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-II: MAIN REPORT

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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Outline of the Study
Project Formulation on WATSAN Sector
Recommendations

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Chapter-III Cost Estimate
- Part-A CAPEX Estimation Sheet (Excel)
- Part-B OPEX Estimation Sheet (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

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 km

LOCATION MAP — Modeling Area

Compostela; Compostela WF; Liloan; San Vicente WF; CAMOTES SEA; Construction; Consolacion; Cebu City; Casili WF; Canduman WF; Mandaue City; Bulk Water (Abejo North); N; Bulsian Dam; Re-construction; WTP; Construction; Cansaburo WF; Lahug WF; Construction; Construction; CEBU STRAIT; Under-ground Dam; Improvement; Talisay City; Bulk Water (Abejo South); Mahanga WF; 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

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Abbreviations

Organization

ADB.....Asian Development Bank
BCWD .....Baguio City Water District
BWSA.....Barangay Water Supply and Sanitation Association
DBP .....Development Bank of the Philippines
DECS.....Department of Education, Culture and Sports
DENR .....Department of Environment and Natural Resources
DILG.....Department of Interior and Local Government
DOH .....Department of Health
DPWH .....Department of Public Works and Highways
DTI .....Department of Trade and Industry
EOJ .....Embassy of Japan
GOJ.....Government of Japan
GOP .....Government of the Philippines
IBRD.....International bank for Re-construction and Development (WB)
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
MMDA .....Metropolitan Manila Development Authority
MWSS .....Metropolitan Waterworks and Sewerage System
NAMRIA.....National Mapping and Resource Information Authority
NEDA.....National Economic and Development Authority
NGO .....None Governmental Organization
NJS .....NJS Consultants Co., Ltd.
NK .....Nippon Koei Co., Ltd.
NWRB .....National Water Resources Board
NSO .....National Statistics Office
PMO .....Project Monitoring Office
PMU .....Provincial Monitoring Unit
PPDO.....Provincial Planning and Development Office
PTA.....Philippines Tourism Authority
RWSA.....Rural Water Supply and Sanitation Association
UNDP .....United Nations Development Program
UNICEF.....United Nations International Children's Emergency Fund
WB.....World Bank (IBRD)
WD .....Water District
WHO.....World Health Organization

Personnel	
AGM	Assistant General
BD	Billing Department
CD	Construction Department
C/P	Counterpart
CPD	Corporate Planning Department
ENG'D	Engineering Department
EWRKC	Environment and 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	
CPH	Census on Population & Housing
F/S	Feasibility Study
HRD	Human Resources Development
IEE	Initial Environmental Examination
IRA	Internal Revenue Allotment
IRR	Implementation Rules and Regulations
IT	Information Technology
LGC	Local Government Code
M&E	Monitoring and Evaluation
M/P	Master Plan
MIS	Management Information System
NRW	None Revenue Water
O/M	Operation and Maintenance
ODA	Overseas Development Assistance
OVI	Objectively Verifiable Indicator
PCM	Project Cycle Management
PIs	Performance Indicators
SRR	Study Role and Responsibility
WATSAN	Water Supply and Sanitation
WRMU	Water Resources Management Unit
WSP	Water Supply Provider
Technical	
BOD	Bio-chemical Oxygen Demand
Ca	Calcium
Cl	Chloride
CS/V	Construction Supervision
D/D	Detailed Design

E-Coli .....Escherechia Coliform
EC .....Electric Conductivity
FEM.....Finite Element Method
FDM .....Finite Different Method
Log.....Logarithm
Mn.....Manganese
NO_2 .....Nitrate
pH .....Power Hydrogen
PNSDW .....Philippines National Standard for Drinking Water
PWL.....Pumping (Production) Water Level
SI.....International System of Units (Système International d'Unités)
SWL.....Static Water Level
Temp. .....Temperature
TH.....Total Hardness

Unit

cm .....Centimeter (length)
cm/s.....Centimeter per second (speed)
HHs.....Households (number)
kgf.....Kilogram force (force)
km .....Kilometer (length)
Lpcd.....Litter per capita day (amount of water consumption volume)
Lps .....Litter per second (amount of water volume)
m^2.....Square meter (area)
m^3/day.....Cubic meter per day (amount of water volume)
m .....Meter (length)
masl.....Meter above sea level (elevation)
mbgs .....Meter below ground surface (depth)
mbsl .....Meter below sea level (elevation)
mg/L .....Milligram per litter (content of component)
N .....Newton (force, N = 1.01972 x 10^{-1} kgf)
Pa .....Pascal (pressure, Pa = N/m^2)
psi .....Pound per square inches (pressure)
m.mho/cm.....Micro ohm^{-1} per centimeter (electric conductivity)

…….

Chapter-I Introduction

I-1 Scope of the Study

I-1.1 Authorization

Improvement of water supply system and facility has become an urgent subject in the Philippines, because a drastic augmentation of water needs have been demanded according to rapid growth in society and economy since early 1990's. JICA conducted the study for master plan on water resources development and management in the twelve (12) water resources regions of the Philippines in 1998. In this master plan, the nine (9) areas were selected as the critical cities with serious water constraints to be remedied. Cebu city was nominated as one of such nine (9) water deficit areas.

Metropolitan Cebu, next to Manila as national capital, is a secondary gateway of international transportation by air and sea in the Philippines. Metropolitan Cebu Water District (MCWD) has a service area currently covering four (4) cities and four (4) municipalities. Most of water source depends on groundwater and current intake amount of raw water is estimated at approximately 165,000 m^3/day in 2010 which supplies only forty three percent (43%) of total demand in service area.

MCWD needs water source development on a large scale such as surface water intake in future for solution of water crisis. Such plans are new dam construction in the central of Cebu Island. However, careful consideration in society and environment, and huge investment cost shall be required for the large scale development of surface water source. Consequently, MCWD shall be relying groundwater development and de-salination of seawater for coming up to residential expectations at the moment.

Basic policy of groundwater conservation was prepared by the NWRB in early 1990's. NWRB conducted the water resources assessment for prioritized critical areas (phase-I) in 2004. Subject study areas were Metropolitans of Manila and Cebu where groundwater situations have been deteriorated seriously because of chaotic groundwater exploitation. In the said study, groundwater model was produced and groundwater flow in future was simulated.

The proclamation of groundwater regulation was issued officially with approval of the National Governments in November 2006 and regulatory guideline was added in May 2007. One of regulatory areas is MCWD well field locating in Metropolitan Cebu. Therefore, the MCWD shall control the intake amount in such well fields and shall be required to develop groundwater in other well field on the other hand.

Additionally, effective water supply would be realized with due consideration of saving water consumption and reducing none-revenue water (NRW). Furthermore, countermeasures on improvement of un-sanitary environment should be considered for water quality preservation both in groundwater and seawater. Because amount of waste water will be increased resulting from the improvement of water supply.

Considering these circumstances, the Government of the Philippines requested the technical support from the Japanese Government. In response to this request, JICA dispatched the Preliminary Study Team on July 2007. Implementation arrangement (I/A) and minutes of meeting (M/M) were signed

and exchanged on the 24th day of July 2007 for implementation of the study for improvement of water supply and sanitation in Metro Cebu (hereinafter called as "the Study"). The original I/A was amended on the 11th day of November 2008.

JICA announced an official notice for this study on the middle of November 2007 and nominated the consortium of NJS and NK as an official study team on the middle of December 2007. Fieldwork of the study was commenced on the beginning of January 2009 because of I/A amendment 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.

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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. Major frameworks of the study are described according to following categories.

I-2.1 Contents of the Study

Following contents of the study were confirmed by both parties (MCWD and JICA) during study period that has same contents of the Implementation Arrangement (I/A) and the Minutes of Meeting (M/M) signed on the 27th of July 2006 by MCWD and JICA.

(1) Sector and Field

The study included an official jurisdiction of MCWD that was water supply and sanitation (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	• Mid-term Plan on Institutional Capacity Development and Physical Improvement/ Expansion • Support to Formalities of Initial Environmental Examination (IEE)	• Basic Plan on Sectoral Improvement in Terms of Institutional Capacity and Physical System/ Facility • Introduction of Activity Models in other LGUs
Engineering	• Action Plan on Groundwater Conservation and Development with Technical Evaluation Guideline on Groundwater Development • Action Plan on Facility Improvement with Project Cost Estimation for Physical Improvement/ Expansion and Financial Analysis • Technical Support of NRW Reduction, Recommendations on Water Supply Services for Poverty Stratum and Examination of Saving Water Consumption • Introduction and Operationalization of Simulation softwares (V-MODFLOW and WaterCAD) including Technical Transfer for Sustainable Operation	• 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 according to current issues and problems of the WATSAN sector that were recognized by MCWD and JICA during the preliminary study period in July 2007. The study had put emphasis to water supply sector.

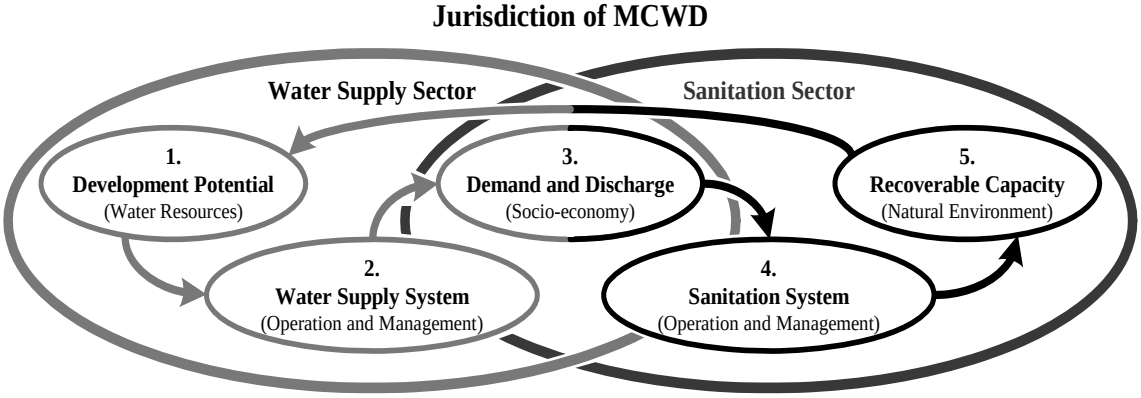

Figure-I.01 Major Components in the Study

Work items and their relationships in this study are indicated in Figure I-02.

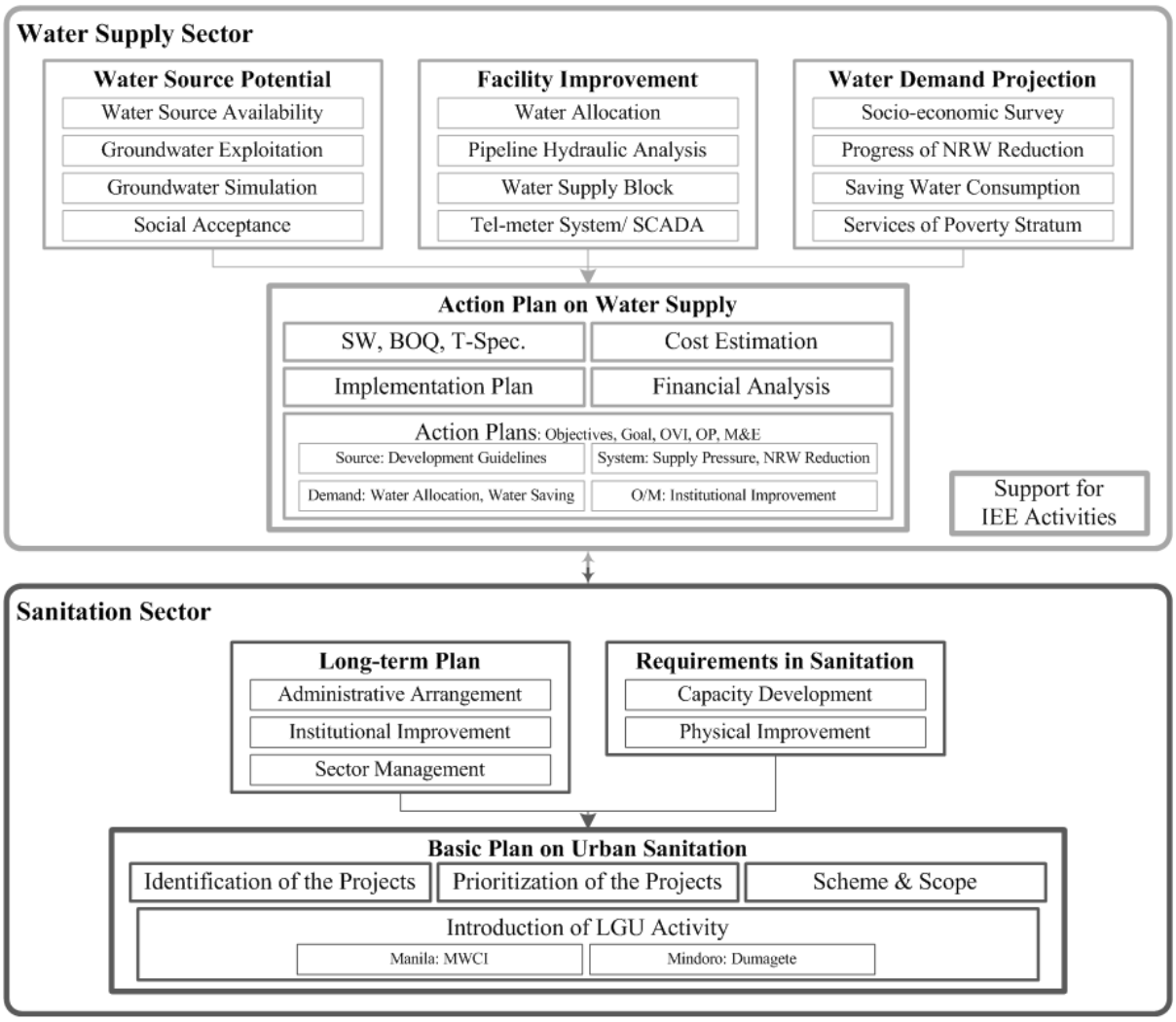

Figure I-02 Relationship of Major Study Items

I-2.2 Organization and Schedule

Following organization and schedule of the study were confirmed by MCWD and JICA during study period that has the same contents of I/A and M/M signed on the 27th of July 2007 by MCWD and JICA.

(1) Organization of the Study

Organization could be classified by relationship and nationality. MCWD and JICA exchanged I/A and M/M as a level of "decision making", while MCWD and the study team had signed M/M as an internal level. For external relations, MCWD coordinated relevant stakeholders in the Philippines and the study team managed the contractor (investigation/ survey) and the supplier (procurement). Figure I-03 shows the study system.

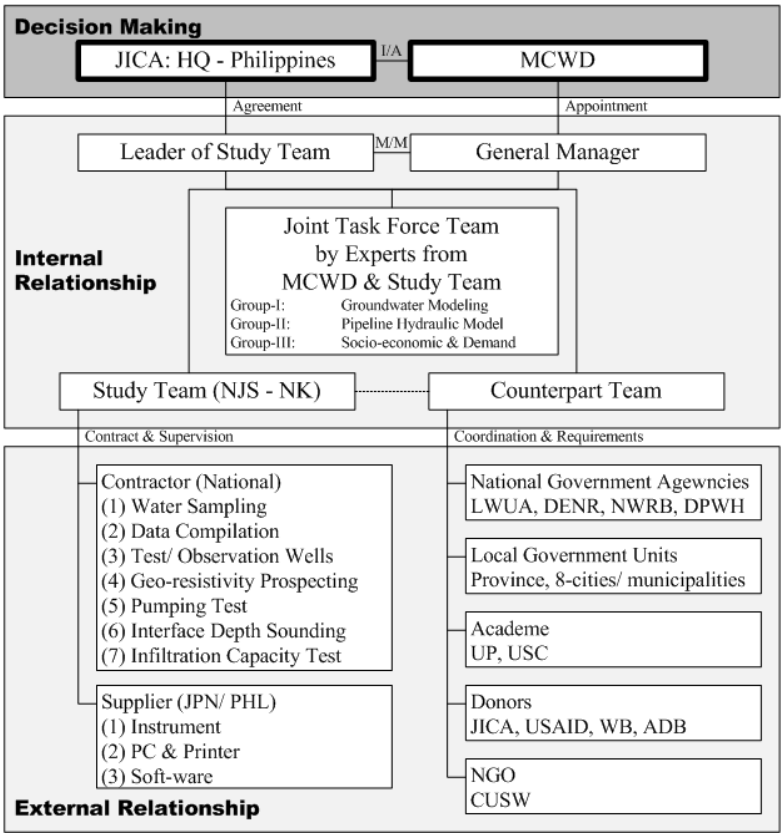

Figure I-03 Study System

(2) Assignment of the Study Team and the Counterparts

Three groups were organized for this study depending on the occasions as mentioned below.

- Stakeholder's Committee,
- Joint Task Force Team, and
- Counterparts: MCWD - JICA Study Team

< Stakeholder's Committee >

The aim of this organization was to integrate planning information and to confirm work sharing and action to be taken by the stakeholders based on the study results. Major activities of the Stakeholder's Committee were "aggressive participation to implement their roles in the action plans" and "decision making for critical issues and measures." The members were organized by following relevant groups.

1) Chair: MCWD (MCWD - JICA Study Team)
2) Members: LGUs, National Government Agencies composed of
   - Provincial Government of Cebu
   - Local Government Units of Cebu, Talisay, Mandaue, Lapu-lapu, Cordova, Consolacion, Lilo-an and Compostela
   - LWUA, NWRB, DENR, DPWH
3) Observers: Academe, Donors, NGO composed of
   - Academe: University of the Philippines, University of San Carlos
   - Donors: JICA, USAID and ADB
   - NGO: Cebu Uniting Sustainable Water Foundation Inc.

< Joint Task Force Team >

Three task force teams were created for quick decision making of critical milestones. The GM of MCWD and Team Leader of JICA Study Team would oversee these task force teams.

1) Team-1: Groundwater Flow Simulation
   - MCWD 4 Experts from EWRKC
   - Study Team 2 Experts of Hydrogeologist, Groundwater Modeler
2) Team-2: Socio-economic Survey
   - MCWD 3 Experts from Corporate Planning Department
   - Study Team 1 Expert of Socio-economist
3) Team-3: Pipeline Hydraulic Analysis
   - MCWD 6 Experts from Technical Service Group Departments of Engineering and Project Management
   - Study Team 2 Experts of Facility Planner, Pipeline Analyst

< Counterparts: MCWD - JICA Study Team >

MCWD counterparts were nominated according to the study field. Two experts were changed: "Urban Sanitation Planner" by the other expert during the 1st fieldwork, while "Corporate Management/ Financial Analyst" by two experts in the fields of "Corporate Management" and "Financial Analyst" from the 2nd fieldwork.

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 (see Figure I-04):

Phase-I: Analysis on the present conditions of water supply and sanitation, including a simulation of groundwater flow

Phase-II: Planning on improvement of water supply and sanitation

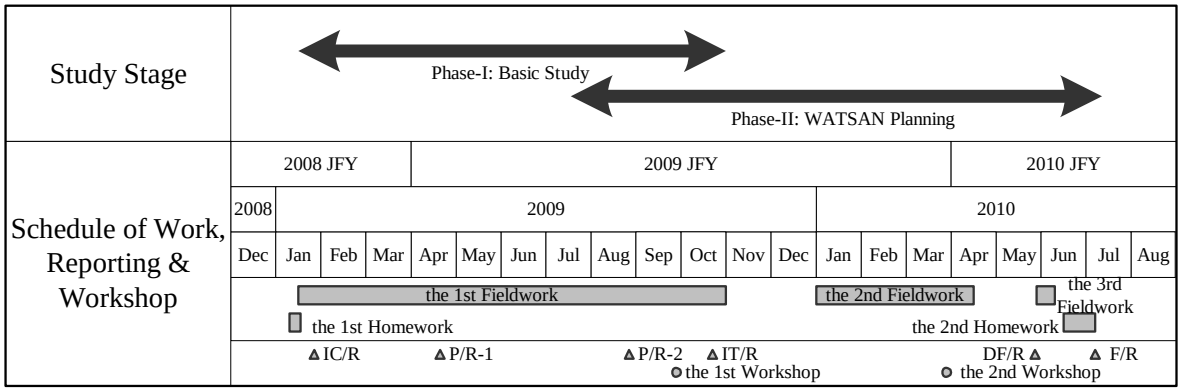

Figure I-04 Work Schedule

(4) Participants in the Workshop and Seminar

Workshop-I: Basic Study Results and Brief WATSAN Sectoral Plans (53 persons × 2 days)

- MCWD: 15 persons (8 EWRKC, 2 Corporate, 1 Operation, 4 Engineering)
- Study Team: 9 persons (Experts)
- LGUs: 1 person (Province of Cebu)
  12 persons (MCWD Franchise LGUs)
- National GAs: 2 persons (NWRB)
  1 person (LWUA)
  4 persons (DENR)
  1 person (DPWH)
- Academe: 3 persons (USC)
- Donors: 2 persons (JICA)
- NGO: 3 persons (CUSW)

Workshop-II: Improvement Plan of WATSAN Sector (35 persons × 2 days)

- MCWD: 17 persons (3 EWRKC, 1 Corporate, 6 Operation, 6 Engineering)
- Study Team: 7 persons (Experts)
- LGUs: 1 person (Province of Cebu)
  5 persons (MCWD Franchise LGUs and Others)
- National GAs: 1 person (LWUA)
- Academe: 1 persons (USC)
- Donors: 2 persons (JICA)
- NGO: 1 persons (CUSW)

Seminar: V-MODFLOW

< Basic Course, 10 attendee × 2 days >

(1) to introduce the outline of groundwater modeling, and
(2) to exercise the typical tutorials by participants (MCWD).

