JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
METRO CEBU DEVELOPMENT AND COORDINATION BOARD (MCDCB)

THE ROADMAP STUDY FOR SUSTAINABLE URBAN DEVELOPMENT IN METRO CEBU

FINAL REPORT

SUPPORTING REPORT 2: ROADMAP PLAN

JUNE 2015

ALMEC Corporation
Oriental Consultants Global Co., Ltd.

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ABBREVIATIONS

ADB	Asian Development Bank
AEC	ASEAN Economic Community
AGT	Automated Guideway Transit
AIEZ	Agro-Industrial Economic Zone
ASEAN	Association of Southeast Asian Nations
ATC	Area Traffic Control
BAR	Building Area Ratio
BEMS	Building Energy Management System
BOD	Biochemical Oxygen Demand
BOI	Board Of Investment
BPAP	Business Processing Association of the Philippines
BPM	Business Process Management
BPO	Business Process Outsourcing
BRT	Bus Rapid Transit
CALABARZON	Cavite, Laguna, Batangas, Rizal and Quezon
CAR	Cordillera Administrative Region
CBD	Central Business District
CCFL	Cold Cathode Fluorescent Lamp
CCI	Chambers of Commerce and Industry
CCPL	Central Cebu Protected Landscape
CCRB	Central Cebu River Basins
CCRBC	Central Cebu River Basin Council
CCRBMC	Central Cebu River Basins Management Council
CDPO	City Planning and Development Office
CEDF	Cebu Educational Development Foundation
CEO	Civil Engineers Office
CICC	Cebu International Convention Center
CIDP	Committee on Infrastructure Development and Planning
CIPC	Cebu Investment Promotion Center
CITOM	City Traffic Operation and Management
CLUP	Comprehensive Land Use Plans
CNIS	Comprehensive National Industrial Strategy
CPA	Cebu Port Authority
CPDO	City Planning and Development Office
CUSW	Cebu Uniting for Sustainable Water Foundation
CV-RDP	Central Visayas Regional Development Plan
CVURPO	Central Visayas Rural and Urban Project
CWD	Carcar Water District
DAO	DENR Administrative Order
DB	Distribution Block
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DOH	Department of Health
DOST	Department of Science and Technology
DOT	Department of Tourism
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highways
DRRMP	Disaster Risk Reduction and Management Plan
DSM	Demand Side Management Program
DTI	Department of Trade and Industry

DTM	Digital Terrain Model
DWUP	Division for the Welfare of the Urban Poor
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EMB	Environmental Management Bureau
EPR	Extended Producer Responsibility
ERC	Energy Regulatory Commission
ESCO	Energy Service Companies
EV	Electric Vehicle
FABCOMs	Focus Area Based Committees
FAR	Floor Area Ratio
FDI	Foreign Direct Investments
FITs	Feed-In Tariffs
FS	Feasibility Study
GAA	General Appropriations Act
GDP	Gross Domestic Product
GEMP	Government Energy Management Program
GLA	Greater London Authority
GLC	Greater London Council
GNDP	Gross National Domestic Product
GNMRC	Guimaras National Mango Research Center
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
GTH	Gifts, Toys and Housewares
GVA	Gross Value Added
GVRD	Greater Vancouver Regional District
GVS & DD	Greater Vancouver Sewerage and Drainage District
GVWD	Greater Vancouver Water District
GIS	Geographic Information Systems
HC	Health Care
HIS	Household Interview Survey
HLURB	Housing and Land Use Regulatory Board
HRD	Human Resource Development
HUC	Highly Urbanized Cities
ICT	Information and Communication Technology
IDI	Infrastructure Development Institute
IDP	Industrial Development Program
IEC	Information Education and Communication
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IPA	Investment Promotion Agency
IPP	Investment Priorities Plan
IT	Information Technology
ITO	Inforamtion Technology Outsourcing
ITR	Interim Report
IWRM	Integrated Watershed Resources Management
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JST	JICA Study Team
KOICA	Korea International Cooperation Agency
KPO	Knowledge Process Outsourcing
LCC	Low-Cost Carrier

LGSP-LED	Local Governance Support Program for Local Economic Development
LGU	Local Government Unit
Local RES	Local Retail Electricity Supplier
lpcd	Litter Per Capita per Day
LTFRB	Land Transportation Franchising & Regulatory Board
LTO	Land Transportation Office
LWUA	Local Water Utilities Administration
MCC	Metro Cebu Council
MCDA	Metro Cebu Development
MCDCB	Metro Cebu Development and Coordination Board
MCDL	Metro Cebu Development League
MCDP	Metro Cebu Development Project
MCIA	Mactan – Cebu International Airport
MCIAA	Mactan Cebu International Airport Authority
MCIB	Mega Cebu Investment Board
MCIFDS	Metro Cebu Integrated Flood and Drainage System
MCLUTS	Metro Cebu Land Use and Transport Study
MCWD	Metropolitan Cebu Water District
MEC	Manufacturing Eonomic Zones
MEPZ	Mactan Export Processing Zone
METI	Ministry of Economy, Trade and Industry
MEZ-2	Mactan EcoZone 2
MGB	Mines Geosciences Bureau
MICE	Meetings, Incentives, Conferences, and Exhibitions
MIMAROPA	Mindoro (Occidental Mindoro at Oriental Mindoro), Marinduque, Romblon atPalawan
MIR	Manufacturing Industry Roadmap
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MMA	Metropolitan Manila Authority
MMC	Metropolitan Manila Commission
MMDA	Metropolitan Manila Development Authority
MNDC	Metro Naga Development Council
MP	Master Plan
MRF	Materials Recovery Facility
MRI	Mitsumi Realty, Inc.
MRT	Mass Rapid Transit
MSME	Micro, Small and Medium Enterprises
MVHC	Metro Vancouver Housing Corporation
NAMRIA	National Mapping and Resource Information Authority
NCR	National Capital Region
NCTS	National Center for Transportation Studies
NEDA	National Economic and Development Authority
NEECP	National Energy Efficiency and Conservation Program
NIA	National Irrigation Administration
NIPAS	National Protected Areas System
NLAs	National Line Agencies
NREP	National Renewable Energy Program
NRW	Non-Revenue Water
NSO	National Statistics Office
NWRB	National Water Resources Board
NYC	New York City
NGO	Non-Governmental Organization

O&M	Operations and Maintenance
OD	Origin–Destination
ODA	Official Development Assistance
ODM	Original Design Manufacturing
OEM	Original Equipment Manufacturing
OWS	Osmeña Waterworks Systems
PAG-ASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAMB	Protected Area Management Board
PCU	Passenger Car Unit
PD	Presidential Decree
PDIP	Provincial Development Investment Plan
PDP	Philippine Development Plan
PDPFP	Provincial Development and Physical Framework Plan
PEZA	Philippines Economic Zone Authority
PIDS	Philippine Institute of Development Studies
PIPP	The Philippine Investment Promotion Plan
PPA	Philippine Ports Authority
PPDO	Provincial Planning Development Office
PPP	Public-Private Partnership
PRRC	Pasig River Rehabilitation Commission
PSWMFP	Provincial SWM Framework Plan
PUV	Public Utility Vehicles
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PHP	Philippine peso
QOL	Quality Of Life
R&D	Research and Development
RA	Republic Act
RAFI	Ramon Aboitiz Foundation, Inc.
RC	Roller Compacted Concrete
RCC	Roller Compacted Concrete
RCOA	Retail Competition and Open Access.
RE	Renewable Energy
RES	Retail Energy Supplier
RO	Reverse Osmosis
RO-RO	Roll-On Roll-Off
RROW	Road Right-Of-Way
RULAs	Regional Units of Line Agencies
S&T	Science and Technology
SEIPI	Semiconductors and Electronics Industry of the Philippines Inc.
SEZ	Special Economic Zone
SLF	Sanitary Landfill Facilities
SRP	South Road Property
SWM	Solid Waste Management
TEU	Twenty-foot Equivalent Units
TEZ	Tourism Economic Zones
TFO	Transport Franchising Office
TIA	Traffic Impact Assessment
TMG	Tokyo Metropolitan Government
TMO	Traffic Management Office
TOD	Transit Oriented Development
ToR	Terms of Reference

TPTM	Transport Planning and Traffic Management
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
USC-CAFA	University of San Carlos College of Architecture and Fine Arts
USC-WRC	University of San Carlos, Water Resource Center
USD	US dollar
WB	World Bank
WCIP	West Cebu Industrial Park
WD	Water District
WFR	Watershed Forest Reserve
WSRE	Waste Segregation and Reduction Enhancement
WSREP	Waste Segregation and Reduction Enhancement Program
WTE	Waste To Energy
WTP	Water Treatment Plant
WTTC	World Travel and Tourism Council

1 STUDY SCOPE AND PROGRESS

1.1 Study Scope

1) Study Background

1.1 Metro Cebu is the Philippines' second largest metropolis with a population of 2.55 million in 2010, and is considered the economic center of the central region of the country. Historically, the area has been a regional trading hub supported by the Mactan Cebu International Airport (MCIA) and the Cebu Port, and recognized for its world-class marine resorts. In recent years, the region has been experiencing high levels of private business investments and industrial expansion such as in the Mactan Special Economic Zone and various other industrial parks/centers.

1.2 However, due to rapid urbanization and population growth, various interrelated urban issues have emerged across the sectors of transport, traffic, drainage, water, waste management and energy. This requires a more comprehensive and sustainable development approach to address the diverse range of urban challenges accompanying the rapid growth of Metro Cebu.

1.3 The Japan International Cooperation Agency (JICA) conducted the "Study on the Cebu Integrated Area Development Master Plan" way back in 1994 and neither local governments nor any other international development agencies have conducted a study of this kind since then. It is, therefore, recognized that a new comprehensive and integrated metropolitan development plan, which includes land use, urban structure, and spatial dimensions as well as infrastructure, transport, and other key sectoral plans for Metro Cebu, should be prepared.

1.4 In 2013, JICA in collaboration with the City of Yokohama supported Metro Cebu, through the Metro Cebu Development and Coordinating Board (MCDCB), to come up with a long-term development vision called "Mega Cebu Vision 2050." Furthermore, JICA and MCDCB have agreed to conduct a follow-up study to formulate a spatial, structural, land use, and prioritized projects/action plans to realize the Mega Cebu Vision 2050.

2) Study Objectives

1.5 The ultimate objective of this study is to draw up the roadmap and detailed action plan which consists of the following:

(i) A long-term roadmap (up to 2030, thence up to 2050) in order to realize the Mega Cebu Vision 2050;

(ii) A detailed action plan consisting of priority projects for the short term (1–3 years) and medium term (4–6 years); and

(iii) A hazard map covering Metro Cebu and the northern part of Cebu Province.

3) Study Area

1.6 The study area covers Metro Cebu consisting of the seven cities of Cebu, Danao, Mandaue, Lapu-Lapu, Talisay, Naga and Carcar, and the six municipalities of Compostela, Liloan, Consolacion, Cordova, Minglanilla and San Fernando (see Figure 1.1.1).

1.7 In the aftermath of Typhoon Yolanda (international name: Haiyan) which devastated parts of Cebu Province in November 2013, the study area was extended to

cover the northern part of Cebu Province only in terms of map preparation and hazard map analysis.

Source: JICA Study Team.

Figure 1.1.1 Location and Coverage of Metro Cebu

4) Counterpart Agency

1.8 The counterpart agency for this study is the MCDCB, chaired by the Governor of Cebu Province and co-chaired by the Mayor of Cebu City and the President of Ramon Aboitiz Foundation, Inc. (RAFI).

1.2 Study Activities

1.9 The overall study work flow is shown in Figure 1.2.1 and the general activities of the study are as follows:

1) Study Mobilization

1.10 The JICA Study Team (JST) submitted the Inception Report to MCDCB in November 2013. It was deliberated upon in separate meetings with the Steering Committee, the Cebu Province Governor (chairman of MCDCB), and the Cebu City Mayor (vice chairman of MCDCB) and was accepted. The first stakeholder consultation seminar originally scheduled for November 2013 was postponed to January 30, 2014 due to Typhoon Yolanda which struck part of Central Visayas on November 8, 2013 and caused severe damages. The first seminar was attended by 91 participants from MCDCB, the 14 local government units (LGUs), national government agencies, the academe, and JST. The agenda included pre-feasibility studies suggested by JST for the short-term priority projects, and disaster prevention planning and management.

2) LGU Outreach Meetings

1.11 JST, in collaboration with MCDCB, conducted two rounds of outreach meetings at the 13 LGUs to collect data and information, and to understand urban infrastructure and urban development related issues. The first round of outreach meetings was done during the period November–December 2013 while the second was in January–February 2014.

3) Database Development for Planning Works

1.12 JST conducted a Home Interview Survey (HIS) and some traffic surveys from February to April 2014. The preparation of maps and GIS works commenced at the same time as the surveys. The results of these surveys were analyzed and a database was developed for planning works. The data and maps generated in this study are all contained in Supporting Report 1: Database Formation, which is an integral part of this report.

4) Short-Term Priority Projects Preparation

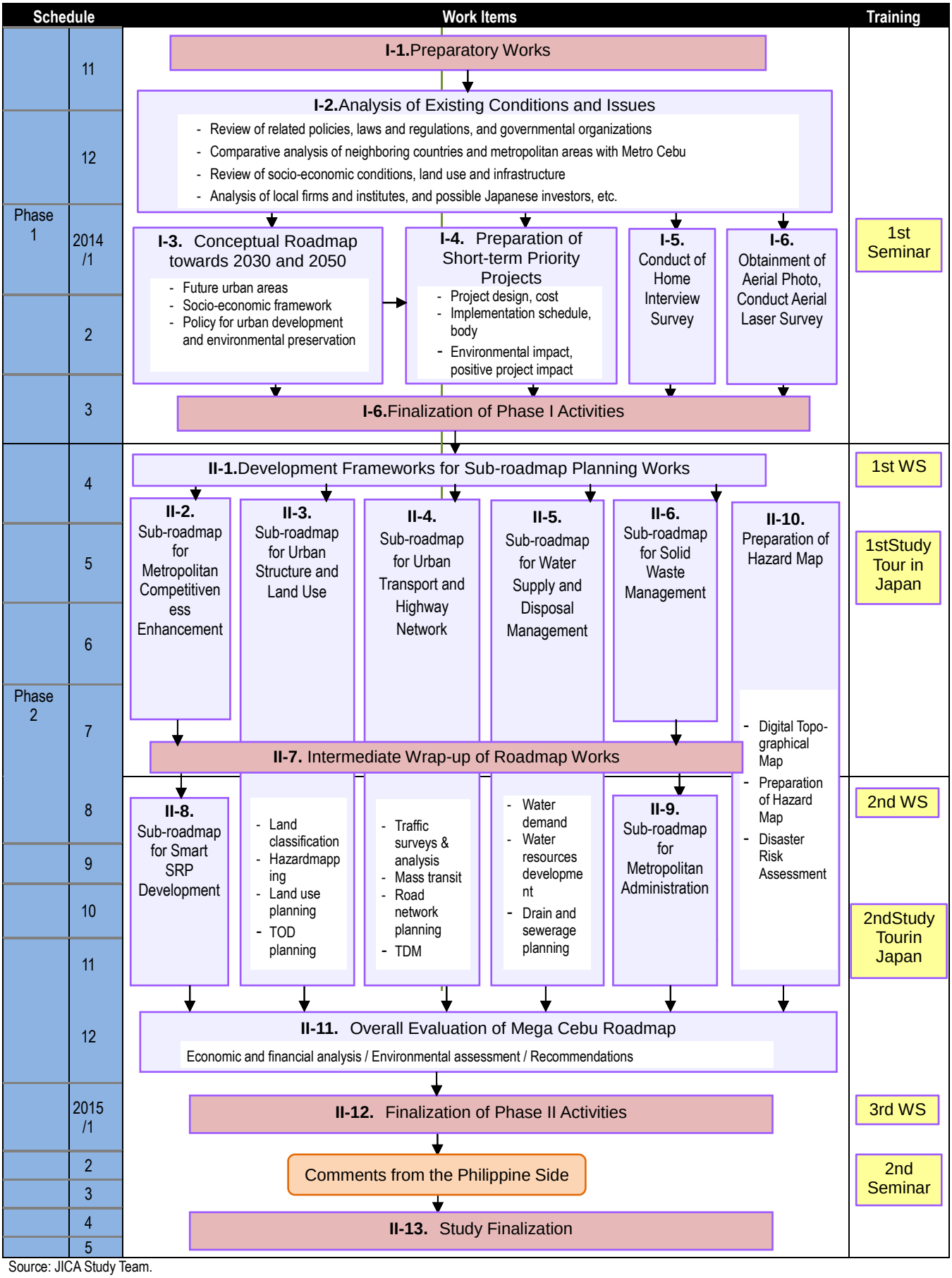
1.13 Short-term priority projects subject to pre-feasibility studies (pre-FS) were identified during the first seminar on January 30, 2014 as well as during the two workshops held on February 27 and March 7, 2014. As a result, around 20 projects were identified. Pre-FS have been conducted for 7 projects.

5) Development Frameworks for Sub-Roadmap Planning Works

1.14 In order to formulate a roadmap for each sector, a development framework as a precondition for each roadmap has been considered and outlined in Chapter 2.

6) Sub-Roadmap Planning Works and Related Workshops

1.15 Sub-roadmap planning works were undertaken. JST conducted a number of workshops (WS) in connection with the sub-roadmaps for “Economic and Investment,” “Water Supply,” “Land Use” and “Smart SRP Development.” Participants to these workshops were from the LGUs as well as from the organized metropolitan sub-team consisting of representatives from selected national government offices, the provincial government, and MCDCB.



Source: JICA Study Team.

Figure 1.2.1 Overall Study Work Flow

7) Deliberations on the Interim Reports

1.16 JST submitted Interim Report 1 (ITR-1) on April 8, 2014 and it was deliberated upon and accepted by the Steering Committee. JST then held the first workshop on April 10, 2014 with about 100 participants from MCDCB, 13 LGUs, national government agencies, the academe and private companies.

1.17 Interim Report 2 (ITR-2) was submitted by JST on August 12, 2014. It was, likewise, accepted by the Steering Committee. Similar to the first report, JST held the second workshop on August 13, 2014 with about 100 participants from MCDCB, 13 LGUs, national government agencies, the academe and private companies.

1.18 Interim Report 3 (ITR-3) was submitted on January 29, 2015 by JST. This was also deliberated upon and accepted by the Steering Committee. In addition, JST held the third workshop by sector. The workshop for “Transportation and Land Use” was conducted on January 27, 2014 while the workshop for “Water-related Issues" (water supply, septage and drainage) was conducted on January 28, 2015 each with about 60 participants from MCDCB, 13 LGUs, national government agencies, the academe and private companies.

8) Study Tours in Japan

1.19 Two study tours were conducted in cooperation with Yokohama City during the study period. The first study tour was from May 25 to 31, 2014 while the second tour was from October 27 to November 2, 2014.

1.20 The first study tour was composed of 10 participants from MCDCB, national government agencies and LGUs including the Municipal Mayor of Cordova. Seven participants were funded by JICA. The second study tour had 17 participants which included the Governor of the Province of Cebu, the City Mayors of Danao and Naga, and the Municipal Mayors of Compostela and San Fernando. Thirteen participants were funded by JICA. The lists of study tour participants are shown in Tables 1.2.1 and 1.2.2.

1.21 The objective of the first study tour was to observe and learn about the urbanization controls of the City of Yokohama, such as long-term urban development planning and implementation methods, site development, green conservation and public services program in terms of disaster management, municipal solid waste management and final disposal, and heritage conservation. Consequently, the second study tour was geared towards the promotion of Metro Cebu as a prime hub for investment through organized business matching sessions and activities related to the infrastructure and environmental technology acquired from the first study tour. The detailed schedules for the study tours are presented in Tables 1.2.3 and 1.2.4.

9) GIS Training

1.22 Responding to the request from counterpart agencies, GIS training was conducted for four days. The basic course was held on February 12–13, 2015 and the advanced course on February 16–17, 2015. Both training courses had about two participants each from the 13 LGUs, MCDCB, RAFI, and the Province of Cebu.

Table 1.2.1 Participants of the 1st Study Tour in Japan

	Name	Position and Organization
1	Mr. Adelino P. Sitoy	Mayor, Municipality of Cordova
2	Mr. Efren B. Carreon	OIC / Assistant Regional Director, National Economic Development Authority
3	Ms. Salome Palang	Municipal Planning and Development Officer, Municipality of Consolacion
4	Mr. Mariano Richeto Alcordo	Consultant, City of Carcar
5	Ms. Marlene Bedia	Executive Director, Mandaue Chamber of Commerce and Industry
6	Ms. Christine Homez	City Planning and Development Officer, City of Talisay
7	Ms. Evelyn Nacario Castro	Executive Director, RAFI-EADSC / MCDCB RPOD
8	Ms. Mary Therese S. Cho	Vice Mayor, Municipality of Cordova
9	Mr. Bong Hwan Cho	Consultant, Municipality of Cordova
10	Mr. John Kevin Hernandez	Youth Ambassador, Mega Cebu Program (MCDCB RPOD PMO)

Source: JICA Study Team.

Table 1.2.2 Participants of the 2nd Study Tour

	Name	Position, Organization
1	Mr. Hilario P. Davide III	Governor, Province of Cebu / MCDCB Chairman
2	Mr. Joel P. Quino	Mayor, Municipality of Compostela
3	Mr. Valdemar M. Chiong	Mayor, City of Naga
4	Mr. Antonio L. Canoy	Mayor, Municipality of San Fernando
5	Mr. Ramon D. Durano III	Mayor, City of Danao
6	Ms. Dominica B. Chua	COO / Vice-Chair, RAFI / MCDCB RPOD
7	Mr. Roland G. Tabuñag	Municipal Environmental Officer, Municipality of Liloan
8	Ms. Winefreda A. Dedel	Assistant Planning Officer, City of Mandaue
9	Mr. Isabelo R. Montejo	Regional Executive Director, Department of Environment and Natural Resources (DENR 7)
10	Mr. Rafael Christopher L. Yap	Executive Director, Cebu City Traffic Operations Management (CITOM)
11	Mr. Roy L. Lotzof	Chair, MCDCB RPOD FABCom on HR, Assets, and Partnerships
12	Mr. Fortunato O. Sanchez Jr.	Chair, MCDCB RPOD Sub-Com on Infra and Utilities
13	Ms. Socorro A. Tan	Vice Chair, MCDCB Sub-Com on Health and Environment
14	Mr. Gordon Alan P. Joseph	Chair, MCDCB Executive Committee
15	Ms. Crystal Star P. Aberasturi	Mega Cebu Ambassadress, MCDCB
16	Ms. Jobella A. Davide	Wife of Governor, Province of Cebu
17	Mr. Charlton James B. Canoy	Governor 's Executive Assistant, Province of Cebu

Source: JICA Study Team.

Table 1.2.3 Schedule of the 1st Study Tour

Date		Institution	Activities
25 May	Sun	Arrival (Cebu -> Narita)	
26 May	Mon	Theme: Overview of Urban Development in City of Yokohama	
		JICA	[Seminar] Introduction on Y-PORT Project in City of Yokohama
		JICA Study Team	[Meeting] about Metro Cebu Roadmap Project between JST and Metro Cebu Study Tour Team
		City of Yokohama	[Briefing] Urban Development Master Plan in City of Yokohama
		City of Yokohama	[Lecture] Minato Mirai 21 (MM21) Project
		UR, City of Yokohama	[Lecture] Urban Renaissance Agency (UR)
		Ministry of Land, Infrastructure, Transport and Tourism (MLIT)	Introduction of MLIT
		JICA Study Team	[Inspection] City Tour in Tokyo
27 May	Tue	Theme: Importance of Site Development	
		City of Yokohama	[Site Visit] MM21 Project
		City of Yokohama	[Site Visit] Landmark Tower
		City of Yokohama	Trial Ride on Metro
		City of Yokohama	[Lecture] Kohoku New Town Project
		City of Yokohama	[Site Visit] Terminal, Green Matrix, and Urban Agriculture
28 May	Wed	Theme: Conservation of Green Area / Flood Prevention	
		City of Yokohama	[Lecture] Conservation of Green Area
		City of Yokohama	[Lecture] Rainwater Drainage Control
		City of Yokohama	[Site Visit] Flood Control Basin / Border between an area designated for urbanization and a controlled urbanization area
		City of Yokohama	[Site Visit] Motomachi District and Yamate District
29 May	Thu	Theme: Municipal Solid Waste Management and Final Disposal Plant and Heritage Conservation	
		City of Yokohama	[Site Visit] South-Honmaki Final Disposal Plant
		City of Yokohama	[Lecture] Municipal Solid Waste Management
		JICA Study Team	[Site Visit] Kamakura
30 May	Fri	Theme: Business Matching with Japanese Enterprises	
		JICA Study Team	[Site Visit] Trial Ride on Kanazawa Seaside Line and Seashore Development
		City of Yokohama	[Seminar] Y-PORT Working Seminar
31 May	Sat	Departure (Narita -> Cebu)	

Source: JICA Study Team.

Table 1.2.4 Schedule of the 2nd Study Tour

Date		Institution	Activities
27 Oct	Mon	Arrival (Cebu -> Narita)	
28 Oct	Tue	Theme: New Transportation System (AGT) and Traffic Control	
			[Courtesy call] JICA HQ
			[Courtesy call] Vice-Minister, Ministry of Land, Infrastructure, Transport and Tourism (MLIT) [Briefing] City Bureau, MLIT
			[Site Visit] Tokyo Metropolitan Traffic Control Center
29 Oct	Wed	Theme: Yokohama City Center Development and Environmental Friendly Technology of Japanese Countries	
			Transfer (Shibuya→Yokohama)
			[Site Visit] Landmark Tower Observatory Floor, Introduction of City Center Development
			Participation in "Yokohama Day" which is an international forum and exhibition of cutting edge technology
			[Reception] Smart City Week Reception
30 Oct	Thu	Theme: Best Practice in Cities in Foreign Countries	
			[Site Visit] Bus tour: Introduction of Yamate District and Motomachi District
			[Site Visit] Coastal Area Development from Sea Ship Tour and Bay Bridge
			Participation in "Asia Smart City Conference"
31 Oct	Fri	Theme： Transit Oriented Development (Development of Core Centers and Public Transportations)	
			[Site Visit and Briefing] Industrial and Residential Complex Development on Public Transportation along a Railway Line (Municipal hospital, seaside marina, HAKKEIJIMA)
			[Site Visit] Road flood warning system Warning system to provide information via water gauge on small and medium-sized rivers Flood control basin / border between an area designed for urbanization and controlled urbanization area
1 Nov	Sat	Theme: Heritage Conservation	
			[Site Visit] Kamakura Heritage Conservation
2 Nov	Sun	Departure (Yokohama/ Tokyo→Narita→Cebu)	

Source: JICA Study Team.

1.3 Study Organization

1) Counterpart Agency

1.23 The counterpart agency for this study is the Metro Cebu Development and Coordinating Board (MCDCB) chaired by the Governor of Cebu Province and co-chaired by the Mayor of Cebu City and the President of Ramon Aboitiz Foundation, Inc. (RAFI). The members of the Steering Committee are listed in Table 1.3.1.

Table 1.3.1 Members of the Steering Committee

	Name	Institution
1	Hon. Hilario P. Davide III	Chair, MCDCB / Governor, Province of Cebu
2	Hon. Michael L. Rama	Co-Chair, MCDCB / Mayor, Cebu City
3	Mr. Roberto E. Aboitiz	Co-Chair, MCDCB / President, RAFI
4	Mr. Gordon Alan P. Joseph	Chair, Execom and Chair, FABCom on Integrated Development and Planning / CBC
5	Ms. Dominica B. Chua	Vice Chair, Execom / Vice Chair, RAFI
6	Mr. Efren Carreon	Secretariat, MCDCB and Co-Chair, FABCom on HR, Assets and Partnerships / Regional Director, NEDA 7
7	Mr. Jerome Gonzales	Member, MCDCB / Provincial Director, DILG 7
8	Ms. Tess Chan	Chair, FABCom on HR, Assets and Partnerships / CCCI
9	Mr. Stanley Go	Chair, FABCom on Environment and Public Safety
10	Mr.Lope Doromal	Chair, FABCom on ICT and Knowledge Management / IBM
11	Hon. Teresa Alegado	Co-Chair, FABCom on Integrated Development and Planning / Mayor, Municipality of Consolacion
12	Mr. Isabelo Montejo	Co-Chair, FABCom on Environment and Public Safety / Regional Director, DENR 7
13	Mr. Edilberto Paradela	Co-Chair, FABCom on ICT and Knowledge Management / Regional Director, DOST 7

Source: JICA Study Team.

1.24 In addition, JST requested MCDCB to organize two counterpart teams. One is the metropolitan sub-team consisting of designated representatives from key national government agencies and the provincial government (see Table 1.3.2). The other is the LGUs counterpart team consisting of assigned representatives from all 13 LGUs comprising Metro Cebu. The total number of members in the LGU counterpart team is 96 persons (see Table 1.3.3).

Table 1.3.2 Metropolitan Sub-Team

No.	Name	Organization
1	Atty. Wilbert Taneca	Bureau of Local Government Finance-Department of Finance, Local Assessment Office
2	Ms. Esperanza “Hope” Melgar	Department of Trade and Industry Provincial Office
3	Engr. Nonato Paylado	Department of Public Works and Highways-Region 7
4	RTD Eduardo M. Inting	Department of Environment and Natural Resources-Region 7
5	Ms. Judy Gabato	Department of Tourism-Region 7
6	Mr. Jerome Gonzales	Department of the Interior and Local Government-Region 7
7	Ms. Grace Q. Subong	Department of Social Welfare and Development
8	Ms. Ma. Teresa Alambra	National Economic and Development Authority-Region 7
9	Mr. Dionisio Ledres	National Economic and Development Authority-Region 7
10	Ms. Evelyn Nacario-Castro	RAFI-EADSC / MCDCB RPOD

Source: JICA Study Team.

Table 1.3.3 Designated LGU Counterparts

No.	Name	Position	LGU
1	Hon. Nice Apura	City Mayor	Carcar
2	Architect Richeto Alcordo	Sewerage and Drainage, Water Supply, Public Transport and Highway Network	Carcar
3	Engr. Santiago S. Calinawan Jr.	Water Supply, Sewerage and Drainage	Carcar
4	Engr. Idelyn Gantuangko	Public Transport	Carcar
5	Ms. Mary Genelyn M. Arcillas	Land Use, Highway Network	Carcar
6	Engr. Josephine M. Bayawa	Solid Waste Management	Carcar
7	Hon. Mary Therese S. Cho	Vice-Mayor	Cordova
8	Mr. Leonides A. Ator	Municipal Planning and Development Coordinator	Cordova
9	Mr. Soripo Singculan	Municipal Engineer	Cordova
10	Mr. Nicolas B. Entrena	Project Evaluation Officer	Cordova
11	Mr. Gregorio R. Jumao-as	Consultant	Cordova
12	Mr. Ximgil Dino Sitoy	SB on Infrastructure	Cordova
13	Mr. Danilo Sinugbuhan	Former Vice- Mayor	Cordova
14	Mr. Carmelo L. Tejero	Land Use Sector	Compostela
15	Engr. Santos Misael F. Gica	Highway Network Sector	Compostela
16	Engr. Ebonito R. Alivio	Public Transport Sector	Compostela
17	Mr. Wilfredo Hinoguin	Solid Waste Management	Compostela
18	Engr. Mario Mahilum	Solid Waste Management, Sewerage and Drainage, Water Supply	Compostela
19	Hon. Glen A. Villaceran	Sewerage and Drainage	Compostela
20	Mr. Felix Alferez	Water Supply Sector	Compostela
21	Hon. Valdemar Chiong	City Mayor	Naga
22	Ms. Kristine Vanessa T. Chiong	Program Coordinator/ Point Person	Naga
23	Engr. Joveno Garcia	City Planning and Development Coordinator	Naga
24	Mr. Jose Ramiro Hilado	Environment and Safety	Naga
25	Ms. Grace Marquez	Committee on Human Resources, Assets and Partnership	Naga
26	Mr. Bruce Constantine U. Opura	Chair. Committee on ICT and Knowledge Management	Naga
27	Ms. Delia M. Tibay	Chair. Committee on Constituency and Capability Building	Naga
28	Mr. Senen P. Paulin	Co-Chair, Committee on ICT and Knowledge Management	Naga
29	Mr. Garry A. Cabotaje	Chair, Mega Patrol/ Communication	Naga
30	Engr. Arthur Villamor	City Administrator	Naga
31	Engr. Ma. Alpha Alojado	City Engineer	Naga
32	Ms. Anabela G. Tan	LGOO VI-OIC/CLGOO	Naga
33	Hon. Carmelino Cruz Jr.	SP Member	Naga
34	Hon. Afshin Mark Senor	SP Member	Naga
35	Engr. Dario Mago	City Engineer's Office	Mandaue
36	Architect Florentino Nimor	City Planning and Development Office	Mandaue
37	Engr. Roberto Ranile	DGS	Mandaue
38	Major Edwin Ermac (ret)	TEAM	Mandaue
39	Mr. Jimmy Pareja	City Tourism Office	Mandaue
40	Ms. Genee Lou Nunez	Public Information Office	Mandaue
41	Mr. Jayzon Sebial	City Planning and Development Office	Mandaue
42	Hon. Antonio Canoy	Mayor	San Fernando
43	Mr. Leo Nicolas Patriana	Program Coordinator/ Point Person	San Fernando
44	Mr. Simeon Lauronal	Municipal Planning and Development Coordinator / Chair, Committee on Integrated Development and Planning	San Fernando
45	Mr. Artemio Alia	Member	San Fernando
46	Ms. Cecilia Umbay	Committee on Environment and Safety	San Fernando
47	Mr. Francis Dino Cabigon	HR Management Officer/ Chair, Committee on Human Resources, Assets, and Partnerships	San Fernando
48	Mr. Joel Umbay	Department of Education, IT Officer/ Chair, Committee on	San Fernando

No.	Name	Position	LGU
		ICT and Knowledge Management	
49	Mr. Walter C. Lagcao	Member	San Fernando
50	Ms. Eugenia E. Tee	Chair, Committee on Constituency and Capability Building	San Fernando
51	Ms. Alicia A. Brobo	Member	San Fernando
52	Ms. Arnel Canque	Member	San Fernando
53	Mr. Genever Enad	Municipal Information Officer/ Chair, Mega Patrol Communication	San Fernando
54	Hon. Johnny Delos Reyes	City Mayor	Talisay
55	Hon. Romeo Villarante	Vice Mayor	Talisay
56	Engr. Christine Homez	City Planning and Development Coordinator	Talisay
57	Engr. Audie Bacasmas	City Engineer	Talisay
58	Engr. Gamaliel Vicente	Asst. City Engineer	Talisay
59	Mr. Edwin Nierves	OIC, ESWM Collection and Transport	Talisay
60	Engr. Daisy Toledo	District Officer, DPWH 1st District	Talisay
61	Engr. Jefferson Benedicto	Metro Cebu Water District Representative	Talisay
62	Mr. Adano Roble	Program Coordinator/ Point Person	Danao
63	Engr. Rosette B. Villaflor	Member, City Council	Danao
64	Engr. Raymund Meca	Member, City Council	Danao
65	Engr. Leonides Martel	Member, City Council	Danao
66	Mr. Romanico Ocampo	Member, City Council	Danao
67	Mr. Jorge John Cane	Member, City Council	Danao
68	Hon. Vicente Franco Frasco	Mayor	Liloan
69	Mr. Rolando G. Tabunag	Municipal Environment and Natural Resources Office/ Program Coordinator	Liloan
70	Mr. Juanito C. Cantero	President, Association of Barangay Captains	Liloan
71	Ms. Fe M. Barino	Duros Land Representative Representing the Private Sector	Liloan
72	Mr. Martin J. Yungco	Municipal Accountant	Liloan
73	Mr. Ricky S. Hayag	Market Administrator	Liloan
74	Ms. Grethel Ortega	DILG Officer	Liloan
75	Mr. Edwin Yuson	IT-HEAD	Liloan
76	Ms. Nena L. Limpag	Municipal Planning and Development Coordinator	Liloan
77	Engr. Remedios Udtohan	Municipal Engineer	Liloan
78	Mr. Hammurabi Bugtai	HRMO	Liloan
79	Ms. Chiara Pitogo	Representative, Municipal Health Office	Liloan
80	Ms. Mary Fiel Cabua	MSWDO	Liloan
81	Ms. Edna B. Ragas	OIC-Municipal Treasurer	Liloan
82	Mr. Ireneo Noval	Municipal Agriculturist	Liloan
83	Mr. Richard Acaso	Supervisor, Department of Education, Liloan District	Liloan
84	Mr. Roberto B. Motus	Consultant	Liloan
85	Engr. Danilo Capangpangan	Engineer IV	Consolacion
86	Engr. Carlito Maglasang	Municipal Engineer	Consolacion
87	Ms. Helen Capangpangan	LGOO II	Consolacion
88	Dr. Fe Eleanor F. Pardillo	Municipal Health Officer	Consolacion
89	Ms. Aylin Parado	Asst. Municipal Treasurer	Consolacion
90	Mr. Joel Daypuyat	Labor Foreman I	Consolacion
91	Engr. Nestor Sotes	Municipal Engineer	Minglanilla
92	Engr. Domingo Celeste Enad	Municipal Planning and Development Office	Minglanilla
93	Engr. Kit Caryl Rubillos	Engineering Office	Minglanilla
94	Engr. Joselito Nacario	Municipal Planning and Development Office	Minglanilla
95	Mr. Lauraeno Luigi Unabia	Municipal Planning and Development Office	Minglanilla
96	Ms. Ederlita Cena	Municipal Planning and Development Office	Minglanilla

Source: JICA Study Team.
*Note: Counterpart Teams of Cebu City and Lapu-Lapu City are being organized.

1.25 In order to conduct this wide-ranging study in an efficient manner, JST also organized a Philippine Experts Team which includes many Cebu-based consultants and academic researchers. The members of JST and the Philippine Experts Team are listed in Table 1.2.8 and Table 1.2.9, respectively.

Table 1.3.4 Members of JICA Study Team

No.	Name	Position
1	NAGAYAMA Katsuhide, PhD.	Team Leader/ Urban Planning
2	KUMAZAWA Ken	Deputy TL/ Land Use Planning/ Transport Planning
3	Primitivo C. CAL, PhD.	Capacity Development for Planning and Implementation
4	IWADARE Yoshihiko / MATSUOKA Hiroshi	Industrial Development/ Private Investment
5	KOBAYASHI Hisako, PhD.	Public Policy Capability Evaluation/ Public Policy Management / Metropolitan Administration
6	SHIMOMURA Nobuko	Environment and Social Considerations / Consensus Building
7	TAJIMA Rie	Economic and Financial Analysis/ PPP for Infrastructure Development
8	Lynn SISON	Urban Infrastructure Planning
9	HARADA Atsushi	Road Planning
10	HIDAKA Shimao	Water Supply Planning
11	SHIRAI Masami	Drainage and Sewerage Planning
12	YAMAMOTO Masaki	Solid Waste Management Planning
13	OKAMURA Naoshi	Traffic Demand Forecast
14	KANAI Yoshikazu, PhD.	Social and Traffic Surveys
15	SAKAI Yuko	Disaster Prevention Planning
16	JITSUKATA Hiromichi	Smart City Planning
17	KANEKO Natsu	Study Coordinator/ Residential Area Development
18	KAWABATA Rie	Hazard Mapping
19	Alma PORCIUNCULA	Waterworks Organization

Source: JICA Study Team.

Table 1.3.5 Members of Philippine Experts Team

No.	Name	Position
1	Prof. Joseph ESPINA	Urban Structure/ Land Use Planning
2	Ms. Nice IROY	Land Use Planning/ GIS Assistant
3	Ms. Joy ONOZAWA	Green City Design/ Sustainable Urban Design
4	Mr. Alex FILLONE/ Mr. Rene SANTIAGO	Public Transport Planning
5	Ms. Lynn MADRONA	Road Traffic and Road Engineering
6	Mr. Danilo JAQUE	Water Supply and Disposal
7	Mr. Mario DELOS REYES	Solid Waste Management
8	Mr. Rey CRYSTAL	Metropolitan Administration, Finance and Management
9	Mr. Perry FAJARDO	Economy, Business and Investment
10	Mr. Andres MUEGO	Environmental Assessment
11	Ms. Claire Lynn REYES	Mapping/ GIS Assistant
12	Mr. Jerry H. G. SALVADOR	GIS Hazard Mapping Specialist
13	Architect. Socorro ATEGA	River and Watershed Environment Planning Specialist
14	Architect Richeto ALCORDO	Carcar City Land Use Planning Specialist
15	Ms. Joan A. JAQUE	Water Supply, Sewerage and Drainage Specialist

Source: JICA Study Team.

2 DEVELOPMENT FRAMEWORK FOR METRO CEBU ROADMAP

2.1 Mega Cebu Vision and Strategies

1) Mega Cebu Vision 2050 Statement

2.1 The Mega Cebu Vision 2050 statement was formulated in 2013 as follows:[1]

"A vibrant, equitable, sustainable and competitive environment that embraces Cebu's creativity and its cultural, historical and natural resources, with strong citizen participation and responsive governance."

2.2 A catch phrase to promote this vision was created as "MEGA Cebu--Making W.A.V.E.S.", which stands for "Wholesome, Advanced, Vibrant, Equitable, Sustainable." Awareness of and local support for this long-term development vision for 2050 was generated through intensive workshops with local stakeholders of Metro Cebu. From thereon, the 13 LGUs of Metro Cebu started their efforts towards achieving the vision. This initiative is fairly young and, thus, enormous effort is required to gain both spread and momentum.

2) Development Strategies

2.3 The strategic pillars to achieve the vision and guide the desired growth of the metropolis were identified to be: (i) competitiveness, (ii) mobility, (iii) livability, and (iv) metropolitan management. This study aims to formulate a development roadmap addressing these four pillars through seven sub-roadmaps, as shown in Figure 2.1.1. In essence, these sub-roadmaps are straddling several strategies at the same time.

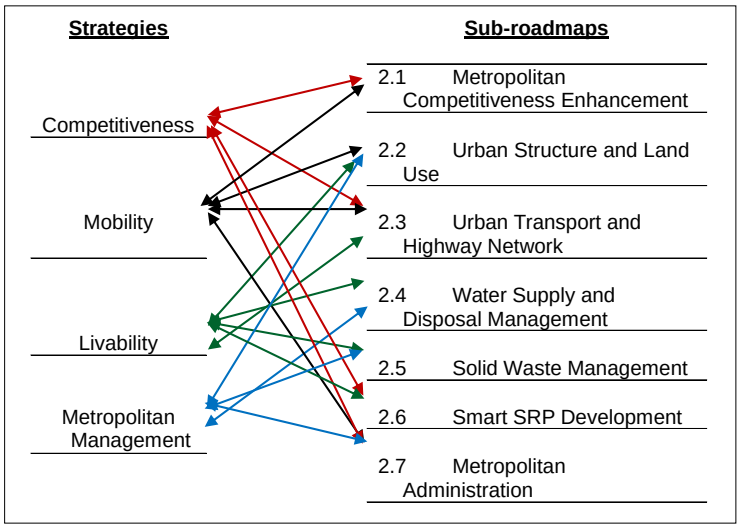
3) Awareness of the Mega Cebu Vision

2.4 Promoting the vision through the sub-roadmaps is the focus of this study. Likewise, another important concern is to raise the awareness of the people of Metro Cebu of the vision and to rally them to participate as well as support the programs and initiatives to attain such vision.

2.5 An indication of the current awareness of the Mega Cebu vision can be gauged from the results of the Household Interview Survey (HIS), which was conducted during the first quarter of 2014. Of the more than 6,500 sample households interviewed from all barangays of Metro Cebu, only about 5% of the households have heard of the Mega Cebu Vision 2050 and less than 1% were already aware of the vision. The rest, or 94% of the households, should be the target for raising awareness of the Mega Cebu vision (see Figure 2.1.2).

