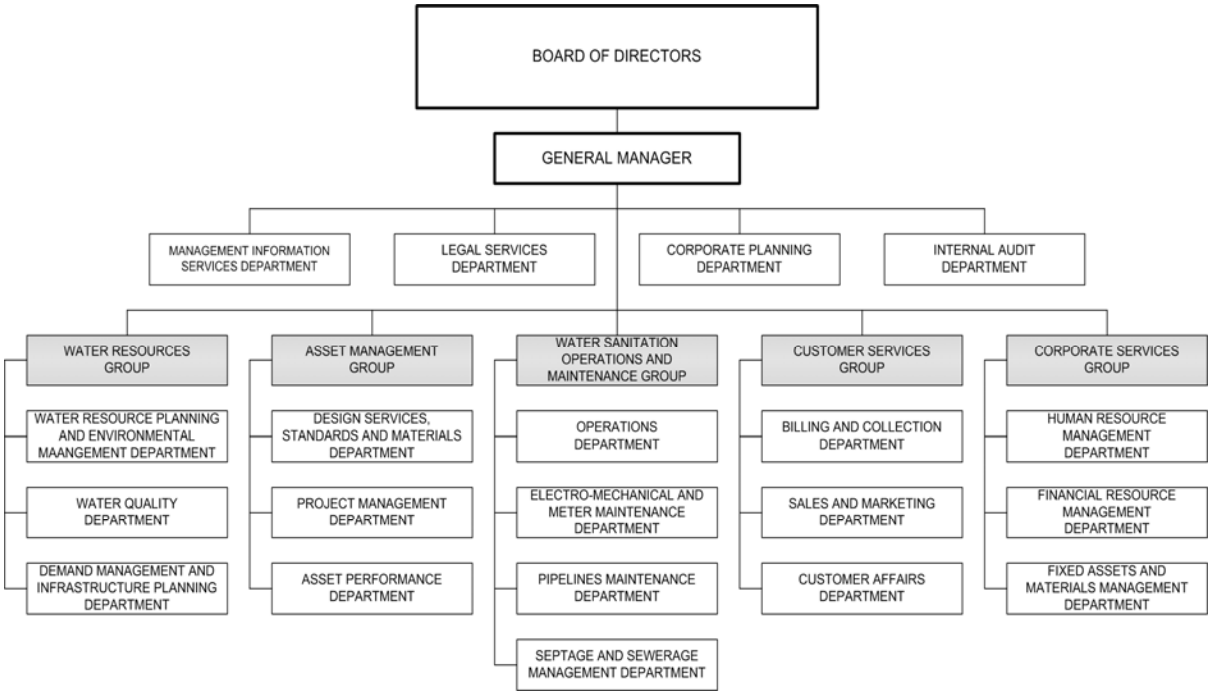

Figure V-02 Proposed MCWD Organizational Structure

The recommendation is generally in line with the CPD-proposal but with certain suggested modifications. It features a more streamlined functions and loads of various units and groups, addresses NRW reduction concern and gives due importance to the function of consumer marketing. Additionally, it considers the possibility of business outsourcing or public-private partnerships.

The existing 4 staff departments with the Office of the General Manager will be retained but with modified functions and activities. Under the new structure, the salient points are as follows. In addition to the CPD-proposed 2 divisions of (a) Strategic Planning and (b) Monitoring and Continual Improvement divisions, a separate division for NRW planning, monitoring and evaluation shall be included. This is in consideration of the fact that NRW performance is a corporate KRA and the overall responsibility of the General Manager.