- MCWD: 10 person (5 EWRKC, 1 Operation, 4 Engineering)
- Study Team: 2 person (Experts)

< Advance Course, 4 attendee × 2 days >

(1) to explain how MCWD-Model-09 was built, and
(2) to discuss how MCWD-Model-09 can be improved.

- MCWD: 4 person (3 EWRKC, 1 Operation)
- Study Team: 2 person (Experts)

Seminar: WaterCAD (9 attendee × 1 day)

< Basic Course, 9 attendee × 1 day >

(1) to introduce the outline of pipeline hydraulic modeling, and
(2) to exercise the typical tutorials by participants (MCWD).

- MCWD: 9 person (7 Engineering, 2 MIS)
- Study Team: 1 person (Experts)

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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

The Philippines composing of 7,107 islands are divided into three (3) regional groups namely Luzon in the north, Visayas in the middle and Mindanao in the south, respectively. Extensive islands exist in Luzon and Mindanao, on the other hand, there are medium to small sized islands in Visayas. Cebu Island is located at the middle of Visayas between Negros and Bohol Islands.

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.

The study area is along the central-eastern side of Cebu Island. This extends from the city of Talisay in the south up to the municipality of Compostela in the north. Also included in the study area is the Island of Mactan, which is part of the MCWD jurisdiction.

(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. Topographical map of the study area is shown in Figure II-01.

(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.

The geology of study area is as diverse as its topography. Simplicity, most of the limestone areas underlain by the Tertiary age rocks having karstic terrain, while where the limestone and metamorphic are absent, gentle slopes cover the topography. The areas underlain by metamorphic always tend to be resistant to weathering and develop rugged terrain with steep slopes. The areas underlain by the younger Carcar limestone is also varied, wherein the formation is observed to be hard, steep slopes have developed and gentle slopes where the limestone is fragmental and porous.

Figure II-02 shows the simplified geological map of groundwater study area indicating the distribution of the different geologic formation and major geologic structures in the said study area,

while geological section of Cebu Island composing of anticline structure is imaged in Figure II-03. Typical geological order is indicated in Table II-02.

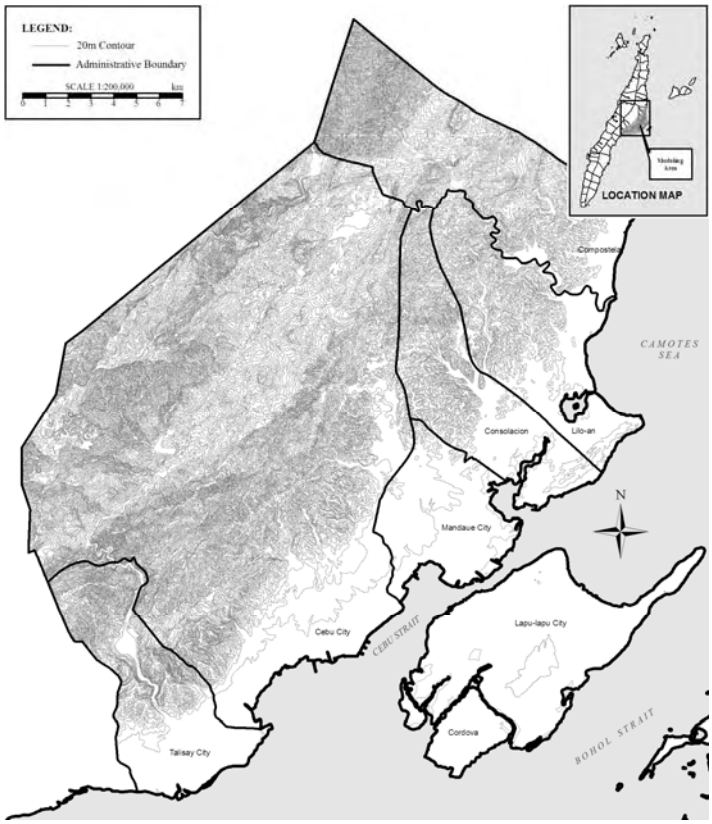


Figure II-01 Topographical Map of the Study Area

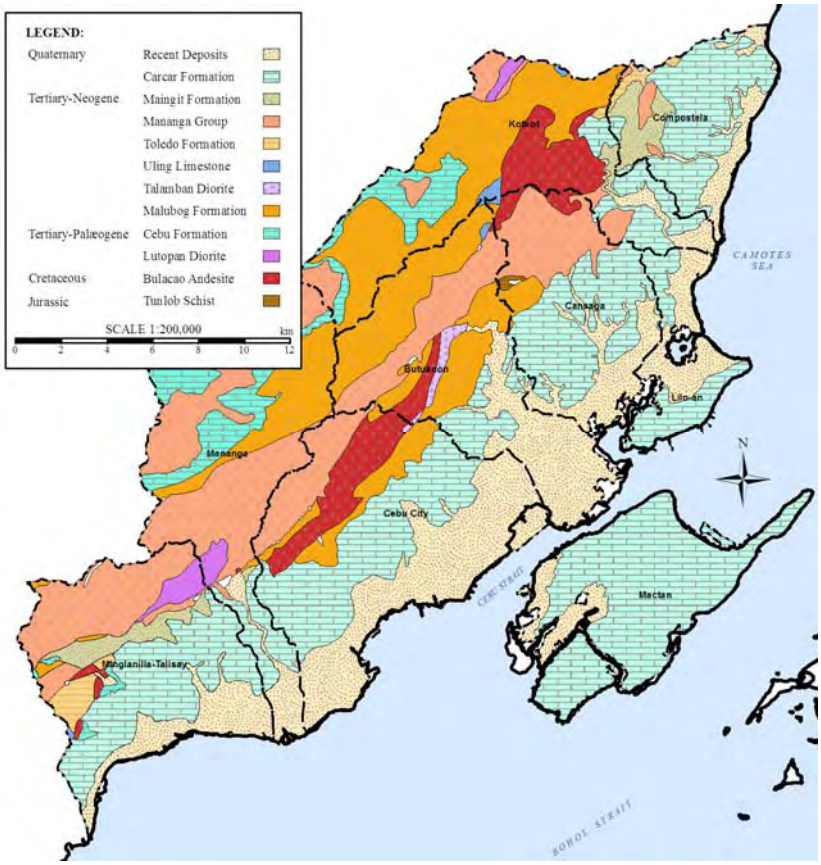


Figure II-02 Geological Map of Groundwater Modeling Area

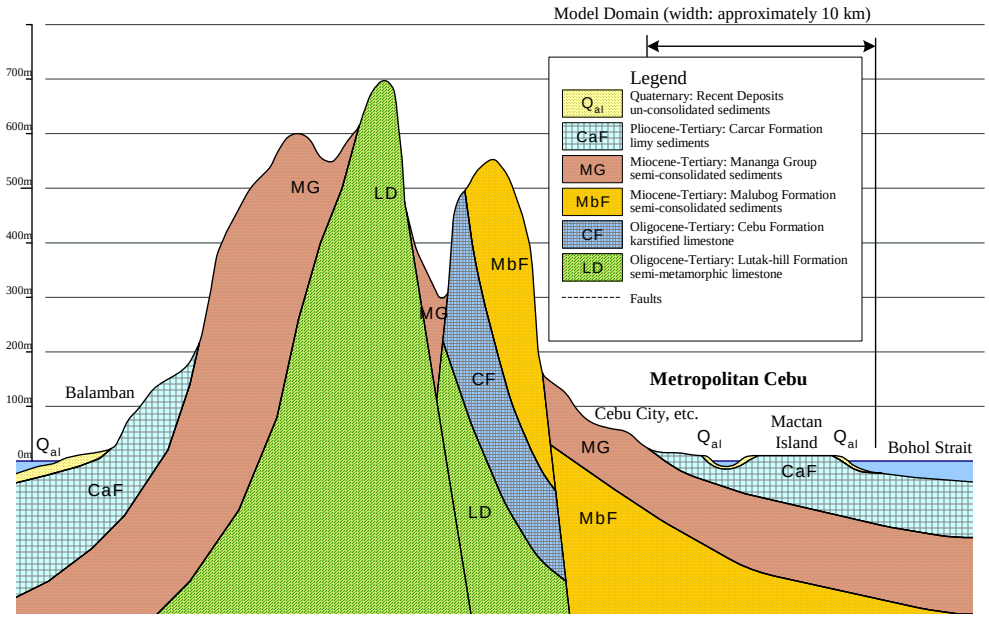


Figure II-03 Geological Section Image of Central Cebu Island

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	25.000	Toledo Formation	Maingit Formation: MG Uling Limestone	Talamban Diorite
				Malubog Formation: MbF		
	Tertiary Palaeogene	Oligocene	38.000	Lutak Hill Formation	Cebu Formation: CF	
		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. Table II-02 and Figure II-04 show catchment area and relative location of the water resources management units with major river network in the groundwater study area.

Table II-02 Catchment Area of WRMUs in Groundwater Study Area

WRMU	MAC	M-T	MAN	CEB	BUT	CAN	LIL	KOT	COM	Total
Area (km^2)	57.0	76.1	87.1	98.3	72.5	54.9	21.3	80.5	39.7	587.5

Note: Abbreviations of name at each WRMU are:

MAC:	Mactan	M-T:	Minglanilla-Talisay	MAN:	Mananga
CEB:	Cebu	BUT:	Butuanon	CAN:	Cansaga
LIL:	Lilo-an	KOT:	Kot-kot	COM:	Compostela

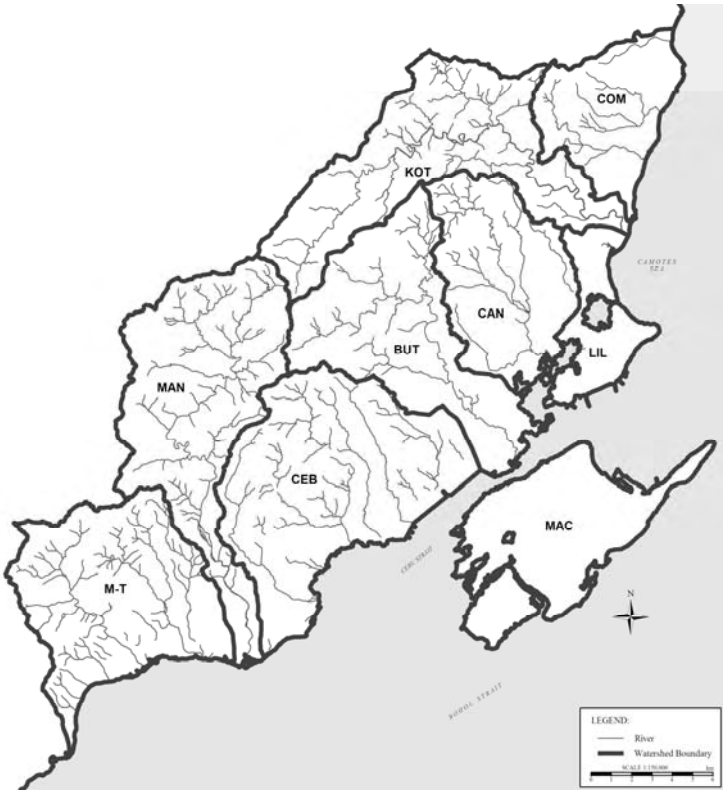


Figure II-04 Major River Network in the Groundwater Study Area

(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 as shown in Figure II-05. 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.

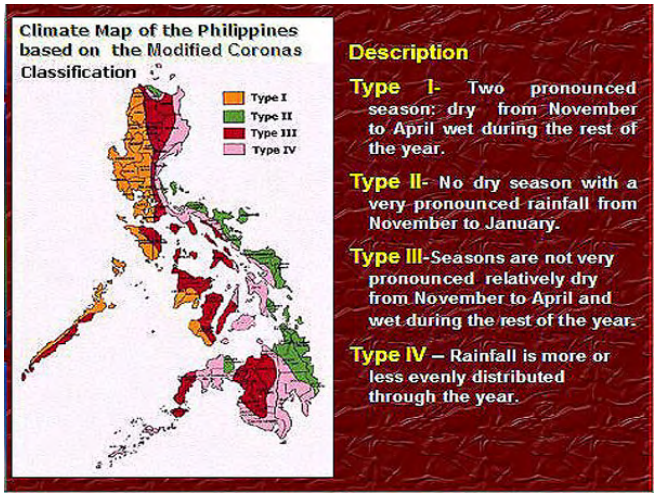


Figure II-05 Climate in the Philippines

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.

Based on the available one PAGASA climatological-normals and fifteen WRC (called as long record stations; from the year 1982 to 2004) in the study area and its surrounding, isohyetal map of the average annual precipitation over the study area is shown in Figure II-06.

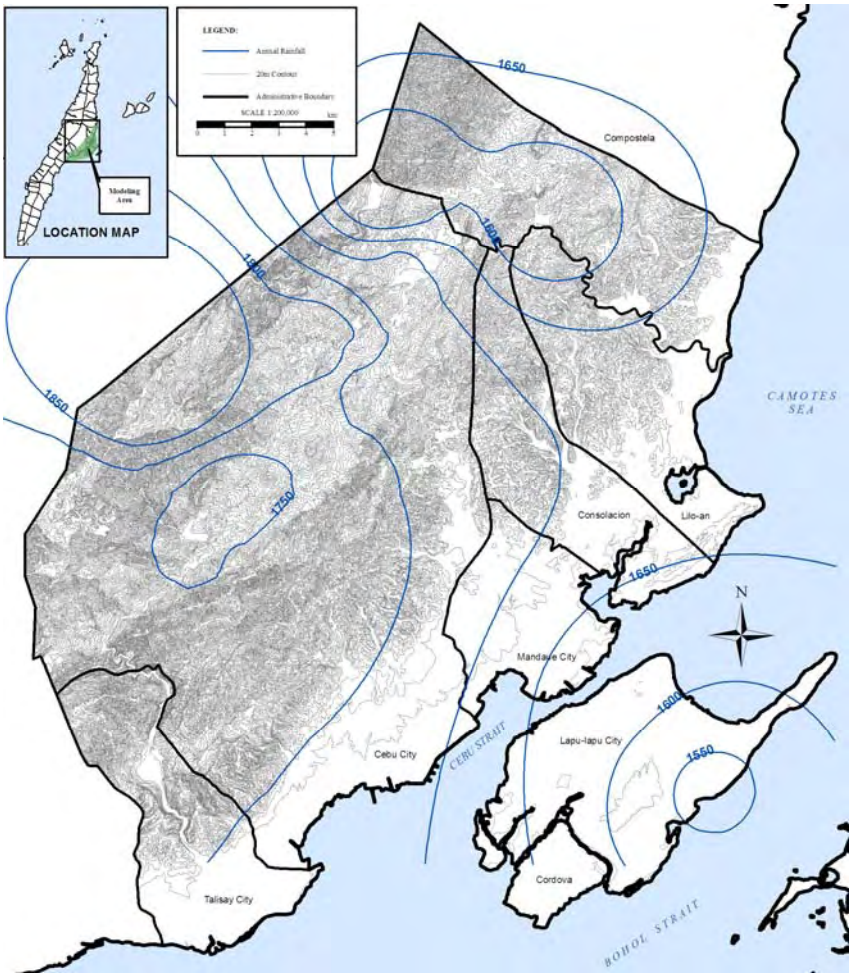


Figure II-06 Isohyetal Map of the Study Area (1982-2004)

There are around 30 synoptic stations in the study area. Some stations have started observations since 1971 and some stations were transferred to the other stations due to physical reasons. Among those stations, typical 3-stations are picked up (see Figure II-07) for observation of rainfall pattern namely Mac-01; plain, But-08; hilly and Man-12; mountainous. General information of the said stations is shown in Table II-03.

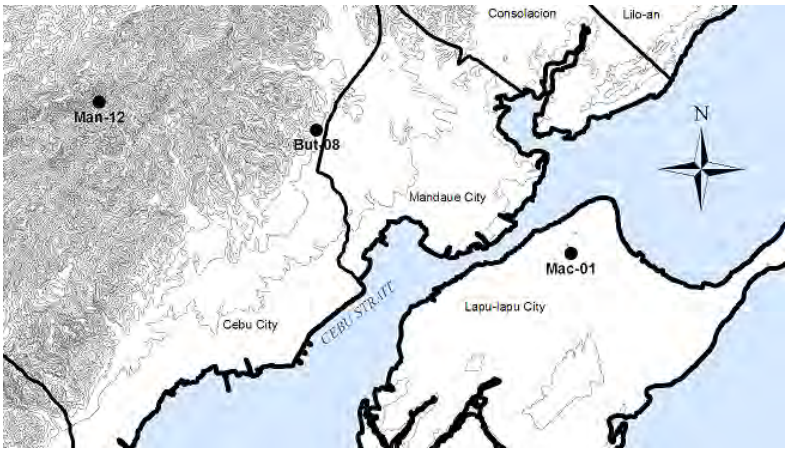


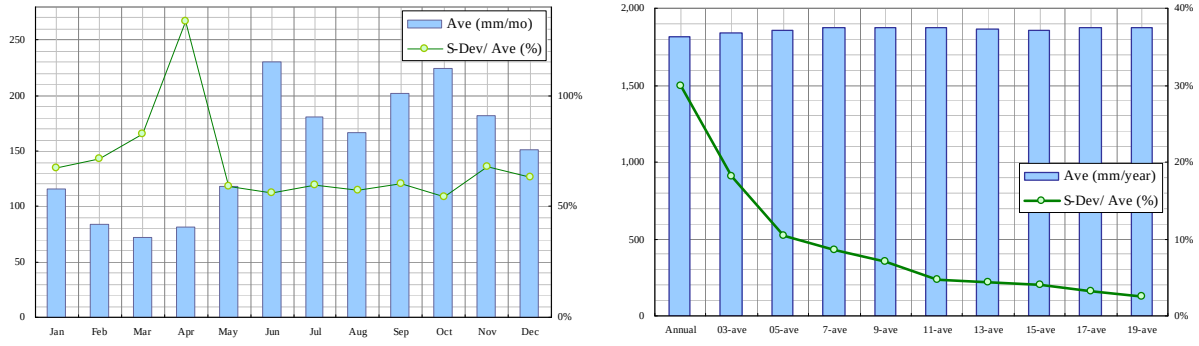
Figure II-07 Typical Stations within the Study Area

Table II-03 General Information at Typical Stations

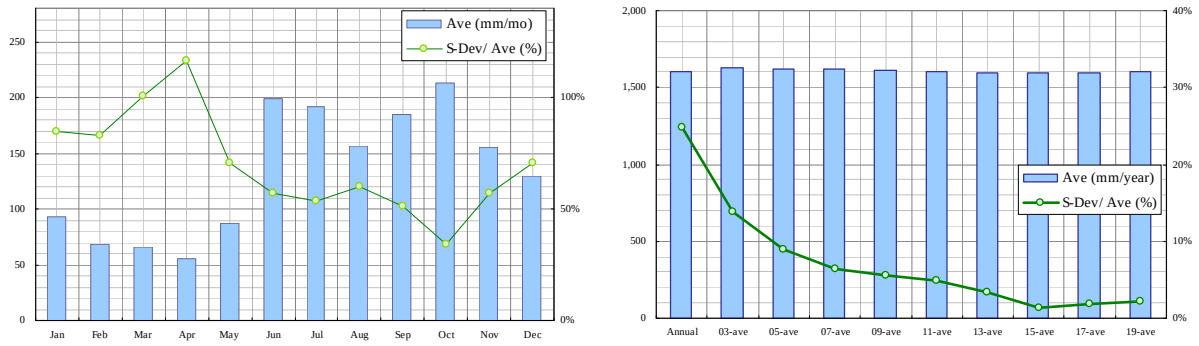
Location	RCPI*[1]	Talamban	Mactan Int'l Airport
Code Name	Man-12	But-08	Mac-01
Watershed	Mananga	Butuanon	Mactan Island
Correlation Factor	0.635	0.032	1
Elevation*[2]	715m	70m	21m
Latitude	10-21'55"	10-21'12"	10-19"13"
Longitude	123-51'11"	123-54'37"	123-58'38"

RCPI*[1]: Radio Communication of the Philippines, Inc. Elevation*[2]: It was measured by the altitude meter.