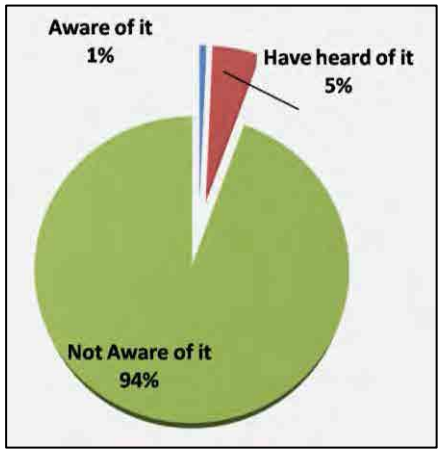
2.6 Location-wise, more residents of Cordova, Cebu City, Consolacion and City of Talisay are aware and have heard of the project as compared to residents from other cities and municipalities (see Table 2.1.1). Nevertheless, these numbers still need to be raised. The low awareness levels of local communities only points to the need for the continued communication and promotion efforts as well as for the mounting of more aggressive public information campaign to encourage more stakeholder participation in Metro Cebu's long-term plans.

[1] By the Metro Cebu Development and Coordinating Board (MCDCB) with technical assistance from the Japan International Cooperation Agency (JICA) in collaboration with the City of Yokohama.



Source: JICA Study Team.

Figure 2.1.1 Mega Cebu Development Strategies and Study Sub-Roadmaps



Source: JICA Study Team, HIS 2014.

Figure 2.1.2 Awareness of "Mega Cebu Vision 2050" in Metro Cebu

2.7 It should be noted, however, that the survey itself already introduced the vision to the sampled residents and presented the development strategies of Mega Cebu for choosing their perceived important development strategies.

4) Grassroots-Identified Development Strategies

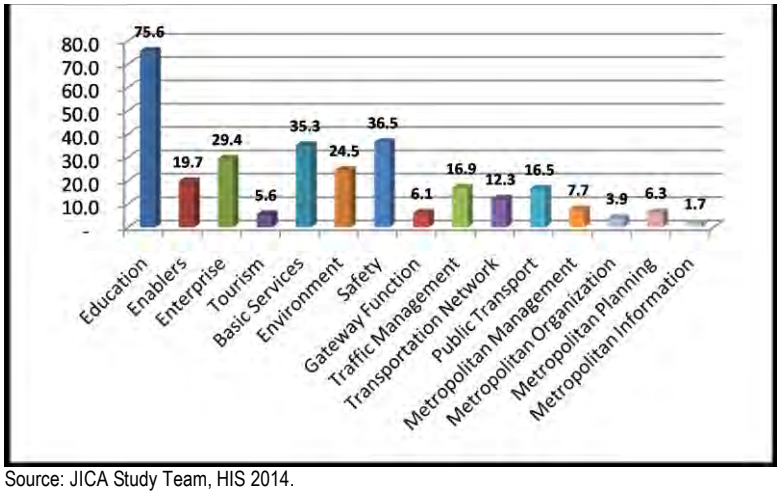
2.8 The HIS provides rich information for ascertaining development directions from the grassroots level. The sampled residents were made to choose the three most important development strategies of Mega Cebu Vision 2050 from among the 15 flash-card development items.

2.9 Aggregately, education (higher education, skills training, matching for workforce, and foreign language) was considered by 76% of the respondents as one of the more important development strategies. This was followed by safety and basic services at 37% and 35%, respectively. Running third are enterprise and environment with 29% and 25%, respectively, as shown in Figure 2.1.3. On a per LGU level, education remains a unanimous first choice.

Table 2.1.1 Awareness of "Mega Cebu Vision 2050" by Number of Households and by LGU

City/Municipality	Aware of it		Have Heard of it		Not Aware of it	
	No.	%	No.	%	No.	%
City of Carcar	0	0	8	3.5	223	96.5
Cebu City	20	0.9	178	7.8	2,077	91.3
Compostela	0	0	1	1.1	94	98.9
Consolacion	5	1.8	18	6.6	250	91.6
Cordova	2	1.8	17	14.9	95	83.3
Danao City	1	0.4	3	1.1	280	98.6
Lapu-Lapu City	4	0.4	21	1.9	1,058	97.7
Liloan	1	0.4	9	4	213	95.5
Mandaue City	6	0.7	5	0.6	847	98.7
Minglanilla	1	0.4	12	4.7	244	94.9
City of Naga	1	0.5	2	0.9	219	98.6
San Fernando	2	1.4	2	1.4	137	97.2
City of Talisay	0	0	40	8.7	420	91.3

Source: JICA Study Team, HIS 2014.



Source: JICA Study Team, HIS 2014.

Figure 2.1.3 Overall Importance of Developmental Strategies of "Mega Cebu Vision 2050"

5) Grassroots Feedback for Sub-Roadmap Planning[2]

2.10 Households were also made to provide information that are relevant for the planning of the sub-roadmaps for Metro Cebu till 2050. These are for items covering the concerns listed below and the results for planning considerations on the metropolitan level are given in Table 2.1.2.

- Preparation for disasters;
- Water;
- Sanitation;
- Drainage;
- Electricity and fuel;
- Solid waste collection;
- Traffic congestions;
- Transport measures;
- Governance; and
- Overall assessment of living environment and services.

[2] Detailed results and analyses of the Household Interview Survey are presented in Supporting Report 1: Database Formation, which is an integral part of this study report.

Table 2.1.2 HIS-derived Considerations for Sub-Roadmaps

Sub-Roadmap Item	Selected Survey Data	Planning Considerations- Metro Level	
		Sub-Item	Present Condition (in % of Households)
Water Supply	Main Water Source for Drinking	Water Refilling Station	69%
		Piped Water	13%
	Main Water Source for Other Purposes	Piped Water	50%
		Public Well	16%
	Ave. Monthly Consumption	10 cubic meters or less	53%
		21–30 cubic meters	20%
	Willingness to Pay for Stable and 24-hr Supply	PHP200 or less	86%
Sanitation	Toilet Facility	Pour-flush type	80%
	Black Water Treatment	Septic Tank	86%
	Grey Water Treatment	Drainage (no treatment)	80%
	Septic Sludge Removal	Never done	44%
		Not sure	35%
	Evaluation of HH Sanitation (always and sometimes)	Offensive odor	37%
		Pipe clogging	15%
		Overflow of wastewater	23%
	Willingness to Pay to Improve Sanitation	None	-
		PHP1–100	24%
Drainage	Drainage Condition	Have drainage	58%
		Bad and very bad condition	21%
		Average condition	62%
	Frequency of Flooding	Every year	29%
		Never experienced	62%
Electricity	Average Consumption	50 kWh or less / month	52%
		51–100 kWh / month	26%
	Frequency of Blackout	Several times a year	48%
		1–3 times a month	11%
	Willingness to Pay for Better Source	No additional payment and no need for better service	77%
		PHP50 or less	14%
Solid Waste Collection/ Disposal	Provision of Solid Waste Collection	With collection service	82%
	Frequency of Collection	Once a week	38%
		Daily to 4 times a week	60%
	Alternative Method for Waste Disposal	Burning, burying, throw elsewhere, etc.	16%
	Waste Segregation	With household practice	Above 90%
Traffic Congestion	Congestion Level : to work / school trips	Bad	45%
	Causes of Congestion	Increasing use of automobiles	37%
		Undisciplined drivers	17%
		Lack of traffic management and enforcement	12%
Transport Measures	Preferred Introduction of Public Transport (1)	Street car / tramway	30%
	Preferred Introduction of Public Transport (2)	Urban railway	28%
	Future Improvement Measures	Construction/ Improvement of roads	96%
		Installation / Improvement of traffic signals	95%
		Improvement of sidewalks	94%
Governance	Public Participation in Policymaking Process	Medium Low	52% 27%
	Reflection of Community Interests in Policies	Medium Low	51% 26%
	Transparency and Accountability of Decision-making Process	Medium Low	49% 29%

Source: JICA Study Team, HIS 2014.
Note: Data on LGU level are available in Supporting Report 1: Database Formation.

Table 2.1.3 Overall Assessment of Current Living Environment and Services

Aspects			Highly Unsatisfied		Unsatisfied		Average		Satisfied		Highly Satisfied	
			No.	%	No.	%	No.	%	No.	%	No.	%
Living Environment	1	Safety/security in neighborhood	260	4.0	1,055	16.2	4,201	64.4	926	14.2	78	1.2
	2	Preparedness to natural/ man-made disasters	122	1.9	923	14.2	4,677	71.8	722	11.1	66	1.0
	3	Neighborhood association	76	1.2	766	11.8	4,612	70.8	959	14.7	103	1.6
	4	Housing	272	4.2	1,284	19.7	4,277	65.7	641	9.8	38	0.6
	5	Air quality and odor	218	3.3	1,103	16.9	4,384	67.3	760	11.7	48	0.7
	6	Noise	144	2.2	1,115	17.1	4,490	68.9	708	10.9	55	0.8
	7	Sanitary condition	239	3.7	1,488	22.9	3,955	60.8	754	11.6	70	1.1
	8	Landscape/ historical places	304	4.7	1,582	24.3	3,695	56.7	822	12.6	110	1.7
	9	Parks/ greenery	357	5.5	1,797	27.6	3,434	52.7	790	12.1	136	2.1
	10	Entertainment	362	5.6	1,517	23.3	3,889	59.7	677	10.4	73	1.1
Quality of Public Service	11	Electric supply	229	3.5	891	13.7	4,074	62.5	1,278	19.6	43	0.7
	12	Water supply	227	3.5	1,071	16.5	3,821	58.7	1,307	20.1	84	1.3
	13	Sewage system	594	9.1	1,694	26.0	3,819	58.7	391	6.0	13	0.2
	14	Drainage system	699	10.7	2,182	33.5	3,227	49.5	385	5.9	23	0.4
	15	Telecommunication	82	4.2	835	42.9	0	0.0	941	48.3	90	4.6
	16	Solid waste collection	436	6.7	1,388	21.3	3,244	49.8	1,325	20.3	121	1.9
	17	Health care	79	1.2	741	11.4	4,269	65.5	1,361	20.9	67	1.0
	18	Education	66	1.0	667	10.2	4,105	63.0	1,462	22.4	218	3.3
	19	Public transport	156	2.4	901	13.8	4,664	71.6	732	11.2	57	0.9

Source: JICA Study Team, HIS 2014.
Note: Data on LGU level are available in Supporting Report 1: Database Formation.

6) Perspectives from LGUs for Sub-Roadmap Planning

2.11 From the perspective of the LGU planners and decision makers, development issues were identified during the series of meetings and workshops held between November 2013 and February 2014. Basically, four major development issues emerged for Metro Cebu. These are septage and sewerage management, solid waste management, transportation, and water supply. At the same discussion venues, development priorities were aired by each LGU and exchanges on views for relevant projects for consideration under the Mega Cebu Vision 2050 sub-roadmaps were made.

2.12 With the exception of the City of Carcar, all the LGUs identified septage and sewerage management as a critical development issue. Solid waste-related concerns, including the dumping site and sanitary landfill, are also high in the priority issues of all the LGUs except Naga City, which has an advanced materials recovery facility under a PPP scheme.Transport-related issues include traffic congestion, public transport, and roads and other transport infrastructure. Nine LGUs are experiencing serious traffic congestion while six LGUs regarded the issue pertaining to public transport to be within manageable level. Eight LGUs have difficulties with water supply and some LGUs pointed out salt water intrusion as one of their water supply problems. These issues are caused by rapid population increase and urbanization occurring in suburban areas of the existing urban center. In addition to Cebu City, Consolacion, Compostela, and Liloan in the north, and the City of Talisay, Minglanilla, and San Fernando in the south identified population increase or inflow as issues. As a result, informal settlements mushroomed in those LGUs as well as in the urbanized areas of Mandaue City and Cordova. The development issues of the 13 LGUs are summarized in Table 2.1.4.

2.13 Development priorities of the LGUs are varied, as shown in Table 2.1.5. Many of their priorities are aligned under the development sub-roadmaps covered in this study where interrelated impacts on a metropolitan scale will be felt.

2.14 With majority of the LGUs represented during the workshops, best practices and lessons learnt were shared among themselves. The possibility of replication is high as many issues are the same across some LGUs.

Table 2.1.4 Summary of Development Issues of 13 LGUs in Metro Cebu

	Development Issues/ LGUs	City of Carcar	Cebu City	Compostela	Consolacion	Cordoba	Danao City	Lapu-Lapu City	Liloan	Mandaue City	Minglanilla	City of Naga	San Fernando	City of Talisay
1	Septage and Sewerage		●	●	●	●	●	●	●	●	●	●	●	●
	Drainage		●								●			●
2	Solid waste management	●	●	●	●	●		●	●	●	●			●
	Dumping site/ sanitary landfill			●			●						●	
3	Traffic congestion/ management		●	●		●	●	●	●		●		●	●
	Public transport/ terminal		●		●	●	●	●				●		
	Roads/ bridges/ transport infrastructure		●			●				●	●			●
	Port	●										●		
4	Water supply/water resources		●	●	●	●		●				●	●	●
	Salt water intrusion							●		●				●
5	Population increase/ urbanization/ population inflow		●	●	●				●		●		●	●
	Informal settlers		●	●	●	●				●				●
	Development control									●	●			
	Housing/ socialized housing		●			●								
6	Economic development				●				●	●				
	Public market			●										●
7	Environment		●							●				
	Pollution (air/ water/ others)/ contamination		●							●				
	Flooding	●											●	
	Coastal management		●											
8	Education								●	●				
	Health care								●					
9	Power supply					●		●						
10	Poverty	●												
	Social security	●												
	Social issues	●												
11	Public buildings											●		
12	Institutional Issues		●											

Source: JICA Study Team.

Table 2.1.5 Development Issues, Priorities, and Good Practices of 13 LGUs in Metro Cebu

LGU	Development Issues	Development Priorities	Good Practices
Compostela	• Public market • Septage management • Increase in population • Relocation areas for informal settlers • Water supply (develop own water supply because of abundant water supply) • Solid waste management and dumping site • Traffic congestion	• Road development • Reclamation • Sea-based transport • Development of IT park with fiber-optic line • Water supply	• Major supply of ampalaya (bitter gourd) • Community coastal cleaning
Consolacion	• Public transport • Water treatment, septage and sewerage programs • Rapid urbanization and population inflow • Informal settlement • Economic development • Water supply (80% supplied by MCWD) • Solid waste management	• Health care • Agriculture • Security • Education • Improvement of public services • Economic development • Infrastructure development • Environmental preservation • Cultural preservation • Tourism • Housing policy • Sports	• "Dynamism in education" program • Community college • 60% subsidies for education (40% tuition paid by students)
Liloan	• Education • Health care • Economic development • Traffic congestion on trunk roads • Population increase • Garbage disposal facilities • Septage and sewerage treatment facilities	• Education • Health care • Sea-based public transport • Sanitary landfill • Septage and sewerage system	• Purok system of governance (segregation) • Best emerging LGU • Best performing LGU (clean and green)
Cebu City	• Drainage • Roads and bridges • Public transport • Environment and coastal management • Population increase • Traffic congestion • Informal settlers • Solid waste management • Air pollution • Septage and sewerage management • Housing • Water supply • Environment (disposal of hazardous waste) • Institutional issues - overlapping of functions (river easement-LGU, DPWH and DENR)	• Hospital • Improvement of roads and drainage • Implementation of circumferential road • Septage and sewerage • Public transport (BRT) • Regulation of tricycle and trisikad	• Management of informal settlers (legal and humane procedure for treating informal settlers/ provision of resettlement area for informal settlers), provision of access roads in informal settlements (after a fire calamity) • Barangay frontline services of City Hall • GIS • PPP linkage for improvement of police stations/ provision of gadgets/ equipment)
Mandaue City	• Economy • Education • Informal settlement • Transportation infrastructure • Environment • Development control • Salt water intrusion or contamination • Pollution caused by industry • Solid waste management • Septage and sewerage	• School • Roads • Drainage for Fortuna Street • Traffic management • Informal settlement • Tourism • Transport (PUJ and buses) • Talisay–SM–Mandaue BRT • Solid waste management • Septage and sewerage	• New vision for Mandaue (from industry to quality and consumer products) • Development of slums in coastal area • Institute for Solidarity in Asia • 27 barangays all interconnected by backbone fiber-optics command • Center for emergency response (fire, police and traffic)
Danao City	• Traffic congestion • Public transport • Dumping site • Sewerage and septage	• Road network • Bulk water supply system • Sewerage	• Awarded for tax collection efficiency • Seal of good housekeeping
Talisay City	• Water resource and water supply • Population increase • Sewerage • Salt water intrusion • Solid waste management	• Improvement of drainage • New roads and road widening • Public market • Relocation of informal settlements • Schools • Solid waste management (each	• Child-friendly city • Incentives for informal settlers • Teachers' aid volunteer (hired by LGU)

LGU	Development Issues	Development Priorities	Good Practices
	• Drainage • Public market • Roads, transport • Traffic management • Informal settlers	barangay should have a Materials Recovery Facility) • Rehabilitation of earthquake-hit schools • International marina • SRP fish port	
Carcar City	• Social security • Poverty incidence • Existing port • Flooding • Social issues (drug addicts) • Solid waste management	• New city center • Road widening and diversion bypass roads	• Awarded for good housekeeping • Tax collection efficiency • Zero solid waste • Cultural talent • Planning of a new city center
Minglanilla	• Rapid population inflow • Development control • Traffic congestion • Drainage (creeks have no outlets) • No sewerage system • Solid waste management • PHP100-million flyover by DPWH	• New public market (including public transport terminal) • Trunk road development (old PNR ROW) • 100 ha. reclamation and industrial estate • Modern traffic signal installation • Port expansion to have a RORO from Minglanilla to Bohol	• Zero waste
Naga City	• Mass transport • Port • Public buildings (police, fire, etc.) • Septage • Lack of water supply	• Water supply • Road repair • Tourism resource • Drainage and sewerage • Port • New Naga public market • Education (new college)	• Septage and sewerage project • Smile of City employees • Materials recovery facility (MRF)
Lapu-Lapu City	• Water supply • Solid waste management • Power supply • Waste water treatment • Transport and traffic congestion • Salt water intrusion	• Reclamation (northern part) • Sport recreation • Urban redevelopment • Road widening • Drainage • Intermodal transport • Water resource	• Service with a smile • Good housekeeping • Tricycles not allowed on national road highway
Cordova	• Traffic congestion • Solid waste • Informal settlement • Water supply • Lack of sanitary landfill • Public transport terminal • Power supply (island barangays depending on solar energy) • Narrow roads • Socialized housing • Sewerage	• New Mactan bridge • New port • Reclamation • Bridge from Cordova to Bohol • RORO transport system from SRP to Shell Island and Causeway from Shell Island to Cordova • Septage and sewerage	• Green card sanitary system for monitoring of solid waste management
San Fernando	• Population increase • Water resource and water supply • Dumping site • Traffic • Septage • Flooding	• Sanitary landfill • Secondary diversion road • Implementation of circumferential road	• Initiation of own sanitary landfill

Source: JICA Study Team.

2.2 Socioeconomic Development Framework

1) Population Projection

2.15 The future population of Metro Cebu until 2050 was projected by regressing logistic curves from the past census data of 1980, 1990, 1995, 2000, 2007 and 2010 (see Table 2.2.1). The population densities were taken into account to prepare the population projection for LGUs in Metro Cebu.

2.16 A long-term population projection available is the population projection by 2040 at the regional level, based on the 2000 Population and Housing Census done by the National Statistics Office (NSO). The population projection started from the regional level or the Central Visayas population. A logistic regression function of the region was obtained from the six available sets of census data and NSO population projection for 2040, and then applied to estimate the population of 2020, 2030, 2040, and 2050. For the population projection of Cebu Province, two logistic regression functions for Cebu Province and outside Cebu Province were initially estimated from the six sets of census data. The future populations of the two areas obtained from the two logistic functions were adjusted to the projected regional population as the control total. Metro Cebu and outside Metro Cebu future populations were estimated in the same manner from the logistic regression functions and the control totals of the estimated future populations of Cebu Province and outside Cebu Province.

2.17 Similarly, the LGU future populations were projected from the logistic regression functions and adjusted to the estimated future population of Metro Cebu. However, for the Metro Cebu population projection, because the estimated population densities of Cebu City, Mandaue City, the City of Talisay, and Cordova became too high, the future populations of these LGUs were adjusted, considering the population density. Then the future populations of the other LGUs were estimated.

2.18 The Metro Cebu population was estimated to double to nearly 5 million people by 2050 from about 2.5 million in 2010. Population growth by 2050 is expected in the suburban areas of Metro Cebu. Population growth in the existing urban areas including Cebu City, Mandaue City, and Talisay City are lower, compared with the surrounding areas such as Liloan, Consolacion, and Minglanilla.

Table 2.2.1 Population Projection by 2050

City/Municipality	Land Area (km^2)	Population								Population Growth Rate (%)							Pop Density (persons/ ha)	
		Actual Census				Projection				Actual Census			Projection					
		1980	1990	2000	2010	2020	2030	2040	2050	80-90	90-00	00-10	10-20	20-30	30-40	40-50	2010	2050
City of Carcar	117.00	57.82	70.8	89.2	107.3	156.9	186.4	215.3	243.8	3.13	2.33	1.87	3.87	1.74	1.45	1.25	9.2	20.8
Cebu City	326.10	490.28	610.4	718.8	866.2	967.3	1,086.7	1,205.4	1,323.6	3.05	1.65	1.88	1.11	1.17	1.04	0.94	26.6	40.6
Compostela	44.73	17.50	22.0	31.4	42.6	63.1	77.5	91.9	106.1	4.23	3.63	3.08	4.02	2.08	1.71	1.45	9.5	23.7
Consolacion	38.98	27.45	41.3	62.3	106.6	155.2	196.6	238.2	279.8	6.01	4.20	5.52	3.83	2.39	1.94	1.62	27.4	71.8
Cordoba	7.41	16.46	22.3	34.0	50.4	57.6	68.4	79.1	89.8	4.93	4.30	4.00	1.35	1.73	1.47	1.28	68.0	121.2
Danao City	142.53	56.97	73.4	98.8	119.3	176.1	212.2	247.8	283.0	3.45	3.02	1.90	3.98	1.88	1.56	1.34	8.4	19.9
Lapu-Lapu City	64.24	98.72	146.2	217.0	350.5	445.6	544.5	643.0	740.9	5.82	4.03	4.91	2.43	2.03	1.68	1.43	54.6	115.3
Liloan	52.10	30.20	42.6	65.0	100.5	153.3	192.8	232.4	272.0	5.38	4.31	4.46	4.32	2.32	1.88	1.59	19.3	52.2
Mandaue City	30.64	110.59	180.3	259.7	331.3	391.7	461.8	531.6	601.1	5.82	3.72	2.46	1.69	1.66	1.42	1.24	108.1	196.2
Minglanilla	65.60	38.50	50.9	77.3	113.2	169.3	211.1	252.9	294.6	4.97	4.27	3.89	4.11	2.23	1.82	1.54	17.3	44.9
City of Naga	92.98	45.83	60.4	80.2	101.6	152.2	184.4	216.3	248.0	4.18	2.87	2.39	4.13	1.94	1.61	1.37	10.9	26.7
San Fernando	74.05	28.32	35.1	48.2	61.0	88.9	107.7	126.3	144.7	3.17	3.24	2.37	3.85	1.93	1.60	1.37	8.2	19.5
City of Talisay	43.70	69.72	98.0	148.1	200.8	236.4	279.7	322.7	365.5	5.61	4.22	3.09	1.65	1.69	1.44	1.25	45.9	83.7
Metro Cebu	1,100.06	1,088	1,453.6	1,930.1	2,551.1	3,213.9	3,809.8	4,402.9	4,993.0	4.14	2.88	2.83	2.34	1.72	1.46	1.27	23.2	45.4
Outside Metro Cebu	3,888.58	1,102	1,339.1	1,426.0	1,616.2	1,844.6	2,041.4	2,237.2	2,432.1	1.57	0.63	1.26	1.33	1.02	0.92	0.84	4.2	6.3
Cebu Province	4,943.72	2,190	2,792.7	3,356.1	4,167.3	5,058.5	5,851.2	6,640.1	7,425.1	2.92	1.85	2.19	1.96	1.47	1.27	1.12	8.4	15.0
Outside Cebu	10,942.25	1,696	1,947.6	2,350.8	2,632.9	3,176.5	3,574.5	3,970.5	4,364.6	2.13	1.90	1.14	1.89	1.19	1.06	0.95	2.4	4.0
Central Visayas	15,885.97	3,886.1	4,740.3	5,707.0	6,800.2	8,234.9	9,425.7	10,610.6	11,789.7	2.58	1.87	1.77	1.93	1.36	1.19	1.06	4.3	7.4

Source: Population actual data: National Statistics Office, Housing and Population Census.
Note: Data on LGU land area were adopted from the CLUPs or data of each LGU.

2.19 By 2050, Cebu City's population alone would reach 1.3 million. The second largest city would be Lapu-Lapu City with 741,000 people, followed by Mandaue City (601,000 people) and the City of Talisay (366,000 people). The estimated 2050 population of other LGUs are Carcar City (245,000), Compostela (106,000), Consolacion (280,000), Cordova (90,000), Danao City (283,000), Liloan (272,000), Minglanilla (295,000), the City of Naga (248,000), and San Fernando (145,000).

2) Projection of Socioeconomic Framework: Baseline Scenario

2.20 The socioeconomic framework for the baseline scenario is estimated and summarized in Table 2.2.2. The baseline scenario is trend-based estimation assuming that the current trend of the socioeconomic growth would continue until 2050 without significant policy change or disruption from inside and outside the country such as political turmoil or economic recession. In the baseline scenario, the prospect of the Philippine economy is taken as a significant indicator for the future economic framework. The expected strong Philippine economy in the future is reflected in the projection.[3]

(1) GRDP

2.21 The GRDP of Metro Cebu in the base year of 2012 is estimated at PHP225 billion in 2000 constant price. This will reach PHP378.6 billion in 2020, PHP690 billion in 2030, and nearly PHP2 trillion in 2050, growing at higher rates than those of Central Visayas and the Philippines. The dominance of the Metro Cebu economy in Central Visayas and Cebu Province would be stronger by 2050. Metro Cebu accounted for 56% and 75% of the regional and provincial economies, respectively, in 2012 and these are expected to further increase to 71% and 79%, respectively, in 2050.

[3] According to Lee and Hong (2010), the Philippine economy is projected to grow at a range of 5.98% to 7.09% by 2020 and from 5.53% to 6.81% by 2030 (Lee, Jong-Wha and Kiseok Hong. 2010. Economic Growth in Asia: Determinants and Prospects. ADB Economics Working Paper Series). In World in 2050, the HSBC (2012) estimates the following growth rates by 2050: 8.40% by 2020, 7.30% by 2030, 6.60% by 2040, and 5.80% by 2050.

(2) Per Capita GRDP

2.22 Per capita GRDP of Metro Cebu was PHP69,000 in 2012, the highest compared with those of Cebu Province, Central Visayas, and the Philippines. This superiority of Metro Cebu would continue with its per capita GRDP growing higher than those of the province, the region, and the country. Per capita GRDP of Metro Cebu is projected at PHP117,800 in 2020, PHP181,100 in 2030, and PHP392,300 in 2050, which is more than five times its 2012 level.

Table 2.2.2 Socioeconomic Framework for Metro Cebu by 2050 (Baseline Scenario)

(1) GRDP

	GRDP 2000 Constant Price (in Billion PHP)				Annual Growth Rate (%)		
	2012	2020	2030	2050	2012–20	2020–30	2030–50
Metro Cebu	224.7	378.6	690.1	1,958.6	6.74	6.19	5.35
Cebu Province	298.8	499.0	898.9	2,492.3	6.62	6.06	5.23
Central Visayas	397.7	631.4	1,074.7	2,773.8	5.95	5.46	4.86
Philippines	6,311.7	10,291.9	17,630.1	45,761.9	6.30	5.53	4.88

(2) Per Capita GRDP

	Per Capita 2000 Constant Price (in 000 PHP)				Annual Growth Rate (%)		
	2012	2020	2030	2050	2012–20	2020–30	2030–50
Metro Cebu	69.7	117.8	181.1	392.3	6.77	4.40	3.94
Cebu Province	68.8	98.6	153.6	335.7	4.61	4.53	3.99
Central Visayas	56.5	76.7	114.0	235.3	3.89	4.05	3.69
Philippines	65.9	93.7	140.1	297.4	4.50	4.10	3.83

Source: Estimated by the JICA Study Team.

3) Projection of Urbanization

2.23 This section analyzes urban development experiences in Metro Cebu based on data from the Philippine Economic Zone Authority (PEZA) and the Housing and Land Use Regulatory Board (HLURB). PEZA project sites are industrial estates, business centers, IT parks, R&D centers, and shopping complexes. They provide formal employment opportunities to the local populace. HLURB data show subdivisions and other residential development projects or formal housing projects suitable for the middle to high income groups.

(1) Residential Development

2.24 HLURB data show the residential development trend in Metro Cebu. There were 6,541 projects covering a total of 2,696 ha reported to HLURB between 1995 and 2012 (see Figure 2.2.1). The average project site area was 4,123 m^2 or almost one acre.

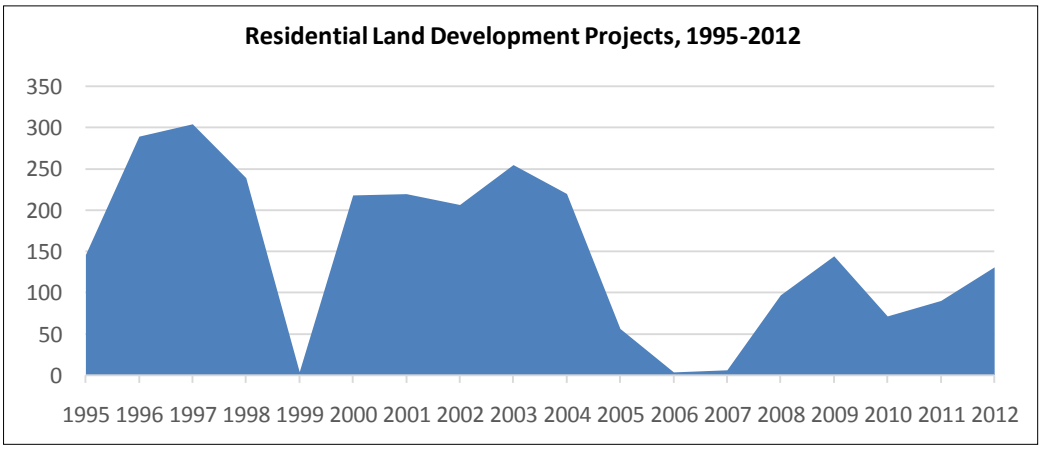
2.25 In the late 1990s, Metro Cebu experienced a real estate boom which was brought about by concerted urban infrastructure development efforts such as the Metro Cebu Development Project (MCDP). After the Asian Financial Crisis in 1997-1998, another boom occurred in the early 2000s resulting from a favorable economic development environment. In January 2007, Cebu hosted the 12th ASEAN Summit. Since 2008, moderate land conversion to residential use has been reported to HLURB, averaging 107 ha annually.

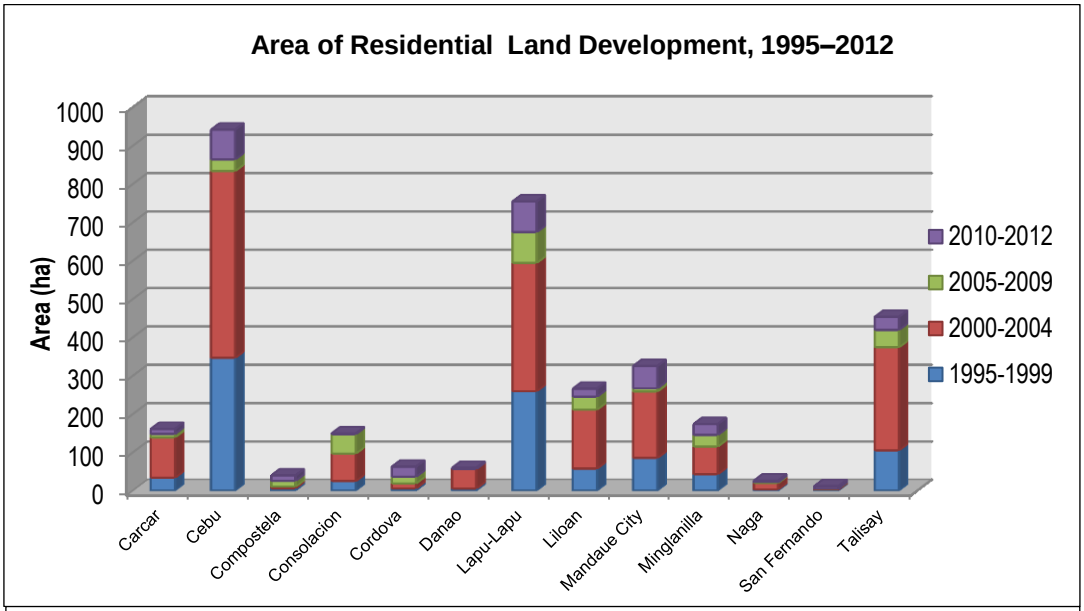
2.26 Among the LGUs, Cebu City recorded the largest residential area development between 1995 and 2012 (761 ha or 1,824 projects), followed by Lapu-Lapu City (616 ha, 1,411 projects), Talisay City (319 ha, 884 projects), and Mandaue City (267 ha, 841 projects).

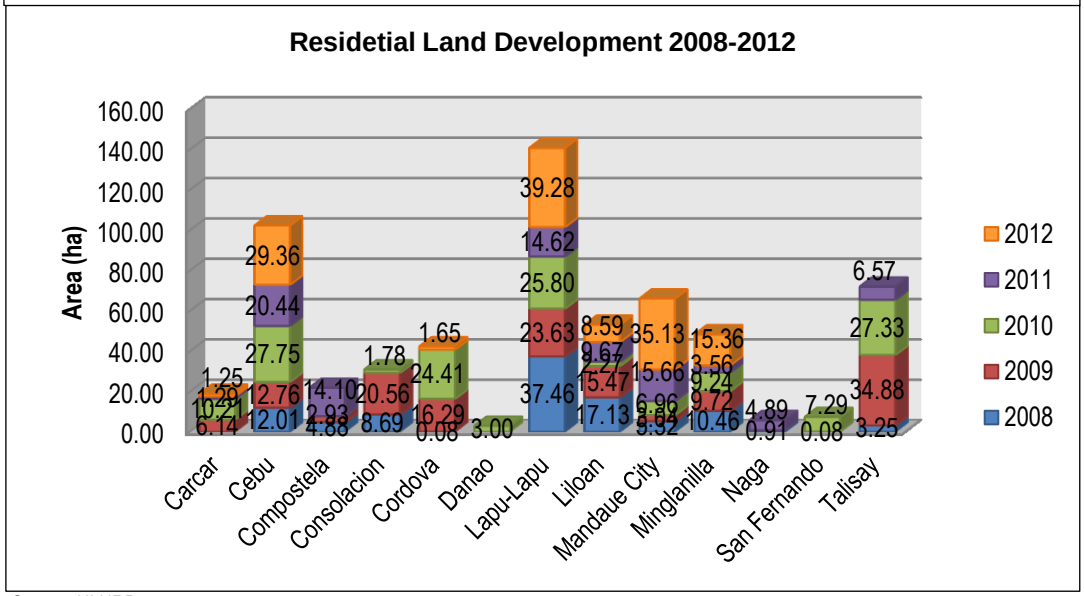
2.27 In recent years (2008–2012), however, Lapu-Lapu City has overtaken Cebu City as the largest supplier of new residential lands. As land scarcity in Cebu City

continues, urbanization pressure goes not only to Mandaue City and Talisay City but also significantly to Liloan and Minglanilla. Another recent phenomenon in residential land development are the larger project sites averaging 1.2 ha from the previous 0.4 ha. This may indicate an active suburban development on the outskirts of urbanization from Cebu City.

2.28 It should be noted that HLURB statistics indicate only project name and land area but do not show the number of residential units to be developed. The supply of new residential units without land use conversion, such as new condominium buildings in old residential areas, may not be reported.







Source: HLURB.
Unit: in hectares (ha).

Figure 2.2.1 Trends in Residential Land Development in Metro Cebu, 1995–2012

(2) PEZA Registered Projects

2.29 PEZA is a government agency under the Department of Trade and Industry

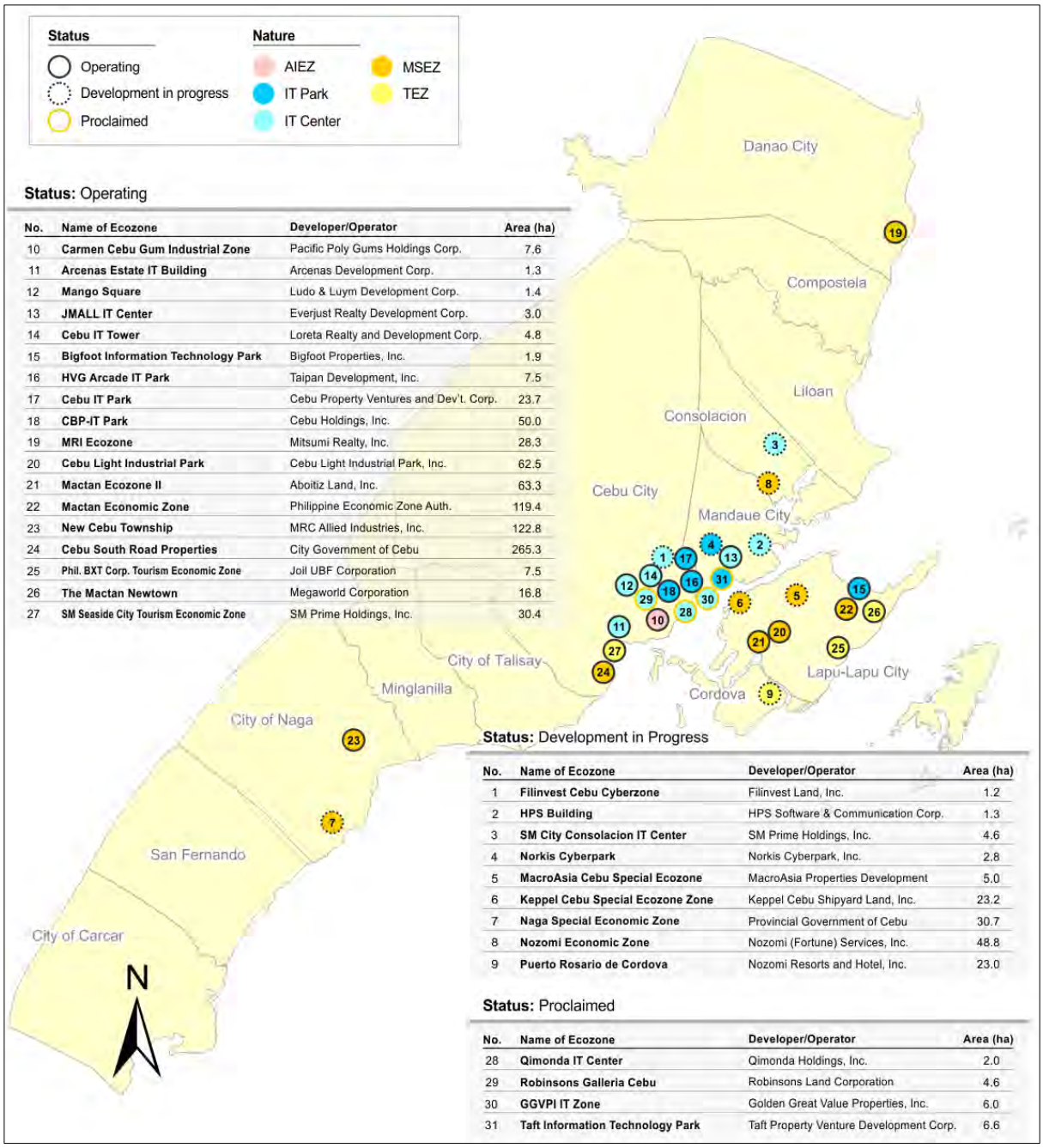
(DTI) that was established in 1995 to undertake investment promotion, employment provision and export facilitation. There are several types of economic zones under PEZA such as manufacturing economic zone, information technology park/center, agro-industrial economic zone, tourism economic zone, and medical tourism park/center. As of February 2014, there were 300 economic zones in operation under PEZA.

2.30 PEZA zones offer substantial incentives to investors. These include exemption/ reduction of corporate tax, customs exemption when importing machinery, equipment/ parts and raw materials, exemption from property tax, and so on. In the case of a manufacturing economic zone, each site office has ample authority to support manufacturers, including issuance of building permit, export/import permit, and visa for employees and their family members.

2.31 There are 64 PEZA registered projects in Metro Cebu, covering a total of 989 ha. In terms of development phase, 37 projects with 825 ha are operating, 14 projects with 143 ha are under development, and 13 projects with 21 ha are proclaimed (see Figure 2.2.2 and Figure 2.2.3).

2.32 As to project type, six manufacturing economic zones (MEC) currently operate in Metro Cebu, including Cebu SRP (265 ha), Mactan Economic Zone (112 ha), Mactan Economic Zone II (63 ha), Cebu Light Industry (62 ha), and New Cebu Township (123 ha). There are as many as 27 operating IT park/center projects, occupying a total of 101 ha. Among them, the Cebu Business Park (50 ha) and Cebu IT Park (24 ha) are representative. Three tourism economic zones (TEZ) and one agro-industrial economic zone (AIEZ) also operate in Metro Cebu. Among the abovementioned operating projects, many sites are fully occupied while some still remain largely vacant such as Cebu SRP and New Cebu Township in Naga City. Both the large-scale projects are rather mixed and self-contained for commercial, business, R&D, and residential development.

2.33 Many more IT park/center projects are under preparation, including 21 projects with 33 ha which are either in development or proclaimed. Four MEC projects with an aggregated area of 143 ha are under preparation. Nozomi Economic Zone (Consolacion, 49 ha), Keppel Cebu Special Economic Zone (Lapu-Lapu City, 28 ha), and Naga Special Economic Zone (31 ha) will take an important role in industrial development. One TEZ is also prepared in Cordova.