Table V-05 Proposed Functions of MCWD Groups

GROUP/ Departments	Group Functions
OFFICE OF THE GENERAL MANAGER • Corporate Planning • Internal Audit • Legal Services • Management Information Services	Responsible for (a) providing the strategic direction and overall management guidance in the preparation and implementation of corporate strategic and marketing plans and programs; (b) monitoring and evaluation of overall corporate performance and those of individual groups/units with the use of KRAs and KPIs; (c) planning and implementation of IT applications support plans and data base maintenance to meet the needs for automation of the different units within and MCWD as a whole; (d) ensuring the adequacy and effectiveness of internal controls and quality of performance of the organization; (e) providing the legal support needs of MCWD and its various units.
WATER RESOURCES • Water Resource Planning and Environmental Mgt. • Water Quality • Demand Management and Infrastructure Planning	Responsibilities include: (a) identification, exploration and development of new ground and surface water sources including management of stakeholders; (b) monitoring, evaluation and protection from degradation of ground and surface water sources and MCWD wells; (c) purchase and monitoring of bulk water supply and contracts; (d) establishment of hydrometric and hydrologic data and monitoring systems for Central Cebu; (e) setting evaluation criteria and issuance of permit for private well drilling; (f) implementation of Philippine environmental laws; (g) assurance of MCWD water quality; (h) demand management and corresponding infrastructure planning.
ASSET MANAGEMENT • Design Services Standards and Materials • Project Management • Asset Performance	Responsible for (a) the development of detailed project/systems design and evaluation criteria, (b) technical standards for materials and equipment, (c) contracting out or actual construction/project implementation, (d) technical supervision and technical evaluation of finished projects, (e) development and maintenance of asset database and GIS, and (f) preparation and monitoring of the MCWD asset renewal program.
WATER OPERATIONS AND MAINTENANCE • Operations • Electro-Mechanical and Meter Maintenance • Pipelines Maintenance • Septage and Sewerage Management	Responsible for (a) preparation, implementation and monitoring of the production and distribution plans and strategies; (b) preventive and corrective maintenance and repairs of pumps and production facilities/equipment, meters and fire hydrants; (c) meter testing and monitoring of meter accuracy; (d) leak detection and repairs (e) road restoration; (f) fabrication of fittings; (g) preparation, implementation and monitoring of MCWD plans, policies and strategies for its septage and sewerage service operation which includes septic tank desludging and septage treatment design and operation.
CUSTOMER SERVICES • Billing and Collection • Sales and Marketing • Customer Affairs	Responsible for the implementation of (a) billing and collection policies (meter reading, billing - preparation, distribution, collection analysis and adjustments); (b) maintenance of customer database; (c) planning, implementation and monitoring of sales, marketing and retention strategies for MCWD consumers; and, (d) customer relations – customer queries, complaints and customer surveys for feedbacks
CORPORATE SERVICES • Human Resource Mgt. • Financial Resource Mgt. • Fixed Assets and Materials Management	Responsible for: (a) recruitment, manpower development and attendant personnel services including the implementation of OHSAS (occupational health and safety advisory services) and payroll processing; (b) overall financial management - treasury, budgeting, cash/investment management, fund sourcing, expenses/disbursements control , accounting and financial reporting; and (c) fixed assets and materials management including assets database and inventory control, maintenance and physical security.

The MIS shall be retained to provide the timely and accurate information/ data requirements for performance monitoring in addition to its regular functions of servicing the computerized system and

processing needs of the whole organization. What is important is for the users of information to define their specific needs and for the MIS to enhance its in-house capability to adequately address these needs.

The IA functions should be in accordance with the provisions of Administrative Order No.278. It shall assist MCWD management achieve an efficient and effective fiscal administration and performance of agency affairs and functions. It shall perform staff functions encompassing the examination and evaluation of the adequacy and effectiveness of internal controls and the quality of performance. The scope of internal audit work shall include the review of risk management procedures, internal control systems, information systems and governance processes.

With regards to the regrouping/rationalization of the 5 non-staff departments, the general groupings of departments are considered adequate to meet the present needs of MCWD. The delivery of sewerage services which should be one of the major functions of MCWD and the need to institutionalize GIS as an important management tool to a more efficient operation should be given due attention and consideration in the design of the new organizational structure.