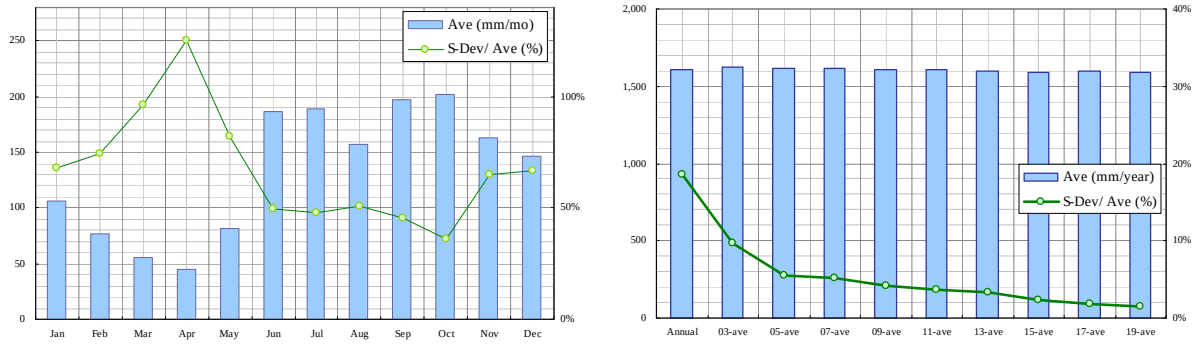
Figure II-08 illustrates the precipitation patterns (Left: monthly distribution and Right: annual variation) using records from the year 1977 to 2005 at typical 3-stations mentioned above.



RCPI/ Man-12: Mountainous



Talamban/ But-08: Hilly



Mactan International Airport/ Mac-01: Plain

Figure II-08 Monthly Distribution and Annual Variation of Rainfall

Coefficient of variation (standard deviation per average) in monthly distribution of 3-stations has similar pattern which means starting period of wet season sometime in April. Same variation in annual rainfall indicates high ratio in mountainous and low ratio in lowland/ plain comparatively.

Annual variations have the correlation trend of variation coefficient and year-average which means drought cycle (odd year base) may be more or less 7 years in the groundwater study area.

(6) Vegetation and Land-use

Brief land-use map shown in Figure II-09 is available in the regional DA (investigation year is not mentioned).

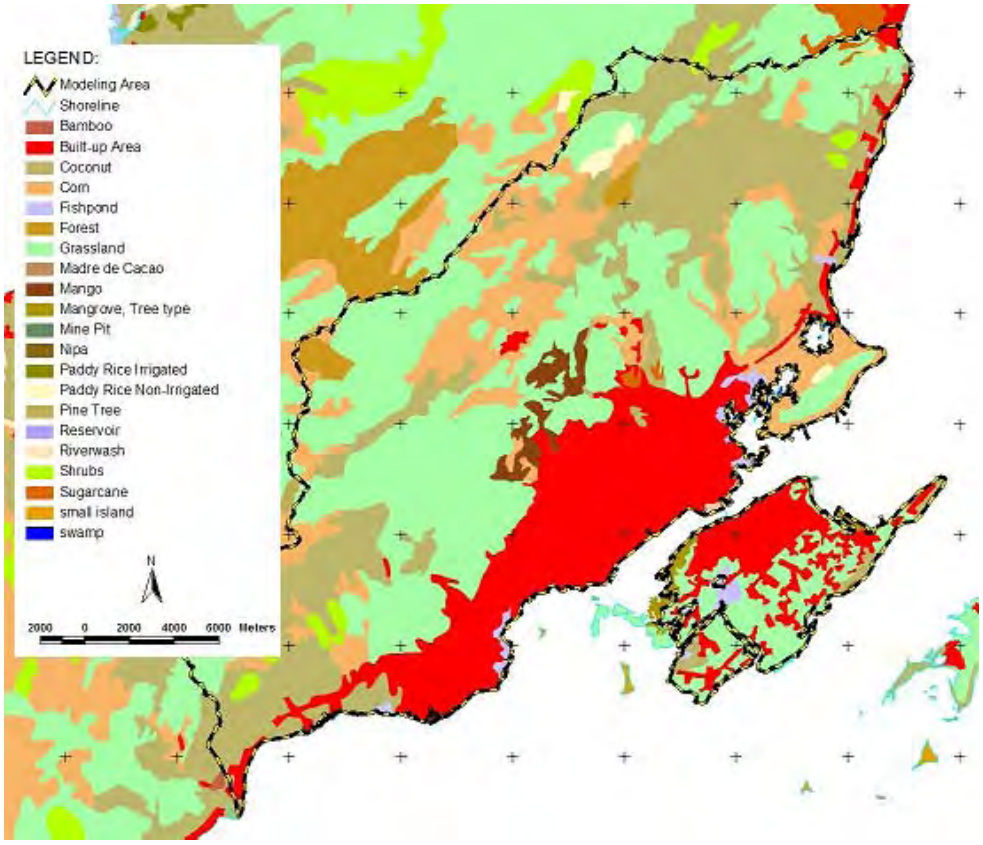


Figure II-09 Land-use Map of the Study Area (source: DA)

With all the available data used as reference by this study, land-use map of LGUs would be referred. As of now, LGUs in the study area (4-cities and 4-municipalities) have their land-use maps; however completion year of those maps were not indicated. Most of land-use maps have classifications of following six major categories:

1) Built-up Area,
2) Agricultural Area,
3) Forest Area,
4) Wetlands,
5) Open Space and
6) Others.

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.

Actual contrast in the past years can not be recognized by the recorded information. However, changes of land use patterns in the study area can be summarized into the following features.

- the intensification of suburban commercial area at major intersections and transport routes,
- increase in the number of squatter housing areas,
- the conversion of agricultural and fishpond lands to residential and or commercial use,
- the development of middle and upper class residential subdivisions on urban peripheries,
- the development of townhouses and high-rise condominiums for middle class and upper class income in the main urban core, and
- the location/ relocation of new and existing industries into industrial zones/ and outside industrial zones where land is cheaper and along major transport routes.

Information of land-use will be used for calibration of the initial groundwater model. According to this situation mentioned above, satellite images of recent and past periods will be referred.

(7) Hydrogeology (Groundwater)

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

- Alluvial Sandy Sediments: It is distributed along the coastal in Cebu Island and the western coast in Mactan Island with maximum thickness reaching up to 50m in Cebu Island. This formation is composed of clastic deposit made of volcanic rocks and limestone. Its permeability is comparatively high with $1.0E^{-1}$ cm/sec estimating of geometric mean from MCWD wells. There are Non-MCWD wells developing groundwater from this formation. Shallow wells are used for municipal water and deep wells have been constructed for mainly economic activity. However the saltwater intrusion has been aggravated.
- Alluvial Coarse Sediments: This formation is distributed in river valleys with limited thickness. Its composition and permeability are almost the same to sandy sediments mentioned above. It provides riverbed-water, as well as offering possibilities for infiltration schemes such as at Jaclupan on the Mananga River. According to the depth of infiltration wells, thickness of deposit may be about 40m.
- Carcar Limestone: This aquifer is distributed below the recent deposit and can been seen at hilly area in Cebu Island and the entire of Mactan Island. It is composed of un-consolidated coralline limestone with $5.3E^{-2}$ cm/sec estimating of geometric mean from MCWD wells. Most of MCWD wells intakes groundwater from this formation 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 and Mananga valleys, and thickness was not investigated yet. It is composed of consolidated sandstone with small yield.
- Cebu Limestone: It can be found at higher altitudes with un-known thickness. It is composed of consolidated coralline limestone with less permeable rocks. Exploitable groundwater may be spring.

Location of MCWD production wells on the geological map is indicated in Figure II-10. In this map, Carcar Limestone Formation is outcropped at the inland of Cebu Island and Mactan Island, and underlies along the coastal area under the alluvial formation. MCWD production wells are

located along the coastal side of Carcar Limestone Formation. In this regard, major aquifer of groundwater development for MCWD wells can be recognized as this formation.

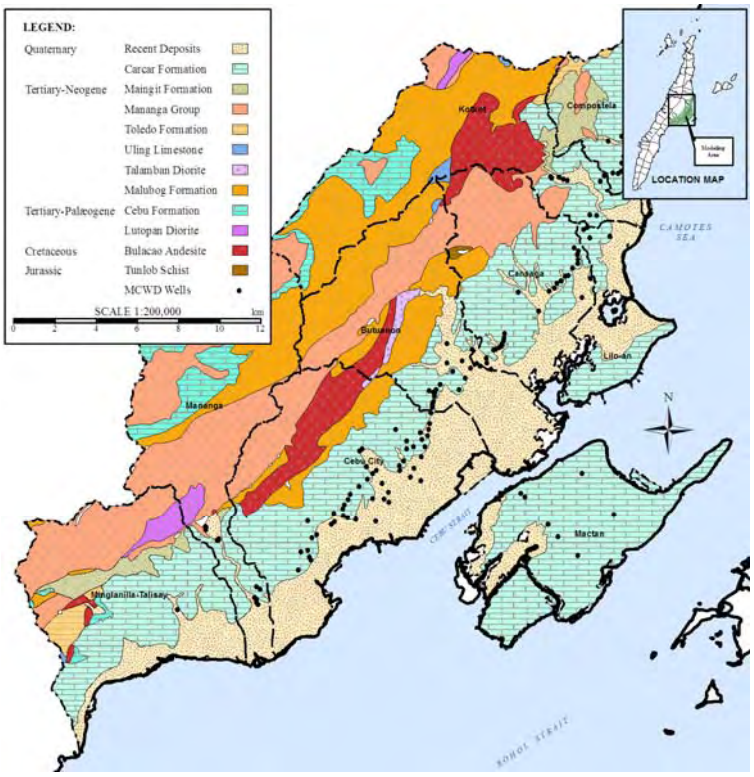


Figure II-10 Location Map of MCWD Wells in 2008 on the Geological Map

(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-04. The number of threaten species in the Philippines is 216 and 425 for plants and animals respectively.

Table II-04 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 >

The species of priority concern for conservation in the Philippines are regulated by DENR-AO No. 48 of 1991. In total, 163 species are designated as the species for conservation as shown in Table II-05.

< 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.

Table II-05 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

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. The cities of Cebu, Mandaue and Lapu-lapu have the biggest share in the population as shown in Table II-06.

Table II-06 Total Population and Population Density in the Study Area

LGUs (MCWD Franchise)		Population Census in 2007	
		Population	Population Density
City	Cebu	798,809	2,803.8
	Lapu-lapu	292,530	4,827.2
	Mandaue	318,575	10,679.7
	Talisay	179,359	3,784.7
Municipality	Compostela	39,167	757.7
	Consolacion	87,544	2,591.6
	Cordova	45,066	4,457.6
	Lilo-an	92,181	1,669.6
Total		1,853,231	3,231.4

Source: NSO, 2007 Census of Population. Population Density: Capita/ km^2

Mandaue City has the highest density of 10,679.7 persons per km^2 followed by Lapu-lapu City with 4,827.2 and Cordova with 4,457.6 persons per km^2, respectively. The municipality of Cordova has a high population density due to its small land area but high population growth. On the other hand, the municipality of Compostela is the least densely populated municipality in the study area with about 757.7 persons per km^2. Population density by barangay level in the study area is shown in Figure II-11.

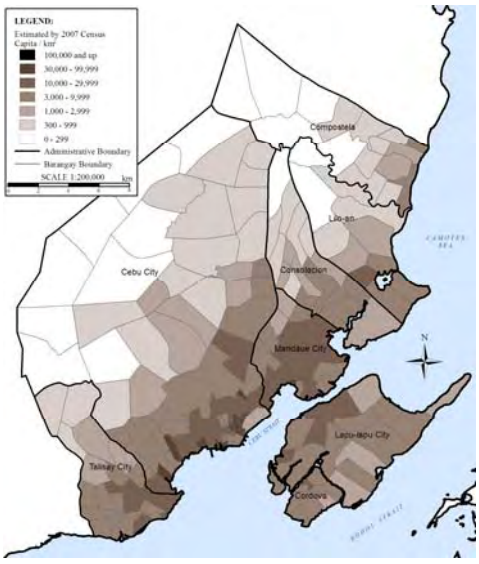


Figure II-11 Barangay Population Density (2007 Census Base)

(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-07.

Table II-07 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. The metropolis is host to various manufacturing industries, shopping centers, educational institutions, financial institutions, and other service-oriented establishments that cater not only to the needs of the people in the region but also those from other provinces in the Visayas and Mindanao. As reported by the Department of Trade and Industry (DTI) in 2005, the dominant service sectors in Metro Cebu are tourism, trade, transportation, and information technology (IT)-enabled services.

In recent years, IT companies have significantly contributed to the growth of the economy of Metro Cebu. Many of the new graduates from various disciplines usually serve as the labor force for IT companies of foreign direct investors (FDIs) such as call centers and business process outsourcing. There are at least 19 FDIs in Cebu, which are primarily American, Australian, and Japanese firms.

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. Most of the country's major shipping lines are based in Cebu. These include Cebu Ferries, Sulpicio Lines and Gothong Lines which ply the Luzon-Visayas, intra-Visayas, and Visayas-Mindanao routes.

Over the years, the number of financial institutions in Cebu has increased. Metro Cebu has branches of international and national banks with head offices in Metro Manila. Among the international banks operating in the province are Hongkong Shanghai Banking Corp. (HSBC), Maybank, Standard Chartered Bank, and Citibank.

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.

Because of its strategic location and good seaport, Cebu City is the center of trade and industry. It hosts several large banks, financial institutions, and business establishments such as hotels, restaurants, call centers, recreation/entertainment facilities, and shopping malls. On the other hand, Mandaue City is a favored location for factories and manufacturing firms while Lapu-lapu City hosts three export processing zones and several hotels and resorts. Talisay City and the other municipalities have also contributed its share to the economic growth by serving as the residential areas. The presence of a skilled workforce entices various establishments and manufacturing firms to set-up their business in these areas.

(4) Water Supply

Table II-08 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 & Socio-Economic Profile Based on the 2000 Census, a study undertaken by JICA, Cebu SEED (Socio-Economic Empowerment and Development) Project, and Office of Population Studies (OPS).

Table II-08 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
	Lapu-lapu	44,439	12.6	17.2	6.2	26.3	4.8	14.1	2.1	16.8
	Mandaue	54,882	28.2	35.6	4.8	19.5	1.6	0.9	0.2	9.2
	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
	Consolacion	12,837	16.8	15.4	4.4	39.3	8.9	3.8	5.3	6.0
	Cordova	6,520	6.6	14.5	7.8	29.2	9.5	17.6	5.5	9.3
	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

The 1990 Census of Population identified five types of water sources: (1) community water supply system, (2) private water supply system, (3) safe and un-safe wells, (4) springs/ lakes/ rivers/ rain and (5) water vendors. In the Population Census 2000, the bottled water was added as the sixth source together with other sources. Defining safe water sources to include community/ private water supply system and safe well, the data showed that about 84% of the total households in the study area had access to safe water sources in 2000. The City of Lapu-lapu and the municipality of Cordova had the lowest percentage of households with access to safe drinking water, at 67% and 68%, respectively.

The other cities/ municipalities of Cebu Province that are outside Metropolitan Cebu had lower percentages of HHs (59%) with access to safe drinking water supply. The better condition of water supply in Metropolitan Cebu can be attributed to the presence of MCWD. The records of MCWD showed that it provided water at an average of 141,600 m^3/day in 2002 with a production capacity of 151,953 m^3/day from its 67 production wells, 34 direct supply wells, and a surface water source (Buhisan Dam).

Water from 67 production wells was distributed from reservoirs to service areas while water from 34 wells was supplied directly to households in 2002. There were 92,484 service connections

with demand billings of 135,205 m^3/day. The MCWD service area constitutes about 52% of the total population. The rest of the households were supplied by privately owned wells and private water vendors/ providers. Some of the well fields of MCWD were within the watershed areas of Lilo-an in the north and Talisay in the south.

(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-09 shows the percentage of households in the eight cities/ municipalities by type of toilet facility. The data show that 80% of households in the study area had sanitary toilet facilities.

Table II-09 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 & Socio-Economic Profile Based on the 2000 Census, op cit

(6) Cultural Heritage

The cultural heritages in Metro Cebu identified by Cebu Provincial Tourism and Heritage Council are summarized in Table II-10. The natural heritage includes cave, rock, waterfall, lake, seashore/ beach, coral reef, tree, etc. and the built heritage includes church, monument, cemetery, school, house, bridge, plaza, etc.

Table II-10 Summary of Natural and Built Cultural Heritage in Metropolitan Cebu

LGUs	Type	No. of Heritage
Cebu City	Not Studied	
Mandaue City	Natural	Not Studied
	Built	13
Lapu-lapu City	Not Studied	
Talisay City	Natural	9
	Built	16
Consolacion Municipality	Natural	1
	Built	6
Cordova Municipality	Natural	10
	Built	16
Lilo-an Municipality	Not Studied	
Compostela Municipality	Not Studied	

Note: As of October 2008.
Source: Cebu Provincial Tourism and Heritage Council
(http://cebu.gov.ph/links/CulturalMapping/heritage%20home.htm, cited March 11, 2009)

(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. The outline of the site is summarized in Table II-11.

Table II-11 Ramsar Site in Metropolitan Cebu

Site	Date of Designation	Region	Area	Coordinates
Olango Island Wildlife Sanctuary	1-July 1994	Cebu	58 km^2	10º16'N 124º03'E

Source: The List of Wetlands of International Importance (March 3, 2008), (http://www.ramsar.org/, cited on March 12, 2009)

UNESCO designates 5 World Heritages in the Philippines, which are 2 natural and 3 cultural ones. But none of them is located in Metro Cebu.

(8) Briefing of Socio-economic Survey

Survey methodology is referred to the Part-A of Chapter-I in the Volume-III Supporting Report.

< Household (HH) >

- Profile

Profile of the households respondents are shown in Table II-12.

Table II-12 Household Profile

City/ Municipality	No.	%	Average No. of HH Members	Average Monthly Income/ HH	Own well				Individual faucet			
					Yes		No		Yes		No	
					No.	%	No.	%	No.	%	No.	%
Compostela	15	2.0	5.5	7,205	2	13.3	13	86.7	7	46.7	8	53.3
Consolacion	37	5.0	5.7	9,968	6	16.2	31	83.8	10	27.0	27	73.0
Lilo-an	30	4.0	4.7	10,336	2	6.7	28	93.3	10	33.3	20	66.7
Mandaue	140	18.8	5.8	9,054	13	9.3	127	90.7	46	32.9	94	67.1
Cebu	335	44.9	6.1	11,302	21	6.3	314	93.7	170	50.7	165	49.3
Talisay	66	8.9	5.4	9,003	9	13.6	57	86.4	18	27.3	48	72.7
Lapu-lapu	106	14.2	6.0	9,914	21	19.8	85	80.2	18	17.0	88	83.0
Cordova	17	2.3	5.6	15,035*[1]	0	0.0	17	100.0	6	35.3	11	64.7
Total	746	100.0	5.9	10,381	74	9.9	672	90.1	285	38.2	461	61.8

Note*[1]: Including one HH with very high income. When it is excluded, the average will be estimated at 11,109 PHP/HH.

- Water Use

As shown in Table II-13, groups belonging to A, B-1, B-4 and D-1 (A: bottled water, B: MCWD, C: private vendor, D: own well, E: rainwater and F: others) are majority of users, while own well with electric pump has the highest consumer (264 Lpcd). This is two times more than the daily average per person in households with MCWD individual faucets (111 Lpcd). Water from wells with electric pump has a higher consumption rate since it is freely available (except for the electric cost), thus making it overused.

The least consumer is noted among users of bottled/ distilled water (1 L) as it mostly used for drinking purposes and of MCWD water truck (10 L) since it is not readily available. But combining all water sources, the average per capita daily consumption is four times lesser (65

L) than well with electric pump alone and nearly two times lesser than MCWD individual faucet alone.

Table II-13 Total and Average Consumption by Water Source (Q4: Consumption)

Water Sources	Price in PHP	Water Consumption			Total No. of HH	Monthly HH Income
		HH (L/ month)	Capita (L/ month)	Lpcd		
A: Bottled/ Distilled water	1.59	229	39	1	397	12,144
B-1: MCWD individual faucet	0.03	20,648	3,321	111	235	4,265
B-3: MCWD communal faucet	0.17	3,115	553	18	11	7,164
B-4: MCWD consumer's water (neighbor)	0.30	2,595	464	16	201	8,319
B-5: MCWD water truck	0.09	1,995	285	10	2	9,750
C-1: Private vendor's water truck	0.30	2,759	528	18	18	6,173
C-2: Private vendor's individual faucet	0.07	12,326	2,323	77	36	12,910
C-3: Private vendor's individual faucet through homeowner's association	0.18	11,360	1,959	65	5	9,789
C-4: Private vendor's communal faucet	0.10	2,574	558	19	13	6,179
C-5: Private vendor's other water	1.17	2,922	483	16	20	6,410
D-1: Public/communal well	0.18	3,382	575	19	202	9,360
D-2: Own well with electric pump	0.10	60,779	7,928	264	14	18,306
D-3: Own well without electric pump	0.08	7,095	1,172	39	95	7,666
E-3: Rivers, lakes, springs, etc	0.04	5,580	1,009	34	47	8069
E-4: Rainwater harvesting	—	2,222	370	12	16	7,812
Total	—	11,435	1,946	65	746	10,381

Note1: Classification of drinking water sources are:

A: Mainly supplying from the purification shop,
B: MCWD water supply,
C: Non-MCWD water supply (drinking water from C-5 category is delivered to users by vendor)
D: Water supply using wells
E: Other water supply

Note2:B-2: B-2(Bulk Supply of MCWD Water) total is combined with B-1(MCWD Supply).

Note3:E-1/E-2: E-1/E-2 is not in the questionnaire.