Status: Operating

No.	Name of Ecozone	Developer/Operator	Area (ha)
10	Carmen Cebu Gum Industrial Zone	Pacific Poly Gums Holdings Corp.	7.6
11	Arcenas Estate IT Building	Arcenas Development Corp.	1.3
12	Mango Square	Ludo & Luym Development Corp.	1.4
13	JMALL IT Center	Everjust Realty Development Corp.	3.0
14	Cebu IT Tower	Loreta Realty and Development Corp.	4.8
15	Bigfoot Information Technology Park	Bigfoot Properties, Inc.	1.9
16	HVG Arcade IT Park	Taipan Development, Inc.	7.5
17	Cebu IT Park	Cebu Property Ventures and Dev't. Corp.	23.7
18	CBP-IT Park	Cebu Holdings, Inc.	50.0
19	MRI Ecozone	Mitsumi Realty, Inc.	28.3
20	Cebu Light Industrial Park	Cebu Light Industrial Park, Inc.	62.5
21	Mactan Ecozone II	Aboitiz Land, Inc.	63.3
22	Mactan Economic Zone	Philippine Economic Zone Auth.	119.4
23	New Cebu Township	MRC Allied Industries, Inc.	122.8
24	Cebu South Road Properties	City Government of Cebu	265.3
25	Phil. BXT Corp. Tourism Economic Zone	Joil UBF Corporation	7.5
26	The Mactan Newtown	Megaworld Corporation	16.8
27	SM Seaside City Tourism Economic Zone	SM Prime Holdings, Inc.	30.4

Status: Development in Progress

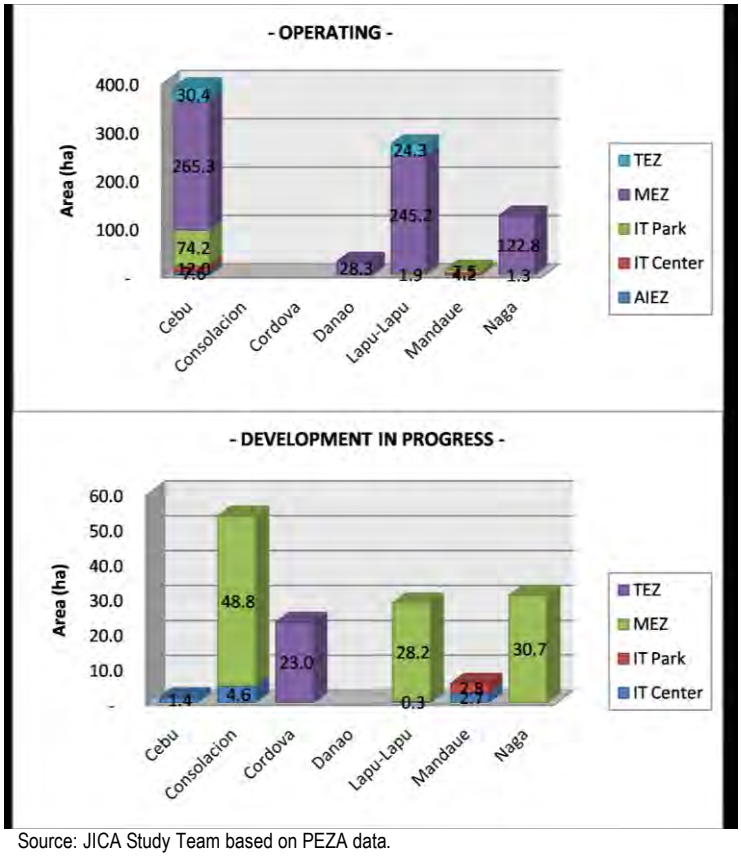
No.	Name of Ecozone	Developer/Operator	Area (ha)
1	Filinvest Cebu Cyberzone	Filinvest Land, Inc.	1.2
2	HPS Building	HPS Software & Communication Corp.	1.3
3	SM City Consolacion IT Center	SM Prime Holdings, Inc.	4.6
4	Norkis Cyberpark	Norkis Cyberpark, Inc.	2.8
5	MacroAsia Cebu Special Ecozone	MacroAsia Properties Development	5.0
6	Keppel Cebu Special Ecozone Zone	Keppel Cebu Shipyard Land, Inc.	23.2
7	Naga Special Economic Zone	Provincial Government of Cebu	30.7
8	Nozomi Economic Zone	Nozomi (Fortune) Services, Inc.	48.8
9	Puerto Rosario de Cordova	Nozomi Resorts and Hotel, Inc.	23.0

Status: Proclaimed

No.	Name of Ecozone	Developer/Operator	Area (ha)
28	Qimonda IT Center	Qimonda Holdings, Inc.	2.0
29	Robinsons Galleria Cebu	Robinsons Land Corporation	4.6
30	GGVPI IT Zone	Golden Great Value Properties, Inc.	6.0
31	Taft Information Technology Park	Taft Property Venture Development Corp.	6.6

Source: PEZA.

Figure 2.2.2 PEZA Registered Development Projects in Metro Cebu



Source: JICA Study Team based on PEZA data.

Figure 2.2.3 PEZA Registered Development Projects in Metro Cebu per LGU

(3) Estimation of Urban Land Demand

2.34 Based on the development experience in Metro Cebu between 1995 and 2012/2013, the annual urban land demand is projected to be 52 ha for PEZA projects and 150 ha for HLURB projects, calculated as follows:

(a) **PEZA:** (Total PEZA Project Sites: ha) / (Duration: 1995–2013) = 988.8 / 19 = 52.0 ha/year

(b) **HLURB:** (Total HLURB Project Sites: ha) / (Duration: 1995–2012) = 2,696.4 / 18 = 149.8 ha/year

2.35 Since Metro Cebu is most likely to increase its population as it experienced in the last decade, say, 60,000 people annually, at least the same development pace of PEZA and HLURB related development will be required up to the year 2050. However, economic growth must be considered in the assumption. As the local economy grows, more middle-income people will enter the formal property market and they will work at the formal sector. If all the new population segment (60,000 per year) belongs to over the middle-income group, a formal residential land scale of 300 ha (200 persons per ha) will be required. Under such situation, no new informal settlement will burgeon in the metropolis. They will also require double the space for formal employment. The magnitude of urban land demand is, thus, estimated in Table 2.2.3.

2.36 The Study adopts urban land demand in the 2010s on a trend basis and no new informal settlements and workplaces in the 2040s. Thus, the new urban land requirement between 2011 and 2050 is estimated at 12,120 ha, which is equivalent to 11% of the Metro Cebu territory.

Table 2.2.3 Urban Land Demand in Metro Cebu, 2011-2050

Type	Yearly Demand (ha)	Aggregated Demand (2011–2050; in ha)	JST Estimated Demand (2011–2050; in ha)
Residential Land under HLURB Category	150–300	6,000–12,000	9,000
Industrial and Service Land under PEZA Category	52–104	2,080–4,160	3,120
Total	202–404	8,080–16,160	12,120

Source: JICA Study Team.

2.3 Trade and Investment Framework

1) Economic Outlook

2.37 In spite of the natural disasters that hit the country in the fourth quarter of 2013, the Philippine economy has continued to enjoy a solid growth and many of the international organizations such as ADB, the World Bank and IMF have a fairly positive outlook on the coming year's performance.

2.38 ADB reported that "robust private consumption and investment drove economic growth higher in 2013. Strong growth is expected to continue in the forecast period, though moderating from last year. Rehabilitation and reconstruction activities in areas hit by natural disasters may have a significant impact on the economy in late 2014 or 2015. Inflation is forecast to pick up this year but remain within the central bank's target range. The challenge is to translate solid economic growth into poverty reduction by generating more and better jobs." [4]

2.39 The IMF says that "the Philippines delivered another impressive macroeconomic performance in 2013. Growth accelerated to 7¼ percent on account of robust domestic demand including higher public spending and private investment, supported by accommodative monetary and financial conditions. Despite a series of natural calamities, growth was also sustained in line with resilient growth in Asia. We forecast GDP growth to ease to a still-robust 6½ percent in 2014 and year-end inflation to moderate to 4 percent. With potential growth estimated at 6¼ percent, the positive output gap is expected to widen slightly in 2014 as the fiscal stimulus from reconstruction activities related to Supertyphoon Yolanda further supports growth." [5]

2.40 The study area, Metro Cebu, constitutes the core part of the Central Visayas Region, which also enjoys a positive economic performance. The region's long-term vision is that by 2030, the Central Visayas Region will be a leading growth center in the country, responsible for steering the economy of the Philippines to greater heights, with the macroeconomic targets for 2011–2016, as follows:

(i) Raised the growth of the GRDP to a range of 8.6–9.1%;

(ii) Realized a per capita GRDP of at least PHP22,027;

(iii) Raised real investment rate to a range of 25.8–26.5% of GRDP;

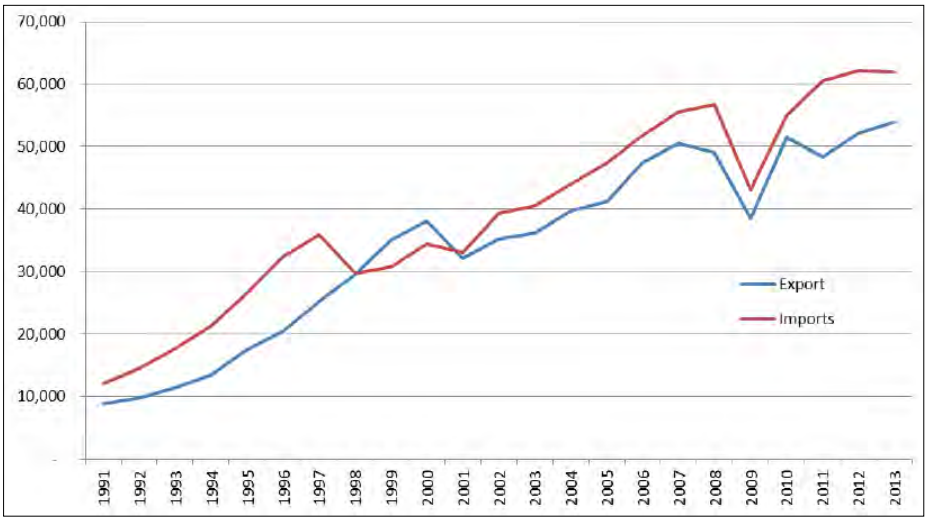
(iv) Raised employment rate to a range of 94.9–95.4%; and

(v) Lowered the incidence of poverty among the population to 16.2% and among families to 14.1%.

[4] Asian Development Outlook 2014, ADB.
[5] International Monetary Fund (IMF) staff mission to the Philippines for the 2014 Article IV consultation.

2) Trade

2.41 Together with the steady growth of the economy, Philippine export and import performance has also showed a robust growth. Exports in 2013 (including services) expanded by 7.7% from its 2012 level (see Figure 2.3.1).



Source: PHILEXPORT based on NSO data.

Figure 2.3.1 Philippine Exports and Imports, 1991–2013 (in USD FOB)

2.42 The total exports of Cebu show constant growth in the past two decades, even during the Asian Financial Crisis in 1997. Imports to Cebu are mostly raw materials for foreign export firms that locate in Cebu's growing number of export processing or special economic zones. As Table 2.3.1 shows, despite the lack of space for locators in the economic zones and the limited expansion space at the Cebu Port and MCIA, trade volumes are growing in recent years.

Table 2.3.1 Gross Value Added (GVA) in Trade in Central Visayas Region

Trade	2010	2011	2012
Level (in 000 PHP)	52,901,306	55,346,781	62,047,109
Growth Rate (%)	9.8	4.6	12.1

Source: NEDA Region 7.

2.43 Cebu's exports are directed mostly to the US and Japan. The rest are shipped to other countries in Asia, Europe and Canada. Most of Cebu's imports also comes from the US and Japan.

2.44 No longer traditional in composition, exports from Cebu are now mostly composed of manufactured goods, notably semi-conductors, electronics and other related items coming from Cebu's growing number of foreign export firms. Export of furniture, fashion accessories, garments, toys and housewares are also increasing from Cebu's local producers. In addition, Cebu is also known for the processing and export of marine products as well as other traditional export crops collected and processed by Cebu's growing number of export entrepreneurs.

3) Domestic and External Trade at the Cebu Port

2.45 Historically, Metro Cebu is the Visayas' trading hub supported by the Cebu Port. In 2010, the port had a share of 7.0% in terms of cargo throughput among the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA) ports while its domestic container

volume had a more significant share of 13.1%. The port handles mostly general cargo and containerized cargo. However, bulk cargo and vehicles are rarely recorded. It may reflect the local industry structure such as assembling, manufacturing (except vehicles), and trade and commercial activities.

2.46 In recent years, Cebu Port has suffered from shallow berth facilities of up to -8.5 meters. It is a serious concern particularly among international shipping operators when assigning their container ships on the routes to Cebu. Another issue is the small container yard. There are several container depots around Cebu Port to offset its container yard shortage.

2.47 JICA's Cebu Port Master Plan, which was completed in 2002, addressed these issues earlier on. However, no action has been taken in terms of infrastructure development. The METI report in 2012 updated the new container terminal development plan at Consolacion from the JICA master plan. With new container port development or under no capacity limitation condition, the METI report forecasts port traffic up to 2030, as shown in Table 2.3.2. The CPA will integrally manage the existing port and a new port.

Table 2.3.2 Cargo Demand Forecast at the Cebu Port

Type	Unit	2001	2010	2015	2020	2025	2030
Total Cargo	Thousand ton	9,240	12,475	13,842	16,392	19,658	23,826
International Container	TEU	112,700	202,213	257,003	343,160	453,500	594,326
Domestic Container	TEU	310,845	247,295	325,429	364,744	412,675	466,904

Source: METI Report for New Container Port and the Redevelopment of the Existing Cebu Port, 2012.
Note: The figures from 2015 are projected.

4) Air Passenger Traffic at Mactan Cebu International Airport (MCIA)

2.48 Due to the operation of low-cost carrier (LCC) services at MCIA and more direct international flights especially to/from Korean airports such as Inchon and Busan, MCIA has experienced unprecedented air traffic growth since 2009.

2.49 In regard to MCIA's development, there is only available KOICA's air traffic projections. Based on KOICA's projection, MCIA will handle 13.4 million passengers in 2030 (see Table 2.3.3). By 2040, MCIA passengers will increase to 15.0 million by 126 thousand aircraft movements. Under this 2040 scenario, MCIA would be very congested if only one runway would serve the airport operation.

Table 2.3.3 Demand Forecast at MCIA

	Unit	2013	2015	2020	2025	2030	2035	2040
Airport Passengers	Thousand persons	6,996	7,732	10,264	12,256	13,405	14,296	15,010
Aircraft Movements	Aircraft	64,945	69,804	90,172	106,061	114,521	121,117	126,003

Source: Master Planning for Mactan Cebu International Airport, 2011, KOICA.
Note: Year 2013 figures are actual. Others are projected.

5) Investments

2.50 Cebu is now one of the most progressive investment centers in the country and in Asia. Many foreign investors are attracted to Cebu because of its abundant supply of highly skilled and educated labor force, strategic location, availability of infrastructure, presence of related and supporting industries, good peace and order situation, and supportive local government officials.

2.51 Over the past 10 years, investments in the province of Cebu had been very robust.

From 2004 up to the coming of the Lehman's financial shock in 2008, total accumulated investments in Board of Investments (BOI)-approved projects reached USD2,881 million, creating 26,777 new employment (see Table 2.3.4). This was equivalent to 93.6% of the entire investments in Central Visayas. Investments in BOI-approved projects in Cebu declined after 2008 as many foreign investors became reluctant to increase their investments in Asia. However, new investments in Cebu already started recovering in just a few years.

Table 2.3.4 BOI-Approved Investments, 2004–2013

(Thousands Dollars)

	2004	2005	2006	2007	2008	2009	2010	2001	2012	2013
Cebu										
New Investment	1,651	312,324	252,339	321,526	505,734	17,243	44,554	280,397	1,027,440	118,604
New Employment	492	3,076	3,743	2,563	2,925	2,759	2,063	4,110	1,983	3,056
Central Visayas										
New Investment	51,980	321,267	252,339	339,992	513,688	17,701	45,315	280,397	1,063,653	186,565
New Employment	579	3,281	3,743	3,655	3,029	2,779	2,179	4,110	2,058	3,382

Source: BOI Cebu Extension Office.

2.52 According to PEZA, a total of 278 industry locators in the six economic and export processing zones in Cebu have poured in PHP13.8 billion in investments and provided employment to over 116 thousand persons (see Table 2.3.5). The Information Technology Business Process Outsourcing (IT-BPO) industry is a big sector in Cebu's economy. There are 139 locators in this particular sector in Cebu. The Cebu Investment Promotion Center (CIPC) estimates that there are 95,000 IT-BPO employees.

Table 2.3.5 Manufacturing Sector Ecozones

	Investments (PHP mil.)	Number of Locators	Number of Employees	Export Sales (USD mil.)
MEZ 1	2,980	158	60,739	2,213
MEZ 2	770	54	15,620	308
CLIP	367	35	1,957	24
WCIP	8,478	20	16,662	692
MRI Ecozone	1,048	7	20,814	285
New Cebu Township	141	4	859	27
Total	13,784	278	116,651	3,550

Source: PEZA.

2.53 Based on the total employment level and their daily wage rates, CIPC estimates that these foreign direct investments (FDI) contribute PHP8.2 billion of monthly payroll to Cebu's economy (see Table 2.3.6).

Table 2.3.6 FDI Contribution to Cebu Economy

	Employee	Monthly Wage (PHP million)
Direct effect on the economy of Cebu		
Manufacturing Sector	116,650	1,393
IT – BPO Sector	95,000	1,900
Indirect effect on the economy of Cebu		
Support industries such as cafés, restaurants, accommodation, transport, malls, etc,	211,650	1,617
Maintenance and Operating Expenses		3,293
Total	423,300	8,203

Source: JICA Study Team based on FDI data of the Cebu Investment Promotion Center.

6) Tourism

2.54 The island of Cebu is located in the center of Central Visayas. As an economy, it has a dual characteristic. One is the presence of a highly urbanized and modern area in the central eastern part of the island that comprises Metro Cebu. The other includes the rest of Cebu which remains rural in character with its people depending mostly on traditional fishing, farming and small-scale business for their livelihood.

2.55 As the first island in the Philippines to be colonized and settled by the Spaniards, Cebu is rich in history and cultural heritage. Countless number of historical and architectural artifacts can be found not only in Cebu City, where Christianity was first introduced in the country, but also in its rural towns and barangays. In addition to this rich historical and cultural heritage, Cebu is also gifted with breathtaking natural attractions and white sand beaches that can be found in almost all its coastal towns and cities and numerous small islands. Add to this the presence of many travel-related amenities and activities along with the presence of an international airport and seaport, good medical and educational facilities and these explain why Cebu has become a major destination of choice for visitors in the country.

2.56 In 2013, Cebu's total number of tourist arrivals breached the 2.5 million mark at 2,598,250 composed of 1,152,821 foreign tourists and 1,439,247 domestic tourists (see Table 2.3.7). This represented a 16.5% increase over the previous year's total tourist arrivals of 2,230,323.

2.57 From 2006 to 2013, the growth in total tourist arrivals in Cebu averaged 11.2% annually, broken down into 13.9% average annual increase for foreign tourists and 9.4% for domestic tourists. Significant growth in this sector was enjoyed especially in the past two years.

Table 2.3.7 Tourist Arrivals in Cebu, 2006–2013

No. of Tourists		2006	2007	2008	2009	2010	2011	2012	2013
Total Foreign		474,720	602,002	649,593	625,098	708,400	833,441	997,303	1,152,821
Total Domestic		772,767	890,264	946,639	993,172	1,059,834	1,088,797	1,222,035	1,439,247
Grand Total		1,247,487	1,492,266	1,596,232	1,618,270	1,768,234	1,922,238	2,230,323	2,598,250
Annual Growth Rate, (%)	Foreign	-	26.8	7.9	-3.8	13.3	17.7	19.7	15.6
	Domestic	-	15.2	6.3	4.9	6.7	2.7	12.2	17.8
	Total	-	19.6	7.0	1.4	9.3	8.7	16.0	16.5

Source: JICA Study Team based on the Travel and Tourism Economic Impact 2014 Philippines.

2.58 Based on historical growth of tourism in Cebu, the following three forecast scenarios have been prepared (see Table 2.3.8 and Figure 2.3.2):

(a) **World Travel and Tourism Council (WTTC) Forecast:** 6% annual growth, which is the growth forecast rate for 2014 to 2024 by WTTC;[6]

(b) **Past Trend:** 9.0% annual growth, which is the actual trend between 2006 and 2011; and

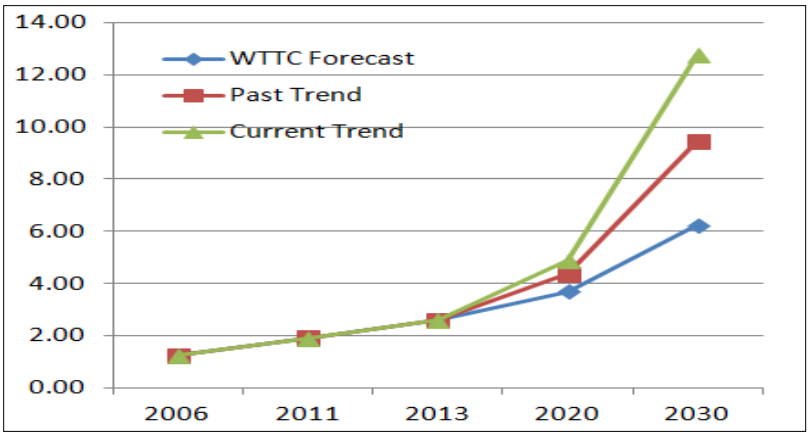
(c) **Current Trend:** 11.2% annual growth, which is the average growth between 2006 and 2013.

[6] Travel and Tourism Economic Impact 2014 Philippines, World Travel and Tourism Council.

Table 2.3.8 Tourist Arrivals Forecast for Three Scenarios, 2020 and 2030

Scenario	Annual Growth Ratio, (%)	2006	2011	2013	2020	2030
Scenario (a)	6.0	1,247,487	1,922,238	2,598,250	3,685,667	6,226,857
Scenario (b)	9.0				4,357,525	9,464,080
Scenario (c)	11.2				4,915,223	12,789,005

Source: JICA Study Team based on WTTC and historical growth rates.



Source: JICA Study Team based on WTTC and historical growth rates.

Figure 2.3.2 Forecast Scenarios for Tourist Arrivals in Cebu, 2020 and 2030

2.59 According to the WTTC forecast, international tourist arrivals for the Philippines in 2013 of 4,604,902 will increase to 7,880,000 by 2024. Cebu's share in total Philippine tourist arrivals was 25% in 2013 and 59% for Scenario (a), 78% for Scenario (b), and 95% for Scenario (c) in 2024.

2.60 Although the details of the study preconditions are unknown, Scenarios (b) and (c) seem to be too much.

2.61 According to the Department of Tourism (DOT), there were 20,000 rooms available in Cebu in its 2012 survey (see Table 2.3.9). Assuming the average number of guests in a room as 1.7, days of stay per person as 2.5, and occupancy rate as 60%, the accommodation capacity in Cebu is calculated to be 2,980,000. This requires immediate actions to improve accommodation capacity to meet tourist demand. Improvement of occupancy rate and expansion of capacity need to be considered, otherwise within a year or two, capacity will run short of the demand.

Table 2.3.9 Number of Establishments and Rooms by Province/City, 2012

Destination (Region VII / Province)	Existing Establishments							Under Construction		Grand Total			
	Number of Establish-ments	% Share	Number of Rooms: Available	% Share	Expansion	Total	% Share	Number of Establish-ments	Number of Rooms	Number of Establish-ments	% Share	Number of Rooms	% Share
Region VII (Central Visayas)													
Bohol	365	27.94	4,874	17.75	1,250	6,124	20.56	18	671	383	28.20	6,795	21.29
Cebu	509	38.97	5,420	19.74	212	5,632	18.91	13	283	522	38.43	5,915	18.53
Negros Oriental	151	11.56	2,361	8.60	102	2,463	8.27	8	177	159	11.70	2,640	8.27
Siquijor	62	4.74	417	1.51	121	538	1.80	2	9	64	4.71	547	1.71
Cebu City	143	10.94	9,412	34.29	570	9,982	33.51	9	937	152	11.19	10,919	34.22
Lapu-Lapu City	55	4.21	4,199	15.29	34	4,233	14.21	2	47	57	4.19	4,280	13.41
Mandaue City	21	1.60	764	2.78	45	809	2.71	0	0	21	1.54	809	2.53
Total (Cebu)	728	55.72	19,795	72.10	861	20,656	69.34	24	1,267	752	55.35	21,923	68.69
Total (Region VII)	1,306	19.00	27,447	16.90	2,334	29,781	17.22	52	2,124	1,358	19.16	31,905	16.97

Source: Department of Tourism (DOT) 2012 Survey.

2.62 Travel and tourism is an important industry, not only for its direct economic impact but also for its significant indirect and induced impacts (see Table 2.3.10). WTTC recognizes that travel and tourism's total contribution is much greater, and aims to capture its indirect and induced impacts through its annual research.[7]

Table 2.3.10 Travel and Tourism Contribution to the Economy (Estimates and Forecasts)

Philippines	2013 PHP Billion[1]	2013 % of Total	2014 Growth[2]	2024 PHP Billion[1]	2024 % of Total	Growth[3]
Direct contribution to GDP	472.3	4.2	3.8	843.3	4.3	5.6
Total contribution to GDP	1,288.9	11.3	3.8	2,299.1	11.8	5.6
Direct contribution to employment [4]	1,227.0	3.2	1.7	11,595	3.3	2.5
Total contribution to employment [4]	4,295.0	11.3	1.3	5,491	11.3	2.4
Visitor exports	221.0	6.9	2.0	455.7	10.4	7.3
Domestic spending	719.3	6.3	4.4	1,200.7	6.1	4.8
Leisure spending	668.9	2.9	3.2	1,198.5	3.1	5.7
Business spending	271.4	1.2	5.5	458.0	1.2	4.8
Capital investment	81.3	3.6	3.8	123.9	3.2	3.9

Source: Travel and Tourism Economic Impact 2014 Philippines; WTTC Estimates and Forecasts.
Notes: [1] 2013 constant prices and exchange rates; [2] 2014 real growth adjusted for inflation (%); [3] 2014–2024 annualized real growth adjusted for inflation; [4] 000 jobs.

2.63 Assuming that the 2.6 million tourists to Cebu spend an average of USD60 each, half of which may go to the travel agency in the original country, with the indirect and induced impact, roughly USD160 million (2.6 million x 60/2 x 2) will be the benefit to Cebu. The Provincial Government recognizes tourism as a priority sector. Considering the competition with neighboring countries, it is important for Cebu to cooperate with other areas in the region, such as Bohol where the construction of the new international airport has started.

7) Industrial Development

2.64 The Industrial Development Program (IDP) of the DTI-BOI was launched in January 2012 to forge strategic partnerships with industry stakeholders, particularly the private sector, for the crafting of sectoral roadmaps that would contain, among others, the industry's vision, goals/targets, and strategies for the short-, medium- and long-term growth of their industries and the required interventions from government to reach these

[7] Travel and Tourism Economic Impact 2014 Philippines, WTTC.

goals/targets.

2.65 These sectoral roadmaps are the building blocks of the Manufacturing Industry Roadmap (MIR) and the Comprehensive National Industrial Strategy (CNIS). To date, 28 sectoral roadmaps have been submitted to the BOI, of which 24 have been finalized and the rest are drafts.[8]

2.66 These roadmaps will likewise contribute significantly to the formulation of the Investment Priorities Plan (IPP), the annual listing of economic activities that are encouraged through the grant of fiscal and non-fiscal incentives. Using the value chain approach, the roadmaps will be used in determining the specific industry areas that may need to be listed in the IPP to encourage investments and address supply chain gaps.

2.67 Since its inception, the IPP has always been a list of generic categories of economic activities, such as agribusiness, infrastructure, tourism, and so forth. Through research and a process of consultations, BOI identified priority areas for investment, meaning economic activities to which the government would attract investors to achieve national development goals. In 2012, DTI launched the IDP through the industry roadmap project. That initiative established some basic or fundamental principles of governance by which the government wants to approach this new strategy of industrial policymaking and execution.[9]

2.68 The updated Philippine Development Plan (PDP) recognizes the globally-competitive and innovative industry and services sectors contributing to inclusive growth and employment generation to be the following: (i) Agro-industry, (ii) IT-BPO, (iii) Tourism,(iv) Manufacturing, (v) Logistics, and (vi) Construction.

2.69 The Central Visayas Regional Development Plan (CV-RDP) defines the objectives and targets of economic growth as shown in Table 2.3.11, Table 2.3.12 and Table 2.3.13.

Table 2.3.11 Objectives and Target of CV-RDP

Objectives		Targets
1	To accelerate the growth of the region's labor productivity.	• Real labor productivity in the agriculture sector to steadily increase to PHP15,323 by 2016 from the 2009 level of PHP12,297; • Real labor productivity in the industry sector to steadily increase to PHP77,428 by 2016 from the 2009 level of PHP64,703; and • Real labor productivity in the services sector to steadily increase to PHP57,072 by 2016 from the 2009 level of PHP43,840.
2	To generate full, decent and productive employment opportunities	• Realize at least 70,000 net addition to employment in agriculture during the period 2011–2016; • Realize at least 167,000 net addition to employment in industry during the period 2011–2016; and • Realize at least 280,000 net additions to employment in services during the period 2011–2016.

Source: The Central Visayas Regional Development Plan (CV-RDP), II. Objectives, Targets and Strategies.

[8] The finalized roadmap sectors are as follows: (1) automotive, (2) automotive parts, (3) biodiesel, (4) cement, (5) ceramic tiles, (6) chemicals, (7) copper and copper products, (8) electric vehicles, (9) electronics, (10) furniture, (11) iron and steel, (12) IT-BPO, (13) manufacturing, (14) mass housing, (15) metalcasting, (16) motorcycles, (17) natural health products, (18) petrochemicals, (19) plastics, (20) pulp and paper, (21) rubber products, (22) tool and die, (23) retirement, and (24) aerospace. Those in draft form are (1) jewelry, (2) bamboo, (2) coco coir and (3) creative industries.

[9] The 2014 IPP multi-sectoral public consultations for the Investment Priority Plan of 2014–2016, DTI, May 2014.

Table 2.3.12 Annual Targets for Labor Productivity by Sector (Pesos per Worker), 2011–2016

Sector	Target Labor Productivity Level (PHP / worker)					
	2011	2012	2013	2014	2015	2016
Agriculture	12,482	12,669	12,923	13,310	13,909	14,605
Industry	66,987	68,662	70,584	72,631	74,810	77,428
Services	46,464	48,137	49,918	52,014	54,355	57,072

Source: The Central Visayas Regional Development Plan (CV-RDP), II. Objectives, Targets and Strategies.

Table 2.3.13 Annual Targets for Net Addition to Employment by Sector, 2011–2016 (in '000 Workers)

Sector	Target Net Addition to Employment (000 workers)													
	2011		2012		2013		2014		2015		2016		Total	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Agriculture	14	18	15	20	12	17	11	15	10	15	8	13	70	98
Industry	20	23	25	27	25	28	30	33	32	36	35	39	167	186
Services	34	41	40	48	45	54	50	59	55	63	56	66	280	331
Total	68	82	80	95	82	99	91	107	97	114	99	118	517	615

Source: The Central Visayas Regional Development Plan (CV-RDP), II. Objectives, Targets and Strategies.

2.70 Within the Metro Cebu area, the projected population for the years 2030 and 2050 are 3.80 million and 4.99 million, respectively, from 2.55 million in 2010.[10] The projected population for Cebu Province in the years 2030 and 2050 are 5.85 million and 7.42 million, respectively, from 4.16 million in 2010. Philippine population consists of a fairly young generation, with 31.5% of the population younger than 15 years old. This means that out of 2.5 million population increase, roughly 1.5 million of new employment needs to be generated by 2050. Assuming that 70% of new employment is engaged in the commercial sector, then 0.5 million of new employment is required by the industry sector. This will require nine times the MEPZ type industrial land area totaling 2,600 ha, or 30 times the MRI Ecozone type industrial land area totaling 850 ha (see Table 2.3.14).

Table 2.3.14 Manufacturing Economic Zones in Metro Cebu (PEZA Registered)

Name of Economic Zone	Location	No. of Locators	No. of Employees	Land Area (In hectares)
Cebu Light Industrial Park	Basak, Lapu-LapuCity, Mactan, Cebu	35	1,756	62.5
Cebu South Road Properties	South Reclamation Project, Cebu City	-	-	295.7
Mactan Economic Zone	Lapu-Lapu City, Mactan, Cebu	158	58,814	295.7
MactanEcozone II	Basak, Lapu-Lapu City, Mactan, Cebu	54	12,216	63.3
MRI Ecozone	Sabang, Danao City, Cebu	7	16,615	28.3
New Cebu Township	Cantao-an, Naga, Cebu	4	876	122.8
West Cebu Industrial Park	Arpili and Bunoy, Balamban, Cebu	20	16,873	169.9

Source: PEZA and CIPC.

8) Investment Promotion

2.71 BOI formulated and developed strategies to position the Philippines as among the prime investment destinations in Asia. The Philippine Investment Promotion Plan (PIPP) contains workable and practicable investment promotion action plans for consideration by the various investment promotion agencies in the medium term (2010–2014).

2.72 By reviewing the past investments by sector, export performance, analyzing upcoming changes in trade and investment in the ASEAN, opportunities and threats to the

[10] The Roadmap Study for Sustainable Urban Development in Metro Cebu, Interim (I) Report, page 6–5.

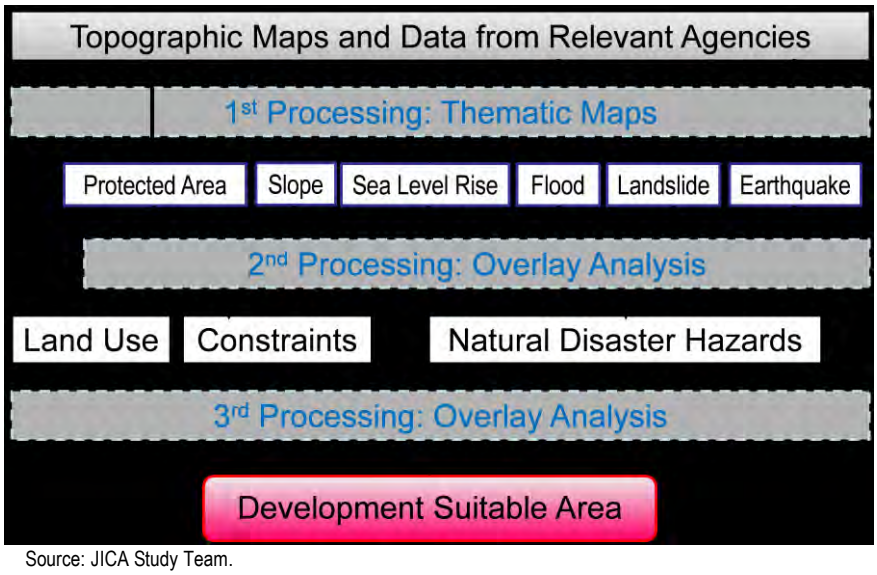
state and major sectors contributing to the national income (e.g., BPO, electronics/ semiconductors, and energy/electricity) as well as some sectors that are mentioned by some government agencies (e.g., NEDA, BOI) as recommended priority sectors (agro-industry, logistics, mining, shipbuilding, and tourism), the PIPP sets targets in the following eight high opportunity sectors: (i) Agro-industry, (ii) IT-BPO services, (iii) Electronics/ Semiconductors, (iv) Energy/Electricity, (v) Logistics Hub, (vi) Mining, (vii) Shipbuilding, and (viii) Tourism.[11]

2.4 Protected Areas and Hazardous Areas

2.73 Urbanization usually accompanies the growth of population and economic activities. However, urbanization should be effectively managed to avoid uncontrolled sprawl of the urbanized area and to make it balanced with a favorable natural environment. In addition, living in hazardous areas should be avoided to secure the safety of all the citizens from damages and harm caused by expected natural disasters.

2.74 An area which can be developed in the future is called a “Development Suitable Area." It is identified based on the topographic map in 1:10,000 scale which is prepared in this study using the results of the LIDAR survey and satellite images. Figure 2.4.1 shows the procedure for identifying the development suitable areas.

2.75 Several thematic maps relating to constraints and natural disaster hazards are prepared to depict the coverage of development suitable areas. The constraints of development are defined by protected areas and slope which are regulated by national standards and where construction of buildings is not allowed. The hazards of expected natural disasters such typhoons, floods, landsides and earthquakes are identified and assessed in detail according to their hazard levels by the topographic map and satellite images. These thematic maps are finally overlaid onto one map to identify the development suitable areas which are outside the constraints and natural disaster hazards areas.



Source: JICA Study Team.

Figure 2.4.1 Methodology of Development Suitability Analysis

[11] The Philippine Investment Promotion Plan (PIPP) 2010–2014, Final Report, March 2010.

1) Constrained Areas

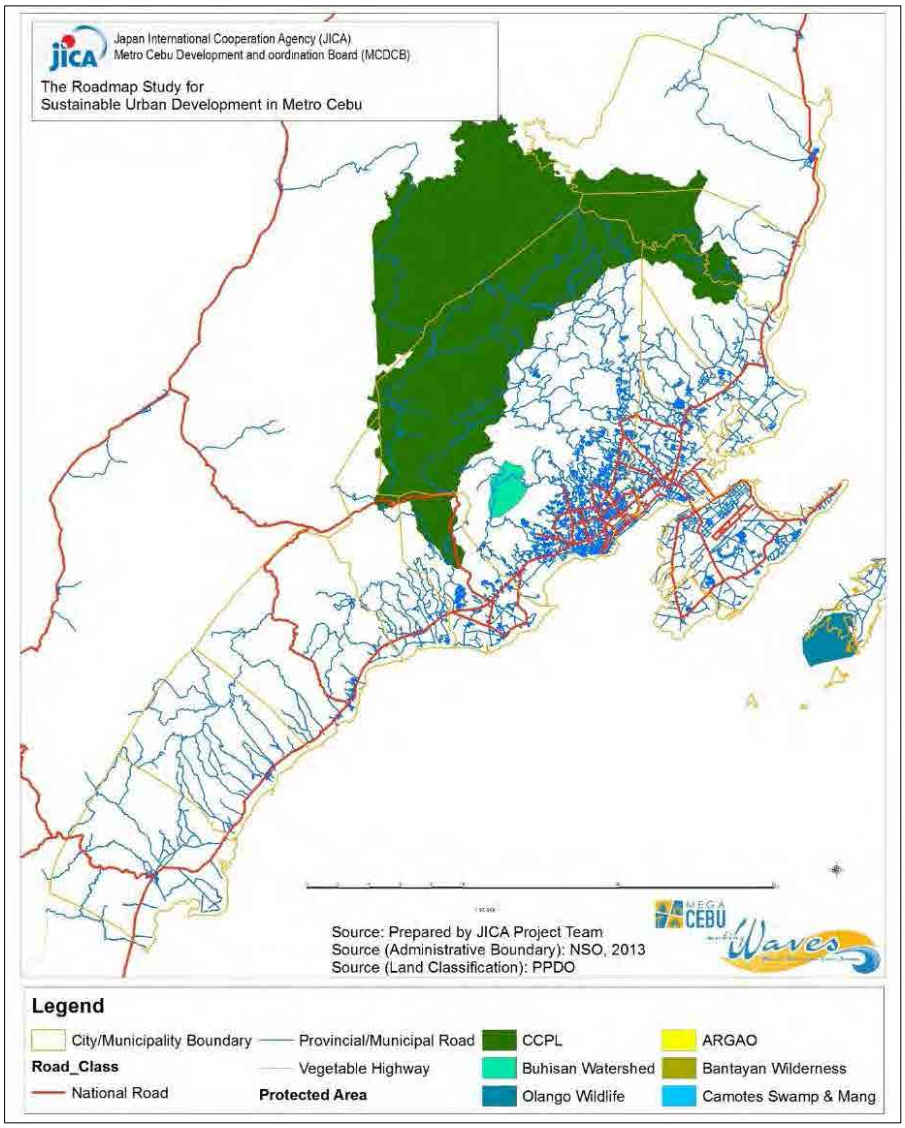
(1) Protected Areas

2.76 Republic Act (RA) 7586, otherwise known as the National Protected Areas System (NIPAS) Act of 1992, defines protected areas as the identified portions of land or water set aside by reason of their unique physical and biological significance. These areas are managed to enhance biological diversity and are protected against destructive human exploration. The law provides the legal framework for the establishment and management of protected areas in the Philippines. Pursuant to the provisions of the NIPAS Act, a total of three protected areas have been established in Metro Cebu (see Table 2.4.1).

Table 2.4.1 Protected Areas in Metro Cebu

Name of Protected Area		Location	Proclamation No./Date	Area (hectares)
1	Guadalupe Mabugnao Mainit Hot Spring National Park	Carcar, Cebu	RA 6429/June 17, 1972 Proc. 335A/May 30, 1986	57.50
2	Olango Island Wildlife Sanctuary (Game Refuge and Bird Sanctuary)	Sta. Rosa, Lapu-Lapu City	Proc. 903/May 14, 1992	920
3	Central Cebu Protected Landscape (CCPL)	Cities of Cebu, Talisay, Toledo, Danao and Municipalities of Minglanilla, Consolacion, Liloan, Compostela and Balamban	RA 9486/June 7, 2007 Proc. 441/August 12, 2003	29,062
	Central Cebu National Park	Balamban, Toledo, Cebu City	Proc. 202/Sep. 15, Proc. 355-A/Mar. 27, 1971	15,393.58 11,893.58
	Mananga WFR/ Mananga River WFR/ Amendment	Talisay, Minglanilla, Cebu City	Proc. 502/Dec. 5, 1989 Proc. 581/May 9, 1990	6,382 6,823
	Buhisan WFR	Buhisan, Cebu City	EO 36/ July 13, 2011	630.89
	Sudlon National Park	Cebu City	Proc. 56/July 10, 1987	9,023

Source: Republic Act 7586.
Note: WFR: Watershed Forest Reserve.



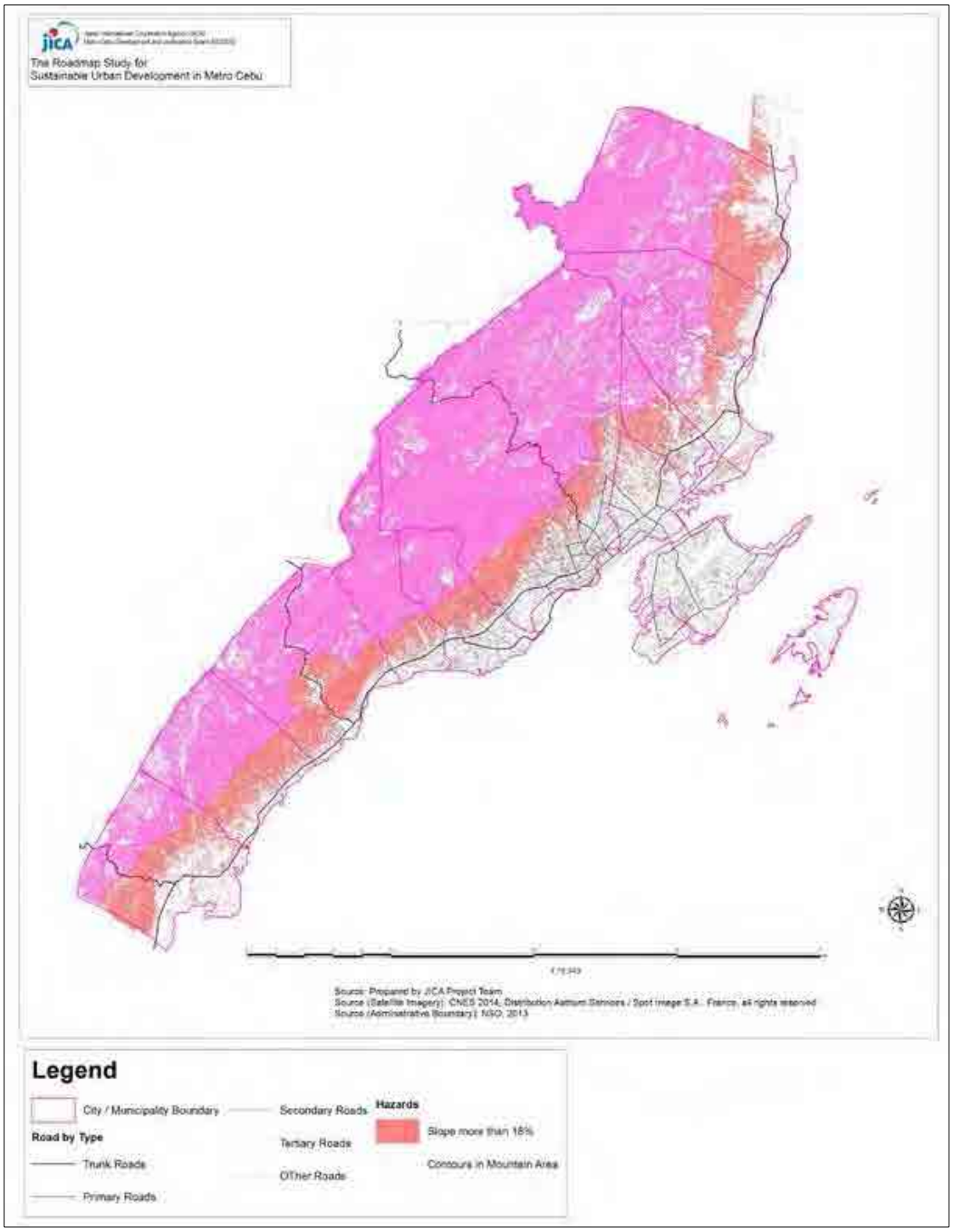
Source: Republic Act 7586, GIS data from PPDO.