The final detailed composition of each group and department will evolve as a result of the recommended change management consultation process. Nonetheless, the following are proposed:

- Inclusion of a full personnel complement for a Septage and Sewerage Department in the proposal for the creation of new positions. Request for additional positions after the approval of the reorganization plan may be more difficult.
- Regular rotation or shuffling of meter readers' geographic assignments to prevent any possible collusion with customers as the former becomes too familiar with the latter. Or, consider the operational and financial feasibility of outsourcing this particular activity.
- Assurance that check and balance will be present in the assignment of functions/ tasks to various units to minimize the incidence of internal collusion and manipulation of performance measurement results.

The corresponding updating of MCWD Operational Manuals and Standards responsive to the needs of the new organizational structure and defined processes should follow immediately. The training and capability building of personnel on the new regime is imperative.

Outsourcing some of MCWD's non-core functions and the maintenance and operation of part of MCWD's facilities is an encouraging move towards the development of PPP. This will allow MCWD to utilize private funds and efficient private sector business know-how in a symbiotic manner beneficial to both parties.

V-3.2 Management Information System (MIS)

MCWD should evaluate and decide on the approach to MCWD data base design. Water database may be by "function" Information parameters for water may be by function or by "inputs" and "outputs" classification or by "organization" or other classification system it deems to be most suitable for its needs. Similar database are also needed for information systems for wastewater management.

In as much as MIS is the system of using the data base and serves as the linkage that can help managers in different parts of an organization communicate, it is recommended for MCWD to determine and agree on who needs the information (user), the kind of information (what) s/he needs to make decisions, how should the information be presented (report format) and how often (frequency of reporting).

The MIS should be designed in such a way that it will be able to screen out the best of all information available and present the most useful information to decision makers. The criteria on usefulness includes: accuracy, form, origin, comprehensiveness, frequency, and timeliness.

The framework and extensive use of GIS for water supply and sanitation asset maintenance and management should be facilitated. Technical assistance for this should be explored.

The outsourcing or subcontracting of some technical services such as systems software development and/ or customization as well as the corresponding application trainings should be considered. This is in the light of MCWD losing highly trained MIS technical personnel to private businesses who can afford to offer much better compensation package and benefits than those allowed under the government's salary standardization law.

The use of PIs in identifying problems, setting targets, and achieving better management is recommended. PIs will enable MCWD to objectively understand the actual status of and changes in its own operations and compare it with other waterworks. This will help determine needed future improvements in operation like upgrading service standards, increasing operational efficiency and strengthening management systems. PI-based evaluation should be started and institutionalized in the organization. It may be a good idea to benchmark or compare these PIs with the "Guidelines for Waterworks (JWWA Q100)" developed by Japan as their domestic standards.

MCWD should continue to use benchmarking as a useful tool in measuring its performance vis-à-vis other LWDs. As a member of the South East Asian Water Utilities Network (SEAWUN), it has access to the benchmark data base for 7 water utilities in South East Asia.

V-3.3 Continued Provision of Safe Water Supply to the Poor

The following institutional and operational measures are recommended to enable MCWD to continue providing water services to the poor without prejudice to its corporate financial viability.

MCWD should design and implement an institutional development program to get LGUs-concerned assume an active role is assuring the availability of safe water to the communities within its territorial jurisdiction as part of its mandate under the Local Government Code. A partnership program between MCWD and LGUs should be forged wherein the latter will take care of the following aspects, among others:

(a) provision of mechanisms for conflict resolution and promoting equity within CWS;
(b) provision of sustainable livelihoods for the community – to facilitate water users' "graduation" to higher water service level;
(c) assisting MCWD come up with the proper definition of the "poor" who should benefit from CWS service;
(d) provision of logistical support for the CWS' coverage expansion;
(e) assisting MCWD in the conduct of community trainings; and
(f) assisting MCWD in monitoring prices to consumer as well as pilferages.

On the other hand, MCWD should design and conduct trainings:

(a) for its CWS franchisees on MCWD policies and procedures, monitoring and preventing water pilferage and possible remedial measures, including legal actions; and
(b) for the CWS subscribers on MCWD policies and procedures, the benefits and corresponding responsibilities of connecting to the communal water system.