- Water Consumption and Average Cost

Noticeable is the consumption trend among different income groups as shown in Table II-14. Generally, HHs with lesser income is compelled to access water sources with higher rate and has lower water consumption compared to high-income HHs. For instance, HHs with a monthly income of between PHP 25,001 and 30,000 consume water nearly four (4) times more (136 Lpcd) than HHs with less than PHP 5,000 monthly income (42 Lpcd). Also, HHs that earn above PHP 30,000 consume water nearly three (3) times more (110 Lpcd) than those with a PHP 5,000 monthly income.

Considering the trend, the lower the income the higher is the water cost over income. The very poor HHs shall access to water sources with higher cost and utilize more than seven (7) times of water cost over income (12.3%) in contrast to HHs with an income of above PHP 30,000 (1.7%) even though water consumption in poor HHs is smaller than that of rich HHs.

As shown in Table II-15, all B1 users (123 Lpcd) and HHs with individual faucet (118 Lpcd) are higher consumers in terms of average Lpcd, while the least users are only B4 users (17 Lpcd).

Table II-14 General Profile of Respondents by Income Range

HH Income (PHP/ month)				Ave. Water Consumption			Ave. Monthly Cost			Rate
Range	Average	No.	%	HH (L/ month)	Capita (L/ month)	Lpcd	HH (PHP)	Capita (PHP)	Ratio over HH Income	(PHP/L)
Refuse to Ans.	-	52	7.0%	21,010	3,641.6	121	566	94	-	-
< 5,000	3,040	172	23.1%	6,104	1,251.4	42	372	66	12.3 %	0.06
5,000≦ to <10,000	7,347	284	38.1%	10,046	1,772.0	59	468	75	6.4 %	0.05
10,000≦ to <15,000	12,764	131	17.6%	11,864	1,730.7	58	566	79	4.4 %	0.05
15,000≦ to <20,000	17,286	42	5.6%	14,005	2,123.5	71	580	84	3.4 %	0.04
20,000≦ to <25,000	22,490	22	3.0%	15,980	2,197.3	73	655	82	2.9 %	0.04
25,001≦ to <30,000	28,692	13	1.7%	24,426	4,071.0	136	582	97	2.0 %	0.02
30,000≦	44,299	30	4.0%	24,554	3,296.6	110	769	103	1.7 %	0.03
Totality	10,381	746	100.0%	11,435	1,945.8	65	499	78	4.8 %	0.04

Table II-15 General Profile of Respondents by Water Users

	Identification					Ave. Monthly Cost		
	Water Users	No.	%	Ave. HH Income (PHP/ month)	Lpcd	HH (PHP)	Capita (PHP)	Ratio over HH Income
A	A users & with others	397	53.2%	12,144	80	606	104	5.0 %
	Non-A users	349	46.8%	8,447	48	350	49	4.1 %
	Total	746	100.0%	10,381	65	499	78	4.8 %
B-1	All B1 users	235	31.5%	14,265	123	726	117	5.1 %
	B1 users only	72	9.7%	12,353	111	478	77	3.9 %
	B1 users with other sources	163	21.8%	15,126	128	836	135	5.5 %
	Non-B1 users	511	68.5%	8,741	36	380	58	4.3 %
	Total	746	100.0%	10,381	65	499	78	4.8 %
B-3	All B3 users	11	1.5%	7,164	24	547	97	7.6 %
	B3 users only	3	0.4%	5,833	21	440	70	7.5 %
	B3 users with other sources	8	1.1%	7,663	25	587	110	7.7 %
	Non-B3 users	735	98.5%	10,433	66	498	78	4.8 %
	Total	746	100.0%	10,381	65	499	78	4.8 %
B-4	All B4 users	201	26.9%	8,319	30	418	74	5.0 %
	B4 users only	60	8.0%	6,596	17	387	68	5.9 %
	B4 users with other sources	141	18.9%	9,093	36	431	77	4.7 %
	Non-B4 users	545	73.1%	11,152	77	532	79	4.8 %
	Total	746	100.0%	10,381	65	499	78	4.8 %
Individual	Yes	285	38.2%	14,234	118	670	109	4.7 %
	No	461	61.8%	8,129	30	379	57	4.7 %
	Total	746	100.0%	10,381	65	499	78	4.8 %

- Awareness

Among non-MCWD users, there are still many HHs that want to connect MCWD, while there are many HHs that want to transfer from MCWD to other water source among MCWD users.

According to the survey results, wanting to connect to MCWD is perceived as highly convenient by most of these HHs (92%), a primary reason related to better services and water quality. There is also a significant portion (4%) that wants to reduce their water expenses since buying water from neighbors is seen as expensive. For those who do not want an MCWD connection, their financial limitation (62%) is the main obstacle for not doing so. However, there are those who are satisfied with their current water sources (17%) so they find connecting to MCWD as unnecessary. Moreover, there are some HHs who resides in lots and houses that they do not own making them less compelled to connect to MCWD.

As shown in Table II-16, comprising 32% of the 746 HHs surveyed, majority of the current MCWD subscribers (76%) want to remain connected to the utility firm as they are satisfied with its service. There are also those who find transferring to another water provider tedious, as this would entail additional documentation and expenses.

However, about 24% of these HHs would like to transfer to another water service provider. The overwhelming reason for transferring is seemed to be the result from a lower price promotion to acquire customers in the mixed service areas where MCWD and other private water supply service providers exist.

Table II-16 Awareness about MCWD

Type	No.	%	Status	No.	%			
MCWD Users	235	32	Wanting to transfer	56	24			
			Not wanting to transfer	179	76			
			Total	235	100			
Non-MCWD Users	511	68	Never connected	508	99	Wants to connect	167	33%
						Does not want to connect	336	67%
						Total	503	100%
						Applied to MCWD but refused	15	3%
			Previous MCWD User	3	1			
			Total	511	100			

- Water Satisfaction

Among the indicators in the following Table II-17, smell, water quality, water pressure and affordability are at lower satisfaction level. The smell is mainly caused by chlorination.

Table II-17 Average Satisfaction Rating for MCWD Water: Q-7

Drinking Water Sources of MCWD	Average Satisfaction Rating (/ point of full score)								
	Water Quality (/5)	Smell (/3)	Taste (/3)	Saltiness (/3)	Color /3)	Rust (/3)	Water Quantity (/3)	Water Pressure (/3)	Affordability (/4)
B-1: Individual	3.89	2.76	2.88	2.98	2.77	2.77	2.03	2.20	2.45
B-3: Communal	3.82	2.73	2.90	3.00	2.73	2.64	2.10	2.09	2.64
B-4: In-direct	3.90	2.74	2.84	3.00	2.76	2.82	1.99	2.15	2.56
B-5: Tanker	3.50	3.00	3.00	3.00	3.00	3.00	2.00	3.00	2.00
All of B	3.89	2.75	2.86	2.99	2.76	2.79	2.02	2.17	2.50

- Saving Water

More than half of HHs are trying to save water and/ or water expense as shown in Table II-18.

Table II-18 Water Consumption per HH and Lpcd by Saving Water: Q-8.2

Trying to Save	No. of HHs	%	Lpcd
Yes	423	57	61
No	323	43	70
Total	746	100	65

Regarding Lpcd, HHs that are trying to save water consume 9 liters less than those are not trying to save water. This saving amount of 9 liter is equivalent to 13% of consumption of those are not trying to save water. Therefore it is expected that 6% (65 Lpcd→61 Lpcd) of consumption can be reduced/ saved if they are trying.

The following Table II-19 shows water use for watering plants by MCWD water. Many of B-1 users are using MCWD water for watering plants (84%). The water for watering plants can be saved by using recycle water and/ or rain water.

Table II-19 Uses of Water by Water Source: Q-4

Water Source	Watering Plants	
	No.	%
B-1	196	84
B-3	6	55
B-4	101	50
Total	303	68

- Sanitation

As shown in Table II-20, most of HHs have own toilets (80%). Including any kinds of toilet, more than 90% of HHs have toilets. Most of those toilets are automatic or manual flush types, which consume more water than pit toilets shown in Table II-21. Most of those having toilets have septic tank (90%), however only 24% of those having septic tank have practicing de-sludging as shown in Tables II-22 and II-23. Thus most of sewage is discharged without treatment.

Table II-20 Ownership of Toilet: Q-9.1

Type of Toilet	No.	%
Own toilet	591	79
Communal/public/common	67	9
Others	17	2
None	71	10
Total	746	100

Table II-21 Type of Toilet: Q-9.2

Type of Toilet	No.	%
Automatic Flush	74	11.0
Manual Flush	572	84.7
Pit on the Ground	15	2.2
Pit on the Water Way	10	1.5
Others	1	0.1
No Answer	3	0.4
Total	675	100.0

Table II-22 Septic Tank: Q-9.3

Type of Toilet	No.	%
With Septic Tank	610	90.4
Without Septic Tank	47	7.0
No Idea	16	2.4
No Answer	2	0.3
Total	675	100.0

Table II-23 Practicing De-sludging: Q-9.4

De-sludging	No.	%
No Answer	0	0.0
Yes	147	24.1
No	401	65.7
No Idea	62	10.2
Total	610	100.0

< Establishment >

- Type of Business/ Establishment

The survey covered 100 business establishments in Metropolitan Cebu. These establishments were categorized according to the type of products or services they were offering.

Table II-24 shows the distribution of respondents, with Offices and Others (those that belong to other categories aside from the 9 earlier identified) having the least respondents; and Shops as the highest. Shops have the highest respondents because of their sheer number. Their services are various, from retailing to wholesaling, from software to hardware, from merchandising to trading, and from selling to buying.

Table II-24 Type of Business/ Establishment: Q-1.1

Type of Business/ Establishment	No.	%
Factory/ Manufacturing	10	10
Shopping Mall	10	10
Restaurant	11	11
Shop	15	15
Office	7	7
School	10	10
Hotel	10	10
Water Supplier	9	9
Hospital	11	11
Others	7	7
Total	100	100

- Well Ownership

Having an own well is a popular amenity in establishments as shown in Table II-25. Nearly half of the establishments (47%) surveyed have wells because of the large volume of water that they need for their operations, whether for their products or for their clients. Manufacturers/ factories, for instance, use plenty of water for their products while hospitals and schools consume a lot of water for patients and students. Water from these wells is mostly suctioned through an electric pump and stored in overhead tanks or cisterns.

But not all of the establishments that own wells have a permit to drill. Since water use is for business purposes, it is important that they get a permit from NWRB, as stipulated in the Water

Code of the Philippines. However, nearly two quarters of these establishments have no permit to drill a well or have no idea whether a permit was acquired or not (see Table II-26).

Table II-25 Has Own Well: Q-1.6

Has Own Well	No.	%
Yes	47	47
No	53	53
Total	100	100

Table II-26 Own Well with Drilling Permit: Q-1.6

Status	No.	%
With Permit	27	57
Without Permit	5	11
No Idea	15	32
Total	47	100

- Water Sources

There are five (5) major water sources used by establishments, which are bottled water, MCWD, private vendor, own well, and rainwater harvesting (see Table II-27).

Table II-27 Water Sources: Q-2 (plural choice)

Water Sources	No.	%
A: Bottled Water	67	67
B: MCWD	63	63
C: Private Vendor	6	6
D: Own Well	47	47
E: Rainwater Collector	4	4
F: Others	1	1
Total	100	100

Bottled water is the most popular water source since this is used by more than half of the establishments (67%). MCWD water is also a popular water source, as more than half of the establishments (63%) use this water. With nearly half of the establishments (47%) use own well, this type of water can also be deemed as popular.

Water sources that are least patronized are from private vendors (6%) and rainwater harvesting (4%). Only one (1) establishment, a small eatery, uses water from a barangay hall for business operations. Water of private vendor is the highest in terms of average consumption though the unit price is higher than MCWD water, while MCWD water and own well water are almost same average consumption as shown in Table II-28.

Table II-28 Average Consumption and Cost by Water Source: Q-2 (plural choice)

Water Sources	Use			Cost			
	No.	L/ month	L/ day	No.	PHP/ month	PHP/ day	m^3/ PHP
A: Bottled Water	67	1,583	53	67	2,853	95	1.80
B: MCWD	62	748,920	24,964	63	35,837	1,195	0.05
C: Private Vendor	6	2,197,167	73,239	6	121,951	4,065	0.06
D: Own Well	47	740,234	24,675	1	4,950	165	0.01
E: Rainwater	4	165,000	5,500	0	-	-	-
F: Others	1	400	13	0	-	-	-
Total	100	951,735	31,725	92	34,625	1,154	0.04

- Awareness of MCWD

There are more establishments (63%) who subscribe to MCWD than those who do not (37%) according to Table II-29. Most of the non-MCWD users (86.5%) do not want to connect the utility firm for various reasons. Public schools, for instance, cannot decide for an MCWD connection since they are dependent on the decisions from higher authorities of the Department of Education. Several establishments (40.6%) with own wells do not also want to connect as they are satisfied with their current water source. Having an own well is perceived as cheaper as and more convenient than MCWD water.

The main reasons (single answer) of non-MCWD users for not wanting to connect to MCWD are having own well (40.6%) and satisfied with current source (15.6%). There are other eight (8) reasons, such as additional cost for connection, complicated application, building is not owned, etc, with several %.

Table II-29 Awareness about MCWD: Q-3

User	No.	%	Willingness	Ans.	No.	%
Non-MCWD	37	37	Wants to connect to MCWD	Yes	5	13.5
				No	32	86.5
				Total	37	100.0
MCWD	63	63	Wants to transfer to another water service provider	Yes	9	14.3
				No	54	85.7
				Total	63	100.0
Total	100	100	-	-	100	100.0

……

II-2 Current Situation of WATSAN Sector

II-2.1 Water Supply

(1) Background

Drinking water could be obtained privately from shallow wells or spring sources since long years back in the Metropolitan Cebu. At the year of 1912, the municipal water supply system owned by Osmena (currently corresponding to downtown in the city of Cebu) had been operated using surface water from Buhisan Dam (at the city of Cebu) and spring source from Hagubiao (at the municipality of Consolacion), as the first public water supply services.

The Metropolitan Cebu was suffered from water shortage in 1957-59 because the Buhisan Dam was dried up in 1957. As a consequence of this phenomenon, the municipal authorities decided to add groundwater source for more sustainable services. There were many deep wells being constructed privately for domestic and commercial utilities other than the Osmena Waterworks.

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

Most of water sources for drinking purpose are fall on groundwater including spring source. Surface water sources are limited in the study area; MCWD uses surface water from Buhisan Dam and Jaclupan (river-bed water).

(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-12.

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%.

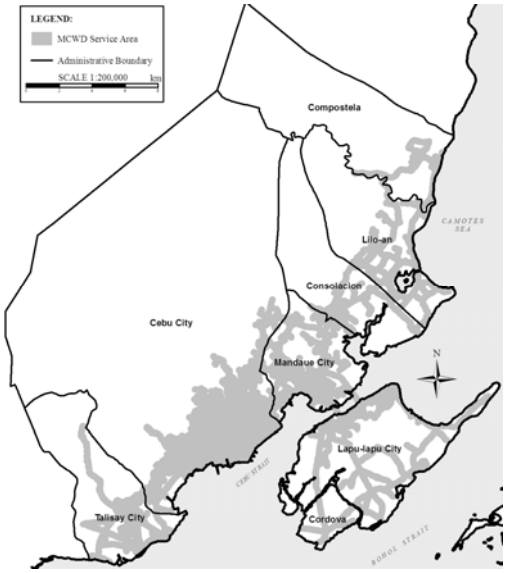
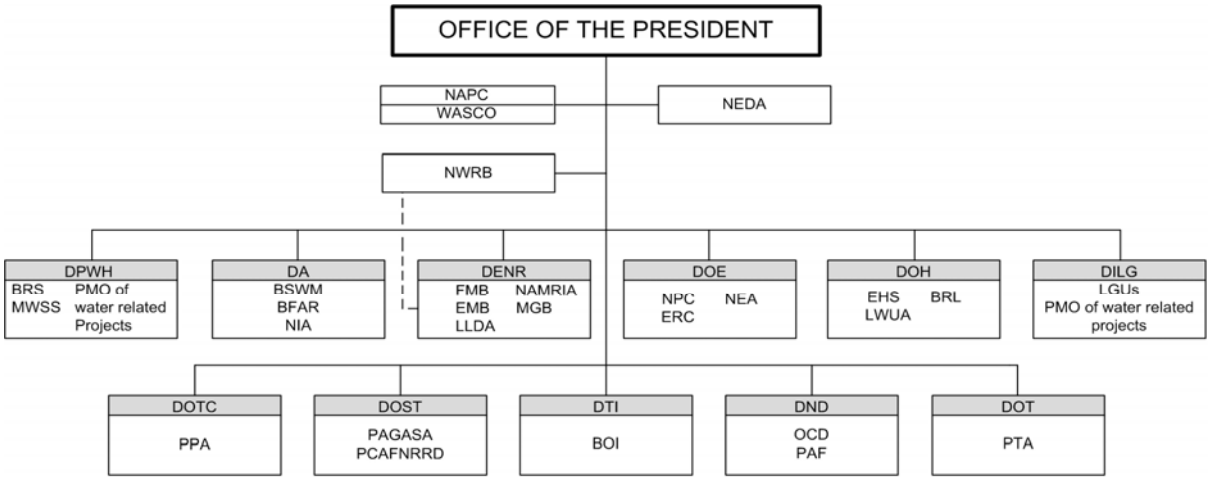


Figure II-12 Service Area of MCWD

(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-13, agencies belonging to each sub-sector generally have independent strategies and programs resulting to overlapping projects/ activities.



*Note: NWRB is under DENR's Administrative Supervision

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-13 National Government Agencies relating to Water Sector

Presidential Decree (PD) No.1067 also known as the Water Code of the Philippines vested the NWRB with the functions of regulating the "utilization, exploitation, development, control, conservation or protection of water resources" while Executive Order (EO) No.123 acknowledge NWRB's role as the government coordinating and regulating body for all water resources-related development. However, NWRB was not given the prerequisite legal clout and corresponding financial, manpower and other logistical resources to effectively function as such. Therefore, institutional fragmentation and poor coordination among agencies persist and result to problems brought about by;

- ambiguous definition of roles and responsibilities,
- overlapping mandates,
- lack of a comprehensive database,
- lack of an integrated sustainable water management policy,
- weak implementation of regulatory policies, and
- uncoordinated efforts in resolving site-specific issues in water resources management (WRM).

To date, no law has been passed creating an independent regulatory body responsible for both re-

source 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.

Essentially more people and more clean water mean larger quantities of waste and wastewater are produced. A series of studies have shown a strong correlation between integrated water supply and sanitation programs and health and environmental improvements, while there is a strong indication that isolated water supply projects can actually exacerbate public health and environmental risks.

(2) Current Service Level

A survey was carried out as part of this study including sanitation conditions. A sample population of 746 was surveyed across the project area. The project area is highly urbanized with the majority of the population concentrated in cities (43% of total population in Cebu city) along the coast at the downstream end of drainage catchments. Approximately 43% of the sample population lives in informal settlements in the major cities with the majority ranging from poor to very poor. About 50% live in single detached houses and the rest in subdivisions, condominiums and compounds.

The survey showed that there is high access to basic sanitation facilities by the population with approximately 80% owning a toilet as shown in Figure II-14.

The 9% of sample population without toilet facilities use fields or riversides and interestingly

42% when asked if they would like a toilet they replied no. About 90% of the population with toilet facilities has septic tanks (on-site treatment). The rest 10% dispose waste untreated in waterways, adjacent land or directly to drains. A 82% of those, when asked if they want a septic tank they said no. It is evident that there is lack of awareness of the need of sanitation. Also socio-economic conditions are pertinent to willingness to sanitation. Approximately 43% of the sample population lives in informal settlements in the major cities with the majority ranging from poor to very poor.

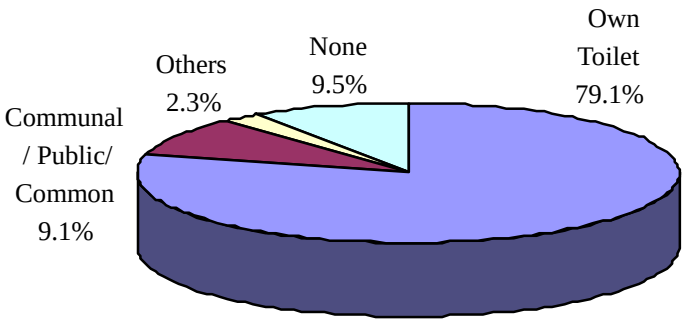


Figure II-14 Toilet Ownership

Although access to toilets is relatively high service coverage and provision is very low. There is no centralized sewerage system or treatment. Only special economic zones are served by small private facilities. This means that the majority of wastewater generated within the area is disposed off untreated. Nationally about half (48.0%) of water pollutants are domestic waste, about 37.0% agricultural and 15.0% industrial. In a highly urbanized area, such as Metro Cebu it is safe to assume that the domestic percentage is much higher.

A summary of the existing sanitation situation along with relevant study area conditions obtaining from socio-economic 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

< Socio Economic Conditions >

- The project area is highly urbanized with the majority of the population concentrated in cities (43% of total population in Cebu city) along the coast at the downstream end of drainage catchments.
- Approximately 43% of the sample population lives in informal settlements in the major cities with the majority ranging from poor to very poor. 50% live in single detached houses and the rest in subdivisions, condominiums and compounds

< Land Use >

- The majority of urban land use is residential and the rest a mix of commercial, industrial, institutional with the exception of Mandaue that is heavily industrialized.
- Rural land use which represents the largest % of the total project area is mainly agro-forestry.
- House plot footprints are generally small without much land available within the cities. Land availability increases away from the urban core.
- The majority of residential houses are single detached.
- Informal settlements are congested with restricted access and services.