Figure 2.4.2 Location of Protected Areas Defined by NIPAS

(2) Slope

2.77 A slope map by 10 m grid is prepared using a Digital Terrain Model (DTM) produced from the results of the LIDAR survey in coastal areas and the contours identified based on satellite images in the mountain areas. By law, the constrained area of slope is more than 18% gradient.[12] These areas cover 72% of the study area (see Figure 2.4.3).

[12] Presidential Decree No. 705 - The Revised Forestry Code; Section 15.



Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

Figure 2.4.3 Slope Hazard Map

2) Hazardous Areas

2.78 The hazards of natural disasters that can be expected have been identified by national agencies such as the Department of Science and Technology (DOST) and the Department of Environment and Natural Resources (DENR). The Philippine Institute for Volcanology and Seismology (PHIVOLCS) under DOST is responsible for data on earthquake hazards and the Mines and Geosciences Bureau (MGB) under DENR is responsible for assessing geo-hazards including landslides and flood hazards. The hazard

maps provided by these agencies are compiled in Supporting Report 1: Database Formation. However, the topographic map in 1:10,000 scale and satellite images can provide a more detailed analysis of the hazards.

2.79 The expected natural disasters can be categorized into two based on the risk management perspectives (disaster scale, occurrence probability and impact). These are summarized in Table 2.4.2. Category "A" consists of disasters with high and medium probabilities of occurrence and with medium to small impacts. They should be managed to minimize damage and loss by implementing mitigation/prevention measures. Category "B" consists of disasters with rare probability of occurrence and with large impact. They should be managed to minimize damage expansion by preparing appropriately for the disaster event. To formulate a zoning plan for controlled urbanization, the areas under category "A" disasters with high probability and affecting daily life are defined as the target of the development suitability analysis.

Table 2.4.2 Disaster Scale, Occurrence Probability and Impact

Impact \ Probability	High	Medium	Rare
Large			• Earthquake
Medium		• Large-scale floods • Landslide	• Tsunami • High-tide by typhoon
Small	• Annual floods	• Lowland areas affected by sea level rise caused by climate change	

A

B

Source: JICA Study Team.

(1) Overall Geologic and Topographic Characteristics

2.80 In the Province of Cebu, a mountain range traverses longitudinally to the south from the periphery of Catmon and Tuburan. There are 700 m-class mountains around Metro Cebu and 900 m-class mountains in the southern areas of Cebu (see Figure 2.4.4). Northern Cebu, however, is located high above sea level, and includes a terrain with low relief with a maximum altitude of approximately 400 m.

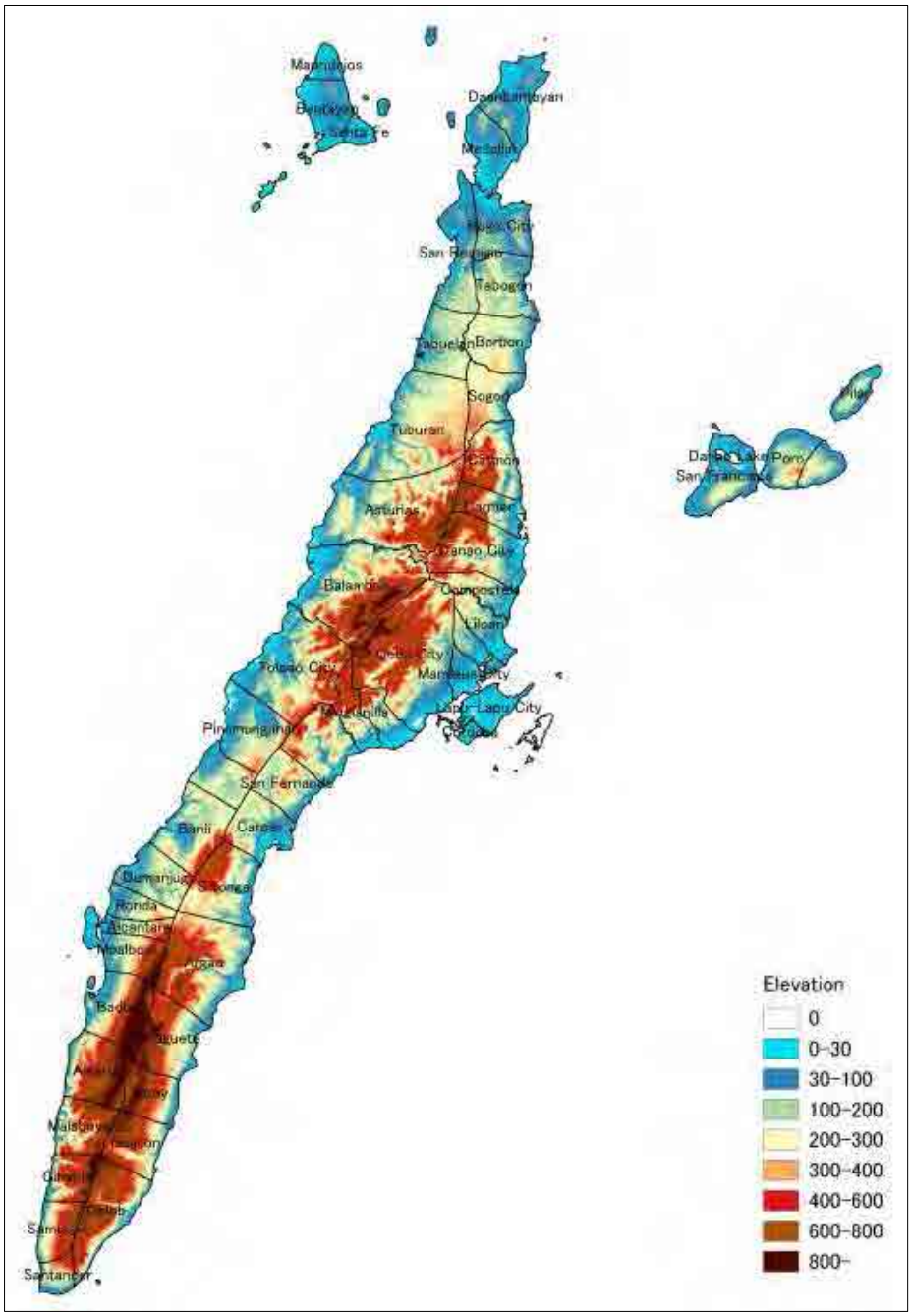
2.81 Looking at the low-lying areas, alluvial plains extend only around Daanbantayan and Cebu City. Since those mountainous land or hill approaches the vicinity of the coastline in other areas, however, valley plains are formed instead of the alluvial plains.

2.82 Cebu's geology is characterized by geological layers formed from the Jurassic Period and the Miocene Epoch (approximately 199.6 million to 5 million years ago) that are concentrated on the perimeter of central mountains, which consist of various lithological characters of limestone to basalt (see Figure 2.4.5).

2.83 The southern areas and northern center of the province include a Barili belt that was formed during the Pliocene Epoch (5 million to 2.58 million years ago), and are made up of hard and porous limestone.

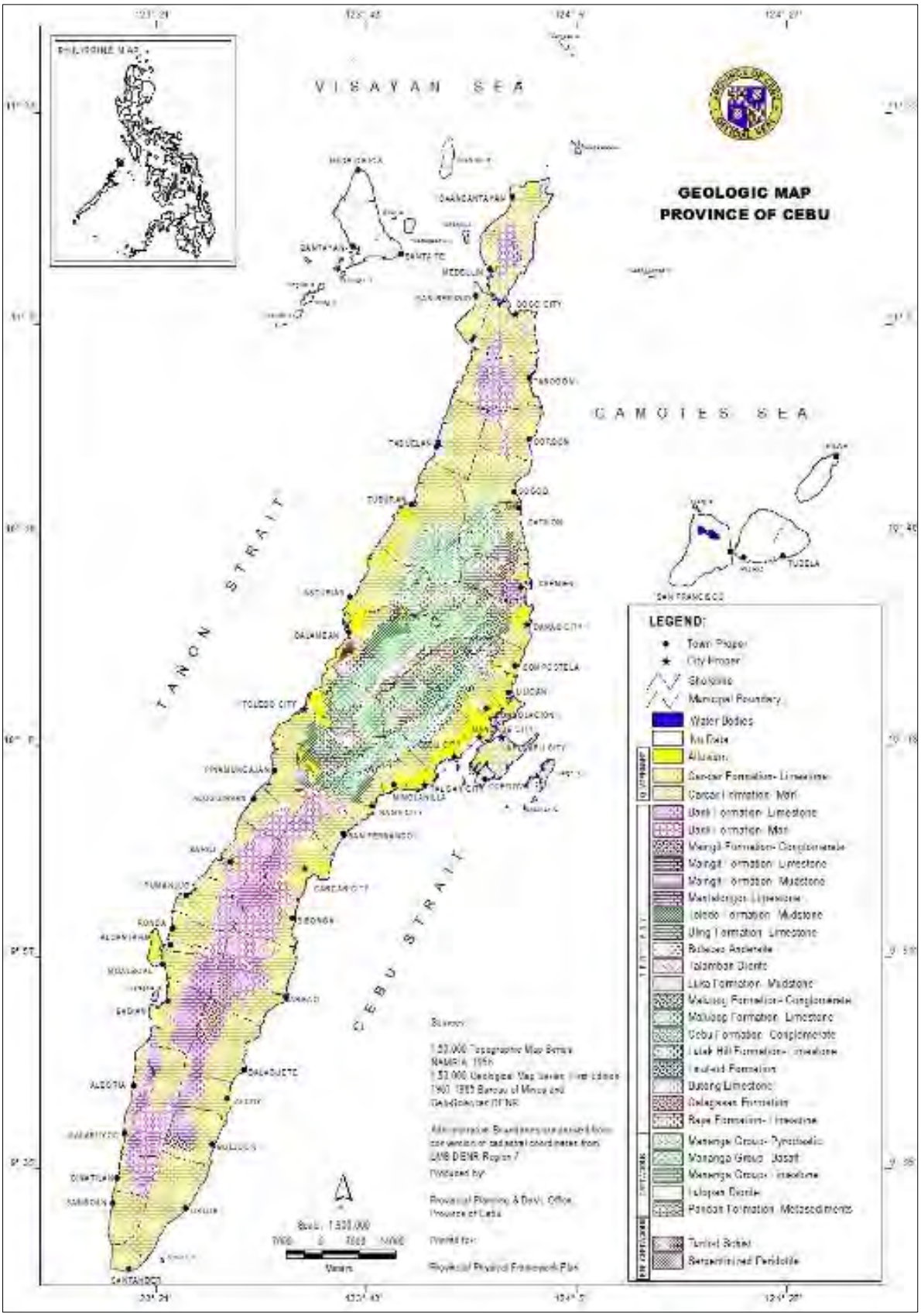
2.84 The whole region of Cebu is covered with a Carcar belt formed during the Pleistocene Epoch (2.58 million to 10,000 years ago) as if the belt surrounds mountains. This Carcar belt consists of coralline limestone that is relatively resistant to weathering but soluble in water. For this reason, the belt contains a lot of pores and has permeability.

2.85 Furthermore, coastal areas have an extended alluvial deposit that was formed with a sea level rise at the beginning of the Holocene Epoch (from 10,000 years ago onward). This layer is formed with sediment that had been transported by rivers. Consequently, it generally consists of sand and silt.



Source: JICA Study Team.

Figure 2.4.4 Altitude Map

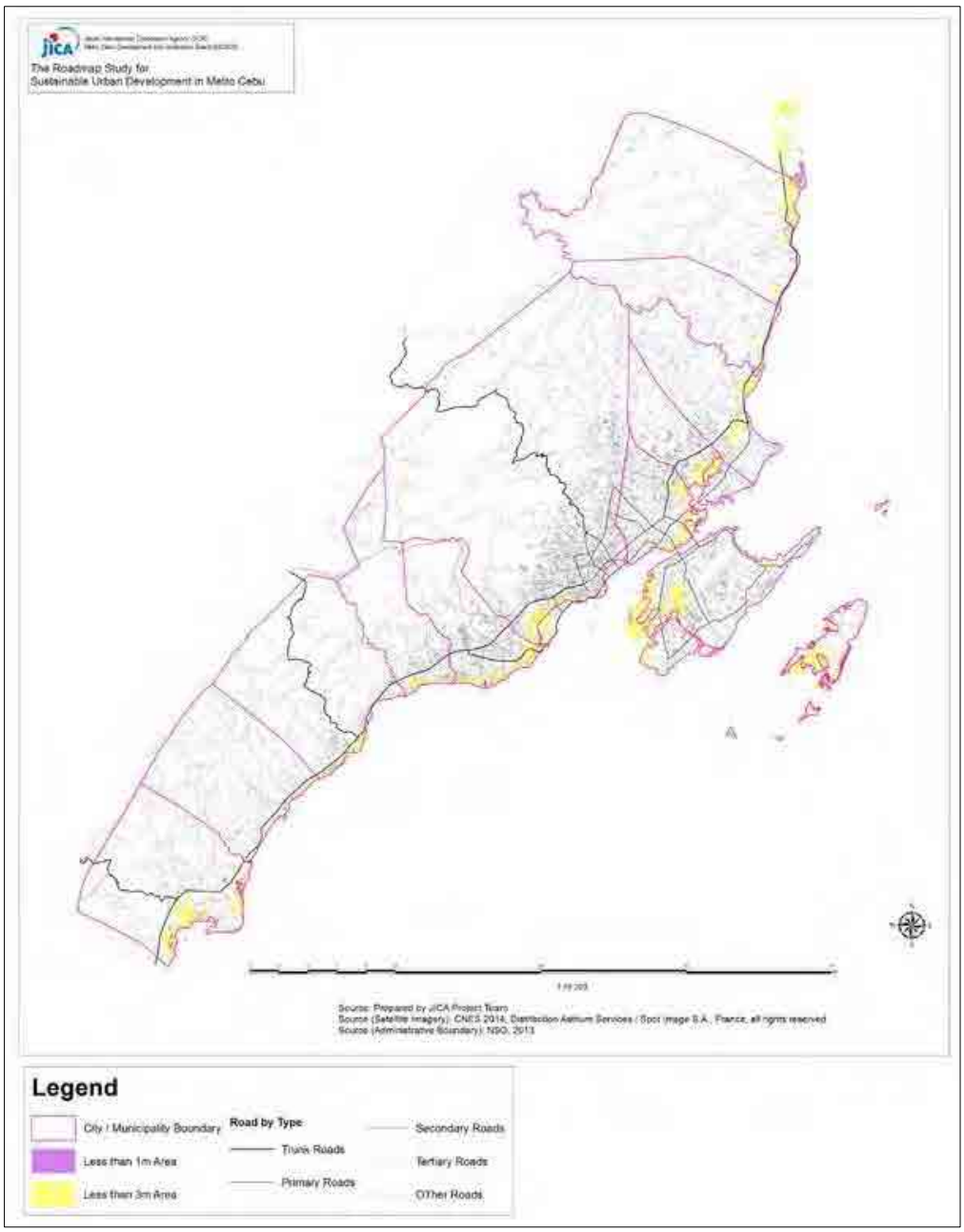


Source: Provincial Planning and Development Office (PPDO), DENR.

Figure 2.4.5 Geological Map

(2) Lowland Area Hazard

2.86 The lowland area can be affected by sea level rise caused by climate change. Identifying the height of sea level rise scientifically is the responsibility of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAG-ASA) under DOST. However, a detailed analysis has yet to be conducted in the study area. Nevertheless, the National Mapping and Resource Information Authority (NAMRIA) under DENR has identified detailed contours from 0 m to 4 m by 1 m as areas possibly affected by sea level rise. Therefore, 2 m is applied temporarily to designate the affected areas. These cover 0.13% of the study area (see Figure 2.4.6).



Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

Figure 2.4.6 Lowland Area Hazard

(3) Flood Hazard

2.87 In general, floods are caused by a combination of various factors, such as (i) geologic and topographic characteristics, (ii) river characteristics, and (iii) human factors. By investigating these characteristics, the flood hazard profile of Metro Cebu can be determined.

2.88 Both the numerical data on observed flow rates during floods and on observed rainfall in the upper reaches of rivers are not available to assess flood hazards. Hence, it is difficult to conduct a detailed investigation on flood characteristics of each river. Based on the topographic and geological characteristics and the river characteristics in Cebu, the following flood characteristics are estimated:

(i) Because an inundation flow spreads on an alluvial fan in a river with an alluvial plain, shallow inundation occurs extensively. An inundation depth or period is partially increased at a segment of the river that partially has a low level of ground height or at an upstream of a fill structure.

(ii) Since a river running through valley plain flows through a narrow flood plain as a main channel, deep and fast flowing inundation occurs.

(iii) In the areas with drainage facilities such as Cebu City, Mandaue City and Talisay City, clogging of the facilities are more likely to increase inundation depth or period.

(iv) Alluvial deposits have been formed through past inundations. According to the geological map, the alluvial deposits in Cebu extend to the coast and exist in the areas with an altitude of up to almost 5 m.

(v) Rivers originating from more steeply sloped mountains exhibit significant rise in water level that is caused by rainfall.

2.89 Based on the collected flood characteristics, flood runoffs and present-state capacity of flow are estimated following the guidelines established by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Japan.[13] Table 2.4.3 presents the results of the analysis of river characteristics and present-state capacity of flow. The results show that flood damage might occur once a year to two years in most of the rivers.

2.90 In order to develop a flood hazard map, flood hazards are evaluated according to three levels (low, moderate, high), which consider inundation patterns and assumed damage types (see Table 2.4.4).

2.91 The hazard levels are identified based on an inundation range according to wide-area cross sections and flood level by cross section, as summarized in Table 2.4.5. Referring to contour lines prepared through the latest LiDAR survey, a valley plain inundated at a probability of one occurrence every 50 years or more is considered a "High" flood level area. When there are fill structures in the lower reaches of a river, that area is also considered a "High" level flood area, with areas lower than the crown height of the structures. A '"Moderate" level flood area assumes an inundation area with potential diffusion of inundation based on the gradients of an alluvial plain. A "Low" level flood area is set on the basis of contour lines (4 to 6 m) depending on geological features. Figure 2.4.7 shows the flood hazard map designating the high, moderate and low flood-prone areas.

[13] Technical Criteria for River Works; Practical Guide for Planning, MLIT, Japan, October 1997.

Table 2.4.3 Estimated Present-State Capacity of Flow

Name of River / Creek		Location (LGU)	Catchment Area (sq.km.)	Length of River /Creek (km)	Flood Type	Mountain Type	Discharge Capacity	Flood Frequency
1	Pondol River	Carcar	44.6	23.1	Alluvial	Moderate mountain	24	–1/2
2	Villadolid River	Carcar	50.3	24.1	Alluvial	Moderate mountain	314	1/2–1/5
3	Pandan River	Naga	45.9	17.8	Alluvial	Moderate mountain	220	–1/2
4	Abuno River	Naga, Minglanilla	21.2	10.3	Alluvial	Steep mountain	45	–1/2
5	Pakigne River	Minglanilla	14.4	7.2	Alluvial	Steep mountain	55	–1/2
6	Mananga River	Talisay, Cebu	68.4	28.9	Alluvial	Steep mountain	429	1/2–1/5
7	Buhisan River	Cebu	14.3	7.4	Alluvial	Steep mountain	104	–1/2
8	Guadalupe River	Cebu	15.3	10.7	Alluvial	Steep mountain	43	–1/2
9	Subangdaku River	Cebu, Mandaue	10.2	6.6	Alluvial	Hill	13	–1/2
10	Butuanon River	Mandaue	50.8	20.1	Alluvial	Steep mountain	268	–1/2
11	Guinsaga River	Consolacion	26.9	8.7	Alluvial	Moderate mountain	26	–1/2
12	Cotcot River	Compostela	63.9	32.9	Alluvial	Steep mountain	56	–1/2
13	Danao River	Danao	59.3	23.4	Alluvial	Steep mountain	62	–1/2
14	Cagat River	Danao	11.2	6.1	Alluvial	Moderate mountain	16	–1/2

Source: JICA Study Team.

Table 2.4.4 Flood Hazards Evaluation

Hazard Level	Topographic and Geological Characteristics	Inundation Patterns	Assumed Damage Types
Low	• Area where an alluvial deposit formed from past flood is observed. (Range of altitudes of 4 m or less to 6 m or less).	• If large-scale flood occurs when a flood frequency is low but a tide level is high, flood damage may occur.	• A large amount of water flows on the surface of a mountain like a river, causing shallow inundation. • A ground lower than its surroundings becomes a pool.
Moderate	• Inundation area in river with an alluvial plain (alluvial fan). • Area where clogging of drainage facilities may cause inner water inundation.	• Diffused inundation, and inundation depth or flow velocity is relatively small. • Inundation spreads from a clogged point of a drainage facility. • Inundation time may be protracted around a low-lying depression or fill structure.	• Inundation occurs extensively, and buildings and other facilities are inundated, but inundation time is short. • The perimeter of a water channel or road is flooded like a river. • A ground lower than its surroundings becomes a pool.
High	• Inundation area in river with a valley plain. • Area where an inundation flow may be blocked by a continuous fill structure.	• Because it flows through the whole of a valley as a main channel, inundation depth or flow velocity is relatively large. • Since inundation is blocked by a fill structure, the level of inundation depth becomes higher and inundation time is protracted.	• Due to sharp rise in water level, buildings and other facilities along a river may be affected. • The upper reaches of a fill structure becomes a pool. • A range of inundation, an inundation depth or flow velocity becomes large, and inundation time becomes longer, depending on flood scales.

Source: JICA Study Team.

Table 2.4.5 Calculated Flood Levels in Mountainous Areas

Name of River / Creek		Water Level at 50-Year Period (m)	Water Level at 10-Year Period (m)	Water Level at 2-Year Period (m)
1	Pondol River	15.0	14.7	13.5
2	Villadolid River	23.6	22.9	21.9
3	Pandan River	12.2	11.7	10.9
4	Abuno River	14.9	14.4	13.5
5	Pakigne River	26.2	25.9	25.5
6	Mananga River	19.9	19.3	18.6
7	Buhisan River	9.4	9.1	8.3
8	Guadalupe River	12.8	12.3	11.7
9	Subangdaku River	11.3	10.6	10.1
10	Butuanon River	16.3	15.5	14.3
11	Guinsaga River	-	-	-
12	Cotcot River	11.7	11.4	8.7
13	Danao River	19.1	18.2	17.0
14	Cagat River	24.8	24.7	24.6

Source: JICA Study Team.
Note: The rivers with blank fields are those where flood levels are difficult to calculate due to topographic features and the status of data development.

2.92 In the case of future large-scale development in Metro Cebu, it is necessary to note the following points in order to prevent flood damage from worsening.

(i) As enormous damages are expected in the areas designated with "High" flood hazard level, it is recommended that large-scale development such as a new town center or industrial area be prohibited or avoided in these locations. For the case of inundation caused by a continuous fill structure, it is important to alleviate flood damage through effective drainage countermeasures. And in consideration of the status of inundation in the lower reaches of a river, it is necessary to take measures against flooding for areas where appropriate.

(ii) In the areas designated with "Moderate" flood hazard level, surrounding elevations and the status of drainage facilities should be checked. After that, it is possible to develop the areas in combination with countermeasures such as raising the ground level and improving drainage facilities.

(iii) When a continuous fill structure is additionally installed, it is necessary to conduct a preliminary evaluation on whether the structure is effective in blocking flood waters.

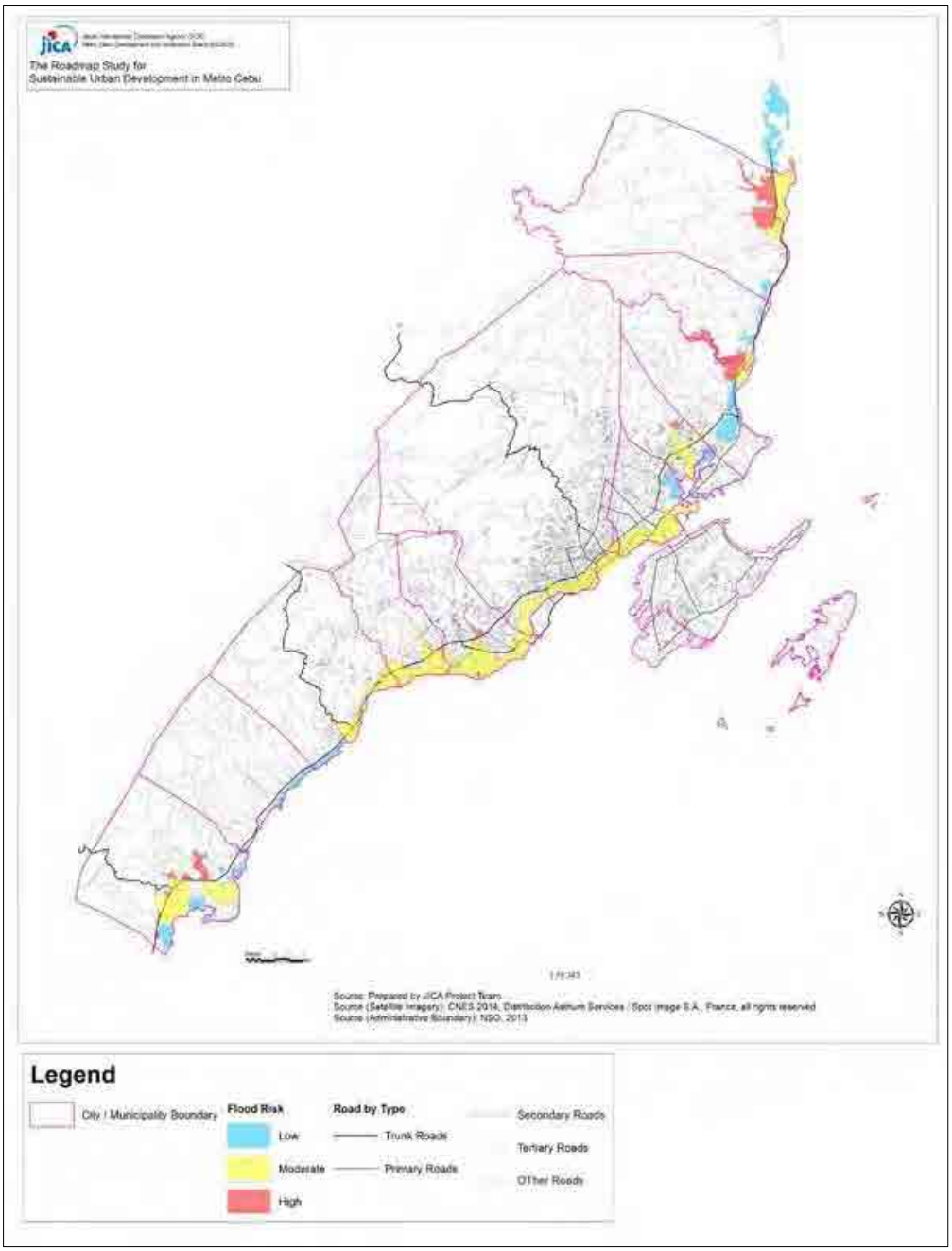
(iv) It is necessary perform checks and maintenance of the drainage facilities and its surroundings to prevent clogging during floods.

(v) It is important to continuously monitor rainfall, river levels and river discharge and properly determine the flood characteristics of each river. It is desirable to place a rainfall gauging station in mountainous areas and a water level gauging station on alluvial fans, plains and other points.

(vi) Prior to undertaking a river improvement project, preliminary evaluation should be conducted for points that cause inundation as well as the effects of inundation on upper and lower reaches of the river. Subsequently, it is necessary to take measures for points to be affected, as needed.

(vii) It is necessary to carefully place a bank or tide embankment as such facility may

exacerbate flood damage during landslide.



Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

Figure 2.4.7 Flood Hazard Map

(4) Landslide Hazard

2.93 Landslide hazard areas were assessed based on the interpretation of remotely sensed data from satellite images, DTM, and contours. This work followed the MGB criteria for landslide susceptibility. The MGB criteria for "High" and "Very High" risk areas are lumped together in the "High" category. Data available in the field, such as rock mass strength and degree of weathering, are not included in the assessment. If available, these field data can help refine the results of this study. Table 2.4.6 shows the definition of hazard level and coverage in the study area while Table 2.4.7 shows the relationship of degrees and conversion to % grade.

Table 2.4.6 Definition of Landslide Hazard Areas

Hazard Level	Definition	Coverage in Study Area (%)
Low	Slope gradients are below 18 degrees	3.2
Moderate	Slope gradients are 18–35 degrees	63.6
High and Very High	Steep to very steep slopes (>35 degrees) and evident active landslides, where inactive landslides are evident (old landslide debris deposits, collapsed sinkholes, old landslide complexes), actively worked mining areas, high erosion along the riverbanks	36.9

Source: JICA Study Team.

Table 2.4.7 Relationship of Degrees and Conversion to % Grade

Slope (in Degrees)	Gradient		% Grade
	X	Y	
0.1	1	573.0	0.17
1	1	57.29	1.75
5	1	11.43	8.75
10	1	5.671	17.6
11	1	5.145	19.4
15	1	3.732	26.8
18	1	3.078	32.5
20	1	2.747	36.4
25	1	2.145	46.6
30	1	1.732	57.7
35	1	1.428	70.0
40	1	1.193	83.9
45	1	1.000	100.0

Source: JICA Study Team.

2.94 In the modified MGB criteria, areas considered highly susceptible to rain-induced landslides include those having steep to very steep slopes (>35 degrees). In terms of ground stability, evident active landslides, relative high density of lineaments or scarps or both over an area of interest, and bulges are considered. These also include areas where inactive landslides are evident, such as old landslide debris deposits and collapsed sinkholes.

2.95 In the remotely sensed images, the terrain appears “deformed” in appearance due to lineaments and scarps that cut it. Actively worked mining areas with their steep walls are considered highly susceptible as well. Instances where high erosion along the riverbanks threatens infrastructure and development projects are also considered highly susceptible to landslides even though the more accurate description would be riverbank erosion or mass wasting along riverbanks.

2.96 The "Moderate" landslide susceptibility category includes areas with slopes having 18–35 degrees. Generally, some lineaments and scarps are also observed but their relative density is low compared to the high density lineaments and scarps in the "High" susceptibility category. The terrain appears relatively not deformed in terms of landslide scarps and lineaments that cut it.

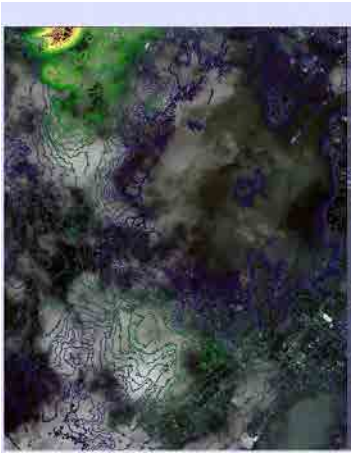
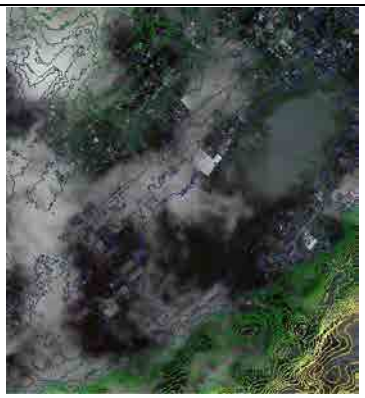
2.97 The "Low" landslide susceptibility category includes those areas with slopes below 18 degrees. In accordance with the MGB criteria, these areas have no identified landslide scarps--old, recent or active.

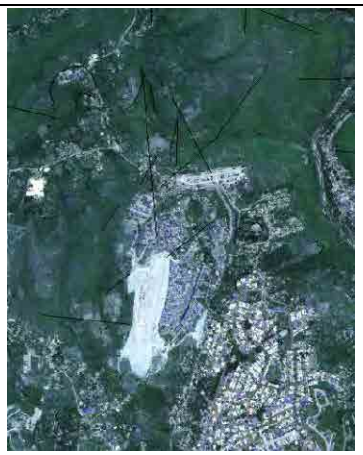
2.98 Lineaments and landslide scarps interpreted from the remotely sensed data were plotted on map layers. A polygon is drawn to cover areas having a relatively high density of lineaments and landslide scarps or both over an area of interest. If available, data on active landslides in the area were plotted. This, together with old and recent landslide scarps and lineaments, help determine the areas highly susceptibility to landslides. The whole analysis was performed in an integrated GIS and image processing environment.

2.99 The findings of the detailed assessment on landslide hazards are compiled in Table 2.4.8.

Table 2.4.8 Characteristics of Landslide Hazards

Hazard Level	Identified Landslide Hazards	Examples
Moderate	(a) **Rolling Hills with Moderate Susceptibility to Landslides:** From the eastern coast of northern Cebu, rolling hills stand out in sharp contrast to the narrow, relatively flat lowland. Further west, the hills rise to mountain areas. The hills, underlain by limestone, form elongated features whose axes generally trend at some angle towards the east. These hills have moderate susceptibility to landslides.	
High	(b) **Active Landslide Areas:** Some hill areas are highly susceptible to landslides. The figure at the right shows that landslides affected the road at least twice. An older landslide scarp (in blue), together with the more recent scarps (in yellow and red) reveal that the area is landslide-prone. Two landslides are close to each other in Compostela. The big landslide (yellow) left some rocks hanging on the wall. The smaller one (right) seems to be a remobilized portion of an earlier bigger landslide (in blue). The site is just north of the boundary with Liloan, about 1.5 km west of the National Highway.	
High	(c) **Bulging Areas on Slopes:** In some instances, bulging areas on slopes indicate either an area that moved or is likely to suddenly move given the right trigger such as intense rain or an earthquake of sufficient magnitude. The figure at the right shows a bulging area that already moved down and can move down further. This bulging area on a slope indicates high landslide susceptibility. The scarp at the top of the bulge reveals that the mass has already moved down. With the right trigger such as intense rainfall or high magnitude earthquake, this mass could collapse. This bulge is located about 2.3 km northwest from the center of Silot Bay.	

Hazard Level	Identified Landslide Hazards	Examples
High	(d) **Suspect Subsidence Areas:** Some features identified are suspect subsidence areas. For example, this semi-circular feature (about 800 m long and 500 m wide) in Liloan could be an incipient sinkhole, or area of land subsidence, or simply a topographic low. This area needs further data, analysis, and ground verification. The site is about 2 km west northwest of the center of Silot Bay near the boundary of Consolacion.	
High	(e) **Silot Bay:** Silot Bay in Liloan is connected to the sea. On the way out to the sea past the bridge, the waters from Silot Bay swirl into small whirlpools. This river outlet is the only river in the study area where the waters swirl a lot as they exit to the sea. The figure at the right shows Silot Bay and its surroundings. The bay measures about 1.4 km long and 1.2 km wide. The contour lines (5 m interval) draped over the image show that Silot Bay is roughly circular and the slopes around it are steep. If we imagine submerging the whole bay area including the surrounding ridge under water, it would likely appear like a circular blue hole. This study proposes that Silot Bay is a cave formation whose roof collapsed. This feature is more commonly called a collapsed sinkhole. Notice the closely-spaced contours that reveal the roughly circular shape of the bay and the steep slopes around it. The ridge surrounding the bay is about 25 m above sea level. These ridge areas around the bay are highly susceptible to landslides. The lower areas near the waters are soft and are susceptible to differential ground settlement.	
High	(f) **Wetland in Lowlands:** Large wetlands in lowland areas with no surface outlets towards the sea were identified as collapsed sinkholes. The low elevation of these wetlands allow freshwater to accumulate. These wetlands may have underground passageways that allow freshwater to drain to the sea. The right figure shows a large wetland in Liloan about 1 km from the coast with no surface creek or river that serves as outlet to the sea.	
High	(g) **Actively Worked Mines:** Actively worked mining areas are considered highly susceptible to landslides. Development of these areas requires extreme caution and rigid implementation of safety procedures. Before abandoning the mine, the quarry slopes must be stabilized for the safety of the general public. Since mining activity over an area is a temporary land use, it is worth considering what future land use these quarries will be after its closure and abandonment. Shown on the figure is a site in Naga.	

Hazard Level	Identified Landslide Hazards	Examples
High	(h) **Developments Very Close to Hillsides and Rivers:** Developments very close to hillsides and rivers can create dangerous situations. In the case of Naga City (figure at the right), upstream in the headwaters are wide scarps between 100 m to 200 m in width. The total length of the scarp series is about 1 km long. The scarp face itself is steep between 30 and 45 degrees. The series of scarps, arranged in semi-round configuration, made the catchment area wider at the top, thus catching more rainwater. If debris temporarily dams the narrow creek that drains the place, the upstream area may flood. If the temporary dam breaches, large amounts of water rushing downwards can trigger landslides and flash floods downstream and affect communities and development projects near its path.	
High	(i) **Old Landslide Debris Deposits Area:** An old landslide debris deposit with communities built on top was recognized. Features like these might be difficult to recognize at ground level. The steep slopes with little vegetation at the scarp face are susceptible to rock falls that may hit residents and motorists below. At the same time, the old debris deposit with the river water passing beside could have differential settling, causing damage to properties and the road. This site is in Naga City near the boundary with Minglanilla.	
	(j) **Hill Development Settings that Need Engineering Intervention:** The figure at the right shows a hill development setting in Naga City that needs good engineering study and intervention. In the figure, a barren slope on the west is directly above some impounded water body of unknown volume. Further below to the east is a building. The barren slope might fail and hit the water body and building below. A few other danger variant scenarios are possible in this setting.	
High	(k) **Areas with Lineaments Need Buffer Spaces:** There are many lineaments observed in the remotely sensed images covering the study area. Lineaments are zones of weakness on the ground. While many may not presently indicate evidences of motion, ground shaking due to strong earthquakes can cause these lineaments to move, thus damaging the structure situated on top of the feature. The figure shows an example of a development project in Talisay City that needs to observe some buffer spaces from the lineaments. An open space at least 5 m on both sides of the lineament is recommended.	

Hazard Level	Identified Landslide Hazards	Examples
High	(l) **Active Landslide Areas:** In some parts of Cebu City and Talisay City, active landslide areas were identified. This particular area, transected by a lineament and marked by a landslide scarp, is highly unstable. Vegetation's inability to grow along a slope is indication of the high potential for landslide susceptibility. The figure shows an area in Brgy. Sinsin, Cebu City with high erosion and active slumping transected by a NW-trending lineament that cuts across the road. This area is highly unstable. When landslides are closely spaced, along with other evidences of ground instability, they may form a large zone that has high susceptibility to landslides.	
High	(m) **Areas Situated at the Confluence of Streams and Trajectories of Landslides:** Areas situated at the confluence of streams and trajectories of landslides are areas of high susceptibility to landslides. These areas, called landslide debris depositional areas, are also at risk to flash floods. Landslide debris may come from afar and move down at great speed. Areas in the path of the debris are in danger. Shown here is an area in Talisay City near the boundary with Cebu City.	
High	(n) **Areas with High Slopes:** Areas with very high slopes are considered to have high susceptibility to landslides. High slopes could be due to road cuts, scarp faces or deep gully erosion. Shown on the right is a site in Carcar City 1.2 km near the boundary with San Fernando.	
High	(o) **Series of Old Landslide Scarps:** Old landslide scarps identified in some hillsides of South Metro Cebu (boundary area between San Fernando on the lower left, and Naga City on the upper right). measure up to 300 m across, suggesting either a single large landslide event in the past or a series of adjacent small landslides that created the present large scarp. In some instances, the series of adjacent scarps are evident, stretching up to 1.5 km in length. While active landslides and fresh scarps are the main indicators of high susceptibility to landslides, the relatively high density of scarps (large number of scarps present over a given area) points to the area as being highly susceptible to landslides. The occurrence of new fresh landslides in the area is very likely.	

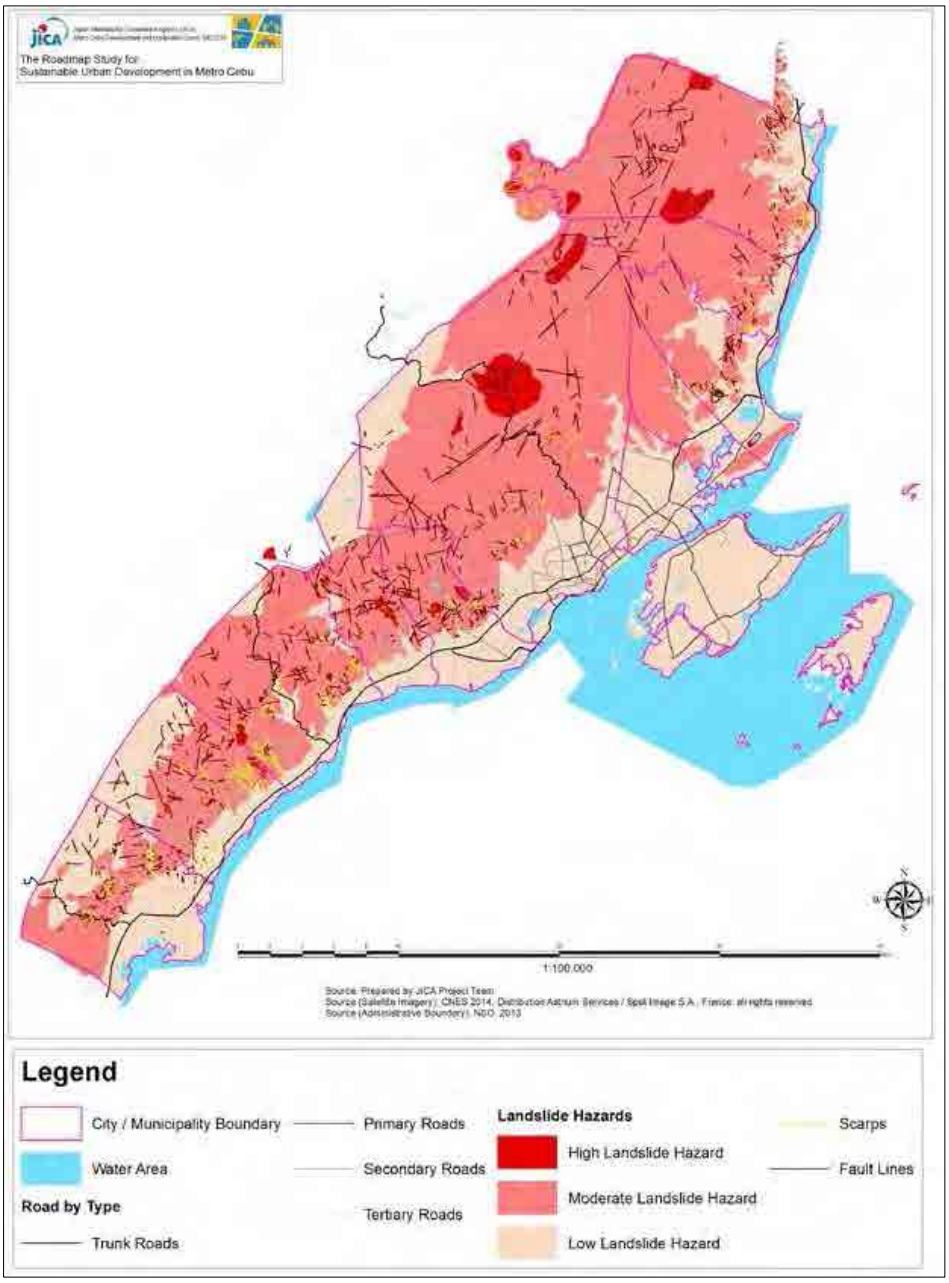
Hazard Level	Identified Landslide Hazards	Examples
High	(p) **Old Landslide Debris Deposits:** Houses built on some old landslide debris deposits areas where debris have stabilized to some degree are at risk to debris remobilization caused by heavy rains, earthquake ground shaking, or both acting singly or together within a short period. The figure shows an old landslide debris deposit with communities on it located in Carcar City.	
High	(q) **Large Sinkholes–Collapsed Cave Formation:** The figure shows an area in Naga City with large collapsed sinkholes measuring about 800 m long and 680 m wide.	
High	(r) **High Erosion and Slumping along River Banks Near Development Areas:** In the urbanized areas near active rivers, some development areas are at risk to riverbank erosion and slumping. Necessary engineering interventions are needed to protect such development projects. The site shown is in San Fernando near Carcar City, about 750 m from the coast.	