The recommended operational measures include:

(a) regular monitoring of water prices through interviews with consumers and/ or consultation with the LGU to ensure compliance with MCWD-prescribed selling prices;
(b) provision of training to CWS on the prevention, calculation and pricing of system loss or NRW;
(c) installation of appropriate and enough number of faucets in terms of distance and number of households covered;
(d) regular monitoring of selling prices, water users, situation of usage and convenience and CWS operation status;
(e) training of communities to create a receptive environment and take collective action for the adoption of improved water and sanitation practices;
(f) regular monitoring to determine illegal direct connection from main communal faucet and development of appropriate systems for warnings and penalizing offenders with fines and imprisonment, in accordance with the provisions of the law on water theft;
(g) provision of specific guidelines to protect the franchisee from pilferage;
(h) training of franchisees on monitoring and preventing water pilferage and legal actions to be taken by the franchisee in case of such event; and
(i) evaluation of the new CWS system after one or two years.

V-3.4 Water Saving

It is recommended to begin the countermeasure which can get user's understanding and cooperation to enable them to cope with increased demand in the near future. The sufficient understanding between the administration and the people is necessary for the introduction because this legislation is taken as "the intervention to the individual right of the administration" as well.

But, even if the measures are imposed on the user, the latter is also benefited (reducing the water tariff and reducing water consumption), and save-packing and silky-shower are often accepted.

< Active Correspondence by MCWD >

MCWD needs to promote a water-saving countermeasure carefully assessing the interests or benefits of customers. It must enrich public relations to provide water users information on available water-saving instruments/ devices.

< Active Correspondence by LGUs and Residents >

Apart from a compulsory water-saving countermeasure through regulations, a community participatory approach, guided by the administration, seems more sustainable to enrich the water saving consciousness citizens.

V-3.5 Introduction of JWWA-PIs System (Q-100)

(1) Effectiveness of PIs Analysis and Evaluation

Management standard for water supply service was recognized as ISO standard in Dec-2007. It is important that the water supply utility shall be analyzed and evaluated using the PIs that had been objectively defined and authorized based on ISO standards.

To date, the funding agency or the water supply utility have been using the PIs developed according to their own scale or criteria. Although common scale and criteria were created, they were only qualitative PIs (Performance Indicators). Presently, the water supply utility will be given international water works recognition only when it uses the ISO-24512 PIs.

The following are the expected benefits of "PI Analysis and Evaluation".

- Numerical Definition of Issues
- Common Understanding among the Stakeholders using PIs
- Establishment of Tendency Analysis and Target using Definite Values
- Verifiable Evaluation and Analysis of Project Progress

(2) Viewpoints of PIs System

PIs analysis using JWWA Q-100 are to define the viewpoints as shown in Table V-06.

Table V-06 Viewpoints for PIs Analysis

Category	Viewpoints
(1) Reliability	Supply of safe and comfortable water for every user? Water Resources Conservation, Water Quality Control, etc.
(2) Stability	Stable supply of water at anytime anywhere? Water Supply Hours/ Pressure, Facility Preservation, Risk Management, etc.
(3) Sustainability	Sustainable and stable supply of safe water? Financial Foundation, Technical Succession/ Evolution, Service Level, etc.
(4) Environment	Contribute to environmental protection? Energy Consumption, Efficiently Use, etc.
(5) Management	Appropriate O&M of drinking water supply system? Enterprise Management, Facility O&M

Note: Above categories do not include the category of "International Corporation" according to JWWA Q-100.

(3) Consideration of PIs System Establishment

MCWD should consider the following improvement points for creation of new PIs system.

- Selection of suitable PIs for Evaluation
- Considerable Viewpoints for PI Evaluation Methodology
- Additional PI or Change Definition of PI according to Institutional Background

(4) MIS with PIs

MIS is not only to estimate PIs but also to manage and control the primary data with definition, accuracy and reliability. Therefore, MIS with PIs would strengthen the relationships of internal MCWD organizations. Additionally, the PIs are very useful to communicate between the contractor such as WTP operation, meter reading, etc. without misunderstanding.

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