< Others Services >

- Approximately 31% of the sample population is connected to MCWD supply with individual faucet and 26% make use of the neighbors MCWD service.
- The rest of the population depends on various sources for water supply.
- Water consumption rates vary significantly. Those with individual faucets consume over 100 Lpcd while those without around 30 Lpcd.

< Solid Waste >

In LGUs the responsibility for 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.

Eight LGUs have their own landfills the remainder send their solid waste to the DPS landfill at Inavawan (Cebu city). Barangays are responsible to DENR for solid waste disposal. Each Barangay has a Councilor tasked with the environment. A pilot project for the composting of market waste was being operated at the Northern Reclamation STP. High quality compost was being produced. A large volume of plastics and other solids was observed along the riverbanks.

(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-15 shows the locations of the main existing facilities.

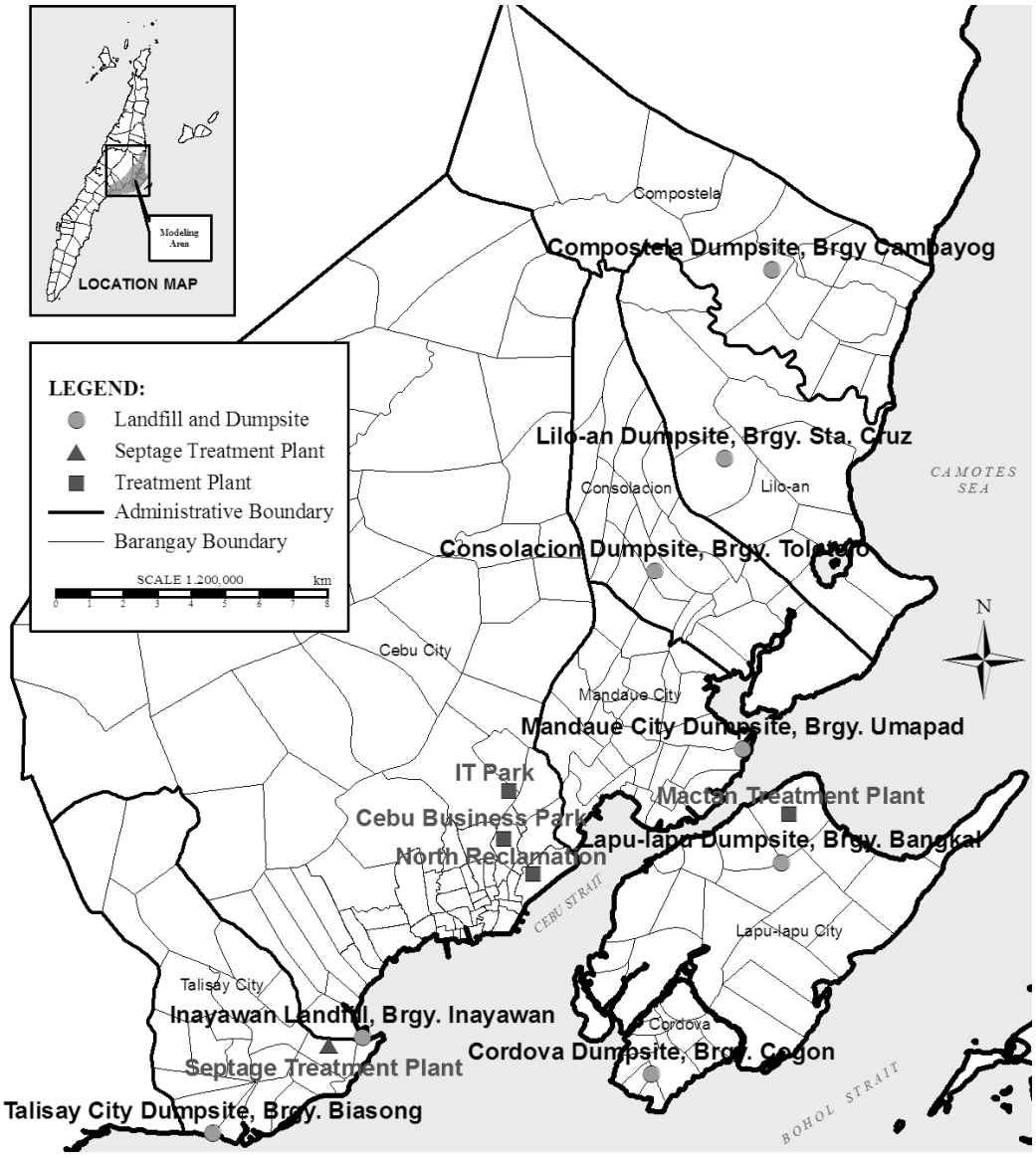


Figure II-15 Existing Treatment Facilities

(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.

There are no existing studies or data that either quantify or qualify the source of pollution but there is a strong indication that poor sanitation is the main contributor. The majority of households, commercial and public buildings are served by private toilet facilities and septic tanks. Their construction and maintenance is the sole responsibility of the developer/owner. Private companies are providing septic tank evacuation and septage transport services for private developments while the DPS is responsible for public buildings only.

(2) Groundwater

The Water Quality Control Division of PDD, in coordination with the Groundwater Division of

EWRKC in 2005, carried out a study of Nitrate contamination in Cebu. 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.

Further raw water sampling was carried out as part of this study at fifty MCWD wells. The results show that 7 wells exceed the value of 50 mg/L NO_3 that is the internationally acceptable maximum standard for drinking water. Alarmingly high Nitrate concentrations were found in areas at the upstream end of Guadalupe River. Well G5B showed the highest concentration at 112.7 mg/L followed by G3 at 96.4 and K3.2 at 90.1 mg/L in dry weather, respectively.

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).

No water washed diseases such as skin and eye infections or water based diseases such as schistosomiasis were registered in the data. It could not be ascertained at this point if this is due to zero occurrence or if these diseases are not included in the surveillance program.

.....

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.

As provided for under PD-198, MCWD is governed by a Board of Directors (BOD) comprised of the chairperson and four other members each representing the business, education, women, and civil society sectors. They are all nominated by the mayor of Cebu city. When MCWD obtained a loan from LWUA, a LWUA representative to the BOD was added for a total of 6 board members. Recently, the Development Bank of the Philippines took over LWUA's seat in the BOD when it MCWD's loan from LWUA was transferred to it.

The Supreme Court Decision of September 13, 1991 declared all Local Water Districts (LWDs) and this included MCWD, as government-owned and -controlled corporations (GOCCs) with original charter. As such, MCWD operations have to be in accordance with government rules and regulations. Despite its status as GOCC, MCWD has from the beginning been operating on a self-liquidating basis. To date, it has not received any subsidy for its operations from the local or the national government.

(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-16 and Table II-30 show the organization of MCWD and the duties/ responsibilities of five Groups and 20 Departments, respectively.

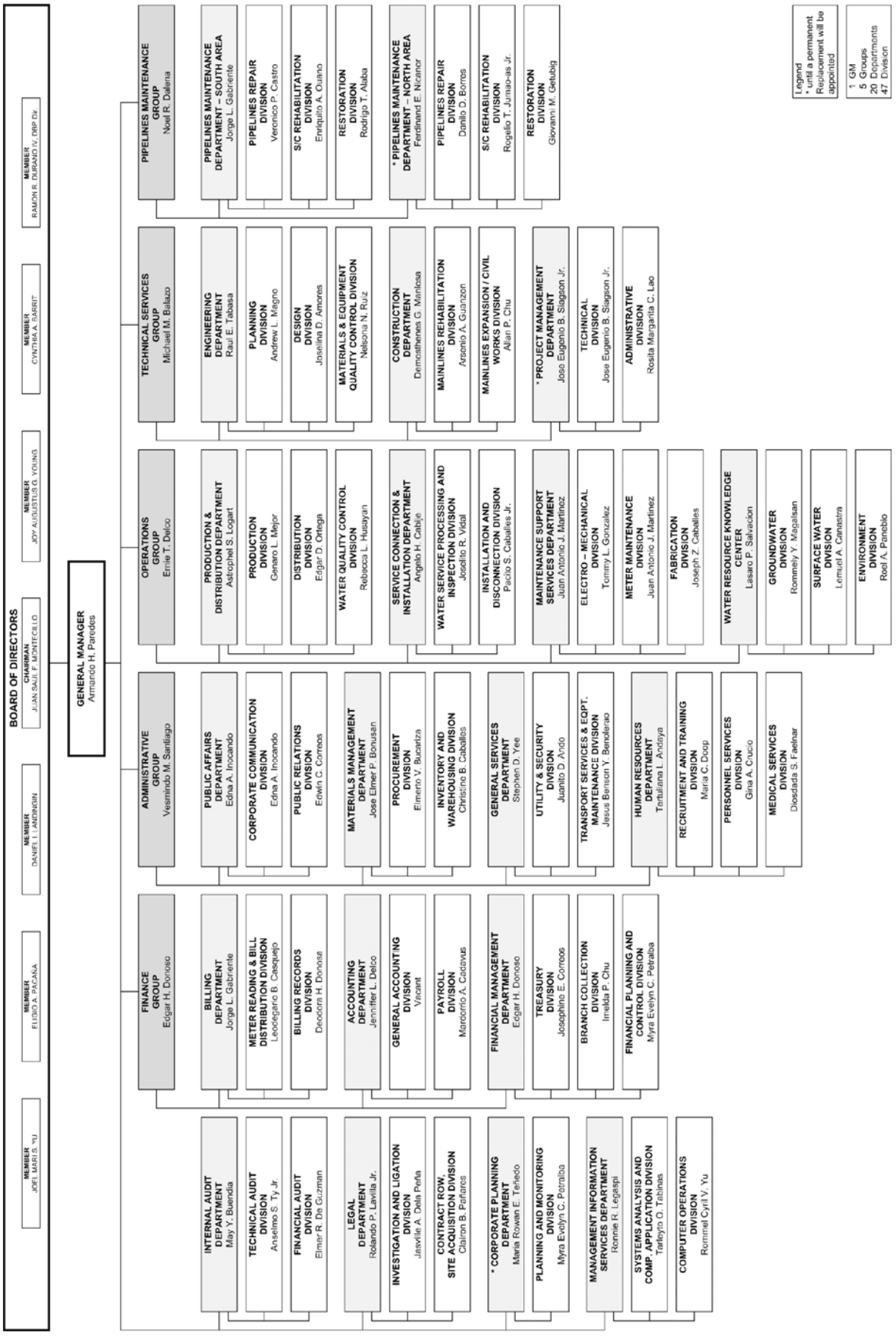


Figure II-16 Current Organization Chart of MCWD (Nov-2008)

Table II-30 Duties/ Responsibilities of MCWD Groups and Departments

Management/ Group	Department	No. of Staff	Major Duty/ Responsibilities
Office of the General Manager GM; 1 Depts.; 4 personnel; 72	-	1	Responsibilities: (a) To manage the overall direction and operations of MCWD; (b) To ensure planning and control in implementing administrative/ operational tasks in order to achieve MCWD goals and target
			Authorities: (a) To appoint all personnel in the District (b) To make decisions on matters those are within the bounds of the GM's authorities.
	Secretariat	4	To provide secretariat support to the General Manager
	Internal Audit	14	To assist management in defining and establishing internal control and evaluate the efficiency and effectiveness of the existing operational systems and continually monitor these controls to ensure that department objectives are met.
	Legal	24	To provide legal support to the management and staff in all its corporate transactions with legal implications involving but not limited to acquisition of right-of-ways, permits and sites, prevention and prosecution of pilferage cases, collection and settlement of unpaid contested water bills, investigation and prosecution of administrative complaints, rendering advice and/or opinions on meritorious queries and supervise security personnel.
	Corporate Planning	7	To provide support in the corporate planning process and in the formulation of major policy descriptions through the provision of well- packaged information in a timely and efficient format.
	Management Information	22	To provide effective and efficient computer services and promotion of computer literacy. To act as catalyst for improving operations and productivity through sound application of information technology. To design and manage the growth of information technology infrastructure in MCWD in an innovative, timely, safe and cost effective manner and conforming to internationally accepted standards.
Finance Group AGM; 1 Depts.; 3 personnel; 93	AGM	1	To provide the general direction, control and overall management of the Group in providing budget, financial, billing and accounting needs of MCWD in a responsive, efficient and cost effective manner.
	Billing	48	To manage the billing activities and ensure timely billing, distribution of water bills and the maintenance of complete, accurate and updated record of concessionaire accounts as well as the implementation of credit terms and policies and various collection strategies.
	Accounting	18	To produce financial information concerning past operations and present conditions, provide a basis for guidance for future operations, disposition and utilization of fund and property and report on financial position and the results of operation for the information of all persons concerned. To provide timely and accurate payroll services.
	Financial Management	26	To administer, plan and program the procurement, custody and use offunds. To continuously improve the collection system by setting up additional collection centers in strategic locations and adapting advanced technology collection mechanisms.
Administrative Group AGM; 1 Depts.; 4 personnel; 110	AGM	1	To provide the general direction, control and overall management of the Group in staffing, controlling, motivating the employees and in providing general support services to the whole organization.
	Public Affairs	19	To continuously maintain and enhance a good corporate image by providing speedy and accurate information to MCWD's publics; handling complaints effectively and efficiently; and, monitoring customer satisfaction.
	Materials Management	22	To procure the necessary equipment, materials, supplies and services in the specified quality, in the exact quantity, at the best price and from the right source through fast and cost effective systems and procedures. To ensure a continuous and steady supply of materials and supplies while maintaining an optimum inventory level of the same and institute tight controls to safeguard these assets.

Management/ Group	Department	Staff	Major Duty/ Responsibility
Administrative Group AGM; 1 Depts.; 4 personnel; 110	General Services	49	As a support and service unit, to provide all departments with adequate and efficient transportation, construction equipment and power generating units. To provide proper maintenance of the plant and structures, efficient support services and good working surroundings.
	Human Resources	19	Acquisition, maintenance and development human resources and providing support for job organization and information.
Operations Group AGM; 1 Depts.; 4 personnel; 271	AGM	1	To provide the general direction, control and overall management of the Group.
	Production & Distribution	93	To operate the water production facilities and to equitably distribute safe, potable water to the concessionaires in an effective manner.
	Service Connection & Installation	67	To install water service connections to applicants in accordance with set technical standards in a given time and to support the drive for the enhancement of the collection efficiency.
	Maintenance Support Services	55	To maintain water metering devices, electrical and mechanical pumping facilities in excellent working condition using correct engineering practice. To provide fabrication services and technical assistance to other departments.
	Water Resources Knowledge Center	55	To undertake continuing exploration and development activities for water sourcing in adherence to sound environmental practices towards the preservation, protection and management of water resources.
Technical Services Group AGM; 1 Depts.; 3 personnel; 107	AGM	1	To provide the general direction, control and overall management of the Group in providing engineering, construction and project management support to the corporation.
	Engineering	68	To conduct scientific studies and investigation for the improvement of the existing water supply system. To anticipate future demand, prepare the detailed engineering design of the water districts expansion/rehabilitation project in a cost-effective manner conforming to approved standards. To provide technical services to other units within the organization.
	Construction	33	To undertake the implementation and close monitoring of the contracted expansion and rehabilitation projects in a timely, safe and cost effective manner and conforming to internationally accepted standards.
	Project Management	5	To monitor and supervise all contracted projects on expansion and development of water sources.
Pipeline Maintenance Group AGM; 1 Depts.; 2 personnel; 237	AGM	1	To provide the general direction, control and overall management of the Group in providing pipeline maintenance services in MCWD-covered areas.
	Pipeline Maintenance South Area	115	To maintain pipelines such as transmission, distribution and service connection lines and restore road pavements affected by the maintenance works and projects, in a prompt and efficient manner to minimize water system loss, prevent and arrest water contamination in order to provide customer satisfaction.
	Pipeline Maintenance North Area	121	To maintain pipelines such as transmission, distribution and service connection lines and restore road pavements affected by the maintenance works and projects, in a prompt and efficient manner to minimize water system loss, prevent and arrest water contamination in order to provide customer satisfaction.
Total Staff Numbers		890	

Source: Corporate Planning Department, Quality Management System and interviews

(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-31 shows changes in MCWD equity and capitalization.

Table II-31 Capital Formation (unit: PHP thousand)

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

Equity increased in 2002 for PHP26.3 million and in 2006 for PHP1.6 million as transfer of assets from the Government of Netherlands (GON) so that EWRKC received by way of transfer assets from the GON. These assets are to be used for the implementation of the Water Remind project.

Balance sheet is presented in Table II-32. The initial loans with LWUA were credit lines that were obtained to finance the various projects of MCWD. Interest rates from these loans ranged from 10% to 14% per annum and were supposed to be amortized over a period from 20 to 26 years.

Republic Act No.7718 amending No.6957 entitled Investment Coordination Committee in NEDA to approve up to P.300 million and NEDA Board Committee if project costs exceed PHP300 million. 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.

Table II-32 Balance Sheet (unit: PHP thousand)

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-abilities/ Capitalization	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

Pursuant to PD 198 Sec. 46, MCWD is exempt from paying income and all other National, Local and Municipal Government taxes and fees including franchise, licenses or permit fees, court litigation charges and import duties for machinery, equipment and materials for its own use.

Table II-33 shows the statement of profit and loss. Cash flow statement is shown in Table II-34.

Table II-33 Profit and Loss Statement (unit: PHP thousand)

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

Source: Audited Financial Statement

Table II-34 Cash Flow Statement (unit: PHP thousand)

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. In 2003, it received its ISO 9001:1994 accreditation from the Bureau Veritas Quality International (BVQI) N.A. This is in recognition of MCWD's Total Quality Management System as one which fully complies with and has satisfied the requirements of ISO 9001 world class standards in work processes and procedures in water services. 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

The existing water supply systems/ facilities in the study area consists of Level-I (point source facility), Level-II (communal faucets), and Level-III (individual connections). Water supply ser-

vices are either provided by Water Districts, LGUs, water cooperatives, Barangay Water Associations and private vendors. The sources of these water systems/ facilities are either deep well, shallow well, dug well or spring.

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.

Financial statements show prior year's profit adjustment every year around PHP30,000 to 40,000 thousand which is recognized through accrual base adjustment. MCWD's year end account settlement starts January 10th every year to accelerate financial statement disclosure. Such adjustment was shown in Table II-35.

Table II-35 Prior Year's Profit Adjustment (unit: PHP thousand)

Year	2003	2004	2005	2006	2007
Adjusted (deducted) amount	23,909	52,196	49,070	30,437	22,927

Source: Audited Financial Statement

(4) Water Tariff Structure

< Water Tariff Table >

Executive Order No.279 requires cost recovery tariff recovering capital cost, and operation and maintenance costs at all service levels. MCWD water fees are structured to attain full cost recovery at a reasonable profit. Production cost includes the cost of NRW.

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-36. Whereas, Philippine water districts, counted 474, average water rates as of June 30, 2008 for a 1/2"domestic connection are shown in Table II-37.

Progressive commodity price scale is defined in "Manual on Water Rates" published by LWUA up to 4" pipe, and above that price may be optionally proposed. MCWD's water tariff is now

under revision.

Table II-36 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

Table II-37 Average Water Rate for a 1/2" Domestic Connection by All WD (June 2008)

Mini. service charge of	Commodity charge of				
10 m^3	11-20m^3	21-30m^3	31-40m^3	41-50m^3	51m^3-up
164.71	18.37	20.35	22.83	25.09	25.75

Source: LWUA Research Division website

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.

The poverty family has been receiving a potable water with much higher expenses than that of MCWD subscribers. Increasing of water tariff rate may not affect the poverty families economically because appropriate promotion, monitoring and management of communal system can reduce such expenses of the poverty family.

< 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. One connection can supply water to a maximum of 30 households. CWS is MCWD's level-II program, designed to help a group of 15 to 30 low-income families in a depressed area, avail of safe, potable and affordable water from MCWD. Any person, entity, cooperative or NGO may enter into a contract with MCWD to sell water in depressed areas at a lower rate compared to normal rates. CWS encourages self-reliance and foster group unity and community development.

MWCD also provides communal faucets to Barangay Water Associations (BWA). Each BWA caters to 25 households. The water charges for BWAs are lower than that of a regular domestic household 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. Of the surface water, Manangan River surface water is dammed at Jaclupan weir and infiltrated into aquifer and then pumped up to the reservoir. This water is categorized into groundwater. Each volume as of December 2008 is summarized in Table II-38.

Table II-38 Breakdown of Water Source

Water Source		Production (Dec. 2008)		Remarks
		Volume (m^3/day)	Percentage (%)	
Groundwater	Own Well Facilities	118,532	71.7	109 wells (incl. obser.)
	Bulk Water	16,025	9.6	3 private firms
Surface Water	Buhisan Dam	4,752	2.9	Tisa WTP
	Jaclupan Infiltration	26,095	15.8	Infiltration Galleries
Total		165,404	100.0	

Source: Corporate Planning Department

Note: Location of facilities is referred to the map in open page.

< Water Service Availability and Water Pressure >

Service hour as of the 4th quarter in 2008 is shown in Table II-39. About 67%, that is two thirds amazingly, of total concessionaries enjoys 24 hour water supply. From the 44% of 4th quarter of 2007, more than 10 points has increased.