Source: JICA Study Team.

2.100 The above findings show that Metro Cebu has many areas highly susceptible to landslides. These areas include active landslide areas/high erosion, collapsed sinkholes/collapsed cave formations, old landslide debris depositional areas, actively mined areas, and mountain areas with very steep slopes (see Figure 2.4.8). The hill areas are moderately susceptible to landslides.

2.101 The use of remotely sensed data provided a synoptic view of Metro Cebu and enabled the recognition and identification of large hazard features such as collapsed sinkholes, old landslide debris depositional areas, and long lineaments that are difficult to recognize at ground level.

2.102 Several existing development areas in Metro Cebu need engineering interventions to reduce their risk to hazards. The results of this study can be refined by site visits and integration of ground data and information. Identified hazardous areas with development projects, both existing and proposed, will need a more detailed ground survey.

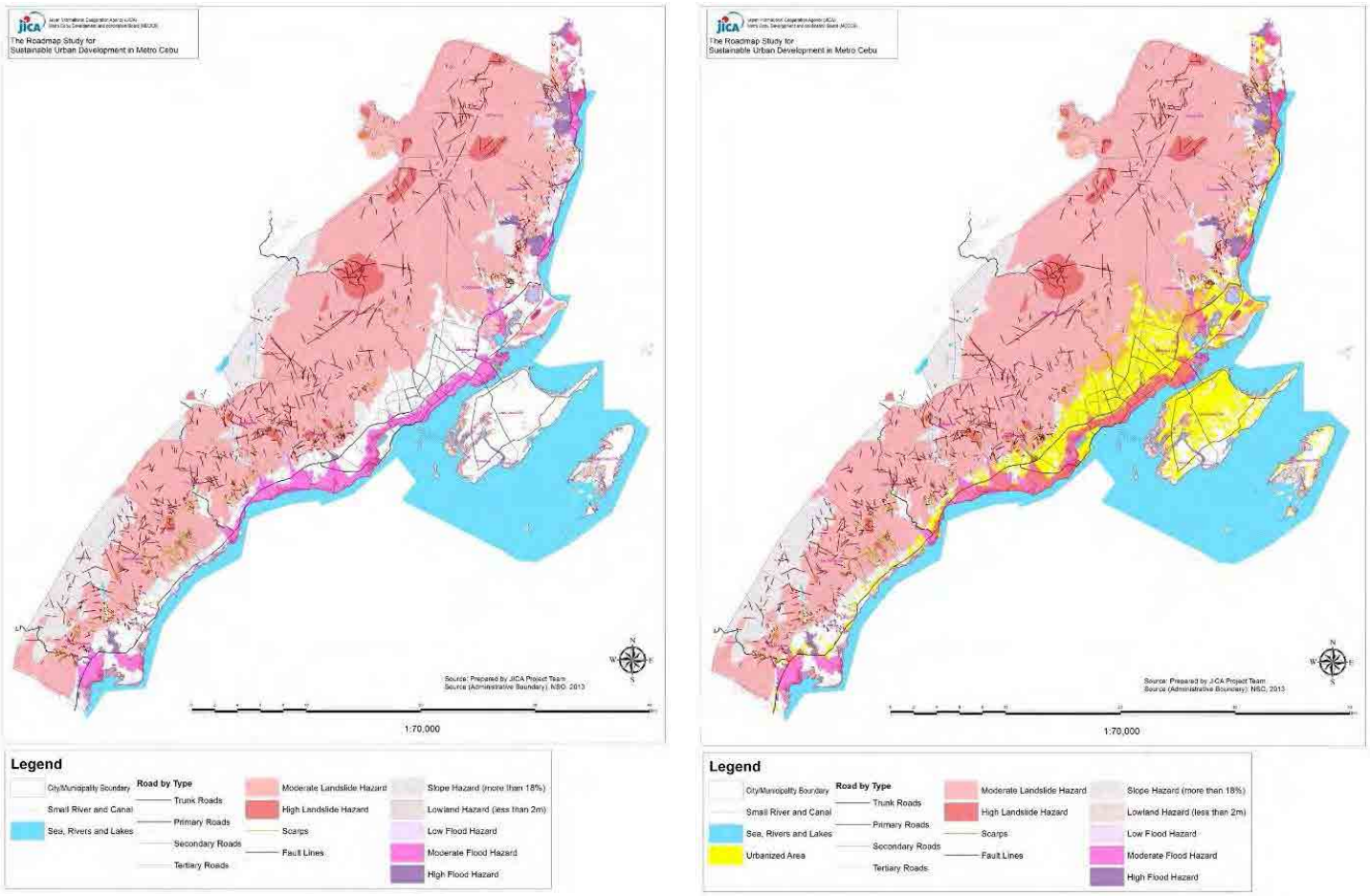


Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

Figure 2.4.8 Landslide Hazard Map

(5) Development Suitable Area

2.103 Development suitable areas can be shown by overlaying the abovementioned constraints and hazard maps in a base map. However, "Low" landslide hazard areas are excluded from this analysis because these areas can be represented more clearly by a slope constraints area map which defines the slope gradient area of more than 18%. The left figure of Figure 2.4.9 shows, in white, the areas with no constraints and hazards, which indicate the development suitable areas. The right figure shows the relationship of constraints and hazardous areas and urbanized area (shown in yellow). Most of the development suitable areas in Cebu City, Mandaue City and Talisay City have been urbanized already and some urbanized areas overlap with hazardous areas. The remaining development suitable areas are spread mainly throughout Danao City, Carcar City and Lapu-Lapu City.



Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

Figure 2.4.9 Development Suitable Area Maps

2.104 The share of hazardous areas to the total urbanized and non-urbanized lands in Metro Cebu is presented in Table 2.4.9. This excludes the flood hazard areas which can be managed by adequate flood control measures. The areas available for future development but which have not been urbanized yet constitutes 10.9% of the total land area.

Table 2.4.9 Hazardous Areas in Metro Cebu

Sub-Total	Urbanized Area (ha)		Non-Urbanized Area (ha)		
			Areas Available for Conversion		No Development Area
	No Hazard Area	Hazardous Area	No Hazard Area	Hazardous Area	Hazardous Area
110,006	14,565	2,044	11,948	14,942	66,507
100.0%	13.2%	1.9%	10.9%	13.6%	60.5%

Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

2.105 Close to 12,000 ha of non-urbanized land in the entire Metro Cebu are available for development. Most of these are in the City of Carcar (3,327 ha), Lapu-Lapu City (2,069 ha), and Danao City (1,429 ha). Expectedly, there is little area available for development in the already highly urbanized Cebu City (see Figure 2.4.10).

Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

Figure 2.4.10 Areas Available for Development in Metro Cebu per LGU

3 SUB-ROADMAP FOR METROPOLITAN COMPETITIVENESS ENHANCEMENT

3.1 Introduction

3.1 One of the development strategy areas in the Mega Cebu Vision 2050 is competitiveness. This chapter discusses proposed directions, strategies and projects that will enhance Metro Cebu's competitiveness mainly through industrial and investment development. It includes an analysis of the current situation, development issues, strengths and challenges, development policy and directions, branding and sub-projects.

3.2 As part of development directions, the Study also examines the experiences of neighboring countries in developing and implementing their respective industrial policies, regional industry models (industry cluster types), and regional industry revitalization models.

3.3 The Study finds that Metro Cebu has potential, which is not fully utilized yet. This potential is shared by the metropolis with its surrounding environs, which necessitates effective human resource development and improvement of good governance. Cebu's strength and potential for Quality of Life (QOL) is a huge advantage. By creating a Metro Cebu brand, Cebu could be positioned as a unique and competitive destination in the country to attract further investments from every direction.

3.4 2015 is an important year for the world, especially for ASEAN member countries, with the establishment of the ASEAN Economic Community (AEC) that will usher in free trade and integration within the community. Competition for shares in the global market is expected to be stronger and Cebu should be prepared for it.

3.5 The Study recognizes the importance of effective coordination of development initiatives within and outside the Metro Cebu area. Because of the lack of space for new economic zones in Metro Cebu, tourism development and synergistic development with the West Cebu Industrial Park (WCIP) and Toledo, integrated coordination planning is included in the long-term roadmap.

3.2 Current Situation

1) Regional Economy

3.6 Since 2009, the regional economy of Central Visayas (Region VII) has grown faster than the economies of the nation and the National Capital Region (see Table 3.2.1). The per capita GRDP of Central Visayas increased to PHP56,500 at constant 2000 price in 2012, at an annual growth rate of 7.9%. Although the per capita GRDP of Region VII was lower than the national average, this economic gap has been reduced by 2012.

Table 3.2.1 Gross Regional Domestic Product per Capita by Region, 2009–2012

(at constant 2000 prices, PHP million)

Region / Year	2009	2010	2011	2012	Average Annual Growth Rate 2009–2012 (%)
Central Visayas	44,993	49,966	52,528	56,507	7.9
Metro Manila (NCR)	162,321	171,442	173,975	183,747	4.2
Philippines	58,199	61,570	62,739	65,904	4.2

Source: National Statistical Coordination Board.

3.7 The growth of the regional economy was driven by all three industrial sectors, which recorded higher annual average growth rates than those of the nation (see Table 3.2.2). In particular, the secondary sector (Industry) significantly expanded its production from 2009 to 2012. Having grown at 14% annually, a growth rate more than twice the national level, the industry sector's contribution to the regional economy increased by 4% to 36.6% in 2012. On the other hand, the primary and tertiary sectors reduced their percentage contribution to the regional economy, in spite of their growth in production in absolute terms (see Table 3.2.2).

Table 3.2.2 Central Visayas Gross Domestic Product by Sector, 2009–2012

(at constant 2000 prices, PHP million)

Sector/ Year		2009	2010	2011	2012	Average Annual Growth Rate 2009–2012 (%)	
						Region VII	Philippines
Primary (Agriculture, Hunting, Forestry & Fishing)	Million Pesos	27,013.2	27,919.0	28,954.9	28,781.4	2.1	1.7
	% Share in GRDP	9.0	8.2	8.0	7.2		
	% Share in GDP	4.1	4.2	4.3	4.1		
Secondary (Industry)	Million Pesos	98,301.7	120,000.0	131,210.4	145,507.4	14.0	6.7
	% Share in GRDP	32.6	35.2	36.1	36.6		
	% Share in GDP	5.9	6.5	6.9	7.2		
Tertiary (Service)	Million Pesos	176,568.0	192,781.7	203,735.9	223,362.9	8.2	6.6
	% Share in GRDP	58.5	56.6	56.0	56.2		
	% Share in GDP	6.0	6.1	6.1	6.2		
Gross Regional Domestic Product	Million Pesos	301,882.9	340,700.8	363,901.2	397,651.7	9.6	6.0
	% Share in GDP	5.7	6.0	6.2	6.3		

Source: National Statistical Coordination Board.

3.8 Although Central Visayas' economy and that of the Philippines have grown steadily, neighboring countries' economies have been growing more rapidly. The same is true for FDI. The Philippines has attracted FDI steadily but the growth of FDI in neighboring countries has outpaced that of the Philippines.

3.9 Employment in Central Visayas has been growing at a faster average annual rate than that of the Philippines. It is the primary and tertiary sectors that have been leading the surge in regional employment, more than the secondary sector. As shown in Table 3.2.3, employment in the industry sector increased by only 0.7% per year, compared to 2.7% and 4.2% of the primary and tertiary sectors, respectively. Combined, the primary and tertiary sectors provided employment to 85% of the region's labor force.

Table 3.2.3 Employment in Central Visayas, 2009–2011

Major Industry Group	2007		2011				Annual Average Growth Rate 2007–2011 (%)	
	Employment (1000 persons)		Employment (1000 persons)		Share in Total (%)			
	Central Visayas	PHP	Central Visayas	PHP	Central Visayas	PHP	Central Visayas	PHP
Primary: Agriculture, Hunting, Forestry & Fishing	817	11,786	906	12,268	31.2	33.0	2.6	1.0
Agriculture, Hunting and Forestry	691	10,342	781	10,803	26.9	29.0	3.1	1.1
Fishing	126	1,444	125	1,465	4.3	3.9	-0.2	0.4
Secondary: Industry	524	5,121	538	5,530	18.5	14.9	0.7	1.9
Mining and Quarrying	15	149	16	211	0.6	0.6	2.1	9.1
Manufacturing	333	3,059	317	3,080	10.9	8.3	-1.2	0.2
Electricity, Gas and Water Supply	9	135	12	148	0.4	0.4	6.7	2.3
Construction	167	1,778	193	2,091	6.7	5.6	3.7	4.1
Tertiary: Service	1,236	16,654	1,459	19,394	50.3	52.1	4.2	3.9
Wholesale and Retail Trade, Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	443	6,354	524	7,399	18.1	19.9	4.3	3.9
Hotels and Restaurants	73	907	89	1,119	3.1	3.0	5.1	5.4
Transport, Storage and Communications	172	2,599	184	2,775	6.3	7.5	1.7	1.7
Financial Intermediation	27	359	28	434	1.0	1.2	0.7	4.9
Real Estate, Renting and Business Activities	69	885	111	1,257	3.8	3.4	12.6	9.2
Public Administration and Defense, Compulsory Social Security	116	1,551	149	1,873	5.1	5.0	6.5	4.8
Education	77	1,035	90	1,199	3.1	3.2	4.0	3.7
Health and Social Work	24	373	28	452	1.0	1.2	3.7	4.9
Other Community, Social and Personal Service Activities	64	849	69	934	2.4	2.5	2.0	2.4
Private Households with Employed Persons	170	1,740	187	1,950	6.4	5.2	2.4	2.9
Extra-Territorial Organizations and Bodies	*	2	-	2		0.0		-2.9
Total	2,577	33,560	2,902	37,192	100	100	3.0	2.6

Source: National Statistics Office, Labor Force Survey.

3.10 PEZA-registered economic zones are the major destinations for FDI in Cebu, which hosts 7 approved export processing zones, 6 IT Parks, 21 IT Centers, an Agro-Industry Export Zone (AIEZ), and 3 Tourism Export Zones (TEZ) (see Table 3.2.4 and Table 3.2.5).

Table 3.2.4 Economic Zones in Cebu

Economic Zones	No. of Ecozones	Investments (in PHP mil.)	Direct Employment	Exports (USD 000)	Imports (USD 000)
Manufacturing Ecozones	7	15,815	116,651	3,551,915	2,960,117
IT Parks / Centers	43	9,239	51,962	4,165,530	2,974,173
Tourism Ecozones	2	196	983	11,860	375

Source: PEZA.

3.11 Most of the ecozones are already fully occupied. The projected 2.5 million population increase by 2050 will create approximately 0.5 million of new employment. This means that around 2,000 ha of MEPZ or 850 ha of MRI Ecozone expansion area would be needed to accommodate additional employment. However, there is no clear geographic indication for the new industrial investment in the Metro Cebu area. Preparation of a feasibility study for industrial parks/estates development projects to accommodate new locations should be done as a short-term project.

Table 3.2.5 Operating SEZs in Cebu

Name of Ecozone	Location	Total Area (ha)	LGUs	Occupancy
MSEZ (7)				
Cebu Light Industrial Park	Basak, Lapu-Lapu City, Mactan	62.49	Lapu-Lapu	
Mactan Economic Zone	Lapu-Lapu City, Mactan	119.37	Lapu-Lapu	
Mactan Ecozone II	Basak, Lapu-Lapu City, Mactan	63.30	Lapu-Lapu	
Cebu South Road Properties	South Reclamation Project, Cebu City	265.28	Cebu	
MRI Ecozone	Sabang, Danao City	28.29	Danao	
New Cebu Township	Cantao-an, Naga	122.83	Naga	
West Cebu Industrial Park	Arpili and Buanoy, Balamban	169.92	Balamban	
IT Park (6)				
Bigfoot Information Technology Park	Barangay Mactan, Lapu-Lapu City	1.92	Lapu-Lapu	Fully occupied
CBP-IT Park	Barangays Mabolo, Luz, Hipodromo, Carreta, and Kamputhaw, Cebu City	50.00	Cebu	
Cebu IT Park	Lahug and Apas, Cebu City	23.70	Cebu	
Lexmark Plaza	Cebu Business Park, Cebu City	0.52	Cebu	Fully occupied
HVG Arcade IT Park	HVG Arcade, Subangdaku, Mandaue City	7.51	Mandaue	Fully occupied
Naga City Technology Park	Barangay Triangulo, Naga City	1.25	Naga	
IT Center (21)				
Arcenas Estate IT Building	Banawa Hills, Labangon, Cebu City	1.28	Cebu	Fully occupied
Benedicto IT Center	A.S. Fortune St., Bakilid, Mandaue City	0.25	Cebu	
Cebu IT Tower	Corner Mindanao and Bohol Streets, Cebu Business Park, Cebu City	4.75	Cebu	
Creativo IT Center	Cebu Business Park, Cebu City	0.16	Cebu	
Crown 7 IT Center	Juan Luna Avenue, Mabolo, Cebu City	0.19	Cebu	
DG3 IT Center	72 N. Escario St. corner F. Ramos Extension, Capitol Site, Cebu City	0.33	Cebu	
GAGFA IT Center	F. Cabahug Street, Barangay Kasambangan, Cebu City	0.32	Cebu	
JESA Building	90 General Maxilom Avenue, Cebu City	0.20	Cebu	
JY Square IT Center III	Salinas Drive, Lahug, Cebu City	0.53	Cebu	
Keppel Center	Cardinal Rosales Avenue corner Samar Loop, Cebu Business Park, Cebu City	0.26	Cebu	
Mango Square	Maxilom Avenue corner Juana Osmeña Street, Cebu City	1.37	Cebu	
Pioneer House Cebu	Lot 8, Blk. 14, Cardinal Rosales Ave., Brgy. Mabolo, Cebu City	0.12	Cebu	
JY Square IT Center	Salinas Drive, Lahug, Cebu City	0.88	Cebu	Fully occupied
JY Square IT Center II	Salinas Drive, Lahug, Cebu City	0.40	Cebu	Fully occupied
Robinsons Cybergate Cebu	Don Gil Garcia Street, Capitol Site, Cebu City	0.48	Cebu	Fully occupied
Synergis IT Center	F. Cabahug Street, Kasambangan, Cebu City	0.46	Cebu	Fully occupied
A. D. Gothong Information Technology Center	National Highway, Subangdaku, Mandaue City	0.15	Mandaue	Fully occupied
KRC IT Zone	Lopez Jaena Street, Subangdaku, Mandaue City	0.66	Mandaue	
JMALL IT Center	A.S. Fortuna Street, Bakilid, Mandaue City	3.03	Mandaue	
Oakridge Information Technology Center	A.S. Fortuna Street, Banilad, Mandaue City	0.07	Mandaue	
Robinland IT/BPO Center	Zuellig Ave., Mandaue Reclamation Area, Mandaue City	0.25	Mandaue	
AIEZ (1)				
Carmen Cebu Gum Industrial Zone	Cogon West, Carmen, Cebu City	7.60	Cebu	
TEZ (3)				
Phil. BXT Corp. Tourism Economic Zone	Barangay Maribago, Lapu-Lapu City	7.50	Lapu-Lapu	
The Mactan Newtown	Barangay Mactan, Lapu-Lapu City	16.80	Lapu-Lapu	
SM Seaside City Tourism Economic Zone	Cebu South Road Properties Complex, Cebu City	30.41	Cebu	

Source: PEZA website, as of December 2013.

3.12 Tourism forecasts for the next couple of decades also indicate the necessity of developing the current accommodation capacity of the tourism sector in Central Visayas.

3.13 WTTC forecasts a 6% annual growth in tourist arrivals from 2014 to 2024. While the actual annual growth between 2006 and 2011 was 9.0%, the current average annual growth rate from 2006 to 2013 was 11.2%. Tourist arrival forecasts for these three growth scenarios are presented in Table 3.2.6.

Table 3.2.6 Tourist Arrival Forecast in Cebu

Recorded Arrivals			Growth Scenarios	Forecast of Arrivals	
2006	2011	2013		2020	2030
1,247,487	1,922,238	2,598,250	6.0%	3,685,667	6,226,857
			9.0%	4,357,525	9,464,080
			11.2%	4,915,223	12,789,005

Source: JICA Study Team.

3.14 A DOT survey in 2012 indicates that 20,000 rooms were available in the Cebu area that year. Assuming the average number of guests in a room as 1.7, days of stay per person as 2.5 and occupancy rate as 60%, the accommodation capacity in Cebu is calculated as 2,980,000. The number of tourist arrivals in 2013 was 2,598,250. This indicates an immediate need to expand accommodation capacity.

2) Infrastructure (Quality of Life)

3.15 The Mega Cebu 2050 project compared Metro Cebu with major Asian cities using the results of a livability survey and assumptions based on available information since there are no corresponding data on Metro Cebu.

3.16 The value of each indicator shows the relative score benchmarked on New York City (NYC). According to this survey, the cities in Southeast Asia such as Manila, Bangkok, Hanoi and Kuala Lumpur have comparatively low scores for almost all indicators (see Table 3.2.7). Metro Cebu is assumed to have similar characteristics as them, but the scores for “Stability” covering public safety, political instability, etc. and “Culture and Environment“ including mild weather, accessibility to recreational facilities, etc. are relatively higher.

Table 3.2.7 Livability in Major Asian Cities

	Livability	Stability	Healthcare	Culture and Environment	Education	Infrastructure
Manila	72	86	64	69	67	72
Bangkok	76	71	68	75	100	78
Hanoi	63	79	59	59	58	58
KL	85	114	68	74	92	86
Singapore	102	136	95	83	83	112
Tokyo	109	129	109	103	100	104
Metro Cebu	65	90	60	75	70	65

Source: JICA Study Team based on the data from Livability Report, Global Livability Survey January 2010, EIU.
Notes: Scores of "Metro Cebu" were evaluated by the JICA Study Team. All scores are based on "NYC=100."

3.17 Based on interviews with business people in Manila, Tokyo and Singapore, aside from infrastructure, the living conditions of expatriates (such as education, culture, leisure and health care) are equally important. Many foreigners in Manila try to go to out of the NCR to relax on weekends but they get to do this only occasionally due to time and cost considerations. In Cebu, they can enjoy these leisurely opportunities almost every weekend if they want. There are sufficient hospitals and educational institutions in Cebu for expatriate staff and their families and for the local staff as well. In this sense, Cebu has quite a strong advantage for the promotion of FDI.

3.18 Availability of tertiary infrastructure for high QOL is important when promoting a location for foreign investors and international organizations. QOL infrastructure such as

international schools for their children, hospitals where English communication is available, churches/worship areas for a variety of religions, and recreation facilities and accommodations of international standard are essential considerations for attracting foreign locators. In this regard, Cebu has a comparative advantage.

3) Industrial Development Policy

3.19 Relevant development policies and plans include the PIPP 2011–2016, IPP, and DTI's IDP Roadmap in 24 sectors as the national plans, the Central Visayas Regional Development Plan 2011–2016 as the regional plan, and the Provincial Development and Physical Framework Plan (PDPFP) 2014–2019 as basis for the Provincial Development Investment Plan (PDIP).

3.20 The PDPFP is a good guideline for provincial development and can be the basis for the roadmap of Metro Cebu. At the same time, there is a need for a more focused industrial development policy to develop an investment promotion plan. To complement limited information at the local level, this Study draws upon good examples and lessons from other countries' experiences.

3.3 Strengths and Challenges of Metro Cebu

3.21 Cebu has several distinct strengths that contribute to its robust economy, but is also faced with some development constraints and challenges. These are discussed in the following section.

(1) Cebu's Strengths

(a) **Strategic Location:** Cebu is centrally located in the Visayas, which makes it highly accessible by land, sea and air transport from any point in the Philippines and by sea and air from other parts of the world. An investor wanting to penetrate the domestic market or venture into export will find Cebu a strategic location for business operation.

(b) **Modern International Airport:** MCIA is only 15 kilometers and 30 minutes away from Cebu City. Mactan Island is now connected by two bridges to mainland Cebu. MCIA provides direct connections to almost all other airports in the country and to most major cities in Asia.

(c) **Highly Educated and Skilled Labor Force:** Its abundant supply of highly educated and skilled labor force and raw labor, who generally speak and understand English, attracts not only labor-intensive industries but high tech and knowledge-based industries. The total number of college graduates in Cebu reached more than 16,000 during the last school year. Of these, 3,247 were in engineering, 2,613 in mathematics and computer science, and 2,438 in medical fields.

(d) **Industry Clusters:** The presence of many industry clusters opens up more possibilities for all the firms in the different clusters to realize more economies of scale from the sharing of readily available inputs and services at more competitive prices from diverse sources. At present, Cebu already boasts of many industry clusters, such as financial services, transport cargo handling and forwarding, tourism industry, traditional manufacturing and agro-processing cluster, electronics and related light industry cluster, and furniture, handicrafts,and fashion accessories cluster.

(e) **Big Domestic Market Base:** The province as a whole had a population base of over 4 million people as of 2010. Some 2.5 million of them were found in Metro Cebu. A big part of the Visayas and Mindanao islands also serves as Cebu City's extended hinterland either as source of raw materials and all kinds of exportable products or as a market for its growing manufacturing output and service activities, made possible by Cebu's close transport linkages with these areas. The Central Visayas Region, as Cebu's market influence, counts a potential market base of over 7 million people.

(2) Development Constraints and Challenges

(a) **Low Productivity:** The Philippines has sustained low levels of productivity relative to its Asian neighbors. Central Visayas has lagged behind other regions in the country in terms of productivity. The labor productivity of the region's agriculture sector in 2009 was the third lowest in the country. Although the industry sector of Central Visayas was the most productive among the region's production sectors, its labor productivity was way below that of CAR, Metro Manila, MIMAROPA, Northern Mindanao, Western Visayas, Davao Region, and SOCCSKSARGEN.

(b) **Weak S&T and R&D Base:** Like most areas in the country, Cebu has a weak science and technology (S&T) and research and development (R&D) base. A study done by the Philippine Institute of Development Studies (PIDS) showed that the government and the private sector have not spent sufficiently for R&D, which is essential in order to keep up with the rapidly changing market. Moreover, the very limited R&D resources were inefficiently allocated among various sectors.

(c) **Pool of Unskilled and Low-skilled Workers in Some Industries:** Despite the presence of highly educated and skilled labor force in the area, there still exists a number of unskilled workers in some industries. Data from NSO show that out of the total number of workers in the region, only 25% of the workers in Central Visayas are either undergraduates or graduates of college. By type of occupation, laborers and unskilled workers comprise the bulk (32%) of the entire working population of Central Visayas. The professional and technical sectors, which require highly-skilled workers, account for only 7% of the total number of workers in the region. This indicates the need for more technical training and HRD.

(d) **High Cost of Doing Business:** The Doing Business 2014 Report of the World Bank ranked the Philippines 108th out of 189 countries surveyed in terms of ease of doing business. Out of the 24 countries in East Asia and the Pacific, the Philippines was among the lowest ranked. The regulatory environment of the Philippines is less conducive to starting up and operating businesses. The same report indicated that the three major cities in Central Visayas–Cebu City, Mandaue City and Lapu-Lapu City--still need to improve their systems for registering new businesses, dealing with construction permits, and registering commercial properties. Out of the 25 Philippine cities included in the survey, Lapu-Lapu City, Cebu City, and Mandaue City ranked 5th, 7th and 13th, respectively, in the aspect of ease in starting a business and also lagged behind other cities in terms of ease in issuing construction permits and registering properties.

(e) **Poor Infrastructure and Logistics Support:** Improving infrastructure and logistics support is another challenge to compete with other investment destinations in Asia. This is necessary to lower production cost and to facilitate the

easy supply chain management from the procurement of inputs to the export of outputs. The integration of the transport system, roads and ports, to reduce travel time remains a challenge. Other logistics support services such communication, water, and power remain inefficient, unreliable and costly.

(f) **Governance:** Good governance is a basic factor to achieve quality investment. The lessons learnt from Singapore's industrial development policy in the 1960s should be the model in this aspect. It requires the government's firm decision and strong political will to clean up corruption. It may take time to change a culture of corruption for the whole nation but Cebu can start changing the culture for a province. Cebu should take the lead in weeding out this corruption culture and if it succeeds, it will develop a reputation among investors that Cebu is the exception from other areas of the country and make it a more competitive investment destination.

3.4 Priority Sectors

3.22 Globally, the evolution in technology, prioritization of business strategies, migration, innovation and trends, environment-consciousness, and value for money have influenced the emergence of technology-based sectors, strengthened hospitality services, and increased the capability for borderless transactions. The Regional Development Council 7 (RDC 7) Development Portal defines the region's priority sectors as follows:

(1) Manufacturing Sector

3.23 Central Visayas is the next region with the most number of manufacturing establishments with employment of 20 and over, outside of the Metro Manila, NCR and CALABARZON regions in Luzon. In the 2010 NSO survey, Central Visayas accounted for 10.2% of establishments and 12.3% of manufacturing employment in the Philippines (see Table 3.4.1).

Table 3.4.1 Selected Statistics of Manufacturing Establishments with Total Employment of 20 and Over (Central Visayas Region vis-a-vis Other Philippine Regions)

	No. of Establishments	% to Total Philippines	Employment as of Nov.15	% to Total Philippines
Philippines	4,918	100	842.562	100
Luzon	3,896	79.3	641,328	76.13
National Capital Region	2,042	41.5	203,083	24.11
Central Luzon	466	9	90,821	9.28
CALABARZON	1256	26	328,485	39
Rest of Luzon (4 regions)	132	3	18,938	20
Visayas	652	13.2	119,374	14.17
Central Visayas	504	10.2	103,439	12.27
Rest of Visayas (2 regions)	148	3.0	15,935	2.0
Mindanao (6 regions)	430	8.7	84,302	10.05

Source: 2010 Annual Survey of Business and Industry, NSO.

3.24 Located in Cebu's manufacturing special economic zones (MSEZs) are light industries producing electronic products, garments, furniture, and some marine-based products. The MSEZs in Mactan Island has, as locators, a large gathering of electronic product manufacturers that are part of the international production networks of major global players in the industry. Combined, the locators in Cebu's MSEZs produced in 2012 exports worth USD3.6 billion, as against USD3.3 billion of imports, for a net trade

surplus of USD234.4 million (see Table 3.4.2, Table 3.4.5, Table 3.4.6 and Table 3.4.7). These industries contributed over PHP6 billion worth of FDI to Cebu's economy, providing 107,150 direct employment (see Table 3.4.3 and Table 3.4.4).

Table 3.4.2 Investments, Employment, Exports and Imports in Manufacturing Ecozones in Cebu, 2010–2012

	2010	2011	2012
Investments(PHP million)	2,230.70	6,335.95	
Direct Employment (No.)		103,593	107,150
Exports (USD million)	1,054.64	3,619.20	3,576.08
Imports (USD million)	935.49	3,369.74	3,341.73
Net Trade (Exports less Imports)	119.15	249.56	234.35

Source: Philippine Economic Zone Authority (PEZA).

Table 3.4.3 Investments in Cebu's Manufacturing Ecozones, 2010-2011

Ecozone	Investments (in PHP million)	
	2010	2011
Total Investments	2,230.70	6,335.95
Mactan Economic Zone	972.78	1,447.09
Cebu Light Industrial Park	1.00	1,525.68
Mactan Ecozone II	792.66	494.96
MRI Ecozone	50.11	91.31
New Cebu Township	-	87.48
West Cebu Industrial Park	414.15	2,689.43

Source: PEZA.

Table 3.4.4 Direct Employment in Cebu's Manufacturing Ecozones, 2010-2012

Ecozone	Direct Employment (No. of Workers)		
	2010	2011	2012
Total Direct Employment		103,593	107,150
Mactan Economic Zone	49,578	58,201	58,814
Cebu Light Industrial Park	1,189	1,434	1,756
Mactan Ecozone II		12,423	12,216
MRI Ecozone	14,903	14,432	16,615
New Cebu Township	1,137	944	876
West Cebu Industrial Park	11,662	16,159	16,873

Source: PEZA.

3.25 WCIP in Balamban stands out as a location for heavy industries, hosting the shipbuilding facilities of Tsuneishi Heavy Industries, Inc. and Austal Philippines. Established in 1994, Tsuneishi builds and exports ships of up to 180,000 deadweight tons using the technology and standards of its Japan-based mother company and a 99% Filipino skilled workforce. Austal Philippines, established in 2013, is set to complete a trimaran, car and passenger ferries, first supplying the European market. As envisioned in its 1994 master plan, WCIP has pursued development in the western side of the province and the next phase to be connected with the Metro Cebu area will be promoted.

Table 3.4.5 Exports from Cebu's Manufacturing Ecozones, 2010-2012

Ecozone	Exports (in USD million)		
	2010	2011	2012
Total Exports		3,619.20	3,576.08
Mactan Economic Zone	1,845.47	2,227.25	1,947.79
Cebu Light Industrial Park	6.19	6.30	13.65
Mactan Ecozone II	-	480.84	311.85
MRI Ecozone	352.98	291.66	305.34
New Cebu Township	41.80	26.96	30.55
West Cebu Industrial Park	653.67	586.19	966.90

Source: PEZA.

Table 3.4.6 Imports to Cebu's Manufacturing Ecozones, 2010-2012

Ecozone	Imports (in USD million)		
	2010	2011	2012
Total Imports		3,369.64	3,341.73
Mactan Economic Zone		1,649.94	1,784.50
Cebu Light Industrial Park		29.24	22.35
Mactan Ecozone II		671.34	506.17
MRI Ecozone	397.95	447.76	369.90
New Cebu Township	24.09	13.89	18.46
West Cebu Industrial Park	481.42	557.47	640.35

Source: PEZA.

Table 3.4.7 Net Exports of Cebu's Manufacturing Ecozones, 2010-2012

Ecozone	Net Exports (in USD million)		
	2010	2011	2012
Total Net Exports		249.56	234.35
Mactan Economic Zone		577.31	163.29
Cebu Light Industrial Park		-22.94	-8.70
Mactan Ecozone II		-190.50	-194.32
MRI Ecozone	-44.97	-156.10	-64.56
New Cebu Township	17.71	13.07	12.09
West Cebu Industrial Park	172.25	28.72	326.55

Source: PEZA.

3.26 The processed food industry in the region includes meat processing, fruit processing, production of beverages and of native delicacies such as dried mangoes and other fruits, candied fruits, rice-based and peanut-based delicacies.

3.27 Giving support to the construction industry are manufacturers of cement and steel products. Combined daily rated capacity of the three major cement players is 14,000 MT. The two region-based companies manufacturing steel bars have a combined daily rated capacity of 1,116 MT, while nail-producing companies have a combined daily rated capacity of 82 MT.

(2) Business Process Outsourcing (BPO)

3.28 The BPO industry is acknowledged as a driving force for economic growth and employment in the country. Typical BPO services involve the contracting of the operations and specific business functions such as operation of human resources departments, telephone call centers, distribution centers, etc. In broader terms, the use of external service providers to effectively deliver IT-enabled processes such as application service is categorized as Information Technology Outsourcing (ITO) and

the contracting to third party providers of relatively high level tasks such as R&D and financial consultancy is categorized as Knowledge Process Outsourcing (KPO).

3.29 Because of its ready supply of professionals equipped with the required language skills, cultural affinity with the US and UK markets, and strong customer service orientation, the Philippines has gained considerable traction as a BPO destination. In 2007, 2008 and 2010, the country has been recognized by the National Outsourcing Association of UK and cited it as the “Off-shoring Destination of the Year.”

3.30 In 2010, the Philippines posted almost USD5.7 billion of pure voice-based revenues, which is even higher than India's. Thus, in stand-alone voice business, the country ranks number one globally. However, India continues to be the leader in the global BPO industry mainly with its strong presence and capacity in information technology (IT) such as software development. On the supply side, while the country produces 480,000 graduates per year, the number of available workforce is undersized compared to India’s 3 million talent pool. The country would need to enhance the capability of its professionals in the IT sector to capture opportunities from India’s BPO market in the IT subsector.

3.31 Nationally, NCR dominantly houses majority of the BPO companies in the country. In 2009, the government and the private sector collaborated on a project “Next Wave Cities” wherein 10 cities were identified with high-growth potential in the BPO services.[1] In 2010, five cities were being eyed as BPO-potential destinations, namely: Dagupan, Legaspi, Metro Subic, Metro Naga, and General Santos.[2] Cebu has earned international acclaim as an investment destination for the BPO industry, though its name was not included in the abovementioned Next Wave Cities. It is ranked 8th "Best Outsourcing Destination" in the world by Tholons and has been cited by fDi Magazine as one of "Asia’s Cities of the Future."

3.32 The Philippine BPO industry grew in 2009 despite the financial crisis, with back-office/ KPO (non-voice) being the biggest-growing BPO sector in the past year. The Business Processing Association of the Philippines (BPAP) estimates that the BPO industry grew by 19% to USD7.2 billion (USD5 billion from call centers, USD1.12 billion from back office services, USD568 million from software, and the rest from other BPO services), making the Philippines the world's second largest BPO market after India (which has a USD9 billion BPO industry).

3.33 BPAP sees the strength of the Philippines in English-dependent BPO, as evidenced by its strong performance in recent years. For 2009, the top revenue-earners among BPOs have been contact centers, KPOs, and back-office operations, all of which are English-dependent. Therefore, it is seen that the Philippines may still continue to promote its BPO services to English-speaking countries, or to companies with English-speaking clientele.

(3) Tourism

3.34 Like many emerging economies, the Philippines is eying tourism to become one of its growth drivers to meet the demand for more jobs for its fast growing labor force and to reduce its high incidence of poverty. The total number of inbound tourists

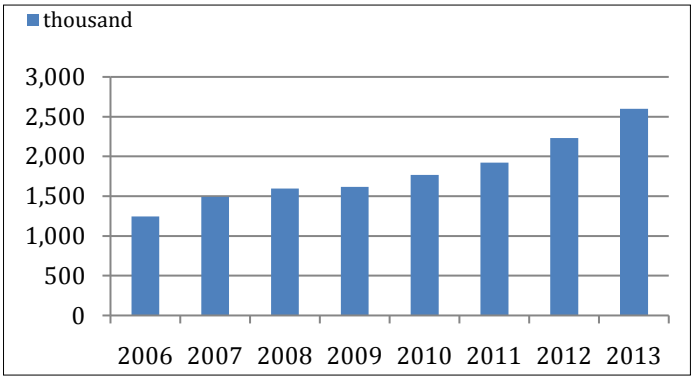
[1] Davao; Santa Rosa, Laguna; Bacolod; Iloilo City; Metro Cavite (i.e., Bacoor, Dasmariñas, Imus); Lipa, Batangas; Cagayan de Oro; Malolos, Bulacan; Baguio City, and Dumaguete.

[2] Philippine Development Plan 2011–2016, Chapter 3 Competitive Industry and Services Sectors, NEDA, 2011.

in the Philippines has grown from 1.76 million in 1995 to 4.68 million in 2013.

3.35 Strategically located in the center of the Central Visayas Region, the island of Cebu is also endowed with breathtaking natural attractions and white sand beaches. It has a rich history and cultural heritage. Added to this is the presence of many travel-related amenities and activities along with the presence of good medical and educational facilities.

3.36 In 2013, Cebu's total number of tourist arrivals (foreign and domestic) reached 2.59 million, with a 16.8% increase over the previous year (see Figure 3.4.1). From 2006 to 2013, growth in total tourist arrivals in Cebu averaged 11.2% annually. The past two years show even more significant growth in both foreign and domestic tourist arrivals.



Source: JICA Study Team based on the Travel andTourism Economic Impact 2014 Philippines.

Figure 3.4.1 Tourist Arrivals in Cebu, 2006-2013

3.37 As discussed in the previous chapter, the travel and tourism sector contributes both direct and indirect impacts to the economy. In 2013, the sector was estimated to have directly contributed PHP472.3 billion to the country's economy, accounting for 4.2% of GDP. The industry's total contribution, however, could have accounted for PHP1.3 trillion or 11.3% of GDP. Both direct and total contributions to the economy are projected to grow by 3.8% in 2014 and by an average of 5.6% annually until 2024.

(4) Electronics/Semiconductors

3.38 In the Philippines, the electronics manufacturing industry has consistently been a top investment draw for the past years. The electronics manufacturing industry is also the country's top export, accounting for 57% of total exports by December 2009. The bulk of electronics exports are components/devices (semiconductors), which comprise 71% of cumulative electronics exports from 2005–2009. Electronic data processing products are second at 18.5%, while others have below 2% share in exports.

3.39 The Semiconductors and Electronics Industry of the Philippines Inc. (SEIPI) expected exports of electronics and semiconductors to increase by 10–15% in 2010. The drivers for the electronics sector are semiconductors, consumer electronics, computer-related electronics, automotive electronics, and, as an emerging subsector, photo-voltaic (solar).

3.40 A possible market for electronics are top electronics companies, which are

based in the USA, Japan, Korea, and Europe (Netherlands), as well as top semiconductor OEM/ODM manufacturers, the largest of which are based in the USA, Korea, and Japan.

3.5 Development Directions

1) Further Development of Industrial Estates

3.41 After the Study on the Cebu Integrated Area Master Plan (CIAMP) in 1994, Cebu has shown progress in many aspects. One of the areas of great progress is in the development of industrial estates. Following the success of the MEPZ, the CIAMP proposed further development of industrial estates and this has led to the current operation of 38 EPZs, IT parks, IT centers, AIEZs, and TEZs. However, considering the rapidly growing investment demand, the spaces available in the existing industrial estates are no longer adequate.

3.42 At this time of the Roadmap Study, 20 years after the CIAMP study, the economic situation in the region has changed enormously. In addition to the development of countries like Singapore, Thailand, Malaysia, Korea and China, the AEC is expected to be established by the end of 2015. AEC will accelerate free trade within the ASEAN countries, thus fostering stiffer international competition.

3.43 Given the current lack of industrial estates space and the need to compete for more foreign and domestic locators, immediate action is recommended for the preparation of a feasibility study for industrial parks/estates development projects to accommodate new locations of strategic industries.

2) LGUs in Cebu

(1) Cluster Development

3.44 In developing identified industries, the government's policy in recent years is to pursue an industry cluster program to foster inter-enterprise linkages among micro, small and medium enterprises (MSMEs) and strengthen collaborative networks. An industry cluster is a geographic concentration of competing, collaborating and interdependent businesses, working on a similar regional infrastructure and creating wealth of regions through exports. It fosters the transfer and adoption of new technologies, creates risk capital, and attracts foreign investment. It breaks down organizational, geographical and sector boundaries, all needed for creating a cycle of sustainable economic growth. The industry clustering strategy is vital for linking manufacturing with other sectors (e.g., mining, agriculture, tourism, construction, etc.), particularly as these affect raw material needs of manufacturing and the manufactured-product requirements of other sectors.[3]

3.45 Industry clusters provide benefits such as the following:

(i) Maximizes capacity through shared hard and soft infrastructure, human resources, R&D and safety standards;

(ii) Provides access to all players, attracting expertise and local suppliers;

(iii) Ensures that top export products or revenue streams are sustained through the development of its value chains down to the provinces and municipalities;

[3] Philippine Development Plan 2011–2016, Cluster Development, NEDA, 2011.