It is remarkable improvement and excellent performance. This is because the PDD has started pressure averaging project by installing PRV (Pressure Regulating/ Reducing Valve) on the lateral pipe. By using PRV and adjusting high pressure area to moderate pressure, another low pressure area is improved. The PDD has already installed 14 PRV of the planned 17 valves. However, hilly areas of Cebu City and major part of Mandaue City still suffer from non-full time service. Water pressure distribution is deeply related to the service area as described above. Water pressure data is shown in Table II-40.

According to the MCWD effective pressure standard, 10 psi which is equal to 7m H_2O height is

enough for domestic water consumption. From the above table, household percentage enjoying more than 10 psi pressure is 86%, which means three fourth of total concessionaries has enough water pressure. In terms of area-wise pressure, areas falled on central Cebu area and major parts of Mandaue City are still suffering from low pressure. Countermeasures to these areas are indispensable.

Table II-39 Water Service Availability (December 2008)

Service Hours	No. of Connections	Occupancy
24	80,794	66.9%
23	276	0.2%
22	7,485	6.2%
21	574	0.5%
20	8,098	6.7%
18	5,994	5.0%
17	1,476	1.2%
16	300	0.3%
15	7,260	6.0%
14	415	0.3%
13	2,397	2.0%
12	3,517	2.9%
11	378	0.3%
10	944	0.8%
8	315	0.3%
7	514	0.4%
Total	120,737	100.0%

Source: Production and Distribution Division (PDD)

Table II-40 Average Pressure (December 2008)

Average Pressure (mH_2O)	No. of Connections	Occupancy
30	3,560	3.0%
28	370	0.3%
25	2,588	2.1%
22	349	0.3%
20	9,664	8.0%
18	2,732	2.3%
17	321	0.3%
16	746	0.6%
15	33,099	27.4%
13	1,069	0.9%
12	6,256	5.2%
11	1,367	1.1%
10	29,413	24.4%
9	500	0.4%
8	8,333	6.9%
7	3,107	2.6%
6	3,647	3.0%
5	12,638	10.5%
4	978	0.8%
Total	120,737	100.0%

Source: Production & Distribution Division (PDD)

< Water Consumption >

Table II-41 shows the number of service connection, water consumption by category and unit water consumption in 2005 and 2008.

Table II-41 Comparison of Water Consumption (Dec-2005 and Dec-2008)

Description	Category	A: Dec-2005	B: Dec-2008	B/ A
No. of Service Connection	Residential	101,869	114,847	+15%
	Commercial	3,479	3,315	-5%
	Communal	249	199	-19%
	Sub-division/ Condominium	37	51	+38%
	Government	184	170	-8%
	Total	105,818	118,582	+14%
Water Consumption (m^3/month)	Residential	2,732,469	3,075,312	+13%
	Commercial	453,214	514,158	+13%
	Communal	32,550	23,959	-26%
	Sub-division/ Condominium	54,127	103,162	+91%
	Government	60,746	64,526	+6%
	Total	3,333,106	3,781,117	+13%
Water Consumption (Lpcd)	Residential	170	166	-2%
	Communal	16	14	-9%

- 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.

  Residential connections increased 15% from 102,000 to 117,000 in three years with little area-wise bias. Number of communal faucets has a bit decreased as individual connection increased. There are many Subdivision/ Condominiums being established in Mactan Island. Nineteen seven percent (97%) of the service connection is for residential use.

- Consumption Amount

  Consumption volume also increased as connection number goes up, showing almost same increase ratio as connection number. Residential consumption increased by 13% in volume in these three years. As of December 2008, 80% of total consumption is for residential use, 14% for commercial use.

- Per Capita Consumption

  Residential per capita consumption does not show much change in these three years. The average of residential in 2008 is 166 lpcd (liter per capita per day). As to communal faucet, assuming 52 households receive water from one faucet and average number per household is 5.1 person, the average lpcd is calculated as 14-16 litter.

  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

< Overall System Diagram >

MCWD has three types of water source; ground water, surface water and bulk water. Ground water and part of surface water are pumped up to the reservoirs or network directly after injec-

tion of liquid Chloride. Of the 109 wells functioning as of December 2008, two thirds are fed to the reservoirs, the rest directly to the distribution main pipes. Additional groundwater source is contracted bulk water supplied directly to the network or reservoir by 3 private companies which have their own desalination/ filtration plants. System diagram is shown in Figure II-17.

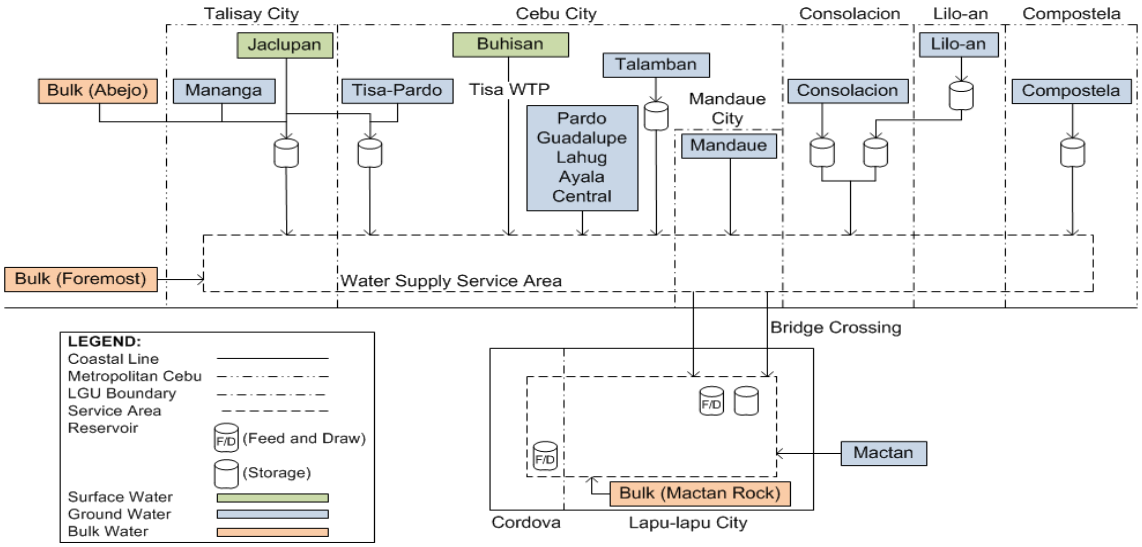


Figure II-17 System Diagram

Surface water sources are Buhisan Dam and Jaclupan infiltration/sedimentation pond. Source water stored in Buhisan Dam is delivered to the Tisa Filter Plant by gravity and treated in the Plant. Treated water is transmitted into network without passing pumping facility or storage reservoirs. Jaclupan water is stored into aquifer and pumped up to the reservoir, so it is not strictly surface water source. Above mentioned 109 pumping facilities include 15 Jaclupan pumping facilities.

As is described above, drinking water is supplied into network through reservoirs and direct injection. The area distributed by gravity by highly elevated reservoirs and that covered by direct injection by pumping are not clearly separated and some reservoirs are fed through transmission/ distribution line working as balancing tank. Then many reservoirs are not only distributing but also receiving water from pipe network pressurized by submersible pumps, especially when consumption volume decreases and statistic pressure increases.

Such conditions make the control of flow and pressure difficult. Reservoirs of 11 numbers at 10 locations exist in MCWD jurisdiction. Total length of pipe network is estimated at nearly 770 km including small diameter (12mm) pipes covering wide area. The pipe with diameter of 300 mm and more is called as transmission pipeline and that with diameter of less than 250 mm is distribution pipeline. With the mixture of direct feeding system and gravity distribution system by reservoir, total system is complicated. This complex system makes the difficulties of flow and pressure control.

< Intake Facility >

- Surface Water

There are two surface water intake facilities; namely Buhisan Dam and Jaclupan Infiltration Field. Historical monthly intake records are shown in Figure II-18.

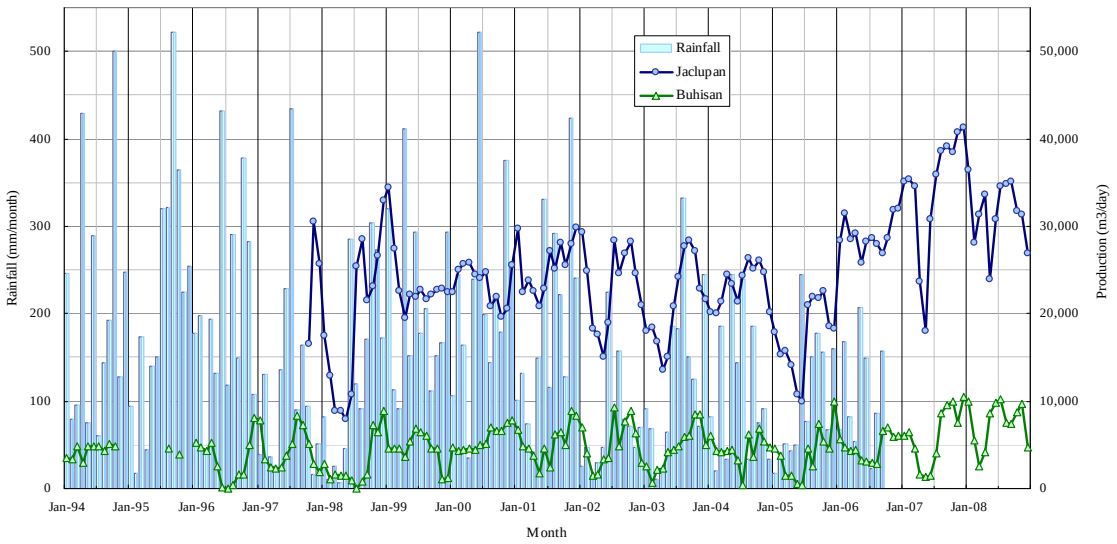


Figure II-18 Historical Records of Surface Water Intake

Buhisan Dam

Buhisan Dam was constructed during 1908-1911 period damming Buhisan River. Main features of the dam are as follows. This dam has been suffering from siltation and small scale of dredging has been continued by MCWD. This dam supplies raw water to the Tisa WTP with maximum volume of 600 m^3/hr or about an average of 4,700 m^3/day.

- ✓ Drainage area at dam site is 6.1 km^2
- ✓ Pond surface area is 5 ha and storage capacity is around 6,000 m^3
- ✓ Dam type is concrete arch and its height is 26 m
- ✓ Spillway length is 13.5 m and it has three 4.5 m wide gates
- ✓ Pipeline from Buhisan dam to Tisa Filter plant is about 2 km of 700 mm cast iron pipe

Jaclupan Infiltration Facility

Mananga infiltration facility is composed of small 7 m height conversion weir, infiltration basin, sedimentation basin, and 20 galleries. It was constructed in 1998 under the Mananga Phase-I Project damming Mananga River, which has 69 km2 of watershed area in its up-stream. Dammed surface water is infiltrated and stored into aquifer before pumping up to the Lagtang reservoir through 6 km of transmission pipe. SCADA system will be installed here with radio-based control system

- Groundwater

Existing production wells are listed in Table II-42.

Some of the wells are in no use due to the disapproval of Local Government Unit, for example, MC-1 to MC-10 well in Compostela. Other some wells were abandoned due to low yield or high salinity. Some of the working wells also have a few troubles.

- ✓ W-9 keeps working under the pavement because paved road was widened.
- ✓ W-2 is installed in the premises of private company, which is an obstacle to the O/M works

Historical intake records are shown in Figure II-19. As of December 2008, daily intake amount was estimated at 118,500 m^3.

Table II-42 Existing Production Wells

Talamban		Mananga		Mactan*[1]		Banilad-Talamban*[1]		Jaclupan	
1]	K - 2.2	26]	W - 1.1	48]	MAC - 1	71]	W - 29	94]	MG - 1
2]	W - 4.2	27]	W - 1.2	49]	MAC - 3	72]	W - 30	95]	MG - 2
3]	W - 4.7	28]	W - 1.3	50]	MAC - 4	73]	W - 31	96]	MG - 5
4]	W - 4.8	29]	W - 1.4	51]	MAC - 5	74]	W - 32	97]	MG - 6
5]	W - 4.10	Lilo-an		52]	K - 2.4	75]	L - 4	98]	MG - 7
6]	W - 4.11	30]	SV - 1*[2]	Lahug*[1]		76]	L - 5	99]	MG - 8
7]	W - 4.12	31]	SV - 2	53]	W - 25	77]	L - 6	100]	MG - 9
8]	W - 4.14	32]	SV - 3	54]	W - 27	78]	L - 7	101]	MG - 10
9]	W - 4.9	33]	SV - 4	55]	W - 28	79]	L - 8	102]	MG - 11
Consolacion		34]	SV - 5	56]	L - 1	Pardo*[1]		103]	MG - 12
10]	W - 5.1	35]	SV - 6	57]	L - 2	80]	W - 2	104]	MG - 14
11]	W - 5.2	36]	SV - 8	58]	L - 3	81]	W - 4B	105]	MG - 16
12]	W - 5.3	37]	SV - 9	59]	CPH	Central Cebu*[1]		106]	MG - 18
13]	W - 5.4	38]	SV - 10*[2]	Guadalupe*[1]		82]	W - 9	107]	MG - 19
14]	W - 5.5	39]	SV - 11	60]	W - 11	83]	W - 15	108]	MG - 20
15]	W - 5.6	40]	SV - 12	61]	W - 12	84]	W - 17	Ayala	
16]	W - 5.7	41]	SV - 13	62]	W - 13	85]	W - 18B	109]	AYALA-1
17]	K - 2.1	42]	SV - 14	63]	W - 13B	86]	K - 3.2		
Tisa-Pardo		43]	SV - 15	64]	G - 1	Mandaue*[1]			
18]	W-5 (MC-5)	44]	SV - 16	65]	G - 2	87]	CAN - 1		
19]	W-6 (MC-6)	45]	SV - 17	66]	G - 3	88]	CAN - 2		
20]	T - 2	Compostela		67]	G - 4	89]	CAN - 3		
21]	T - 5	46]	W - 3.2	68]	G - 5B	90]	CAN - 5		
22]	P - 2	47]	W - 3.3	69]	G - 7	91]	CAN - 6		
23]	P - 4			70]	G - 9	92]	CAN - 7		
24]	P - 6					93]	CAD - 1		
25]	K - 3.1								

Note*[1]: Direct supply to the pipeline network (7 areas by 35 wells)

Note*[2]: Of the 16 Lilo-an wells, SV-10 delivers water to the Lilo-an area, which covers 90% of Lilo-an service area, and also part of SV-1 water goes to the public faucets.

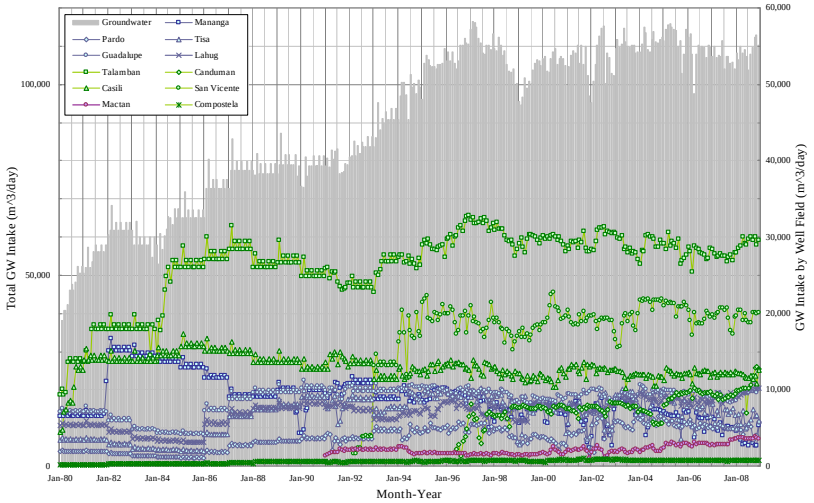


Figure II-19 Historical Records of Groundwater Intake

Regarding groundwater quality, there are two problems in some well fields; saltwater intrusion and nitrate contamination. Water samples from most production wells have been examined monthly by the MCWD Laboratory. Following Figures II-20 and II-21 show historical records of Cl and NO_3 using average in each well field. Other water quality problem is TDS (calcium) exceeding the maximum permissive level insignificantly of the PNSDW-07 but it does not reach the harmful level to affect the human health. To date, there is no report on water quality parameter which exceeds the chronic toxicity level of PNSDW-07.

Well fields with high chloride concentration are San Vicente (Lilo-an) and Mactan (Mactan Island), while with high nitrate contamination is located in hilly area of Cebu city. Causes of these water quality problems are corrosion of limestone in San Vicente, over extraction in Mactan and human waste from new housing development in Cebu city.

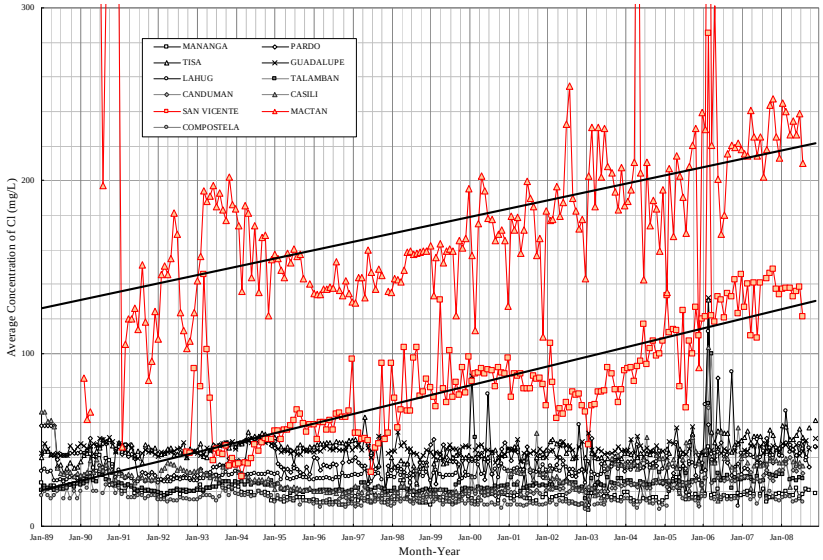


Figure II-20 Historical Monthly Record of Cl at MCWD Well Fields

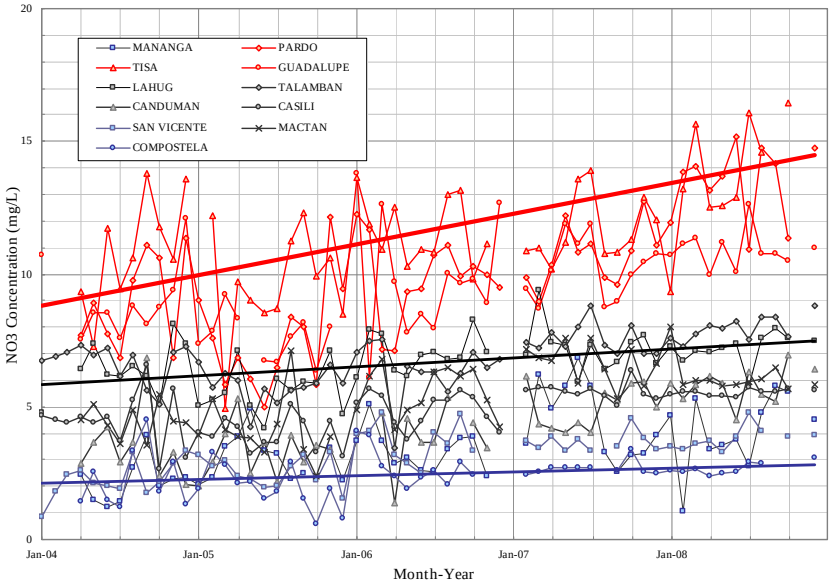


Figure II-21 Historical Monthly Record of NO_3 at MCWD Well Fields

Some distinctive wells are W-13B well and SV-10 well. W-13B well is a SCADA pilot operation well and water pressure and flow data is delivered to the Head Office by wireless transmitter. SV-10 well is initially supposed to feed Lilo-an reservoir, however, it supply drinking water to the Lilo-an municipality.

As to the chlorination of the ground water, chlorination at each well is omitted as far as liquid chlorine is injected at the reservoir they feed. In case well supplies water direct to the network or reservoir they feed has no chlorination facility, liquid chlorine is equipped at each well. The reservoirs with chlorination facility are Casili Reservoir, Talamban Reservoir and Lagtang Reservoir.

- Bulk Water

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.

Abejo Company pumps up ground water from 4 wells and transmits water to the Lagtang Reservoir after chlorination and flow measurement. Third Foremost Company has same style system, but delivery is directly to the network in Talisay City.

< Water Treatment Plant >

Tisa Filter Plant is the only WTP operated by MCWD and was constructed in 1911. Approximate area is 2.5 ha. Source water is delivered by gravity from Buhisan Dam, 2 km away from the plant. In 2008, 4,700 m^3/d of treated water was produced by the Tisa Plant on average, while it treats 10,000 m^3/d in the rainy season. Originally, it was planed as rapid sand filter treatment plant with the clear well of 15,000 m^3 capacity. At present, however, clear well is used as slow sand filter with silica-sand media and clear water is delivered directly to the network without reservoir. Treated water quality is fairly good except high Calcium Hardness.

Three modules of rapid sand filter are only used as stand-by in case of emergency or slow sand filter reparation. Practical main treatment facilities are (1) 2 modules of detouring settling basin, (2) one slow sand filter pond and (3) Chlorination facility. Three types of chemicals, Aluminum Sulfate, Copper Sulfate and PAC, are injected before sedimentation in accordance with the turbidity of source water. Judging from actual production rate of 4,700 m^3/day and filter area of 3,600 m^2, filtering velocity is 1.3 m/day, while velocity goes up to 2.8 m/day during rainy season. These velocities are lower than standard slow sand filter velocity, which is 4 to 5 m/day.

Once in 1991, ADB has made improvement plan to increase plant capacity. Proposed flow diagram is (1) Flash mix tank, (2) Flocculation tank, (3) Sedimentation tank, (4) Rapid sand filter, (5) Chlorination and (6) Reservoirs. Renovation of deteriorated facility is also desirable to provide enough space for new balancing reservoir.

< Reservoir >

There are 10 reservoirs in MCWD jurisdiction area. Their characteristics are shown in Table II-43. 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.

Of all 10 reservoirs or 9 location of reservoirs, only three reservoirs have chlorination facilities, those are Lagtang, Talamban and Casili reservoirs. Other reservoirs collect once chlorinated water and deliver to the network. From the ground level data shown in table, high pressure can not be expected even in the nighttime. As shown in Figure II-16, each reservoir receives water from network.

Totality, rate of direct supply was estimated at 38% of intake amount. Remaining 62% of water sources were supplied through reservoirs by gravity as shown in Figure II-22.

Table II-43 Outline of Reservoirs

No	Code Name	Complete	V m^3	GL	HWL	LWL	e-depth
1	Casili A Tank	1978	5,000	+60.00	+65.60	+59.60	6.00m
2	Casili B Tank	1997	5,000	+60.00	+65.30	+59.60	5.70m
3	Liloan High Level Tank	1997	2,000	+72.00	+75.10	+71.00	4.10m
4	Talamban Tank	1980	5,000	+65.00	+70.60	+64.60	6.00m
5	Mactan MEPZ Tank	1983	3,200				
6	Mactan Saucer Shaped Tank	1997	2,000	+26.00	+46.50	+39.20	7.30m
7	Lagtang (Mananga) Tank	1980	5,000				6.00m
8	Tisa Tank	1995	5,000	+65.30	+70.30	+64.60	5.70m
9	Cordova Water Tower	1993	200	+6.00	+22.33	+17.88	4.45m
10	Compostela Ground Reservoir	1934	270				
Total			32,670				

Note: Data sources were obtained from Engineering Department, MCWD.

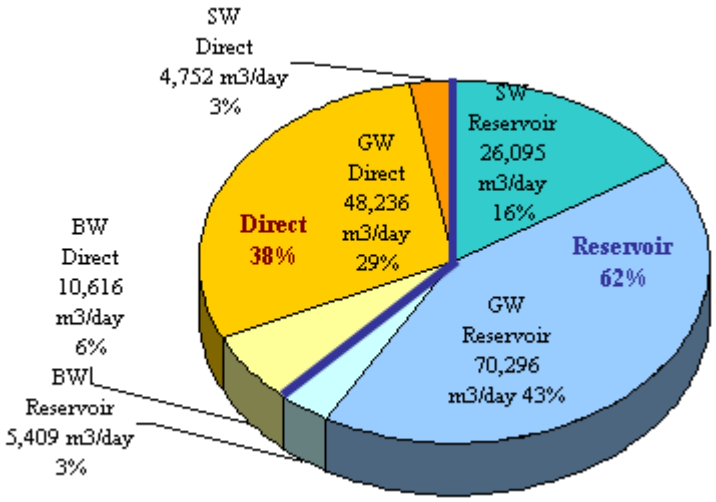


Figure II-22 Distribution Method by Type of Water Sources (Dec-2008)

< Pipeline Network & Service Connection >

Total pipe line length as of Dec. 2008 is nearly 770 km including small size pipe. Breakdown is presented in Figure II-23. As to the length of pipe line, Pipelines Maintenance Group has another data including pipe material. 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.

In Philippine, one service pipe does not link to one household but covers some, sometimes many, households. One rising service pipe from distribution main has branch horizontal parts and flow meter is installed on the house connection pipe connected to this horizontal part like Figure II-24. Rising pipe diameter is from 1/2" to 1" as shown in the Service Connection Mapping figure. This connection is called as "cluster connection."

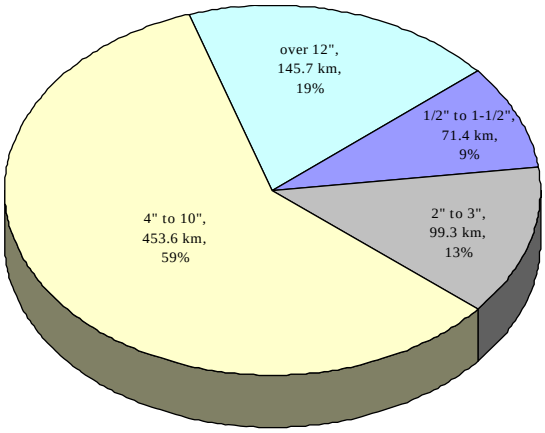


Figure II-23 Total Pipe Length

Figure II-24 Conditions of Stub-out

(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 (DMA; Figure II-24) 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.

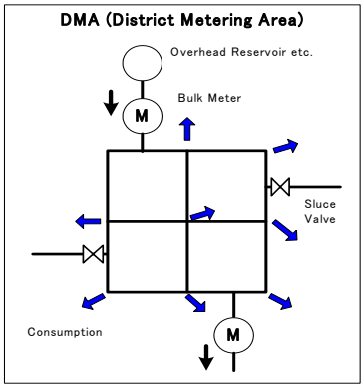


Figure II-25 Concept of DMA System

- 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

- Characteristics of the Distribution Network

  ✓ The whole pipeline network is integrated, and gravity from WTP and many pumped pipelines from wells supply water directly to this network. Therefore the hydraulic flowing situation is quite complicated and keeping proper pressure balance is difficult.

  ✓ In addition, there is water regulating areas. Therefore situation is more complicated.

- Target of Pipeline Network Analysis in Current Situation (see Table II-44)

Table II-44 Input Demand Parameter for Hydraulic Analysis (2008)

Flow Indicators	m^3/day	m^3/hr	Lps
DAF	165,963	6,915	1,921
DMF	199,144	8,298	2,305
HMF	365,119	15,212	4,226

Note: DAF: DMF: HMF = 1.0: 1.2: 2.1 (details are referred to Chapter-III.2)

- Result of Pipeline Network Analysis in Current Situation (see Figure II-24)

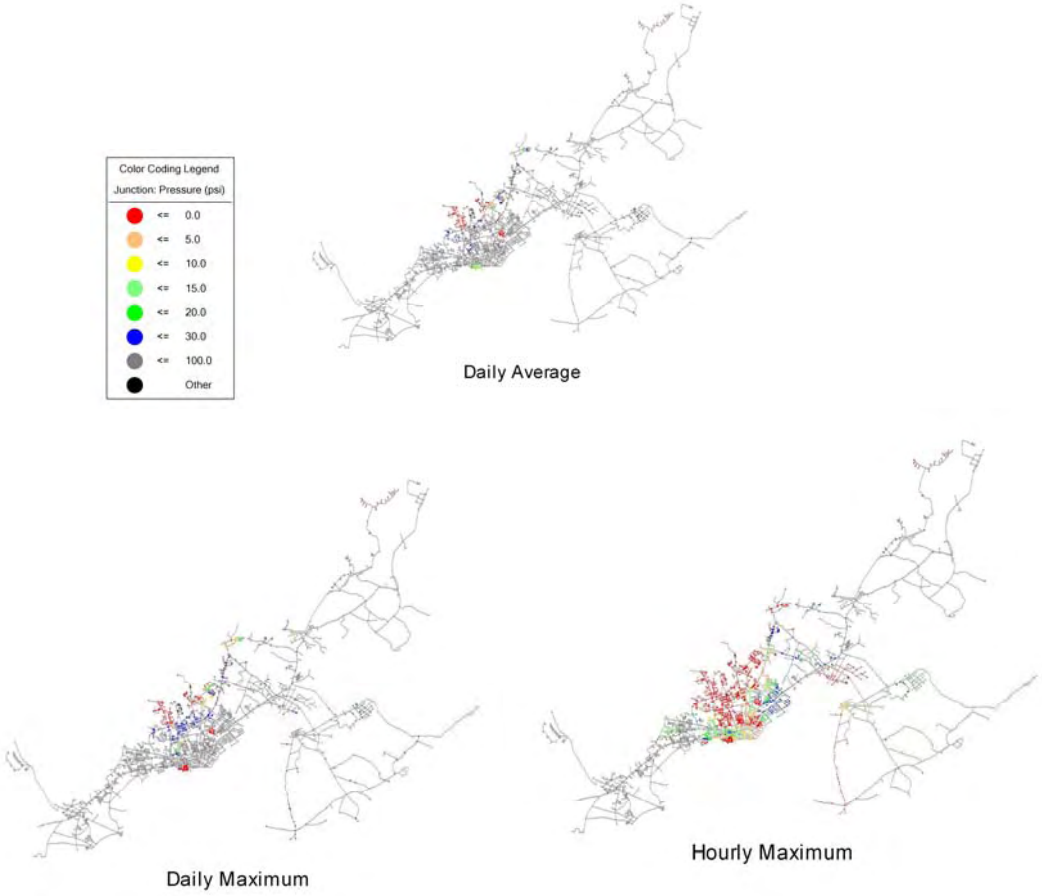


Figure II-24 Result of Pipeline Network Analysis in Current Situation

There is no drastically low pressure pattern in daily average and daily maximum. However it can be seen that in hourly maximum, there are low pressure areas in the center of Cebu city, Mandaue area and Mactan south area, respectively.

< MCWD Technical Standards Manual >

MCWD has already prepared Technical Standards Manual covering Works Standards including design, Water Quality Standards, Material Specification Standards and Standards Drawings.

This Manual was planned and compiled by in-house Technical Working Group and authorized by MCWD Technical Standards Committee. Latest version is dated March 2003 and revision/ addition has been conducted.

(4) Facility O/M Works

< Flow Volume Control >

Production volume is measured at each well point for ground water, at the effluence point of Tisa Filter Plant for surface water and just before injection point for bulk supply water. Although pilot project of SCADA system has just started between W-13B well in Guadalupe and head office of MCWD, meter reading and data collection are still shouldered by manpower for the time being. In future, district meter data can be also transmitted automatically by SCADA system.

Total NRW is calculated subtracting billed water from production water volume. Reverse figure is called system recovery rate (SRR). Area-wise volume control is based on DMA service and improvement of this service is on-going. Thanks to the DMA system, low SRR area can be easily detected and improving efforts are focused on this area.

< 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. This PRV highly contributed to the improvement of service hour as described above.

At present, pipeline pressure is not analyzed using any software. From the on-site pressure test, installation point is selected not theoretically but empirically. Since MCWD's network is so complicated, mixed with direct pump supply and gravity supply, early introduction of the softwares namely WaterCAD is desirable.

EPANET, free software provided by American EPA is being prepared in the Technical Service Group and its input data is said to be easily converted into before-mentioned analysis software.

< Quality Control >

MCWD has its own standards for drinking water quality, based on Philippine National Drinking Standards (latest version is 2007 version) as mentioned in Standards Manual. At present, MCWD laboratory performs much more than National Standard requires. Regular water quality test item and frequency is shown in Table II-45.

Table II-45 Routine Analysis of Laboratory

Location	Analyzed item	Frequency	Remarks
All well points and Treatment Plant	Bacteriological	2-times/ month	Analysis of heavy metal and toxic metal is also checked at least once a year at all wells.
	Chloride (Cl^-)	1-time/ month	
	Turbidity		
	Nitrate		
Tap water of concessionary	Bacteriological	2-times/ month	Fixed sampling is done the rate of one per thousand concessionaries. Over 400 points are selected in proportion to the HH number.
	Chloride (Cl^-)		
	Nitrite		

In case service water is contaminated by Nitrate, it is informed to the concessionary to repair house connection. High salinity of source well causes suspension/ abolishment of the well.

Samples are collected and delivered to Talamban Laboratory. Analysis report is submitted from Laboratory to the chief office every month.

As to the Bulk supply water quality, they check water quality of samples delivered every day from 3 private suppliers, namely Mactan Rock Industries, Abejo and Foremost. They themselves check water quality in case.

II-3.4 On-going Activities of NRW Reduction

(1) Organization

SRR Committee (see Figure II-27) 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.

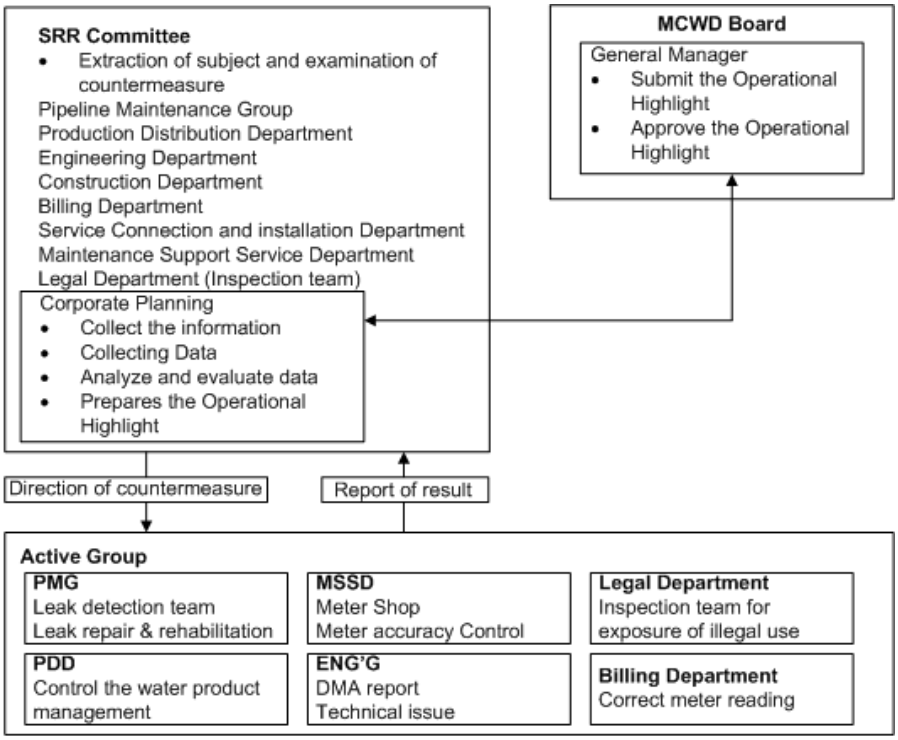


Figure II-27 Organization of SRR Committee

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.

There were two gangs of leak detection team, and each is made up of 9 staff members within the Pipe Maintenance Department: one posted to northern Casili; and the other to the southern Tisa. The two teams were made up of 12 staffs and were organized specifically for conducting leak countermeasures. Additional two leak detection teams were requested in September 2009. There are 4 teams with 24 staffs in total.

(2) On-going Activities

< Leakage Countermeasure >

NRW reduction has mainly been implemented through actual leak detection. The leak detection team was organized in 1984. Since then, an active leak reduction countermeasure has been enforced.

The Leak Detection Team 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.

The leak detection team performs by listening on the road surface above main pipe. The work is performed approximately 1 to 2 km of pipeline every night. However, special procedures are in place whereby emphasis is placed on a particular area when un-usual occurrences (such as bad smell, qualify the miscellaneous germs) are discovered in the water laboratory. In addition, when leakage information is received from customer and the necessity of a leakage survey is approved by the Committee, and then priority is given to such areas rather than the original prioritization.

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-46.

Table II-46 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.

There are two types of illegal connections namely "illegal tapping" and "illegal bypass", both of which are difficult to be un-covered because the pipe is connected under the ground. Any obstruction of water meters such as illegal processing is easily uncovered by the meter readers. When any information related to illegal use is received from the meter readers, then the Legal Department forms an inspection team, and takes a legal action such as suspension of water supply.

The Inspection Team described above is made-up of 3 staff: an inspector, a plumber and a driver, and 2 teams are formed by Legal Department with it. In 2008, they exposed 149 cases of illegal use.

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.

a) New Meter Accuracy Testing

- ✓ A meter error is examined in the meter shop of Talamban
- ✓ It goes to the tolerance of new customer meter that ± 4% is prescribed for it and that a tolerance is set up in 3% with meter factory through the precision test.
- ✓ A supplied meter is examined to all

b) Replacement Schedule

< Replacement >

- ✓ 800 meters replacing every month are being done.
- ✓ 400 meters scrapping disposal and reused for 400 meters in the replaced meter.

< Term >

- ✓ 1/2" is ten years.
- ✓ 1" to 3/4" is 5years
- ✓ 2" is 3 years
- ✓ Over the 3" is 1 year

c) Field Testing of existing Water Meter

One of 1,000 installed water meters (0.1%) are selected for random testing each year. The actual accuracy test is performed at site. If the error is above acceptable limits, then the meter is replaced, even if it is before its normal life of 10-year term. The test method and regulation are as follows:

An error within 3%
✓ A faucet was made full open and 1 m^3 was washed away
✓ In case of 220 litter/hr, washed away

An error within 20%
✓ In case of 30 litter/hr, washed away

< 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

For stub-outs, the project monitoring group (PMG) will continue with its data encoding and targets to have all the stub-out data, past and present, inputted by December 2009. GIS and PMG's ultimate objective is to come up with a detailed leak repair and stub-out records. The leak repair records shall include important information such as location, pipe diameter, pipe material, the PMG team, date of detection and duration of leak repair, discharge and NRW. It shall likewise be established a detailed record of all stub-outs in the franchise area.

All these data is made available to other concerned departments through our Local Area Network (LAN) and Wide Area Network (WAN). However, based on the last internal quality audit, it was found that there is some inconsistency in the GIS data with what is actually on field. To address this issue, EXECOM should first clearly define and delineate as to who or what unit in MCWD is responsible to ensure GIS data accuracy and consistency.

(3) Analysis of NRW

Table II-47 shows the water balance (IWWA) in 2008.

Table II-47 Water Balance (2008)

<table>
<tr><td rowspan="5">System Input
60,738,859m³
Error margin
±1.7%
(100.0%)</td><td rowspan="3">Authorized Consumption
43,268,912m³
Error margin
±0%
(71.2%)</td><td rowspan="2">Billed Authorized Consumption
43,161,251m³
(71.0%)</td><td>Billed Metered Consumption
43,161,251m³
(71.0%)</td><td rowspan="2">Revenue Water
43,161,251m³
(71.0%)</td></tr>
<tr><td>Billed Un-metered Consumption
0m³
(0.0%)</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
107,661m³
Error margin±1.7%
(0.2%)</td><td>Un-billed Metered Consumption
35,581m³
(0.1%)</td><td rowspan="3">NRW
17,577,608m³
Error margin±6%
(29.0%)</td></tr>
<tr><td>Un billed un metered Consumption
72,080m³
(Error margin±26.2%) (0.1%)</td></tr>
<tr><td rowspan="2">Water Losses
17,469.947m³
Error margin
±6%
(28.8%)</td><td rowspan="2">Commercial Losses
506,126m³
Error margin±8.1%
(0.8%)</td><td>Un authorized Consumption
69,428m³
(Error margin±50.7%) (0.1%)</td></tr>
<tr><td>Customer Meter In-accuracy and Data Handling error 436,698m³
(Error margin±5%) (0.7%)</td></tr>
<tr><td colspan="3">Physical Losses
(Error margin±6.2%)</td><td colspan="2">16,963,821m³
(27.9%)</td></tr>
</table>

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.

Figure II-27 shows activities and progress of leak detection works. Since 2002, the number of found leakage points has been decreased, however since the NRW rate reached to 30% in 2005, no particular improvement in NRW has been observed and the number of found leakage points

shows a trend of level off or decreasing.

This implies that expecting any more improvement in NRW is difficult by using the current survey method, and there would be the need that the procedure and techniques have to be re-examined for future NRW reduction.

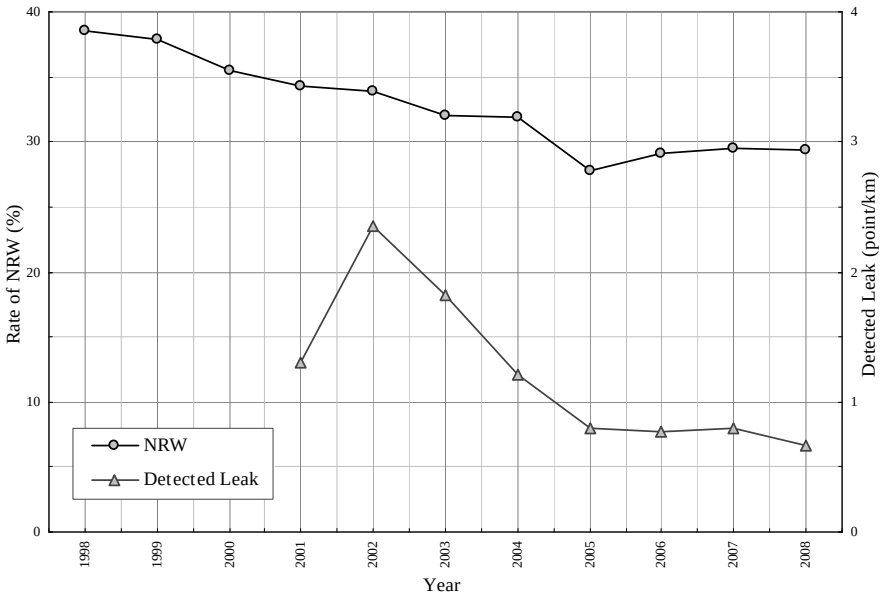


Figure II-28 Transition of NRW Reduction

II-3.5 Existing Development Plan

(1) Investment Plan

Investment plan is shown in Table II-48.