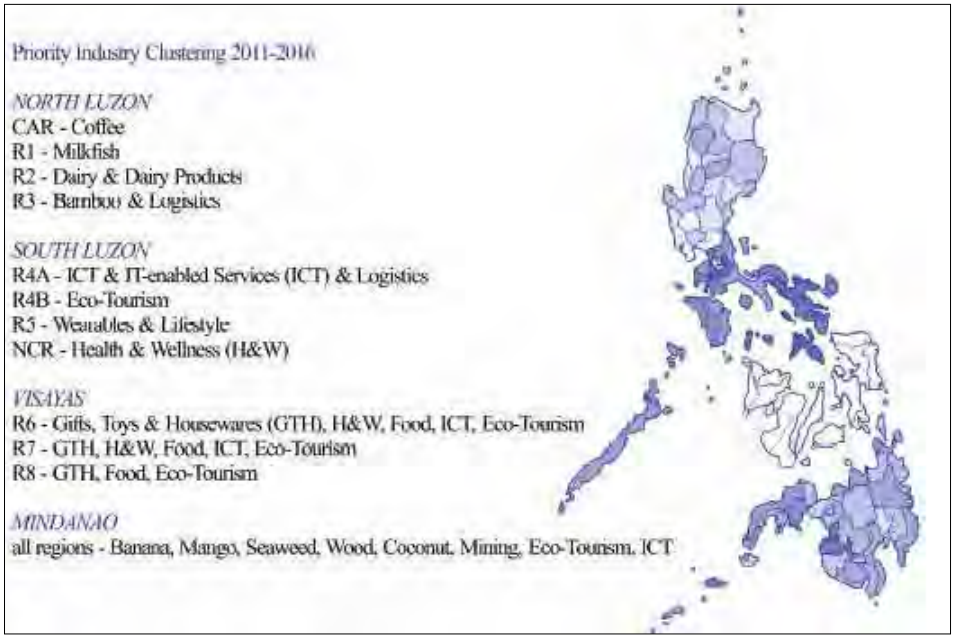
(iv) Offers a focus to attract new investments, encourage local expansion and stimulate start-up of new companies;

(v) Promotes horizontal collaboration and strategic partnership;

(vi) Enhances productivity by providing firms access to specialized inputs and skills, as well as unique information, knowledge and technology; and

(vii) Promotes product complementation that enables longer visitor stay and higher expenditure in tourism destinations.

3.46 An industry cluster map has been developed to guide national and local government agencies, the private sector, development partners, and local communities in developing their respective industry clusters which take into account their comparative advantages (see Figure 3.5.1). For the Central Visayas Region, among the identified priority industry clusters are the gifts, toys and housewares (GTH), health and wellness, food, ICT, and ecotourism.



Source: PDP 2011–2016.

Figure 3.5.1 Industry Cluster Map

(2) Local Development Management

3.47 Guided by the national industry development priorities, the LGUs of the 13 cities and municipalities of Metro Cebu have drawn up their respective local development plans and programs.

3.48 Taking into consideration their strengths, weaknesses, development opportunities and challenges, the LGUs have set their respective priorities (see Table 3.5.1). These vary across the LGUs but among the common priorities are agricultural and agro-industrial development, commerce and light manufacturing, tourism, education and sports, and health. For the key cities, they want to continue pursuing the expansion of manufacturing industries hosted in existing and planned SEZs and industrial parks. Cebu City and Mandaue City particularly seek to expand their growing IT-BPO industries. Indicating the challenge of limited lands for development, several LGUs (Compostela, Minglanilla, Lapu-Lapu City and Cordova) included reclamation projects as among their priorities.

Table 3.5.1 Development Priorities and Directions of 13 LGUs of Metro Cebu

LGU	Priority/Direction	LGU	Priority/Direction
Danao	Development as sub-urban center of Metro Cebu, IT, Agriculture, Agro-industry, New investment to the Industrial Zones 2 & 3 in the northern coastal area, Tourism	Cordova	Second gateway to/from Mactan with new bridge, Reclamation for new business and industrial locations, Marine tourism
Compostela	Reclamation for new industrial locations, Development of IT park with fiber-optic line, Agriculture, Agro-Industry	Cebu	IT/BPO business center (smart city) at SRP, Commercial and business center, High education and training hub, City tourism, Gateway functions of Metro Cebu to international investors and visitors
Liloan	Education, Health care, Agro-industry, Sea-based public transport terminal	Talisay	Public market, International marina, fish port and food processing industries, Agro-industry, Commercial, Industry
Consolacion	Reclamation for new industrial locations, Container port and logistics center, Light industries to complement MEPZ, Agriculture, Tourism, Education, Sports-recreational center	Minglanilla	Light industry, Service industry, Reclamation for industrial locations of SMEs, Agro-industry, Woodcraft and furniture, Bus terminal with a sub-regional market
Mandaue	IT/BPO center, Commercial and business sub-center, Logistics center, Recreational and tourism center	Naga	Development as sub-urban center, Tourism resource center, New Naga public market, Education and vocational training center (new college), Agro-industry
Lapu-Lapu	Sub-urban center with business and commercial functions, Reclamation project (northern part) for new industrial locations, Sport-recreational center, Sophisticated marine tourism, Eco-tourism gateway, Health services	San Fernando	Agriculture, Agro-industry, Industrial estate for basic industrial locations and logistic services
		Carcar	Historical and Eco-tourism, Agro-industry, Food processing industry, Bus terminal with a sub-regional market

Source: JICA Study Team.

3) Human Resource Development/Education

3.49 Cebu is highly organized for human resource development for the IT sector. The Cebu Educational Development Foundation for IT (CEDF-IT), organized over 10 years ago, is a consortium/foundation of academic institutions and private practitioners dedicated to developing human capital for Cebu's target IT subsectors. To further ensure the availability of appropriate skills and the interplay of hardware and software, all of Cebu's 11 universities offer IT courses. Most of the college graduates in Cebu are in the field of business, IT, and engineering (see Table 3.5.2).

3.50 To provide specialist training, there are internationally accredited software learning centers in Cebu. These include CISCO Networking Academies, MICROSOFT Certified Specialist Training Centers, and an ORACLE Programming Academy.[4]

Table 3.5.2 Average Number of College Graduates in Cebu, 2010–2012

	Number	% of Total
Accounting	547	2.4
Business Courses	4,408	19.4
Medical Courses	2,937	12.9
IT Courses	3,858	16.9
Engineering	2,674	11.7
Other Courses	8,333	36.6
Total	22,757	100.0

Source: Cebu Investment Promotions Center (CIPC).

[4] Joel Mari Yu, "State of Development and Prospects of the BPO Industry in Cebu," CIPC, March 2013.

3.51 In addition to the IT sector, Cebu's human resources in the medical service sector such as hospital and health care, general college and ESL, are also highly regarded. Patients from the Visayas Region and neighboring countries come to get medical treatment in Cebu. Also, students go to Cebu to study medical and English courses.

3.52 With the rapid aging of populations in countries like Japan, Thailand, China, etc., the demand for health care and medical services continues to grow stronger. Other countries like Singapore, India and Malaysia are positively investing in this sector to meet the demand of those countries. An industrial development policy for this sector is urgently required for Metro Cebu.

3.53 Graduates of medical courses are the third highest in number being produced by Cebu's academic institutions.

3.6 Roadmap Direction on Industry and Investment

1) Industrial Development Policy

(1) Strengthening Competitiveness(Lessons from Singapore)

3.54 In the past decades, despite achieving certain progress, the Philippines' promotion of industrial growth has paled in comparison with other ASEAN countries. Cebu, as the nation's second premier city, and its surrounding area, Metro Cebu, have a potential to be more flexible and take the initiative to evolve more rapidly than the whole nation to compete with neighboring countries.

3.55 First, it needs to have a more practical and focused industry development policy. When considering the policy, Cebu can draw upon lessons from globally successful developed countries. Singapore's success in economic growth stemmed from its industrialization policy in the 1960s, assisted by the UN's Survey Mission to Singapore led by Dr. Albert Winsemius.

3.56 There are many reports that analyze the Singaporean industrial development success story, including the Winsemius Report, that offer lessons that can be applied for Cebu's contemporary industrial development. However, Singapore's industrial policy at that time cannot be adapted to every developing country, but to one that has a free trade tradition, accumulated capital, and well-developed financial market. These are factors that Cebu is considered to have.

3.57 One of the lessons to be considered from Singapore's industrial development policy is a clear understanding of the current problem, demand for employment, and improvement of the living standard.

3.58 The second important lesson is the firm decision of the Singapore Government at that time to eradicate corruption and establish an efficient bureaucracy. Studying the lessons from failure of neighboring countries in this respect, the Singapore Government strongly resolved to address the problem of corruption. The cleanliness of the Singaporean bureaucracy and transparency in its political decision-making are among the most important factors for the foreign investors' decision to invest in that country.

3.59 All the neighboring countries in the ASEAN region also struggle with the same problems, though at varying degrees. From the lessons of Singapore, it is not too much to say that only the nations who could overcome this problem can be successful. As

earlier mentioned, if the change of the national culture takes time, Cebu should be the pioneer in bringing about change at least in the provincial level.

(2) Regional Industrial Model

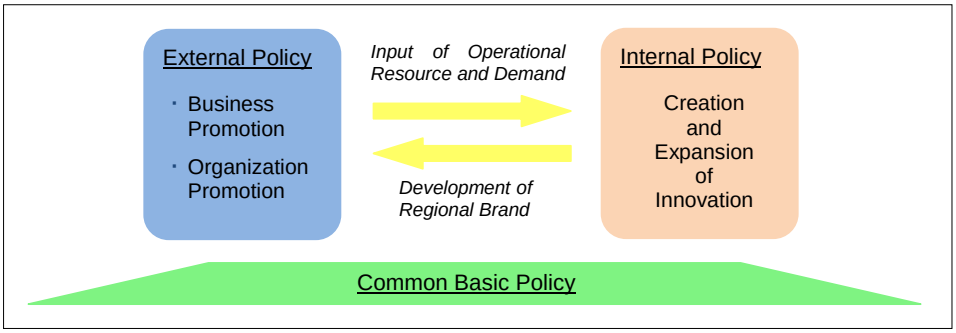
3.60 For regional industrial development to happen, relevant policies should be put in place to improve infrastructure at the following three levels:

(i) Primary Infrastructure for Industrial Accumulation (e.g., social Infrastructure, public laboratory, supplier, etc.);

(ii) Secondary Infrastructure for Industrial Base (e.g., transportation network, communication network, energy, etc.); and

(iii) Tertiary Infrastructure for QOL (e.g., education, health care, culture, etc.).

3.61 Figure 3.6.1 shows the structure of regional industrial development, in which the common basic policy for infrastructure supports external and internal policies.



Source:JICA Study Team.

Figure 3.6.1 Infrastructure for Regional Industry Development

3.62 The importance of the QOL infrastructure for attracting foreign investors and international organizations is often underestimated. QOL infrastructure such as international schools, hospitals, churches and places of religious worship, and recreational facilities and accommodations of international standards cannot be prepared in a very short time. In this regard, Cebu has a comparative advantage and can prioritize the improvement of primary and secondary infrastructure.

3.63 To improve its investment environment, alternative models/types of the regional industry that Metro Cebu targets will be considered, such as the following (see Box 1):

(i) Silicon Valley Model;

(ii) Italian Model;

(iii) Austin Model (collaboration between industry, government and academe); and

(iv) Other regional industry models

- Greater Washington DC (IT, Biotechnology), NY Silicon Alley (IT), Seattle (Biotechnology-IT), Pittsburgh (Biotechnology-IT), North Carolina Research Triangle (Biotechnology-IT);
- Munich (Biotechnology, Germany), Sophia Antipolis (IT, France), Cambridge (IT, Biotechnology, UK); and
- Beijing–Zhongguancun (IT, China), Shanghai (IT, China), Daejeon Daedeok (IT, Korea), Xinzhu (IT, Taiwan).

Box 1 Characteristics of Regional Industrial Models

1. Silicon Valley Model
- Division of process and network of technical enterprises within the area
- Venture companies and medium to large companies, which started as venture companies
- Prevalence of innovation and its outcome in the area
- Established identity as a group, competence and cooperation among groups
- Personnel network beyond the border of organizations, active personnel movement
- Western culture as progressive climate
- Excellent primary infrastructure with first class academy such as Stanford University and Venture Capital

2. Italian Model
- Family business
- Technical enterprise
- Small production in many types in high quality, vivid response to demand
- Profit-oriented rather than larger production backed-up by high level domestic consumers
- Diversification of business and new entrepreneurs as a consequence
- Network-oriented

3. **Austin Model** (collaboration between industry, public and academe)
- Provincial government to invest in education
- Regional government to invest in development of QOL infrastructure
- Research type universities (University of Texas, Austin)
- Coordinator among industry, government and academe to facilitate spin-off enterprise and its networks

Source: Strategy for Regional Industry Development, Nonagase, 2012.

3.64 There is no model which automatically fits a city/region because of differences in culture, age, and surrounding conditions. BPO/KPO is unique since it is dominated by developing countries and Cebu is in one of the leading countries. A Cebu Model could be established in this respect.

3.65 When making an original regional industry model, a Tsubame–Sanjo Model (modified Italian Model) might be a good reference. The characteristics of the Tsubame–Sanjo Model are as follows:

(i) Originated by the technology that has been fostered in the region;

(ii) Integrated solution-oriented companies with high market linkage capability;

(iii) Challenges such as (a) strengthening of access to customer, (b) capability of understanding customer needs, and (c) capacity to propose to niche market;

(iv) Has yet to establish a certain position in the market as stylish Italian Model;

(v) Aggressive investment in R&D and capital investment to internalize important technology to grow into a mid-sized product development-oriented company; and

(vi) Strengthen the ability to respond to market needs and technological innovation, stronger than that of the Italian Model, as a regional industry.

3.66 Since 180 countries are competing to promote FDI, the uniqueness and

attractiveness of Cebu needs to be created in addition to incentives, OSS, SEZ, etc. “Branding” is one of the tools to distinguish goods of high quality. Once established as a reputable brand, one can expect to be able to command a premium price and loyalty from the customers.

2) Regional Branding

(1) Branding

3.67 When thinking of investing in a region, what are the first images investors recall about the region? In other words, what is the typical production in the region? When thinking about the Champagne district of France, for example, one will recall its sparkling wine and vice-versa. Many people understand or misunderstand that the name "Champagne" means sparkling wine. In fact, "Champagne" is one of the names of the sparkling wines which are produced in this particular district of France. Sparkling wines which are produced in other areas cannot use the name "Champagne." So Champagne is the brand of the sparkling wine that guarantees the high quality of taste.

3.68 While marketing is the “creation of a system of selling,” branding is the “creation of a system of sustainable selling.” Regional branding is “adding value that appealsto the region.” The functions of branding include guarantee of quality, differentiation, and recall. Its effects include premium price effect and loyalty effect.

3.69 In this sense, branding is important as it will create an image of products in the mind of target customers. For example, Mercedes Benz or BMW conjures up an image of high quality and luxury cars, while car makers in emerging countries bring the image of cheap but not reliable vehicles. The importance and the power of branding for Cebu should be further explored since Cebu has a lot of potentials that are not fully utilized.

3.70 Cebu mango is globally popular, with a good reputation for high quality and sweet taste. Although Cebu is not a major producer of mango anymore, it still maintains this reputation by producing dried mango. But looking at global prices of mangoes, generally Cebu mango is cheaper than those produced in other areas. While Cebu mango keeps its brand value, a strategy for the next step needs to be structured.

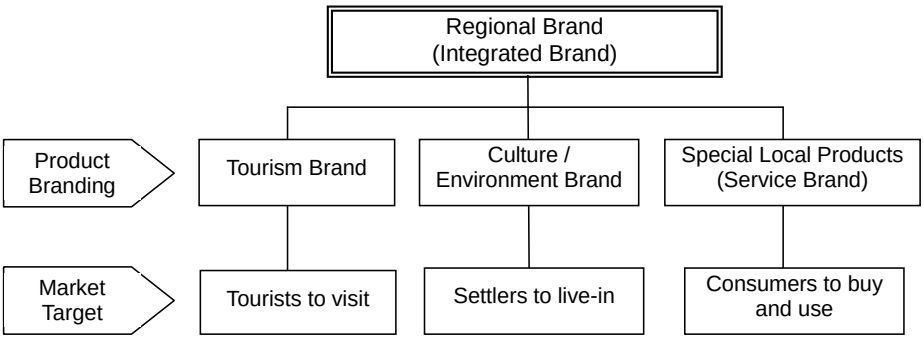
3.71 Cebu’s beautiful beaches attract tourists who love beaches and marine sports. However, why are there not many repeaters? Similar to the Maldives, the Cebu area has plenty of beautiful islands but unlike the Maldives, it does not utilize air taxis or seaplanes to compensate for the lack of rapid inter-island transportation. Why does Cebu not innovate this system even though Subic Bay Port already has? This indicates that resources are not fully utilized.

3.72 Through more research and analysis, those resources could turn out to be more value-added products. Costa Rica may be a good example of how it acquired a reputation as an ecotourism country. According to tourism experts, its neighboring countries such as Guatemala also have similar or higher quality of resources, but only Costa Rica succeeded in acquiring that reputation.

(2) Regional Branding

3.73 By understanding the importance of branding and acknowledging the potential of resources in the region, Metro Cebu should think of positioning itself as a regional brand. Regional branding is to link brands of regional goods and services to foster a regional image and facilitate a good cycle to attract financial and human resources

from outside the region and revitalize the local economy sustainably (see Figure 3.6.2).



Source: JICA Study Team based on "Regional Brand and Attractive Regional Development," Sasaki, 2012.

Figure 3.6.2 Regional Branding for Economic Growth

3.74 It is easy to conclude that the failure to establish a regional brand is due to lack of attractive high quality resources (variety, quality, quantity). However, the essence of regional branding is the establishment of the integrated brand (special local products, culture and environment brand, tourism brand) by fully utilizing regional resources (nature, history and culture, local industry, etc.). An example is the successful honey bee brand in the central area of Tokyo (see Box 2).

Box 2 Example of Regional Branding: Ginza Honeybee

Ginza Honeybee Project (Tokyo)

Ginza is one of the most popular exclusive shopping districts in Japan. In the midst of congested commercial buildings, beekeeping has been started at the roof of one of the buildings since 2006. Unlike most other beekeepers that use Apismellifera, they use Japanese bees in addition to Apismellifera.

Because of the uniqueness of the type of bee as well as its location in Ginza, the honeybee products from this project have been commercially successful. Ginpachi, which means Gin (Ginza) + pachi (bee in Japanese), is one of the regional brands of Tokyo.

Example of Ginza Honeybee Products

Honeybee Products		Honeybee Products	
1	Ginpachi Honey Madrene	5	Ginpachi Chocolate
2	Ginpachi Cocktail	6	Honey Soap, Hand Cream
3	Ginpachi Castella	7	Ginpachi Lemon Omelet Cake
4	Ginpachi Beer	8	Ginpachi Honey Milk Latte

Source: "Regional Brand and Attractive Regional Development", Sasaki, 2012.

3.75 The "Beautiful Villages in the World" and "Okinawa Tourism Promotion" projects (see Box 3 and Box 4) can also provide Metro Cebu with other examples of regional branding success stories. By understanding the importance of regional branding, this Study will propose the establishment of a Branding Institute.

Box 3 Example of Regional Branding: Beautiful Villages

The Most Beautiful Villages in Japan - Union

7 towns and villages across the country including Biei-cho, Hokkaido, founded the union of the "most beautiful villages in Japan" in 2005.

It was modelled after “the most beautiful villages in France” in France (founded by 64 villages in 1982).

It aimed at village revitalization by developing a small rural network for effective promotion. For the small towns and villages suffering from financial difficulties, depopulation and aging, it is more and more difficult to be self-reliant. They strove to differentiate themselves from the other municipalities to enhance their regional brand image by partnering in this Union.

From ”Beautiful Villages in the World” by 5 countries and regions

http://www.utsukushii-mura.jp/

Receiving delegations from other countries such as Taiwan, France, Italy, Wallonie Region of Belgium, Quebec Province of Canada.

Source: “Regional Brand and Attractive Regional Development,” Sasaki, 2012.

Box 4 Tourism Promotion and Regional Brand

Okinawa Tourism Promotion

Okinawan culture is a cross-cultural integration of traditional and foreign culture, called “Chanpuru Culture. ”It is a fusion of traditional Acer, Shimauta and indigenous dances with the American culture, jazz, rock and Latin music after WW II. It blends the traditionally strong influence of Japan and China, Okinawa's own language, the occupation of USA, and its relations with Latin America.

In addition to the traditional arts, a new art and culture has become a driving force for regional development and has led to regional branding.

Source: “Regional Brand and Attractive Regional Development,” Sasaki, 2012.

(3) Strengthening Research and Analysis Function and HRD

3.76 For strengthening the priority sectors, it is necessary to further develop the function of R&D and HRD (Education). Cebu has a reputation for its excellence in education (academe), hospital and health care services. Many students from within and outside the region come to Cebu to study. Not only the universities but also the high quality English schools in Cebu attract foreign students from neighboring countries such as Korea and Japan.

3.77 The advantage of English as an official language will be further utilized as in the BPO/KPO sector. As the academic center of the region, Cebu's high level of educational facilities will enable it to provide high quality human resources to foreign companies that invest in the region.

3.78 Currently, Cebu’s hospitals, health care facilities and their related educational services also have a good reputation in the region. Further strengthening of this sector will expand opportunities for accepting more patients from all over the world. Similar to the CEDF-IT in the IT sector, an educational development center for the health care medical sector is recommended to be established.

3.79 Metro Cebu should develop human resources that instill a national culture of excellence by developing and harnessing a broad range of vocational, clerical, technical, managerial and entrepreneurial skills, propagating firm-level productivity and boosting competitiveness awareness. Harnessing skills and human capital as assets, propagating firm-level productivity and competitiveness should be promoted in line with full human development. Program interventions should be pursued to develop the core values for an entrepreneurial mindset.

3.80 Programs that will bolster an enterprising mindset and a proactive attitude will be pursued. This mindset leads to constant improvement and innovation, creativity in offerings and processes and, therefore, becoming competitive at all times. Individuals become self-driven, resourceful, always positive and optimistic, opportunities- and solution-oriented.

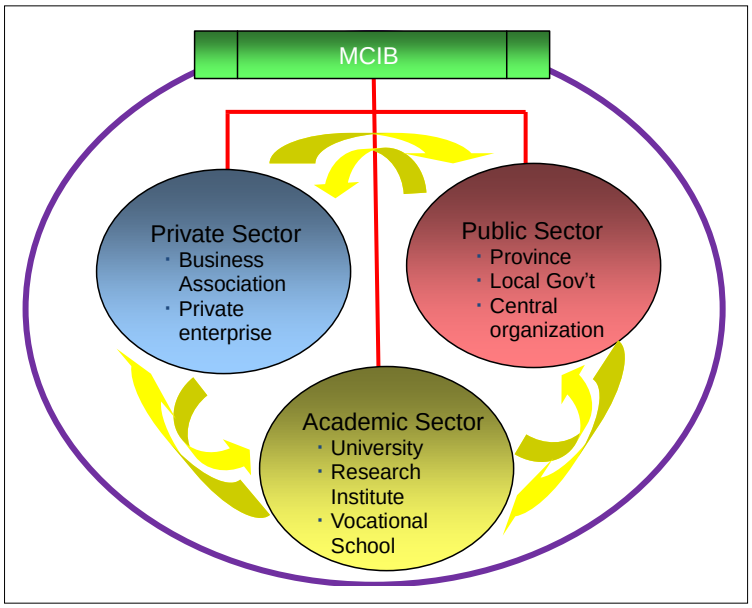
3.81 To ensure market-responsive education and training, the supply side of the labor equation should be addressed through quality education/training and effective assessment and certification systems. Metro Cebu should undertake and maximize capacity-building programs with the support of foreign governments and intra-government organizations under the framework of various bilateral and multilateral engagements. Likewise, linkages among Filipino skilled workers and their business network, technical experts and Filipinos in communities abroad should pursue various multi-stakeholder talent-sharing and brain-gain and skills enhancement initiatives (e.g., Science and Technology Advisory Council, Balik-Scientist Program, and Engineering Research and Development for Technology or ERDT Consortium).

(4) Metro Cebu Investment Board (MCIB)

3.82 After the closure of the Cebu Investment Promotion Center (CIPC) in December 2013, investment promotion is handled by various organizations such as BOI, DTI, Cebu Province, LGUs, chambers of commerce and industry (CCIs), Business Club, PHILEXPORT, etc. All the promotion activities are important and need to be strengthened. However, this situation lacks the organization that represents the whole area, thus bringing confusion and inconvenience to investors. An Investment Board for Metro Cebu needs to be urgently established to facilitate implementation of a unified investment promotion strategy for both public and private sectors and for the entire area.

3.83 As mentioned earlier, research and analysis on the strategies of neighboring countries and global investors such as China+1 and Thailand+1 also needs to be made efficiently to address the stiff competition from neighboring countries and cities. The proposed investment board shall have this function and will take the lead in developing and implementing a unified investment promotion strategy for the area.

3.84 The proposed MCIB should consist of concerned organizations from public, private and academic sectors and will not be dependent on a particular political party, hopefully to be managed through income from membership and service fees. One of the recommended structures of MCIB will consist of four government representatives (Provincial Governor, Mayors from Cebu City, Mandaue City and Lapu-Lapu City, DTI, RDC, etc.) and five representatives of the private sector (business associations such as CCCI, MCCI, Lapu-Lapu CCI, Cebu Business Club, PHILEXPORT and Filnvest, a private enterprise) and will have an executive director and a small staff complement from private and public organizations (see Figure 3.6.3).



Source: JICA Study Team.

Figure 3.6.3 Composition of MCIB

3.7 Sub-Roadmap for Competitiveness

3.85 Under the Mega Cebu 2050 Vision, Metro Cebu is envisioned to be "a vibrant, equitable, sustainable and competitive environment that embraces Cebu's creativity and its cultural, historical and natural resources, with strong citizen participation and responsive governance." The area is expected to be highly competitive, livable, and socioeconomically sustainable, characterized by the following:

(a) **Sustainability:** Creation of attractive urban centers by conservation and revitalization of historic areas;

(b) **Competitiveness:** Strengthening of world-class gateway functions and improving the link between Mactan and Cebu Islands; and

(c) **Livability:** Provision of living conditions with abundant nature and ecology.

3.86 By taking into consideration these visions and goals, further discussion with the provincial government, the 13 LGUs, and MCDCB will be made to develop the vision, goal and targets of the Metro Cebu Sub-Roadmap for Metropolitan Competitiveness Enhancement. In preparation for this, the industrial development and investment promotion strategies need to be developed.

1) Short-Term Roadmap Projects

(a) The Metro Cebu Investment Board (MCIB) is to be urgently established to facilitate implementation of a unified investment promotion strategy for the entire area for both public and private sectors. It should also have the function of investment research, especially to study international investors' strategy on investment. From the lesson of the previous CIPC, this new organization should not be dependent on any particular organization and shall be composed of every party concerned with investment.

(b) Prepare a feasibility study for industrial parks/estates development projects to accommodate new locators of strategic industries based on the above research.

(c) Establish a Branding Institute to study the possibility of the regional branding. It should

establish a good network with academe and research institutes. For example, it should establish a good relationship with the Guimaras National Mango Research Center (GNMRC) by BPI when studying about the Cebu mango's branding. This branding institute could be structured under MCIB.

(d) Establish a Cebu Educational Development Foundation for Health Care (CEDF-HC) as a consortium of industry, academe, government and NGOs that seeks to increase the quantity and improve the quality of professionals in the health care sector and medical services industry. After its establishment, it shall also start its promotion function to the region and neighboring countries for medical health care treatment in Cebu.

(e) A Research and Development Center for Tourism will be established to further utilize the existing tourism resources and facilities and to develop new attractions. Compared to the beaches, Cebu's historical and cultural heritage sites and existing facilities such as the zoo and aquarium are not first class attractions that tourists visit as the main purpose of their trip. The R&D Center will do research on successful examples such as the Singapore Zoo and Churaumi Aquarium (Okinawa) to establish a new aquarium which will have synergistic relations with Oslob's whale shark watching tour. Similarly, the mini-zoo (with tarsiers, deer, etc.) at the Rainforest Park is an attraction that needs to have dramatic improvement.[5]

(f) Research will also cover the quick option to access the resorts that are scattered in the region. Following the success of the Maldives' Air Taxi, a Cebu Air Taxi service using seaplanes, will bring more opportunities for tourists to explore more island resorts. This will develop Cebu as the hub of Visayas Region's resorts such as Malapasqua, Bantayan, Oslob, Moalboal, Dumaguete, Siquijor and Bohol (currently, some of these resorts are out of the visitors' reach because of the distance and poor access). The FS work includes the study on the Cebu Air Taxi and future study to connect cities along the Cebu coasts such as Argao, Carcar, San Fernando, Danao, Bogo, Toledo, etc. Most probably, this research together with the study for establishment of a new aquarium/zoo could be one of the first activities for the proposed Research and Development Center for Tourism.

2) Medium-Term Roadmap Projects

(a) Continue further research and analysis on the strategies of global investors and neighboring countries.

(b) Implement the short-term roadmap project for investment promotion and industrial development and the Metro Cebu brand developed by the proposed branding institute.

(c) Facilitate development of new industrial parks/estates under a newly conceptualized PPP scheme in collaboration with the investment promotion agency (MCIB).

(d) Update the Master Plan for the entire Cebu Province to meet the expanded situation of Metro Cebu.

3) Long-Term Roadmap Projects

(a) Realize the vision of the long-term target set up by the Mega Cebu Vision 2050.

(b) Propagate firm-level productivity and competitiveness in line with full human resource

[5] In the chapter on land use plan, this Study proposes to establish a new aquarium at the proposed reclamation area of the coast of northeastern part of Lapu-Lapu City, near the last station of the proposed MRT line.

development.

(c) Facilitate entrepreneurial mindset and a proactive attitude to assure constant improvement and innovation in the business sector in association with a governmental support program.

4 SUB-ROADMAP FOR URBAN STRUCTURE AND LAND USE

4.1 Introduction

4.1 This sub-roadmap describes the urban structure and land use which direct the physical development of the Mega Cebu Vision 2050 and guides all physical planning works in the Metro Cebu Roadmap.

4.2 Some attributes of the vision statement and the sub-roadmap for urban structure and land use are interrelated, as outlined in Table 4.1.1.

Table 4.1.1 Interrelation Between the Mega Cebu Vision 2050 and Sub-Roadmap for Urban Structure and Land Use

From the Mega Cebu Vision 2050	Planning Items in the Sub-Roadmap
Inclusive, equitable and livable: A developed, responsive and efficient physical and social infrastructure that provides safe, secure and healthy living environment for all members of society	4.2 Urban Structure 4.3 Greening Measures in the Urban Areas 4.5 Tools to Realize the Spatial Plan
Interconnected and compact: Physically, economically and socially integrated Metro Cebu communities where individual growth areas are compact and walkable	4.2 Urban Structure 4.4 Metro Cebu Spatial Plan
Green: Sustainable and resilient development that preserves and nurtures the unique natural environment	4.3 Riverine Environment Improvement

Source: JICA Study Team.

4.3 In order to collaborate with LGUs in land use planning, workshops were organized step by step and individual meetings between JST and the LGUs were done to get feedback from the workshops and others. A total of three workshops were organized in the course of the Study, as follows:

(a) The First Land Use Workshop on July 4, 2014 where participating LGUs presented their existing land use;

(b) The Second Land Use Workshop on September 15, 2014 where participating LGUs presented their future land use plans; and

(c) The Third Land Use Workshop on January 27, 2015 where JST presented the draft spatial plans by LGUs.

4.4 JST has developed various maps, GIS and spatial plans at the scale of 1:10,000 or others. To familiarize the stakeholders and work on the map/GIS database, JST conducted a training course among LGUs and MCDCB participants on February 12-13 and February 17-18, 2015.

4.2 Urban Structure

1) Urban Society in 2050

4.5 The smallest administrative unit in the Philippines is the barangay. Barangays are further classified into urban barangay and rural barangay. In Metro Cebu, 85% of all the metropolitan population, or 2.55 million in 2010, is in urban barangays. This points to the fact that Metro Cebu has already formed a large urban society. In the roadmap planning period, almost the entire population increase will be absorbed into this urban society.

4.6 In the early 1980s, four urban structures were comparatively analyzed towards the

beginning of the 21st century when Metro Cebu would be a metropolis of 2 million people.[1]

4.7 For this planning exercise, the available land resources of Metro Cebu are limited and, thus, the most suitable lands for urban uses have to be carefully developed in order to accommodate the 5 million population forecasted for 2050. Today, with the present state of development of the metropolis, there are not many urban structure alternatives to choose from unlike in previous studies. Only two can be presented, taking future population increase into account.

(1) Monocentric and Densely Inhabited Urban Areas

4.8 Under this urban structure alternative, the present urbanization pattern will continue. Urban development will still be concentrated in Cebu City, Mandaue City and Lapu-Lapu City. Urban sprawl will encompass Liloan, Consolacion, Talisay City and Minglanilla and urban conurbation will intensively strengthen. They will experience dense habitation like Metro Manila.[2] Traffic congestion will become worse and eventually hamper economic and social activities, discouraging spacious suburban development. Many people will try to live on hilly areas if distance to workplaces is reasonable. As a result, landslides from the hillside development areas and floods at the downstream areas will occur at a wider scale.

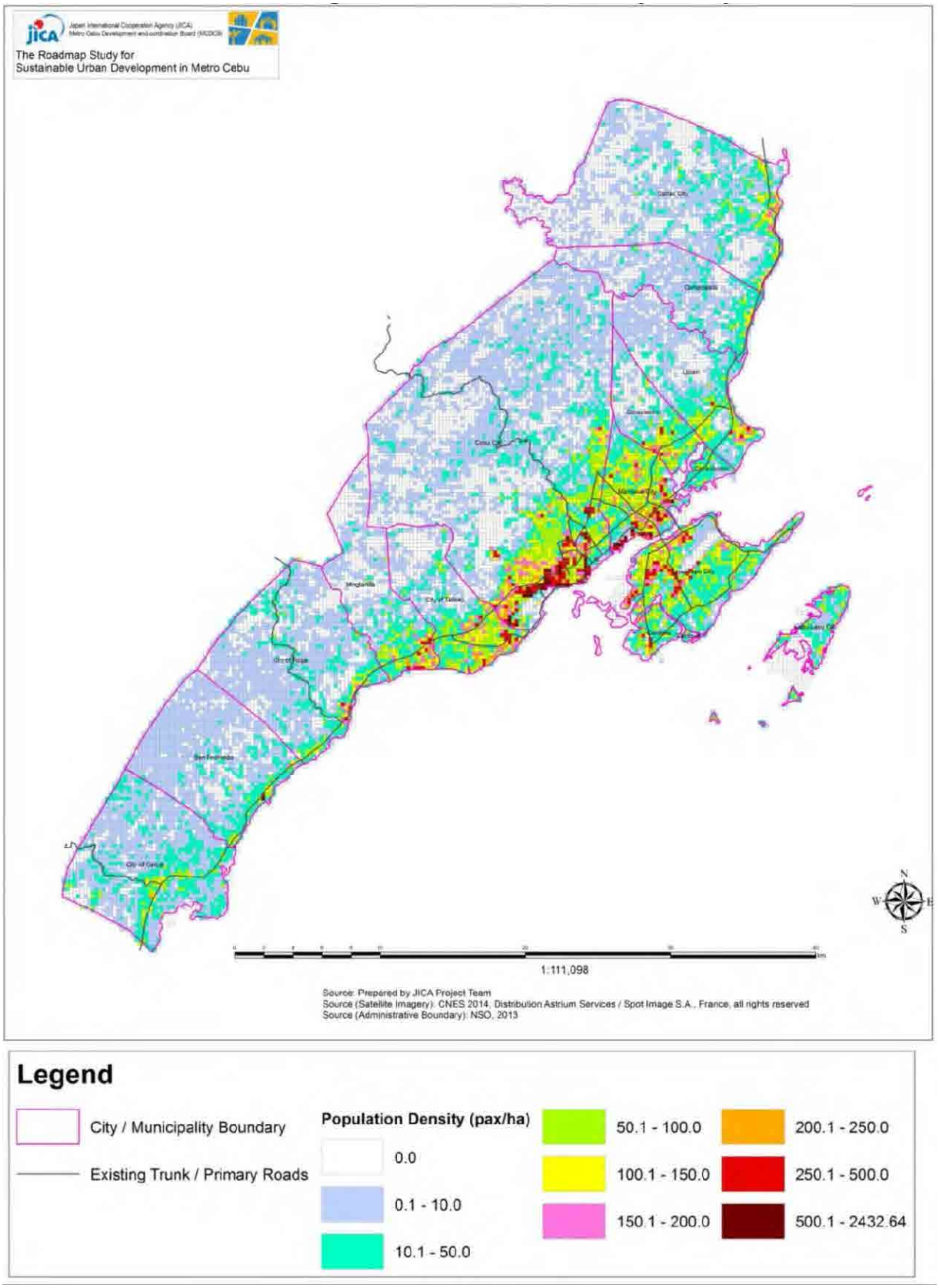
(2) Polycentric and Equitably Developed Urban Areas

4.9 Under this alternative, new workplaces and residential areas will be distributed throughout Metro Cebu. Urban population density will be about 100 persons per hectare and no new urban land with over 150 persons per hectare will be planned. Hillside development will be constrained and favorable urban amenities will be created so as to prevent urban disasters such as landslides and floods.

4.10 The first alternative is the continuation of the existing urban development pattern. Such a monocentric and densely inhabited metropolis will result from slow infrastructure development and poor metropolitan management. In order to realize a polycentric and equitably developed urban place, infrastructure development will take an important role to enhance the development potential of suitable lands for urbanization and guide investment flow to these areas. For industrial development, high-standard highways are essential to connect industrial lands with the port, airport and large cities. For residential development, a railway commuter service must be developed to provide punctual and fast service regardless of road traffic congestion. Incorporation of such prime infrastructures into the spatial plan of Metro Cebu is recommended for its metropolitan planning.

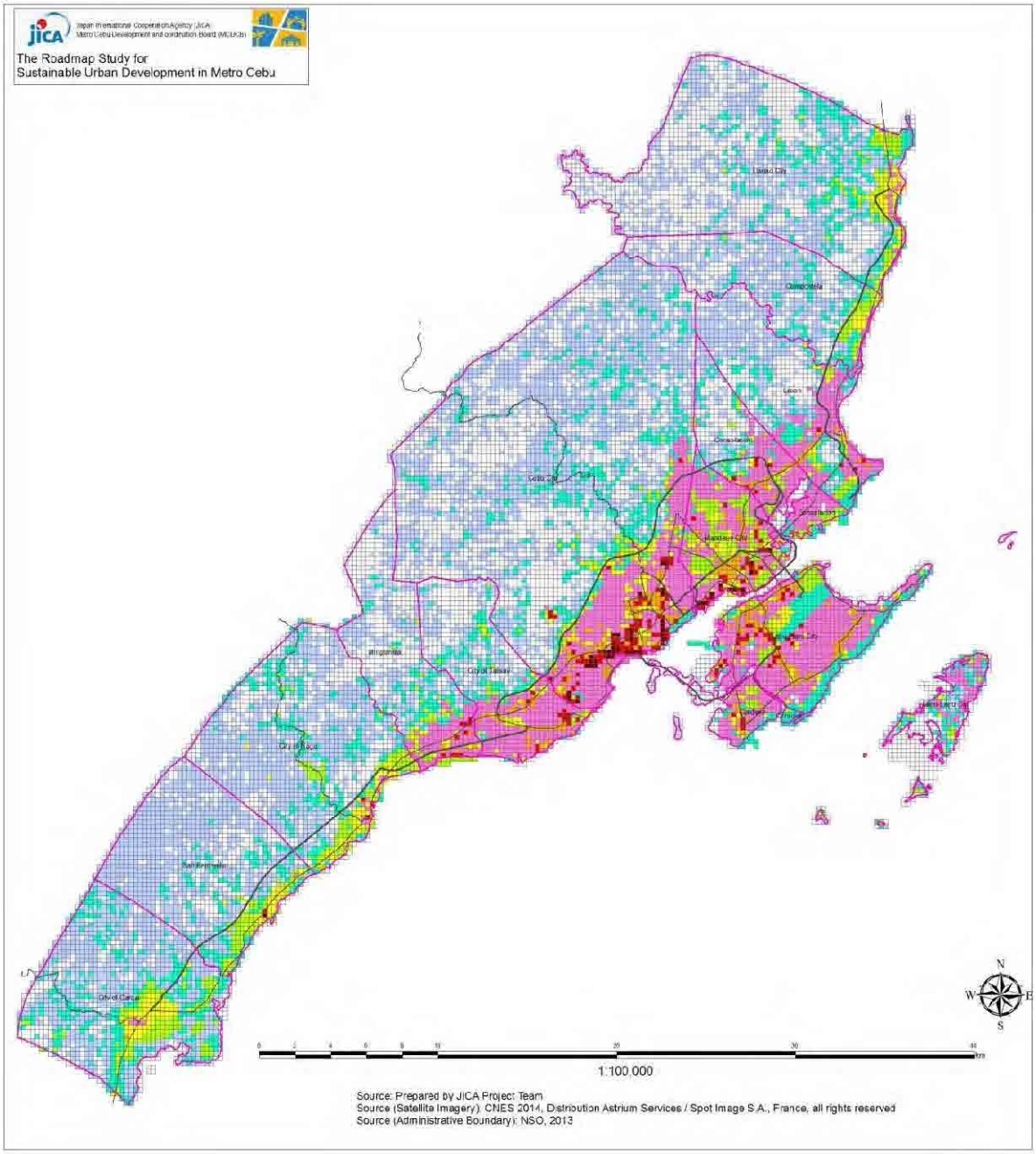
4.11 The roadmap study has physically analyzed Metro Cebu in terms of 17,600 grids. Population distribution patterns have been prepared taking into account existing land use and possible future land use in the grids. Figure 4.2.1 shows the existing population distribution as of 2010. Figure 4.2.2 shows a future population distribution pattern under the monocentric and densely inhabited metropolis while Figure 4.2.3 shows another pattern under the polycentric and equitably developed urban areas.

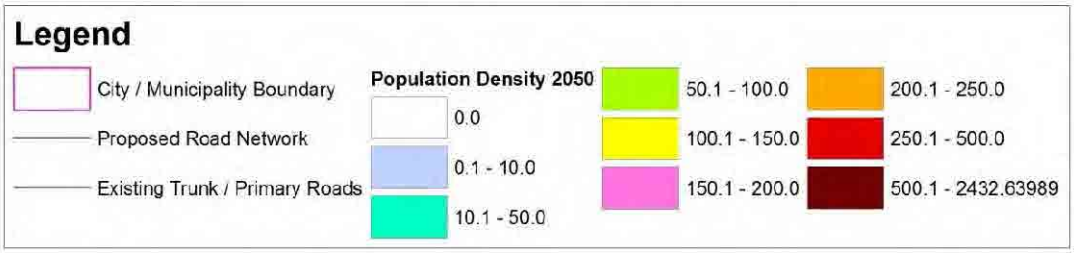
[1] Metro Cebu Land Use and Transport Study (MCLUTS) in 1981.
[2] Metro Manila had a population of 11.9 million in 2010. The land territory (638 km^2) is largely flat, enabling it to support high density habitation (186 persons / ha).



Source: JICA Study Team.