Table II-48 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. The special project in 2008 and 2009 is for reconstruction of the laboratory and sophistication of workshop equipment.

(2) Water Demand Projection

In 1996, MCWD contracted out a water demand study in the MCWD service area (Market Study for the MCWD 1996: EDC Study) to a consultant. In this study, water demand was projected based on the 1995 NSO population census. Afterwards, MCWD reviewed the water demand projection in 2000 to adjust the population data when the population statistics was updated by NSO and other significant parameters in the demand projections like per capita consumption and demand density per commercial/ industrial users.

However, the basic assumptions in the EDC Study were yet employed without any revision. Currently, MCWD is pressed to revise the demand projection in accordance with the 2006 population statistics of NSO. 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 peoples are willing and/ or opt to connect the MCWD system.

Table II-49 Supply and Demand Projections (2007-2014)

		Categories	2007	2008	2009	2010	2011	2012	2013	2014
Total Demand	A: Domestic	Cebu City	51,468	52,699	53,945	55,207	56,486	57,781	59,093	60,423
		Lapu-lapu City	23,664	24,036	24,413	24,794	25,181	25,572	25,969	26,371
		Mandaue City	23,529	23,974	24,424	24,880	25,342	25,810	26,285	26,765
		Compostela	835	879	924	970	1,018	1,068	1,119	1,172
		Consolacion	5,880	5,986	6,094	6,204	6,314	6,427	6,540	6,656
		Cordova	3,545	3,604	3,663	3,722	3,783	3,844	3,906	3,969
		Lilo-an	1,459	1,628	1,804	1,988	2,179	2,379	2,587	2,803
		Talisay	15,891	16,144	16,401	16,661	16,924	17,191	17,462	17,736
		Total	126,272	128,949	131,667	134,427	137,228	140,073	142,961	145,893
	B: Commercial/ Industrial		77,011	79,474	82,018	84,647	87,363	90,170	93,072	96,072
	C: Demand Adjustment		71,839	71,839	71,839	71,839	71,839	71,839	71,839	71,839
	Total (A+B+C)		275,122	280,262	285,524	290,912	296,430	302,082	307,872	313,804
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%

Source: Corporate Planning Department, 2006

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 Metro 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-49 (previous page) shows the water demand and supply projection in coming 5 years prepared by MCWD as of now.

(3) Water Source Development Plan

Generally, "Water REMIND, ODA from Netherlands" 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. Within this year 2009, 5 or 6 wells in Cebu and 3 wells in Mandaue may be constructed.

(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-50.

Table II-50 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.
D. Special	Warehouse, Laboratory, Pump Station Projects

In the Water Source Development Project, another 15,600 m3/day is expected at each tube well point as presented in Table II-51.

Table II-51 Expected New Well Points (2009)

Well Field	Well ID	Expected Yield (m^3/day)	Expected Completed
Mananga	W 2.2	720	March 2009
	W 2.3	600	
Pardo	W 2B	1,680	
Talamban	W 34	720	June 2009
	MC 23	600	
	Camputhaw	600	
	NAZ 1	600	
	W 4.3	1,200	September 2009
	MAN 1	1,680	
Guadalupe	G 10	600	June 2009
Mandaue	CAN 8	1,440	September 2009
	CUB 1	1,440	
	W 5.9	1,440	
Mactan	MB 1	456	December 2009
	MB 2	456	
	MB 3	456	
	MB 4	456	
	MB 5	456	
Total	18 wells	15,600	Year of 2009

……

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.

It is also the policy of the State to ensure the accountability of local government units through the institution of effective mechanisms of recall, initiative and referendum. It is likewise the policy of the State to require all national agencies and offices to conduct periodic consultations with appropriate local government units, nongovernmental and people's organizations, and other concerned sectors of the community before any project or program is implemented in their respective jurisdictions.

(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. Amendment to Article 6 of the Water Code (PD No.1067) shall be initiated by NWRB to this effect. Subsequently, NWRB shall formulate rules ad regulations for the effective enforcement of this requirement within sixty (60) days after approval of the proposed amendment.

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. Further, it should radically improve its collection efficiency as well as its database and accounting sys-

tems.

d. Privatization of all existing Water Districts (WDs) should be vigorously pursued whenever feasible and large commercially viable water services areas like Metro 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. The proposed amendment is as follows:

"Level I (point source system), Level II (communal faucet) and Level III (house connections) water supply projects may be implemented by the concerned LGUs within their jurisdiction. LWUA shall implement only financially viable Level III water supply projects in areas outside the MWSS jurisdiction. DILG's participation will consist of general administration and institution building, such as assistance to the LGUs in the formation of Rural and/ or Barangay Waterworks and Sanitation Associations (RWSAs/ BWSAs) as well as in the identification of water supply systems. MWSS will be responsible for Level III water systems in Metropolitan Manila and adjacent areas. DPWH, together with DILG and DOH, will provide technical assistance (within a period of about 2 years) to LGUs in the planning, implementation and operation and maintenance of water supply facilities.

(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.

Republic Act No.7718 is an act amending certain sections of Republic Act No. 6957

Section-1 of Republic Act No.6957 is hereby amended to read as follows:

"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 incentives to mobilize private resources for the purpose of financing the construction, operation and maintenance of infrastructure and development projects normally financed and undertaken by the Government. Such incentives, aside from financial incentives as provided by law, shall include providing a climate of minimum government regulations and procedures and specific government undertakings in support of the private sector."

(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.

It categorizes WSPs' creditability as creditworthy, semi-creditworthy, pre-creditworthy or non-creditworthy. Creditworthy WSPs shall be eligible to source financing at commercial lending rates from GFIs and PFIs. Pursuant hereto, LWUA, with respect to creditworthy WDs shall enhance and streamline its waiver procedures to effect the reform objectives/ policies enunciated herein. GFIs shall strengthen their skills and develop lending programs specially tailored to the needs of the water supply and sewerage sector.

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. A technical secretariat shall also be created with relevant specialist staff.

The Department of Public Works and Highways together with the LGUs are to prepare a national program on sewerage and septage management. Such program shall include a priority listing of sewerage, septage and combined sewerage-septage projects for LGUs based on population density and growth, degradation of water resources, topography, geology, vegetation, program/ projects for the rehabilitation of existing facilities and such other factors that the Secretary may deem relevant to the protection of water quality.

Each LGU shall appropriate the necessary land, including the required rights-of-way/ road access to the land for the construction of the sewage and/or septage treatment facilities.

Each LGU may raise funds to subsidize necessary expenses for the operation and maintenance of sewerage treatment or septage facility servicing their area of jurisdiction through local property taxes and enforcement of a service fee system.

The Department shall implement a wastewater charge system in all management areas through the collection of wastewater charges/fees. The system shall be established on the basis of payment to the government for discharging wastewater into the water bodies.

The Department shall require owners or operators of facilities that discharge regulated effluents pursuant to this Act to secure a permit to discharge. The discharge permit shall be the legal authorization granted by the Department to discharge wastewater.

Local government units shall share the responsibility in the management and improvement of water quality within their territorial jurisdictions and shall prepare a compliance scheme in, accordance thereof, subject to review and approval of the governing board.

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)

On the 15th day November 2006, NWRB together with DENR/ NEDA/ DOF/ DOJ/ DOH/ NHRC-UP had issued the regulation (No.002-1106) of groundwater development in the critical areas namely: Consolacion, Lilo-an, Mactan, Cebu and Mandaue. This regulation was made according the study results of "Water Resources Assessment for Prioritized Critical Areas (NWRB Groundwater Modeling)" and "Water Resources Integrated Developments (Water REMIND)".

In this regulation, criteria in following Table II-52 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-52 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.

NWRB has examined the said reports and monitoring results of groundwater in Metropolitan Cebu uninterruptedly. Guideline for groundwater regulation (No.004-0507) was established and added to the resolution No.002-1106 on the 16th day of May 2007. Features of this 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.

The act provides a detailed template for the collection and disposal of solid waste. LGUs shall be primarily responsible for the implementation and enforcement of the provisions of this Act within their jurisdictions. Collection of non-recyclable materials and special wastes shall be the responsibility of the municipality or city.

A Provincial Solid Waste Management Board shall amidst other duties develop a provincial solid waste management plan from the submitted solid waste management plans of the respective city and municipal solid waste management boards created by the act.

The Barangay shall be responsible for ensuring that 100% collection efficiency from residential, commercial, industrial and agricultural sources, where necessary within its area of coverage, is achieved. However the Barangay can appoint private operators to carry out this task.

LGUs can be clustered for the solution of common solid waste management problems. The act require the segregation of waste at source, and that at least 25% of all solid waste arising from waste disposal facilities is diverted through re-use, recycling and composting activities and other resource recovery activities

The Act provides detailed guidance on the criteria to be met for the establishment and operation of a sanitary landfill

(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.

The law creates the Central Cebu Protected Landscape-Protected Area Management Board and allocates National Government funds for its operations. A single agency under the Board will manage a protected area that cuts across four cities and five LGUs: Cebu, Talisay, Danao and Toledo cities; and Minglanilla, Consolacion, Lilo-an, Compostela and Talamban.

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-53.

(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.

Currently, DENR AO No.30 of 2003, which is regulating detailed implementing structure and methodology of EIA system, and the "Revised Procedural Manual for DENR AO No.2003-20 (Second Edition January 2008)" are applied in implementing 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.

EIA documents are ideally prepared when prospective proposals are more concrete than mere concept and are preferably available before the project has reached a stage of investment or commitment towards implementation. Proponents are in fact directed to conduct simultaneously the environmental impact study and the project planning or F/S.

Table II-53 List of Relevant Legislations

Category	Title	Code
General Environment	Philippine Environment Policy (1977)	PD 1151
	Philippine Environment Code (1977)	PD 1152
Air quality	Philippine Clean Air Act (1999)	RA 8749
	Air Quality Guidelines and Standards (1993)	DAO 93-14
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

The correspondence of the EIA process in relation to the project cycle is defined below.

* Project Conceptualization and Pre-Feasibility Study
  EIA related activities include self-screening whether the development proposal is covered or not by the Philippine EIS System, and if so covered, the self determination of all requirements in preparation for the application process. At this stage the Proponent undertakes an initial rapid site and impact assessment to determine the criticality of the project location and have an initial scope of key issues.

* Feasibility Study (F/S)
  The proponent initiates the detailed environmental impact assessment. The formulated environmental management plan and corresponding costs and benefits are then inputted into the FS as a basis for decision making of the proponent on its final project option, sitting and design. It is at this stage when the formal EIA application is initiated, wherein positive review and evaluation of the submitted EIA documentation is expected to result to an issuance of a DENR decision document containing the Proponent's commitments and other requirements for the Proponent to comply with existing environmental regulations and environmental best practices.

* Detailed Engineering Design
  The generic measures identified during the EIA study at the F/S stage will now be detailed based on the project facility design and operational specifications. Additional baseline

monitoring may also be required prior to construction or implementation of the project to provide a more substantive basis for defining the environmental management and monitoring plans.

* Project Construction, Development and Operations
  Environmental mitigation measures are fully implemented, and monitoring of the proponent's environmental performance is continuously done, findings and learnings from which shall be fed back into the project cycle for continual improvement of the project, with corresponding updating of the environmental management plans of the project. Major improvements may need new formal applications for DENR approvals, which shall then be related to previous approvals for an integrated environmental management approach of the project.

< Screening for Project's EIA Coverage >

Screening for projects' EIA coverage is examined by the criteria of Environmental Critical Projects (ECPs) and Environmental Critical Areas (ECAs).

The four (4) ECPs and twelve (12) ECAs declared in Presidential Proclamation No.2146 of 1981 and Presidential Proclamation No.803 of 1996 are shown in Table II-54.

Table II-54 Summary List of ECP Types and ECA Categories

List of Environmentally Critical Projects (ECPs)		
A	Golf course projects	
B	Heavy industries – Iron and steel mills, Non-ferrous metal industries, Petroleum and petrochemical industries, Smelling plants	
C	Resource extractive industries – Fishery projects: dikes for/ and fishpond development projects, forestry projects, major mining and quarrying projects	
D	Infrastructure projects – Major dams, Major reclamation projects, Major roads & bridges, Major power plants	
List of Environmentally Critical Areas (ECAs)		Agencies from where to get technical information (if not available from EMB)
A	Areas declared by law as national park, watershed reserves, wildlife preserves, sanctuaries	DENR-PAWB/ CENRO/ PENRO
B	Areas set aside as aesthetic potential tourist spots	DOT
C	Areas which constitute habitat for any endangered or threatened species of Philippine wildlife (flora and fauna)	DENR-PAWB
D	Areas of unique historic, archeological, geological, or scientific interests	NM/ NHI/ NCCA
E	Areas which are traditionally occupied by cultural communities or tribes	NCIP
F	Areas frequently visited and or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activities)	DENR-MGB/ DOST-PAGASA/ DOST-PHIVOLCS
G	Areas with critical slope	DENR-MGB
H	Areas classified as prime agricultural lands	DA
I	Recharged areas of aquifers	NWRB
J	Water bodies	DENR-EMB
K	Mangrove Areas	DENR-PAWB/ LGU
L	Coral Reefs	DA-BFAR/ DPWH/ LGU

Source: Revised Procedural Manual for DENR AO No.2003-20 (Second Edition January 2008)

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 Metro Cebu >

It is desirable for the proponent to understand the location of ECAs to confirm which EIA procedure is required for its project. The location map of ECAs is helpful to mitigate environmental impact by avoiding ECAs in the process of project site selection. However, DENR/ EMB Region 7, which is the responsible organization for implementation of EIA system in Metropolitan Cebu, does not manage the location map of ECAs in its jurisdiction. Therefore, EMB Region 7 regards all project sites in its jurisdiction as ECA, unless the proponent proves its project site is Non-ECA by certificates of concerned agencies shown in Table II-54.

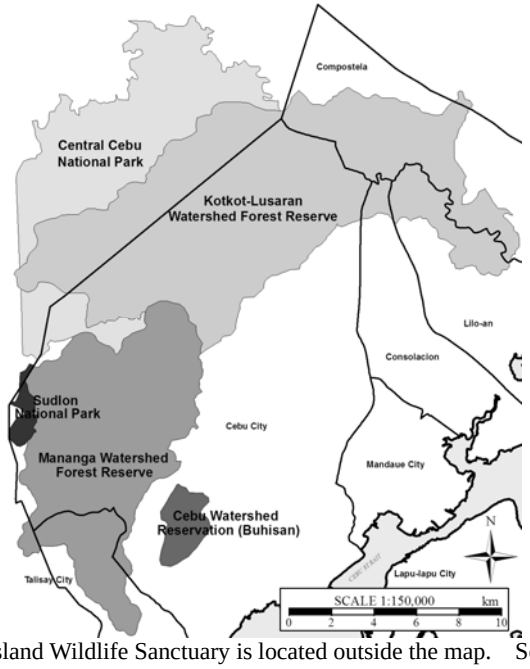
According to DENR/ EMB Region 7, there was a proponent who tried to certify its project site was Non-ECA but it failed. As a part of ECAs in Metro Cebu, the protected landscape in Central Cebu by virtue of the NIPAS Act is shown in Table II-55 and Figure II-29.

Table II-55 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.

Source: Central Cebu Protected Landscape Act (Republic Act No. 9486) of 2007, Presidential Proclamation No. 903 of 1992



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

Figure II-29 Protected Landscape in Central Cebu

< Overview of Procedures of EIA >

- EIS based Projects
  - ➢ Scoping
    - ✓ The proponent is required to implement social preparation (information, education and communication of LGUs) activities, which is used as a basis for identification of stake-holders and issues in preparation for public hearing;
    - ✓ The proponent submits to EMB the letter of request for scoping, attaching PD for scoping with supporting documents;
    - ✓ The prospective review team is formed by EMB. EMB confirms schedule of three-level scoping activity in cooperation with the proponent;
    - ✓ The proponent holds three-level scoping activity, which consists of project briefing with review team, public scoping with project stakeholders and technical scoping with review team.
    - ✓ EMB chief reviews and approves the scoping checklist, rendering the final TOR of EIS study.
  - ➢ EIA Study and Report Preparation
    - ✓ The proponent undertakes EIS study and prepares EIS report.
  - ➢ EIA Report Review and Evaluation
    - ✓ The proponent submits EIS report and the scoping checklist to EMB, and if the scoping checklist is confirmed, EMB initiate the processing of the document;
    - ✓ The proponent pays fee for and submits necessary copies of EIS report for reviewing process;
    - ✓ Substantial reviewing process of EIS report, which includes review team meeting, site visit and public hearing/consultation, is conducted by EMB. In this stage, the proponent has to submit additional information requested by EMB;
    - ✓ Review team submits EIA reviewing committee report to EMB and EMB prepares review process report and recommendation document for the proponent.
  - ➢ Decision Making
    - ✓ The proponent signs the sworn statement of full responsibility on ECC condition;
    - ✓ EMB issues ECC and transmit it to concerned governmental agencies (GAs) and local governmental units (LGUs).
- IEE based Projects
  - ➢ Informal Scoping
    - ✓ The proponent is opt to request EMB to scope IEE report. The proponent and EMB jointly fill out the scoping checklist and the accomplished form may be signed by both parties to serve as official TOR of IEE study.
  - ➢ EIA Study and Report Preparation
    - ✓ The proponent undertakes IEE study and prepares IEE report/checklist.
  - ➢ EIA Report Review and Evaluation
    - ✓ The proponent submits IEE report/checklist to EMB, and if it is confirmed, EMB initiate the processing of the document;
    - ✓ The proponent pays fee for and submits necessary copies of IEE report/ checklist for re-viewing process;

- ✓ Substantial reviewing process of IEE report/ checklist, which consists of reviewing by EMB reviewers and site visit and public consultation (option of EMB), is conducted by EMB. In this stage, the proponent has to submit additional information requested by EMB;
- ✓ EMB prepares review process report and recommendation document for the proponent.

➢ Decision Making

- ✓ The proponent signs the sworn statement of full responsibility on ECC condition;
- ✓ EMB issues ECC and transmit it to concerned GAs and LGUs.

- PD based Projects

➢ PD Report Preparation

- ✓ The proponent prepares PD report.

➢ PD Report Review and Evaluation

- ✓ The proponent submits PD report to EMB, and if it is confirmed, EMB initiate the processing of the document;
- ✓ The proponent pays fee for reviewing process;
- ✓ Substantial reviewing process of PD report, which consists of reviewing by EMB reviewers and site visit (option of EMB), is conducted by EMB;
- ✓ EMB prepares review process report and recommendation document for the proponent.

➢ Decision Making

- ✓ EMB issues CNC and transmit it to concerned GAs and LGUs.

(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 and 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)

The major laws regarding resettlement and land acquisition are as follows:

- An Act to Provide for a Comprehensive and Continuing Urban Development and Housing Program, Establish the Mechanism for its Implementation, and for other purposes (Republic Act No. 7279 of 1992), known as Urban Development and Housing Act

  This act regulates the framework to secure decent housing for underprivileged and homeless citizens and it includes regulation on proper and humane resettlement of squatters.

  Eviction or demolition as a practice is discouraged, however, may be allowed when government infrastructure projects with available funding are about to be implemented. The affected persons shall be provided resettlement sites with basic services and facilities and access to employment and livelihood opportunities sufficient to meet the basic needs. In the execution of eviction or demolition, notice upon the affected persons/entities at least 30 days prior to the date of eviction/demolition, adequate consultation on the matter of resettlement with the dully designated representatives of the families to be resettled and affected communities in the area where they are to be resettled, proper identification of all persons taking part in the demolition, etc. are mandatory.

  The followings are guidelines for Republic Act No. 7279:

  - Implementing rules and regulations to ensure the observance of proper and humane relocation and resettlement procedures mandated by the urban development and housing act (1992);
  - Implementing rules and regulations governing summary eviction (1993);
  - Implementing guidelines for the acquisition, valuation, disposition and utilization of lands for socialized housing (1993).

- An Act to Facilitate the Acquisition of Right-Of-Way, Site or Location for National Government Infrastructure Projects and for other Purposes (Republic Act No.8974 of 2000)

  This act regulates the modes of land acquisition and the procedures in expropriation and compensation for national government infrastructure projects. The property is mainly compensated by monetary valuation and the value of the property is assessed based on the current relevant zonal valuation of the Bureau of Internal Revenue (BIR). In areas where there is no existing valuation of the area concerned and completion of the project is of utmost urgency, proffered valuation is applied for compensation. In the event that the owner of the property contests the

implementing agency's proffered value, the court shall determine the just compensation to be paid the owner.

As for the relocation of squatters, it is regulated that the government through the National Housing Authority, in coordination with LGUs and implementing agencies concerned, establish and develop squatter relocation sites, including the provision of adequate utilities and services.

The following is a guideline for Republic Act No.8974:

- Implementing rules and regulations of Republic Act No. 8974 (2001).

……