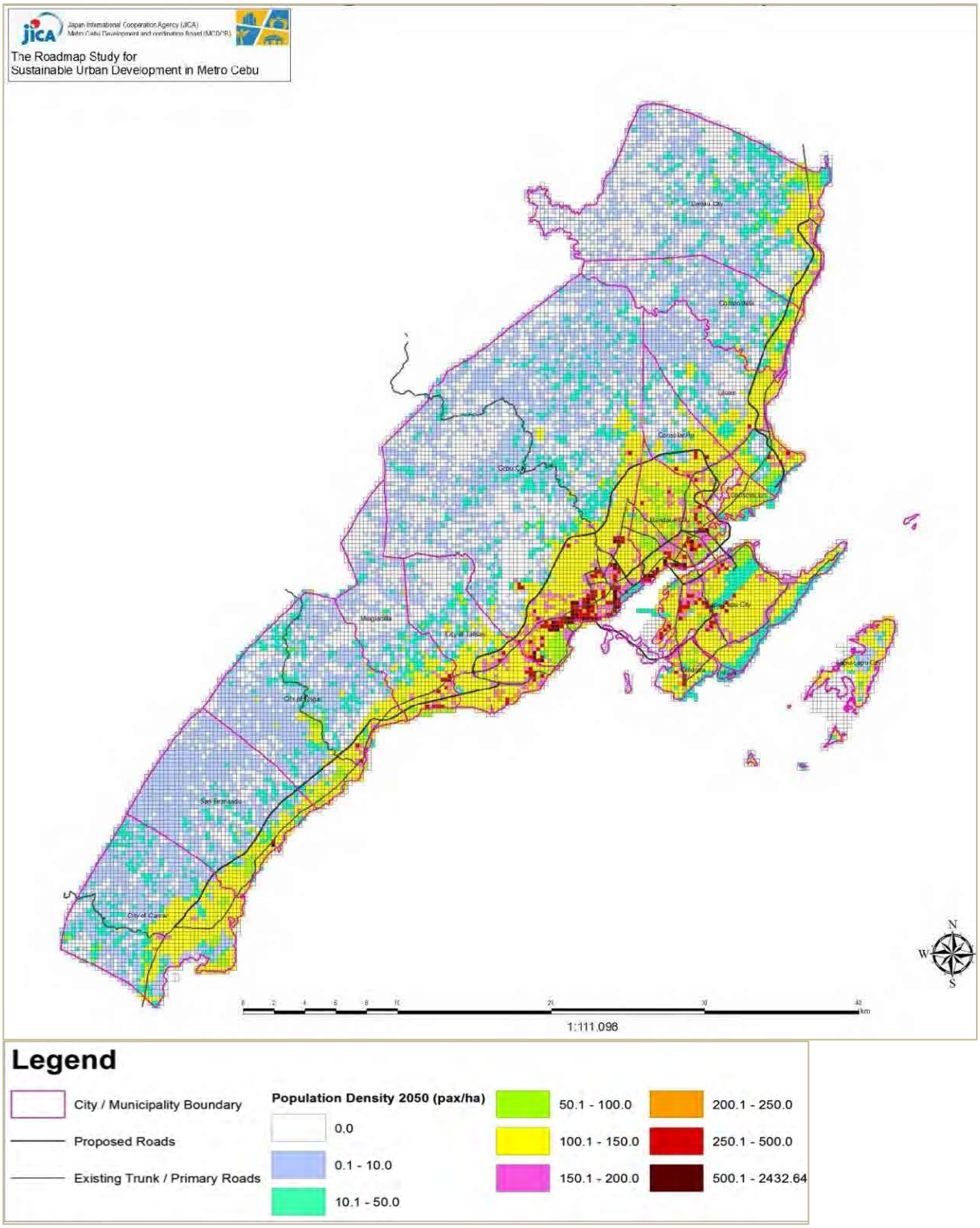
Figure 4.2.1 Existing Population Distribution in 2010





Source: JICA Study Team.

Figure 4.2.2 Monocentric and Densely Inhabited Urban Areas in 2050



Source: JICA Study Team.

Figure 4.2.3 Polycentric and Equitably Developed Urban Society in 2050

2) Urban Structure and Urban Functions

4.12 In Metro Cebu, the following viewpoints are crucial to design an urban structure and urban functions:

(i) Development and preservation policy which addresses inherent local history, culture and geographical conditions;

(ii) Creation of innovative and livable urban environment; and

(iii) Inter-connected and compact urban areas.

4.13 In order to embody the abovementioned viewpoints, the Study applies three planning devices which have been discussed locally. They are:

(1) Urban Cluster System

4.14 Metro Cebu is divided into six clusters to design urban functions. For example, Danao City and Naga City will be developed as growth poles next to the core area (Cebu City, Mandaue City and Lapu-Lapu City).

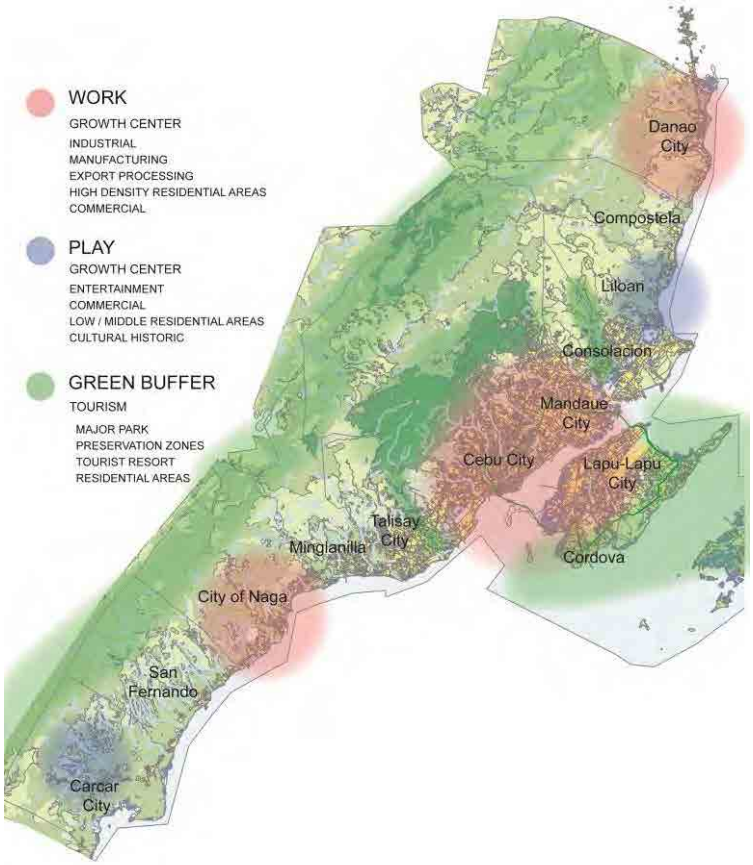
(2) Urban Limits

4.15 Urban limits are set on hilly slopes so as to form less hazardous urban space from landslides and floods. The proposed Metro Cebu Outer Circumferential Road, in particular, will be able to control urban development when no arterial road is planned at the upper lands above the circumferential road.

(3) Green Loop

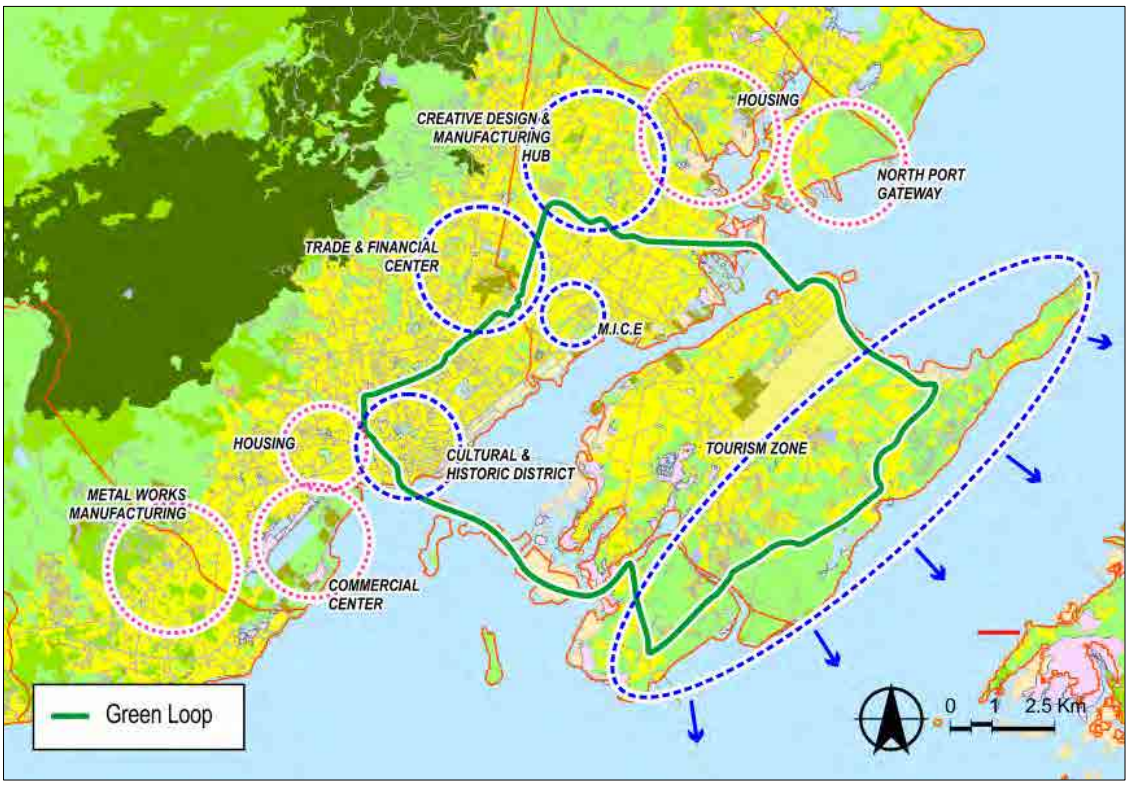
4.16 The Green Loop gives two re-definition concepts on and along the designated road space at Metro Cebu's core area (Cebu City, Mandaue City and Lapu-Lapu City). One is the re-definition of a road user to include not only a road vehicle owner, which is a small percentage of the citizenry, but also pedestrians and bicycle users. The Green Loop project aims to develop comfortable road space for all users. Another re-definition is to identify urban boundary which should promote more attractive urban functions in the Green Loop, namely, Cultural and Historic District, Trade and Financial Center, Meetings, Incentives, Conventions and Exhibits (MICE) Center, Creative Design and Manufacturing Hub, and Tourism Zone.

4.17 The following figures have been prepared to elaborate on these planning tools. Figure 4.2.4 illustrates the concept of urban structure and urban functions in Metro Cebu with green buffers. Figure 4.2.6 depicts seven urban clusters with the projected year 2050 population. Figure 4.2.5 shows the concept of the Green Loop.



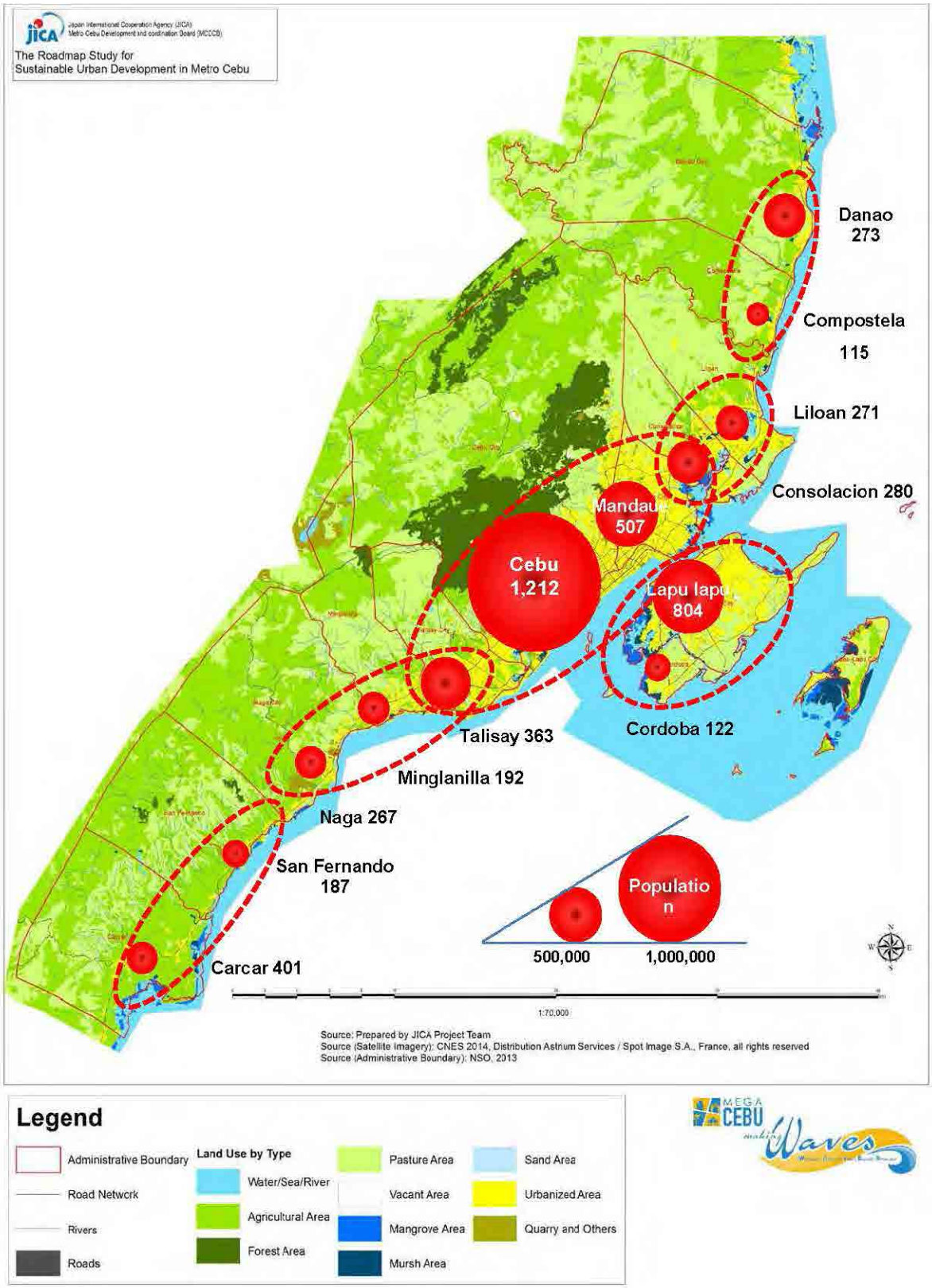
Source: JICA Study Team.

Figure 4.2.4 Concept of Urban Structure and Urban Functions in Metro Cebu



Source: JICA Study Team.

Figure 4.2.5 Concept of the Green Loop



Source: JICA Study Team.
Note: Population figures per city/municipality denote thousand people.

Figure 4.2.6 Urban Cluster System with Population Distribution in 2050

3) Reclamation

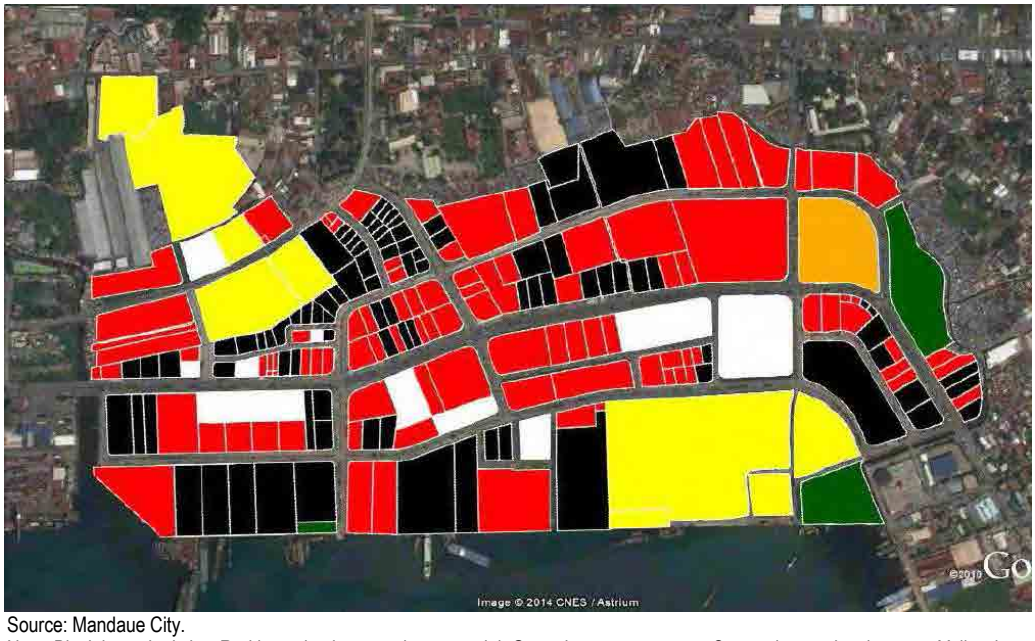
(1) Past and Present Experience

4.18 Reclamation has a large impact on the urban structure. Metro Cebu has experienced large-scale reclamation projects in Cebu City and Mandaue City and small-scale projects in Naga City and other areas. These reclamation projects have contributed to the development of prime infrastructure and essential urban functions. On the other hand, the projects--from preparation, reclamation and development of sites--were costly and time-consuming.

4.19 Since the 1980s, there have been two large-scale reclamation projects in Metro Cebu, namely: the South Point Project in Mandaue City and the SRP Project in Cebu City. The former, covering some 180 ha, reclaimed the land in the 1980s and started development since the 1990s. The project is now at the final stage where numerous logistics and commercial buildings are being built. Even though there are still empty blocks, most of them have been sold and site development is in the pipeline (see Figure 4.2.7). It is noted that the project takes about four decades from reclamation to building development.

4.20 The SRP Project, covering 300 ha, is also time-consuming. The reclamation phase, except the remaining pond of about 60 ha, was done rather smoothly in the late 1990s with the support of Japanese official development assistance (ODA) funds for the reclamation and the reclamation road. Until today, however, SRP development has been slow. Accelerated development pace is expected after the opening of SM Seaside, the largest shopping mall in Metro Cebu, in 2015.

4.21 Naga City constructed a small reclamation site for its city hall, the ocean park and a roll-on/roll-off (RO-RO) port to be developed. The city administration has recently acquired an environmental compliance certificate (ECC) to expand its reclamation site by 11 ha. Such a small-scale reclamation project may be applicable to other LGUs which are distant from the Metro Cebu core area.



Source: Mandaue City.
Note: Black lots – logistics, Red lots – business and commercial, Green lots – open space, Orange lot – redevelopment, Yellow lots – undeveloped with development plans, White lots - unsold.

Figure 4.2.7 Progress of the South Point Reclamation Project

(2) Future Perspective

4.22 From the abovementioned metropolitan experience, reclamation projects have their pros and cons. It is advantageous to create large lots and adequate infrastructure as planned. Compared with ordinary land development, however, reclamation is costly and time-consuming. Its impact on the marine environment must also be considered.

4.23 Many LGUs in Metro Cebu have reclamation plans and concepts for port and industrial development. However, all these plans and concepts may not happen. In the event that they do happen, most of the necessary workplaces up to 2050 would be located at the reclamation sites which would force workers to take inconvenient commuting trips. Furthermore, such dynamic reclamation projects would require movement of huge volumes of earth and sand, resulting in accelerated hillside development.

4.24 On the other hand, it will be impractical not to consider reclamation projects during the roadmap planning period. There are high potential sites with attractive development plans and adequate environmental considerations which may justify considerable investments in reclamation projects. Towards 2050, such well-planned reclamation projects will be implemented within the scope of sustainable metropolitan management.

4.25 The study has collected some large reclamation projects and concepts of over 100 ha, as follows:

(i) Mandaue's Global City Project (131 ha);

(ii) North Lapu-Lapu Reclamation Project (400 ha); and

(iii) Navy's Reclamation Project in Lapu-Lapu City (140 ha).

4.26 Cebu City does not have an original coastline anymore. But Mandaue City and Lapu-Lapu City have potential offshore sites for integrated urban development.

4.27 Some LGUs are considering the following small reclamation projects and concepts of below 100 ha:

(i) Consolacion's Container Terminal Project (80 ha);

(ii) Minglanilla's Port and Industry Development Project; and

(iii) Naga City's Reclamation Expansion Project.

4.28 The development scale and timing of these reclamation projects largely depend on the amounts of committed investments. Consolacion's project expects government infrastructure funding while private investment is anticipated by Minglanilla. Naga City intends to mobilize its own resources to gradually expand its reclamation project.

4.3 Greening Measures in the Urban Areas

1) Urban Development and Greening

4.29 The development model discussed here is that of "smart growth" specifically focused on urban greening to provide a superior environment and energy-efficient urban space. With smart growth, inherent natural and cultural resources of a place are preserved and enhanced to promote the well-being of the public. The following are measures to infuse green design in urban spaces.

(1) Roads

4.30 Roads are a component of the open space that form the urban fabric and are designed to enhance circulation areas and accessibility to individual destinations. Moreover, roads are vital to firefighting and fire mitigation. Countries with strict fire codes require at least 12 m of road abutting high rise buildings for fire safety measures.[3] A citizen's experience with well-designed roads contributes to his/her sense of livability. A common situation in Metro Cebu is a narrow road flanked by informal settlers, living in less than ideal habitats. There are also wider roads, unzoned, and where cars, trucks, motorcycles and bicycles ply together at any given point. There have been many accidents on these roads and recent advocacies have asked for zoning on the roads for equitable access by the Road Rev Movement, the bicycle lane advocacy of the Movement for Livable Cebu, together with several bicycle groups in the city. The same situation is seen on the collector roads, some of which do not have pedestrian lanes, and in areas where there are pedestrian lanes but are also used for parking space or for commercial use. Figure 4.3.1 shows ambulant vendors and motorcycles on the pedestrian lanes. Figure 4.3.2 shows pedestrian lanes converted into outdoor storage places for stores.

Source: JICA Study Team.

Figure 4.3.1 Commerce on Pedestrian Lanes

Source: JICA Study Team.

Figure 4.3.2 Pedestrian Lanes as Store Storage

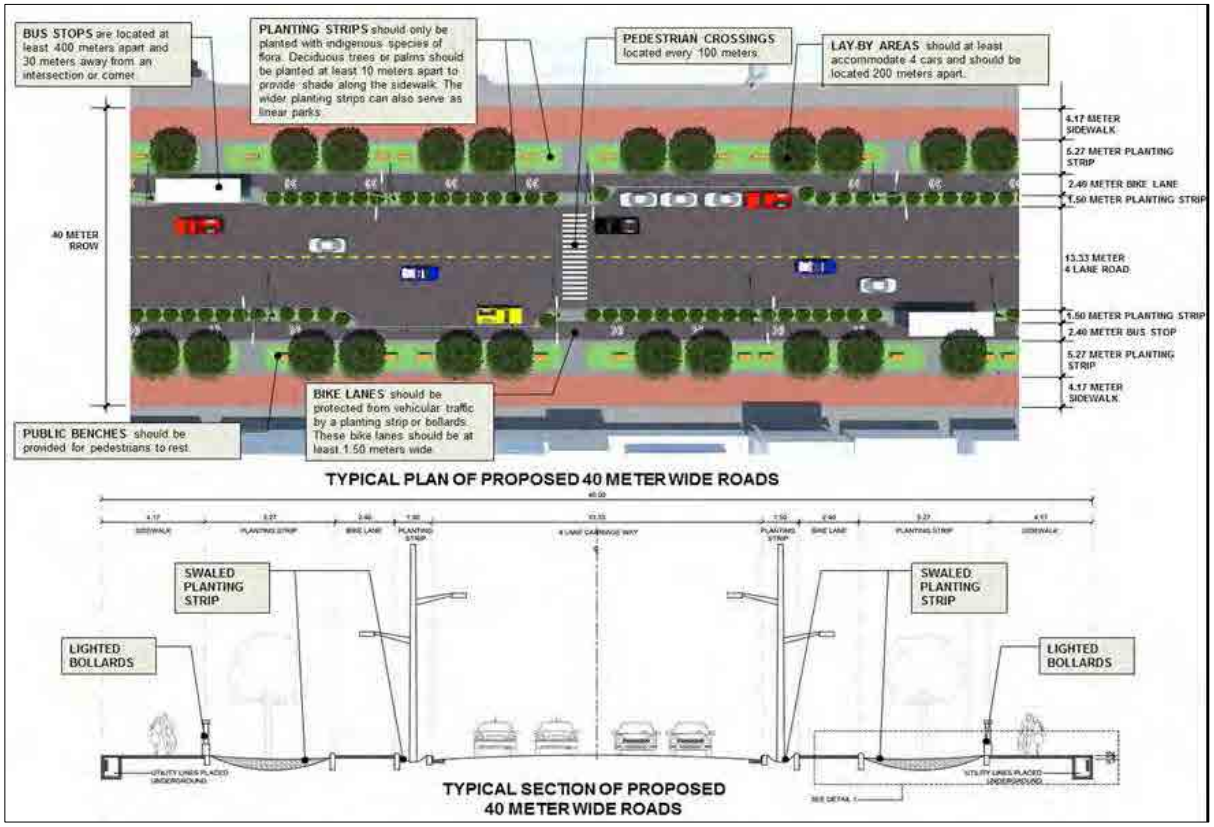
4.31 Roads and streets are a land use category by itself because they are the main venues of accessibility for the citizens. Classification of land use for the roads automatically puts in development design policies/guidelines for streetscapes. Metro Cebu streets are seen and experienced immediately by everyone and usually give the first impression as to whether the city is livable or not. Current land use and zoning practices focus on policies regulating the usage of properties only and do not include design development guidelines for the streetscape for the different modalities of transport (motorized, non-motorized and walking pedestrians). Current roads are not sympathetic to the density of users in a particular setting.

4.32 The design of roads requires not only an engineering study but a social sensitivity and environment impact study as well. Moreover, the studies on the design of roads must address the rights to economic enhancement for each citizen. Roads are important in delivering basic services to people and are a major factor in creating a quality of life for its citizens. However it is often found that there are densely populated areas with a 1 m pedestrian lane (using here the minimum requirement for pedestrian

[3] www.nafoindia.org

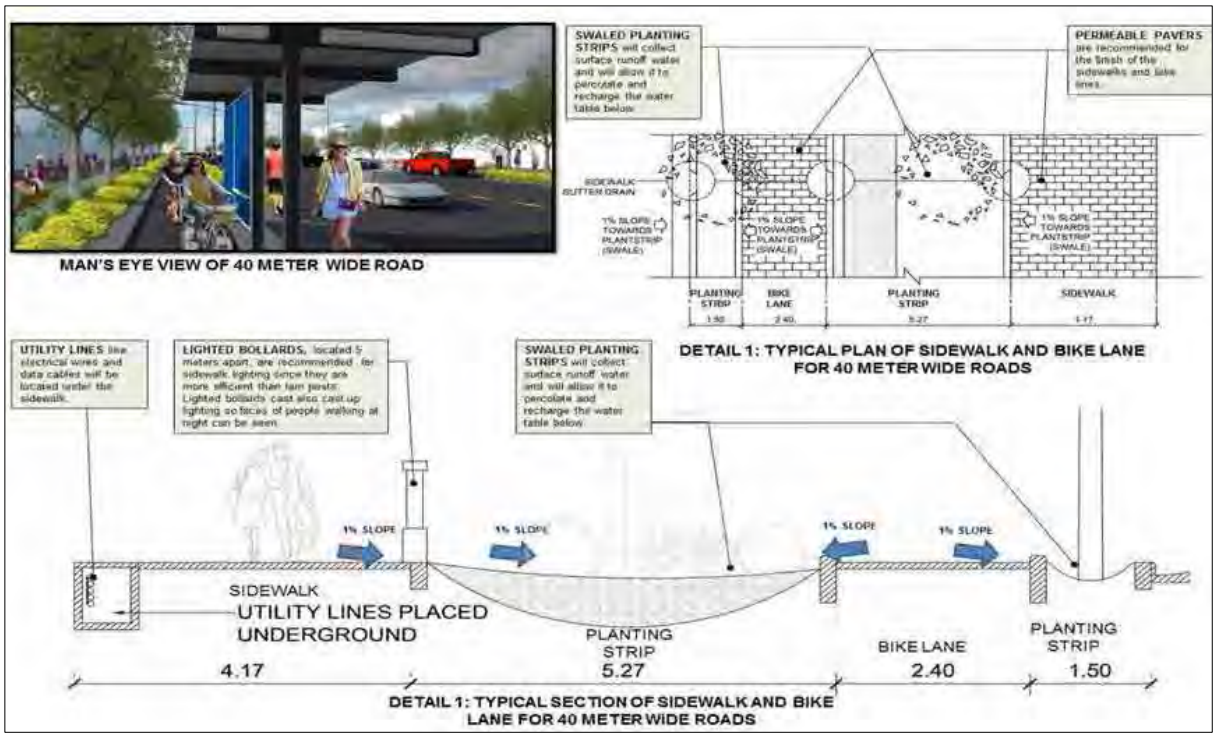
lanes, as per the National Building Code). While roads are designed and built for mobility, roads in Metro Cebu do not have adequate conditions for the majority of the people who do not have cars and for those who choose to walk. This practice directly contributes to increasing poverty levels by not addressing the basic need of equitable transport accessibility for the common people and acknowledging their economic status.

4.33 In green urbanism, roads need to be sensitive to the transportation choices of users. Trees and street furniture make the roads a seamless experience from indoors to outdoors, thus affording a sense of well-being for its users. Figures 4.3.3 to Figure 4.3.6 illustrate some suggestions on greening 40-m and 20-m roads.



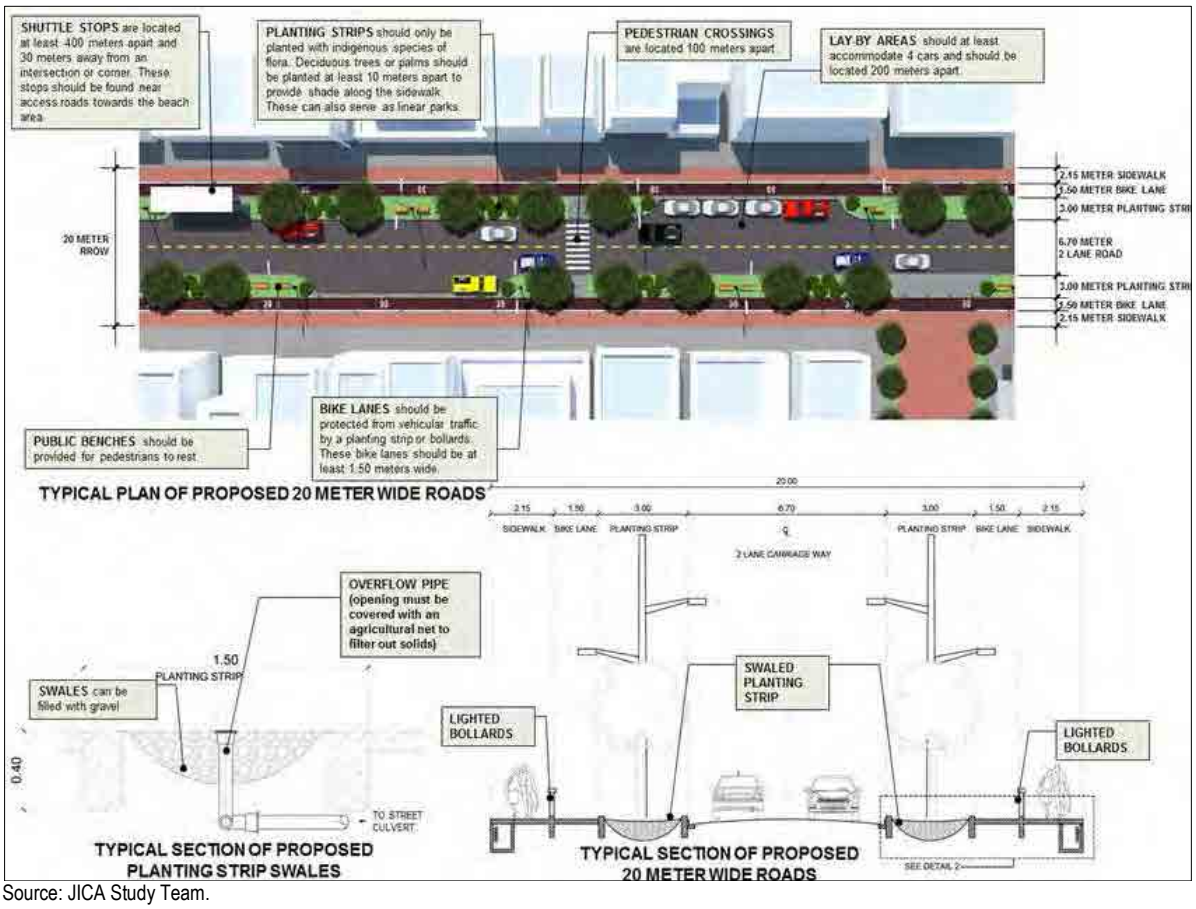
Source: JICA Study Team.

Figure 4.3.3 Suggestions for Arterial Roads (40-meter RROW)



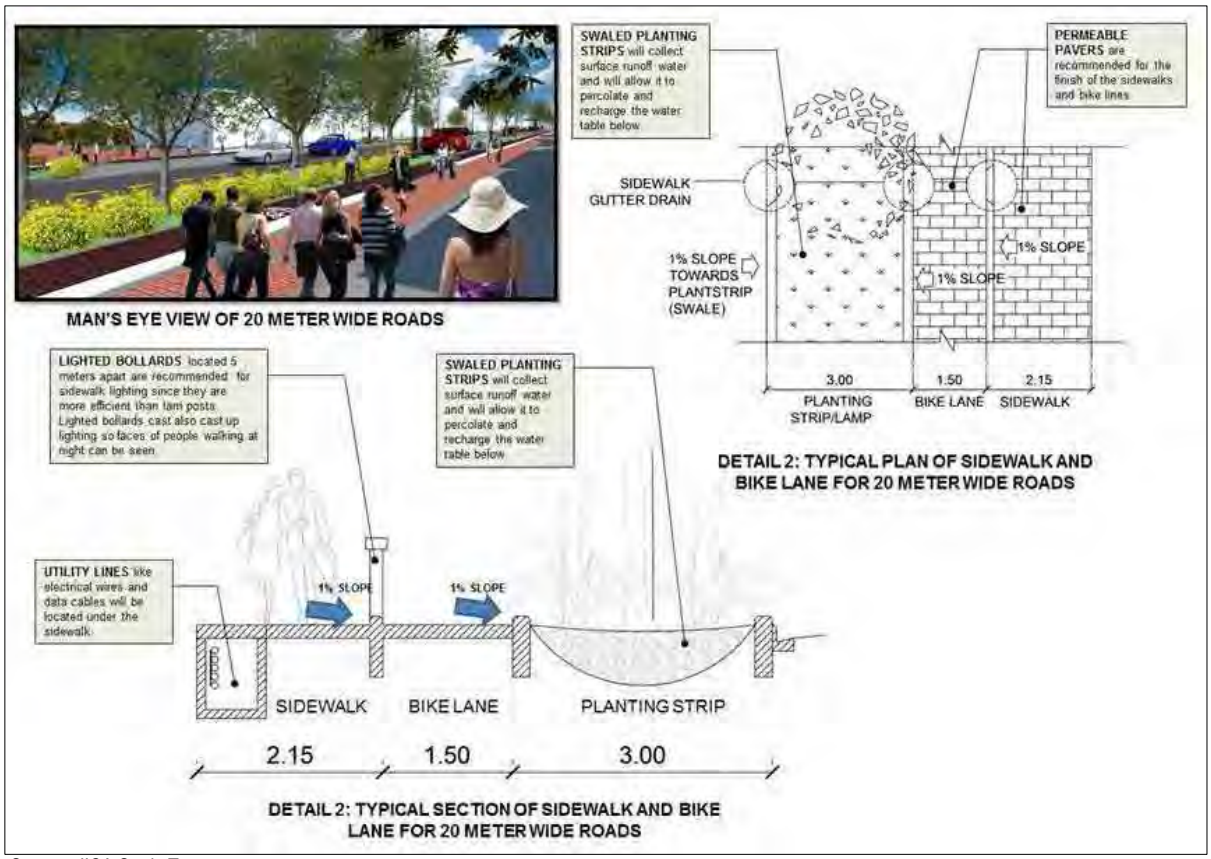
Source: JICA Study Team.

Figure 4.3.4 Details of RROW of 40-Meter Roadway



Source: JICA Study Team.

Figure 4.3.5 Suggestions for Collector Roads (20-meter RROW)



Source: JICA Study Team.

Figure 4.3.6 Details of RROW of 20-meter Roadway

(2) Parks and Open Spaces

4.34 There are few public parks in Metro Cebu. With the continuing real estate development for high rise condominiums proposed to house employees of fast-growing industries in Cebu, there is now a need for open spaces necessary for balanced health conditions of the people. The city needs these open spaces for fire mitigation purposes as well. Densely populated areas in Cebu see children playing on the streets. Metro Cebu's hilly lands have the potential for development into forest parks and grassland parks with minimal activities, strictly adhering to eco-protection principles in their use. One such measure would be to build canopy walks on stilts so as not to disturb the natural terrain. Access to these areas likewise has to network with the existing road systems.

4.35 Pedestrianization of chosen streets into walkable places for relaxation can be arranged at specific times of the day, especially towards the evening. This is very prevalent in Madrid, for example, where precious urban space enjoys multiple uses for the benefit of the citizens. These spaces offer trees and sitting areas within the city. One other road design strategy would be to form curvilinear roads instead of straight roads, in areas with dense commercial activity. This would encourage pocket resting areas of greenery along the road.

(3) Special Connective Pedestrian Walkways

4.36 This strategy involves another level for the walking public especially in areas with dense buildings. These pathways connect buildings on the upper floors and are open 24 hours a day. Skywalks connecting buildings offer faster mobilization as people

do not have to walk on the street level and traverse through traffic lights, and are also generally safer. They have the added advantage of walking among the tree canopies as well and not at the level of emissions of motorized transportation modes on the street.

4.37 Under this strategy, buildings in the urban area, especially those side by side with each other, will now be opening up part of their outer façades to the walking public, connecting each building most probably on the second floor level. Makati City in Metro Manila offers good examples of such pedestrian walkways as well as parks and open spaces (see Figure 4.3.7)

Source: Makati Greenbelt.

Figure 4.3.7 Image of Green Skywalks

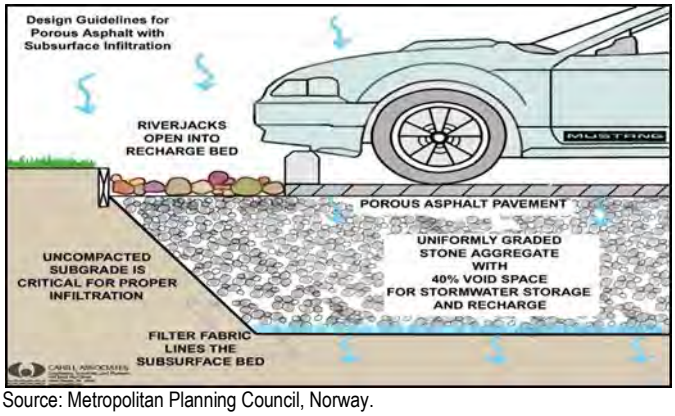
(4) Parking Lots and Pavements

4.38 Parking lot surfaces, especially large areas, are best made permeable within Metro Cebu (see Figure 4.3.8 and Figure 4.3.9). There are numerous aquifers under the ground of the Cebu watershed ecosystem, and the present culvert system has always experienced problems as they are over-utilized. With the onset of climate change, Metro Cebu has now experienced more and stronger rains in recent years. Republic Act 10121, an "Act Strengthening the Philippine Disaster Risk Reduction and Management System," provides for the national disaster risk reduction and management framework and institutionalizes the national disaster risk reduction and management plan. With this plan, it is imperative for development efforts to address disaster mitigation. Through educational campaigns, the understanding of the water cycle where rain needs to replenish aquifers is best undertaken for the citizens in order to gain participation and individual contributions in this sector.

(5) City Waste Water Reuse

4.39 Metro Cebu's present waste water system connects the overflow pipes of individual septic tanks into street culverts that collect street water runoff, and eventually flowing out into the seas and rivers. The JICA roadmap study has made proposals for sewage treatment plants located in strategic points near the major rivers. Water from tertiary waste water treatment systems of sewage treatment plants proposed in the study can be reused for irrigation of the public greenery of cities and municipalities.City nurseries can also be developed within these areas for the production of trees and plants to plant around the cities and municipalities. In addition, these reservoirs or

holding ponds, if sizeable enough, can also be developed into ecotourism parks, thus addressing the need for more open spaces in Metro Cebu for its people. Tertiary treatment waters can be made available for fishing and non-contact water sports as well.



Source: Metropolitan Planning Council, Norway.

Figure 4.3.8 Illustrative Permeable Parking Lot

Source: Metropolitan Planning Council, Norway.

Figure 4.3.9 Water Flow from Porous Asphalt

4.40 The La Mesa Eco-Park in Quezon City, Metro Manila is one such example of water management facility that is enjoyed by the residents as a park destination (see Figure 4.3.10). The park has been developed with trees, landscaped gardens, pathways and bike paths, showcasing how water management systems in localities can coexist with social activities of its people.

Source: http://www.clickthecity.com/travel/a/1018/la-mesa-eco-park-paradise-found.

Figure 4.3.10 La Mesa Eco-Park in Quezon City

(6) Waterways of Cebu

4.41 There is a dire need to revitalize the major river systems and minor rivers in Metro Cebu. As shown in Figure 4.3.11, some residents live very close to or along the Mahiga Riverbanks and waste finds its way into this and other rivers as well. Laws provide buffer zones to remain open and for public use, intended to keep the quality of rivers for healthy fisheries as well as waterways. Within the norms of the Smart Growth model, programs need to address the poor quality of the metropolis' waterways. This will entail a social, economic and physical reform agenda to convert the waterways' conditions at par with livability standards.

4.42 There are three major rivers in Metro Cebu, namely: Mananga, KotKot and Lusaran Rivers. Minor rivers include Lahug (or Mahiga), Bulacao, Buhisan, Guadalupe, and Butuanon Rivers. These provide natural drainage systems and their surrounding areas can be developed into water parks. However, the rivers most often become settlement areas for informal settlers migrating to the cities, and this has caused environmental and social problems. The waterways have become recipients for household wastewater, rainwater runoff, and often times, solid waste as well.

Source: Cebu Metro News.

Figure 4.3.11 Informal Settlement along Mahiga River

2) Preservation of Major Rivers and Ecotourism Park

4.43 Being an island, Cebu holds as one of its life sources the waterways running around and throughout the island. Unfortunately, through inappropriate and sporadic land use, improper dumping of wastes, unbridled urban development, and general apathy towards the environment, the once living rivers–Guadalupe, Lahug, Mahiga, Buhisan and Bulacao--are now “dead.” The sheer abundance of waters in the island setting of Cebu has evolved into a situation where clean water supply is now a problem.

4.44 Cebu Uniting for Sustainable Water Foundation (CUSW) has been at the forefront of local efforts to save, protect and revive water resources such as watersheds, groundwater aquifers, mangrove areas, and waterways. The current state of the rivers is probably the most visible sign of the present problems Metro Cebu faces in the realm of water management. The people living in the waterway areas have been the main targets of CUSW in engaging communities’ unsustainable water management, while still addressing their basic needs. CUSW has integrated their information base with the academe, which develops the future managers of Cebu. The academic sector in Cebu has projects in partnership with CUSW in sustaining the province's waters.

4.45 The "Open Space System Networks for Mega Cebu–Ecotourism Development for River Parks" Project was proposed by CUSW with a three-fold mission: to improve the economic, social, and environmental conditions of Cebu. The most visible symbol of mismanagement of the water resources has now the potential to serve as the strongest impetus toward a renewed interest in revitalizing the localities surrounding them. In the context and framework of the research done for this proposal, the Integrated Watershed Resources Management (IWRM) approach, the watershed is considered as a planning unit mainly due to its social, economic and physical impacts.

4.46 The periphery of the waterway areas features a vast region of hilly land draining into these rivers and streams. The draining fields are referred to as the watersheds. In Cebu, these are the Lusaran-Combado River watershed, Kotkot watershed, Mananga River watershed, Buhisan watershed, and Bulacao River watershed. Revitalizing the rivers begins with protecting these watersheds located at higher altitudes, where communities also thrive.

4.47 In the urban areas, the development of the buffer areas of the rivers onto promenade parkways can function with natural drainage systems and provide infiltration bays. Part of revitalizing activities will include the removal of contaminants, such as garbage, effluents, and waste products from adjacent communities. A social program relocating informal settlers away from the edge of rivers would be a challenging task. A program for wastewater treatment for the manufacturing factories can be facilitated employing natural or biosystem approaches, such as engineered wetlands. Abandoned factories and industrial sites can be reused and adaptive uses can be made for these structures.

4.48 A buffer zone of three meters or more from the riparian zones, as mandated by PD 1067, will provide ample space for public use such as landscaped promenades where erosion control is also a direct benefit. The river parks will offer accessible and transformative spaces for urban dwellers, encouraging walking, exercising and meditation along its path. They will be an oasis of quiet and relaxation within the urban core. Cleaner waterways and riparian zones will create a life-supporting system for healthy biodiversity and psychological well-being.

4.49 Figure 4.3.12 shows a suggestion by CUSW on the treatment of riverbanks in the urban areas. Immediately, Metro Cebu will have increased its area for much needed open spaces and parks with the development of the riverbanks.

Source: Cebu Uniting for Sustainable Water Foundation.

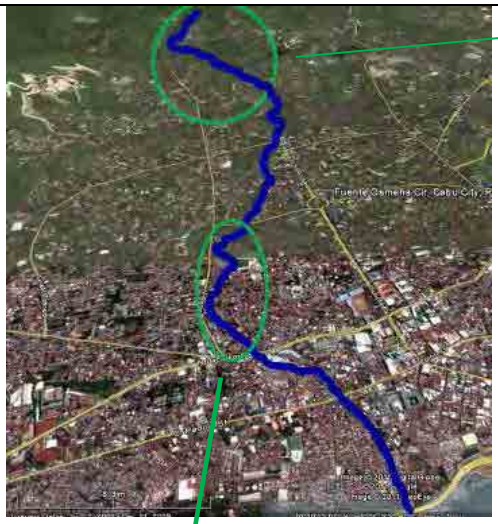
Figure 4.3.12 Concept of CUSW Proposal on Riverbanks

4.50 The Roadmap Study analyses river environment improvement along the Guadalupe River flowing in Cebu City. The improvement plan is divided into two parts: mini dams and gabion dams will be developed to prevent floods and irrigate waters for agricultural use in the upper zone and riverside open spaces will be converted to urban parks together with massive riverine greenery in the middle stream zone.

4.51 The project costs are estimated at PHP233 million. The project effects of flood control and riverine beautification may justify the project costs and get citizen consent. Implementation difficulty comes from a variety of stakeholders. Cebu City is only a stakeholder to be related to both upper and middle stream zones. When a similar riverine beautification project is implemented at the lower stream zone of Guadalupe River, more difficulty must be faced due to many informal settlers.

4.52 More than 10 rivers flow within Metro Cebu. The longest river of Mananga is no more than 24.5 km. Therefore, compact river environment management is possible. Since large open spaces remain along the rivers of Mananga and Cansaga, they can be improved to ecological parks.

4.53 It is suggested that a river environment improvement plan be prepared at every major river in Metro Cebu. Taking no successful practice in the past into account, it is important to experience a good practice at any of the major rivers.



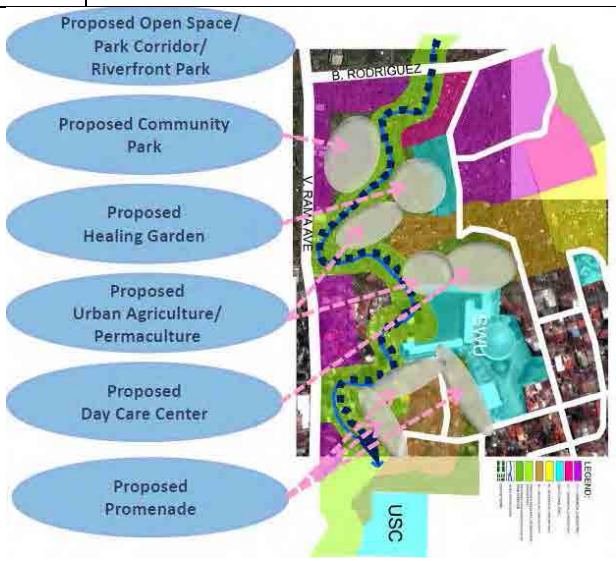
Guadalupe River, Cebu City

(The Upper Stream–Water Resource Preservation and Utilization)

- For flood control and irrigation water, mini dams (eight places) and gabion dams (742 m^3 in total) will be constructed.
- Stakeholders: DOA、DENR、Cebu City and Land owners
- Project Cost: PHP7.6 million

(The Middle Stream – River Environment Improvement)

- Protection of riverside greenery
- Open spaces (public lands and private lands) along the river: To be converted to urban parks
- Stakeholders; Cebu City, local barangays and land owners
- Project Cost: PHP 225 million (aggregated areas of 5 ha)



Urban Parks Layout Plans

Community Park

Daycare Center

Source: CUSW Foundation.

Figure 4.3.13 Water Source and River Environment Improvement Plan of Guadalupe River

4.4 Metro Cebu Spatial Plan

1) Confirmation of Existing Land Use

4.54 At the beginning of the Study, there was no existing land use map available in Metro Cebu since individual LGUs prepared their existing land use maps at different scales, categories and drawing methods. In order to confirm existing land use, JST organized a workshop to coordinate such identified issues and surveyed an original map. Figure 4.4.1 shows all the LGUs' existing land use maps in mosaic while Figure 4.4.2 shows the existing land use confirmed by the Study.

4.55 Based on the existing confirmed land uses, aggregated urban areas account for 15.1% of Metro Cebu's territorial lands. The following major features are observed (see Table 4.4.1):

(i) Among urban land uses, residential use has the largest share, at 10.3% of the total land area and 68.1% of urban areas.

(ii) Roads account for 1.3% of the total land area and 8.4% of urban areas. It is far behind from the satisfactory level, say, 20% in urban areas.

(iii) Among non-urban land uses, agriculture shares the largest, followed by shrub/pasture and forest. Since massive forest land is not dominant, land resilient capacity against heavy rains is not strong.

Table 4.4.1 Areas by Land Use Type in Metro Cebu

Urbanized Area (ha)								
Sub-Total	Road	Residential	Commercial	Industrial	Infra / Utilities	Institutional	Parks and Other Recreational Spaces	Tourism
16,609	1,394	11,316	519	1,385	569	315	1,092	10
15.10%	1.30%	10.30%	0.50%	1.30%	0.50%	0.30%	1.00%	0.00%

Non-Urbanized Area (ha)									
Sub- Total	Agriculture	Shrub / Pasture	Waste / Vacant Land	Water	Forest	Mangrove	Wetland	Sand/ Rock	Quarry & Others
93,397	42,714	38,271	296	1,749	7,905	709	855	20	879
84.90%	38.80%	34.80%	0.30%	1.60%	7.20%	0.60%	0.80%	0.00%	0.80%

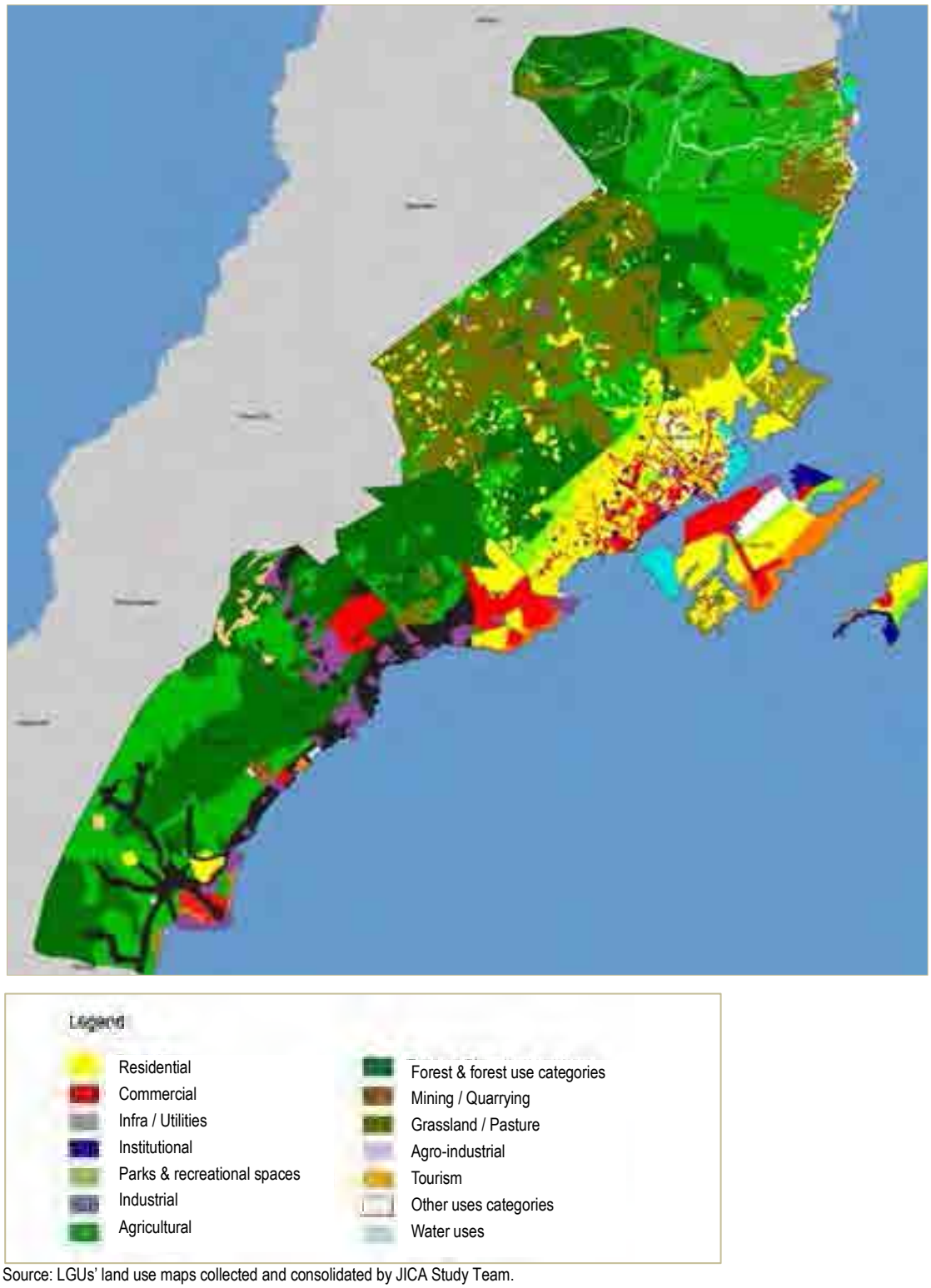
Source: JICA Study Team based on Topographic Map in 1:10,000 scale.

2) Draft Spatial Plan

(1) General Set-up

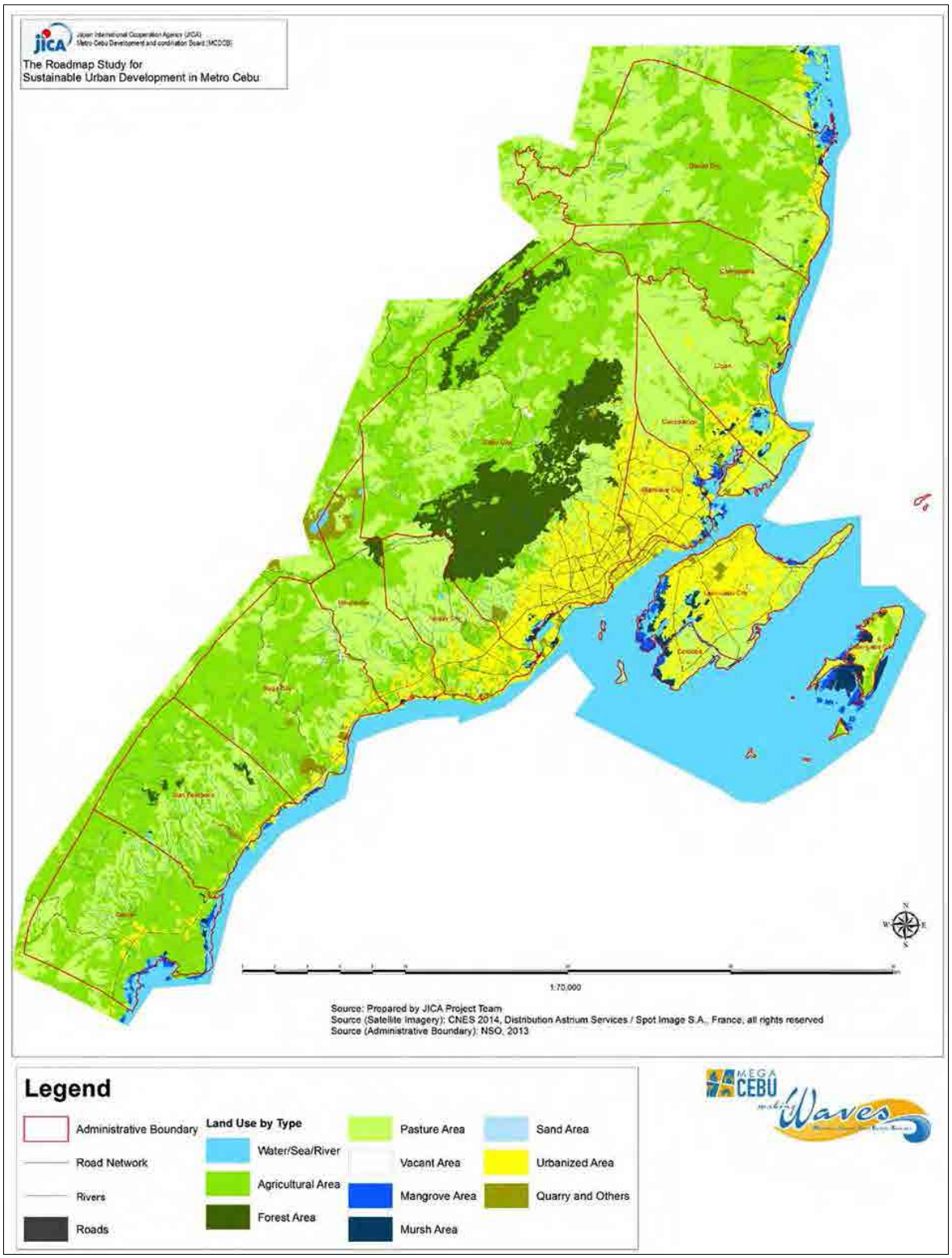
4.56 SWOT (strengths, weaknesses, opportunities and threats) analysis was done by workshop participants in the formulation process of the Mega Cebu Vision 2050. Lack of infrastructure and urban land use plan has been highlighted by the participants. Originating from poor planning, the low level of physical and social infrastructure is recognized as a major bottleneck for development in Metro Cebu.[4]

[4] Workshop on January 23-24, 2013.



Source: LGUs' land use maps collected and consolidated by JICA Study Team.

Figure 4.4.1 LGUs' Land Use Maps in Mosaic



Source: JICA Study Team.

Figure 4.4.2 Existing Land Use Map of Metro Cebu

4.57 To address this, the Study has drafted a spatial plan at a scale of 1:10,000 subject to future urban areas in collaboration with LGU counterparts, relevant central government agencies and local academies and experts. This spatial plan will be finalized as a guiding document when infrastructure projects are planned and private development permits are issued.

4.58 The draft spatial plan illustrates the following planning information:

(i) Urban limits to delineate future urban areas;

(ii) Future land use zones (residential, commercial, industrial, tourism, agriculture, public facilities, infrastructure, parks and open spaces, rivers, preserved mangroves, preserved forest);

(iii) Inter-city roads, collector roads in urban areas; and

(iv) Inter-city rails.

4.59 The lands for public facilities include those for administrative offices, schools, hospitals, libraries, etc. The lands for infrastructure include those for airport, port, station square, sanitary landfill, water supply/distribution, sewerage/septage treatment plant, etc.

4.60 The main points discussed among the LGUs of Metro Cebu and relevant central government agencies at the workshop[5] include, among others:

(i) How to determine and illustrate future urban areas such as urban limits;

(ii) Planning contents of trunk infrastructure which affects metropolitan structure as well as LGUs;

(iii) Planning contents of local infrastructure which will be mainly developed by LGUs and private urban development in the permission process with related LGUs;

(iv) Appropriateness of the planned future land use zones and necessity of further detailed land use zones[6]; and

(v) Others in relation with a long-term spatial plan towards 2050.

4.61 All the LGUs which are going to issue their next CLUPs in the coming years, have signified their intent to incorporate the Metro Cebu Spatial Plan into their CLUPs.

(vi) The Metro Cebu Spatial Plan and its land use table are indicated in Figure 4.4.3 and Table 4.4.2.

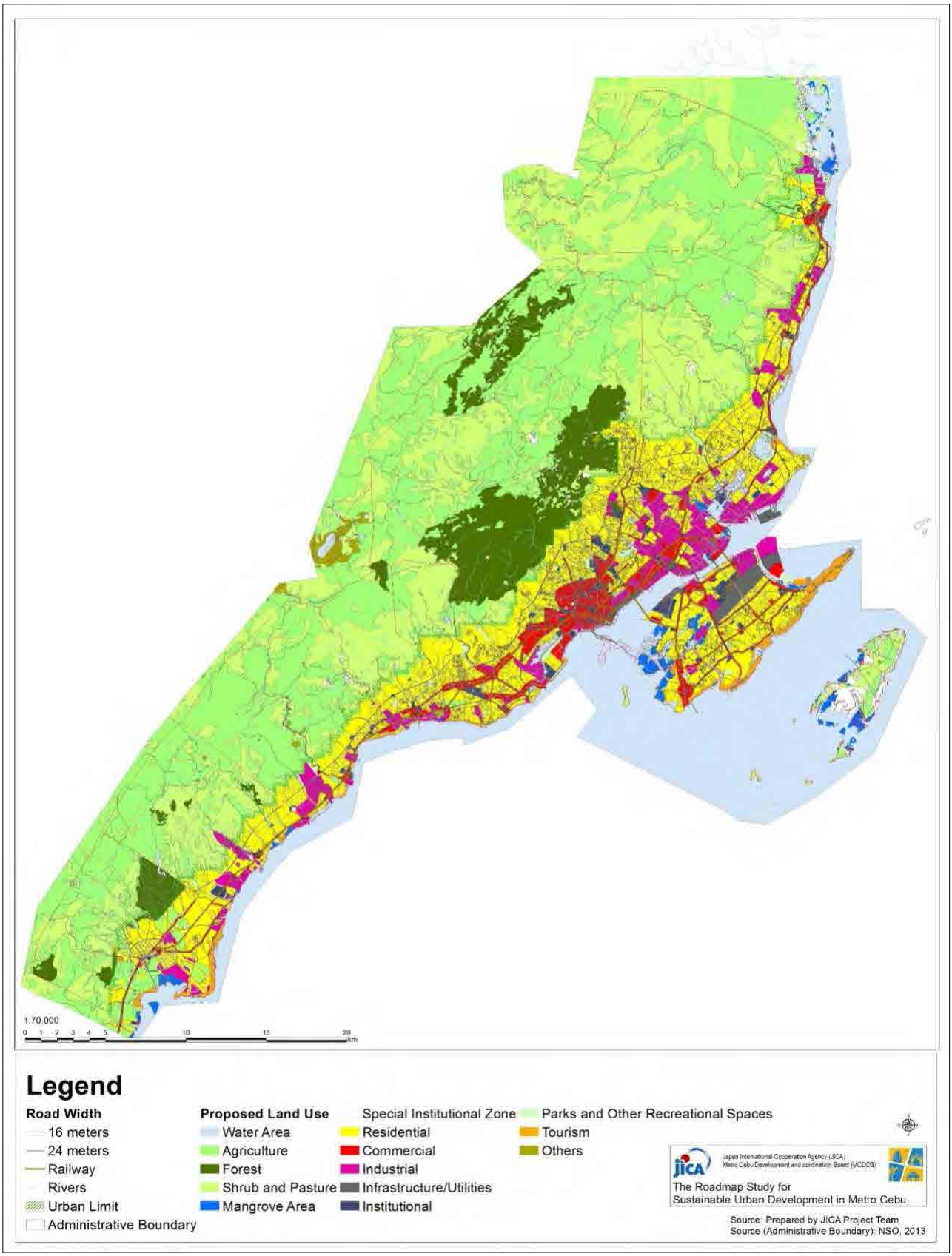
Table 4.4.2 Land Use Plan of Metro Cebu (Year 2050)

LGU	Urbanized Area								Non-Urbanized Area
	Residential	Commercial	Industrial	Infrastructure/ Utilities *	Institutional	Parks and Recreational	Tourism	Sub-total	
Metro Cebu	19,240	2,747	4,224	886	1,146	1,024	956	30,223	71,116

Source: JICA Study Team
Note: * excluding road and rail ROW.

[5] The workshop was held on January 27, 2015 at Harold's Hotel.

[6] According to HLURB's land use zone code, residential lands are further divided into high density residential land (more than 20 houses/ha), low density residential land (less than 20 houses/ha), and social housing land.



Source: JICA Study Team.

Figure 4.4.3 Metro Cebu Spatial Plan

(2) Draft Urban Spatial Plan by LGU

(a) Carcar City

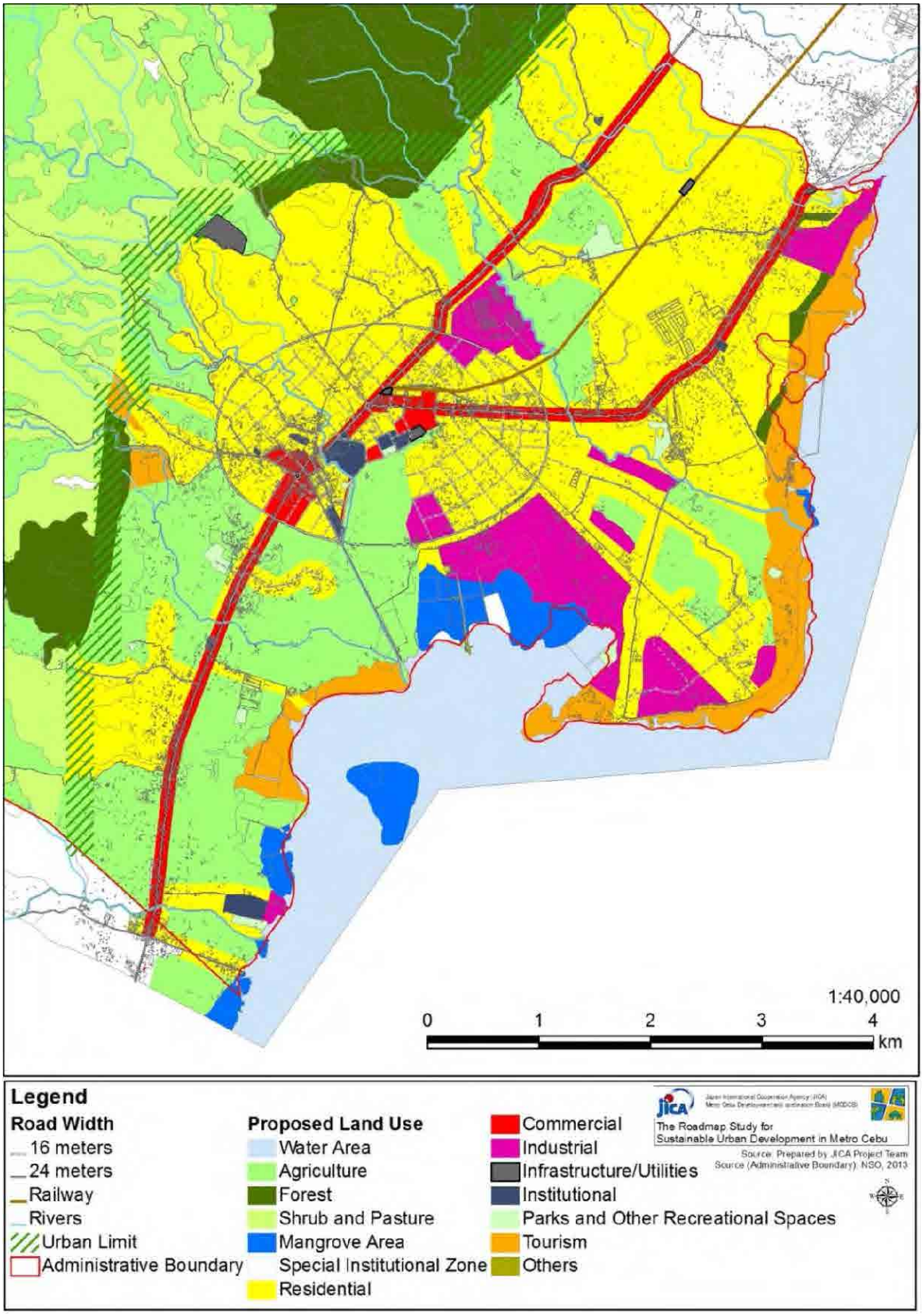
(i) **Demography:** According to the 2010 Census, the total population of Carcar City was 107,300 persons. The annual growth rate from 2000 to 2010 is 1.87% per year, which is the lowest in Metro Cebu. In contrast, the highest population increase of 3.34% per year is anticipated for Carcar during the projection period 2010–2050 due to its abundant lands for future urbanization. The city's population in 2050 is projected to be 400,500 persons.

(ii) **Urbanization:** Currently, urban lands of 442 ha account for merely 3.8% of the city's territory. Excluding hazardous lands (steep lands of over 18% slope and lowlands less than 2 m above sea level), the city has 3,327 ha of land suitable for future urbanization.

(iii) **Land Use Policy:** Urbanization will widely occur except in productive farm lands. Some lowland and mangrove areas will be preserved (see Figure 4.4.4). The city center area will be expanded while agro-industrial lands will be developed to generate job opportunities. Ecotourism will be promoted along selected coastlines.

(iv) **Infrastructure Development Policy:**

- Two trunk roads will serve between the Carcar City center and San Fernando, namely: the Cebu South Road and the proposed Second Cebu South Road.
- MRT South Line will extend to Carcar Center Station. In the city, two more stations will be allocated, i.e., Can-asujan and Perrelos.
- In the city center **a**rea, a dense road network will be developed with a regional public transport terminal.



Source: JICA Study Team.

Figure 4.4.4 Draft Spatial Plan for Carcar City

(b) **Cebu City**

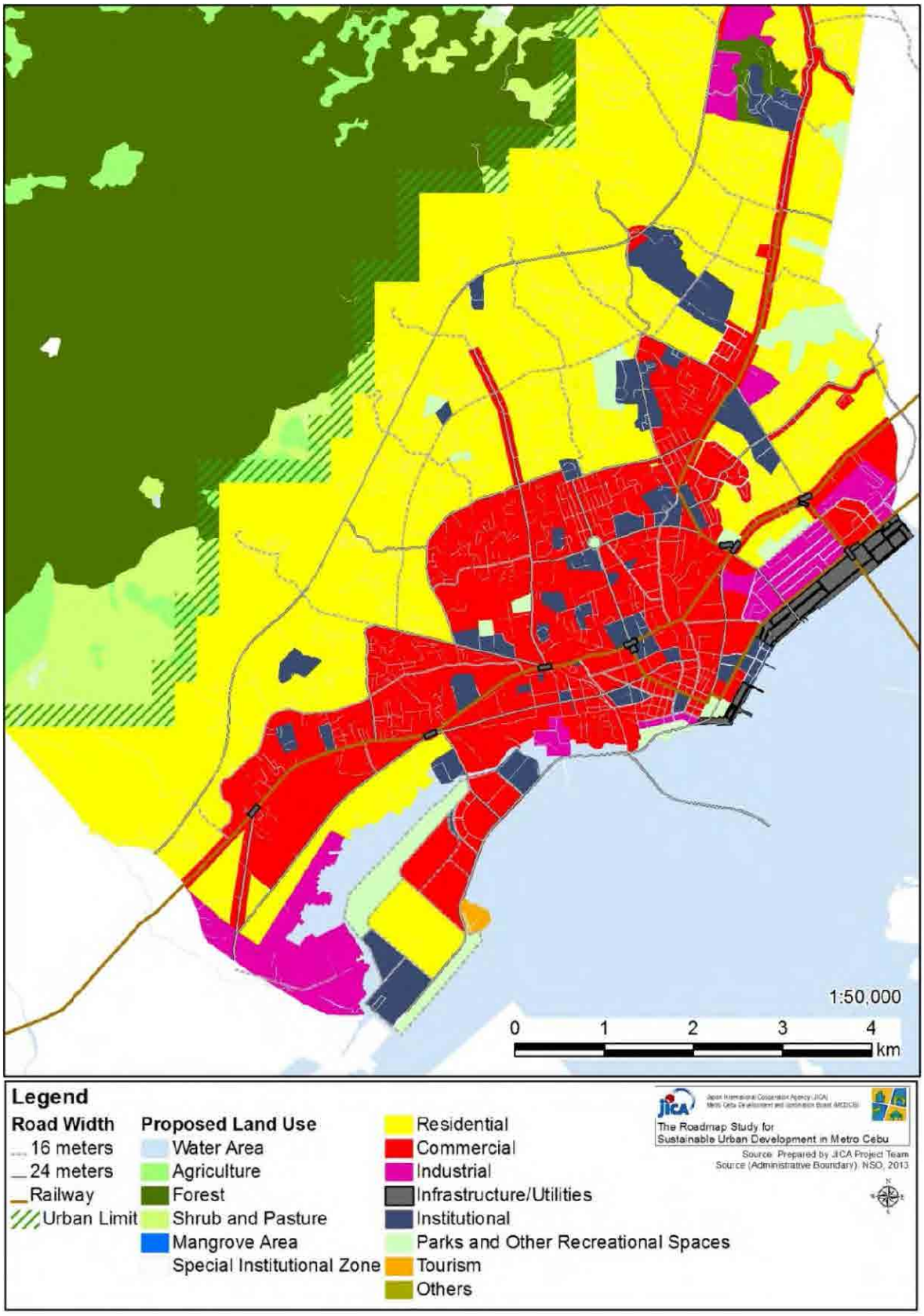
(i) **Demography:** Cebu City had a population of 866,260 in 2010. The annual growth rate from 2000 to 2020 is 1.88%, which is the second lowest in Metro Cebu. Some areas are extremely congested, such as Barangay Suba San Nicolas (1,189 persons/ha) and Barangay Pasil (932 persons/ha). The city's forecast population in 2050 is 1,211,600 with an annual growth rate of 0.84%, the lowest in Metro Cebu during the planning period.

(ii) **Urbanization:** It covers 4,968 ha or 15.2% of the total territorial lands (32,610 ha). Among the urbanized lands, 811 ha is considered hazardous (hilly terrain or lowland). Since almost all lands suitable for urban use have been developed, the remaining available lands for future urbanization are merely 365 ha.

(iii) **Land Use Policy:** New urban lands will be provided along the proposed Metro Cebu Outer Circumferential Road and with SRP on a limited scale (see Figure 4.4.5 and Figure 4.4.6). Hilly lands above the suggested urban limit will not be developed. SRP will meet various urban uses such as commercial, business, institutional, residential, recreational and open spaces. Congested informal settlements located mainly along the coastline and riverines will be improved as part of the river improvement and social housing development programs.

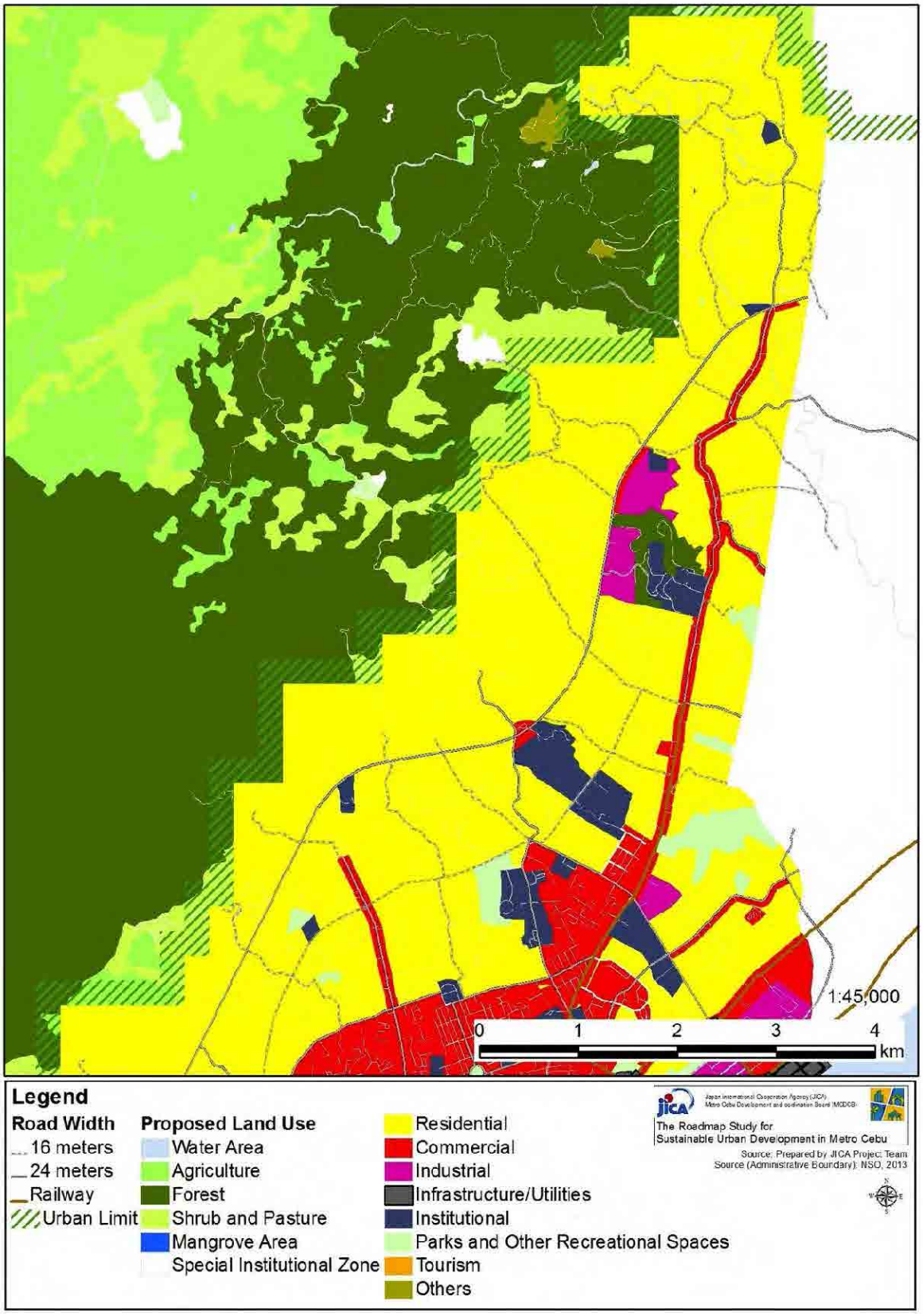
(iv) **Infrastructure Development Policy:**

- The Metro Cebu Inner Circumferential Road will be completed. The Metro Cebu Outer Circumferential Road and the Third Bridge between Cebu City and Cordova will be constructed.
- Congested roads will be widened while congested intersections will increase their capacity through flyovers/underpasses. ATC will be introduced at major intersections. In line with road widening, wider sidewalks and bicycle lanes will be allocated at selected road sections under the Green Loop and other projects.
- Several urban rail lines will be constructed above or below the RROW including the CML (Cebu–Mandaue–Lapu–Lapu) AGT Line (4 stations within the city), MRT Central Line (6 stations within the city), and MRT Mactan Line (7 stations with the city). These lines will be connected to each other at the Cebu CBD to enhance network convenience.
- Part of the Cebu Port functions, such as container shipping and bulk shipping, will be transferred to the proposed port at Tayud, Consolacion.
- Inayawan Sanitary Landfill (SLF) will be completely closed and the site will be reused for open space and other urban renewal projects.
- Major urban rivers (Mahiga River, Kinalumsan River, Lahug River and Guadalupe River) will be improved in a holistic manner, including cleaning, riverbed and riverbank development, allocation of buffer zone, resettlement of informal settlers, and others.



Source: JICA Study Team.

Figure 4.4.5 Draft Urban Spatial Plan for Cebu City (South)



Source: JICA Study Team.

Figure 4.4.6 Draft Urban Spatial Plan for Cebu City (North)

(c) **Compostela**

(i) **Demography:** Compostela is a third class municipality with a population of 42,600 in 2010. The annual population growth rate from 2000 to 2010 is 3.08%. The Study forecasts 114 thousand inhabitants in 2050 with an annual growth rate of 2.50%.

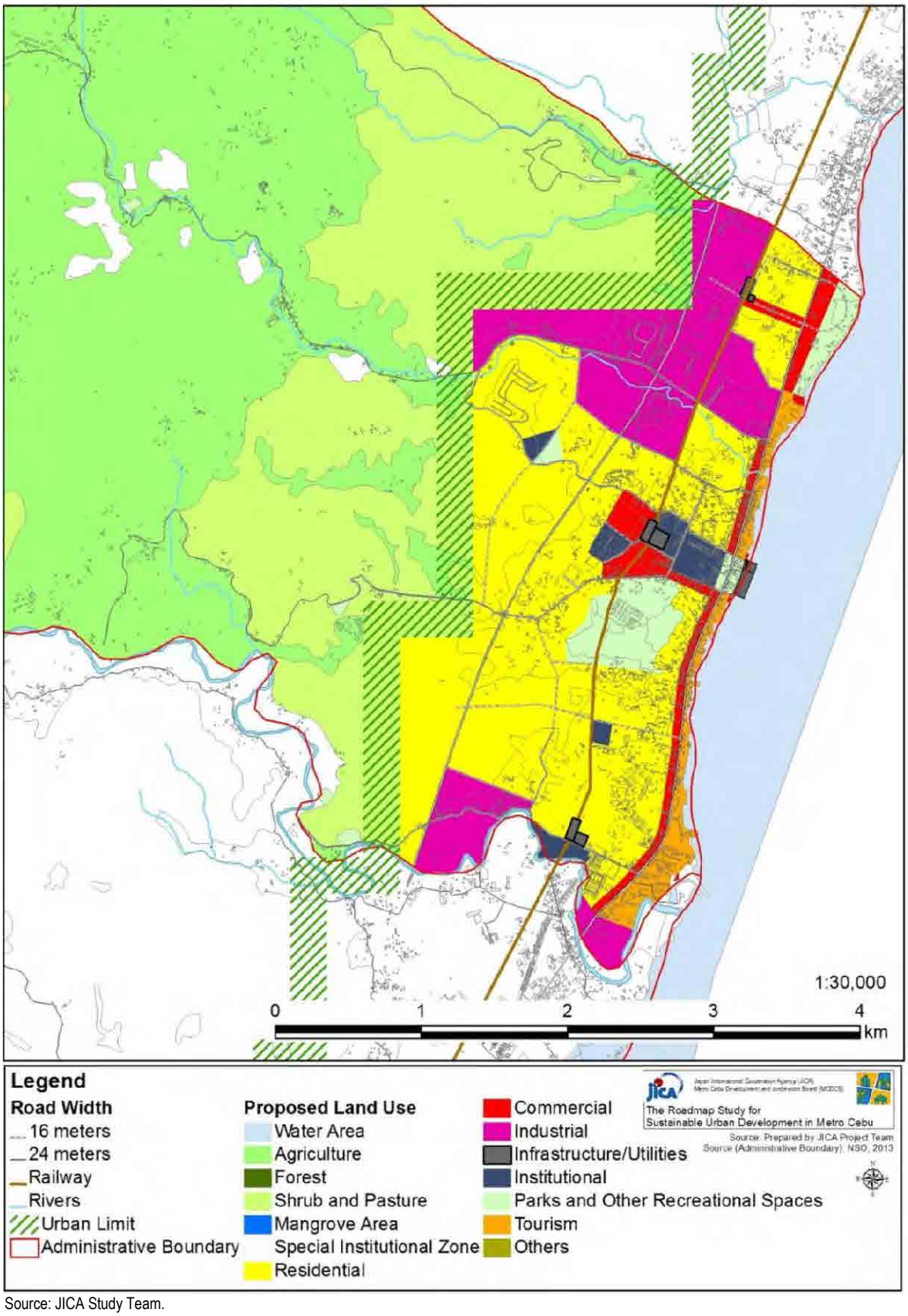
(ii) **Urbanization:** Compostela has an area of 4,473 ha, of which only 162 ha or 3.6% is urbanized. According to the Study's hazard analysis, possible areas for future urbanization cover 572 ha. Compostela has a long coastline where six small to medium beach resort facilities are located, attracting around 600 tourists per week. Compostela has some development issues such as public market, septage management, water supply, solid waste management and dumping site, traffic congestion and relocation of informal settlers. The municipal administration is giving priority to road development, reclamation, sea-based transport, IT park with fiber-optic line, and water supply.

(iii) **Land Use Policy:**

- Orderly urbanization will be realized in line with road and rail development and land use zoning system (see Figure 4.4.7). Since there are ample unused lands, vast hillside development and coastal reclamation will not be necessary.
- Further urbanization will occur within the suggested urban limits based on hazard land analysis.
- Industrial areas will be allocated at Barangay Buluang and Tubigan adjoining with the proposed industrial lands in Danao City. Some more will be allocated at the border with Liloan.
- Commercial areas will be allocated along the Cebu North Road and around the proposed rail stations.
- New residential areas will be distributed along the proposed Second Cebu North Road. Relocation sites or social housing for informal settlers will be considered in residential development.
- A large swampy area near Poblacion will be preserved as open space. The unused coastal area at Barangay Magay will be preserved, too.
- Tourism development will be encouraged at the coastal area of Estaca.

(iv) **Infrastructure Development Policy:**

- The Cebu North Road will be widened to a 4-lane carriageway. The Second Cebu North Road (4-lane) will be constructed in parallel with the Cebu North Road.
- The Cebu Metro North Line will be constructed at ground level with three stations in the municipality. They are at Magay, Compostela Center and Estaca. To secure good accessibility to stations, a station square will be attached to each station.
- Secondary roads to the national highways and collector roads will be configured at adequate intervals.



Source: JICA Study Team.

Figure 4.4.7 Draft Urban Spatial Plan for Compostela

(d) **Consolacion**

(i) **Demography:** Consolacion is a first class municipality with a population of 106,600 in 2010. The annual population growth rate from 2000 to 2010 is 5.52%, which is the highest in Metro Cebu. The Study projects that Consolacion will accommodate 280 thousand inhabitants in 2050, growing at an annual rate of 2.45%.

(ii) **Urbanization:** Consolacion has an area of 3,898 ha, 1,053 ha of which or 27.0% is urbanized. Subdivisions are mushrooming in the urban areas, even in hilly areas (233 ha). According to the Study's hazard analysis, possible areas for future urbanization total 693 ha. Compostela has two distinct geographical features. One is its elevation from the coastline to the highest point above 500 m. The other is its proximity to adjoining LGUs. The widest distance between Mandaue and Liloan through Consolacion is approximately 5 km only.

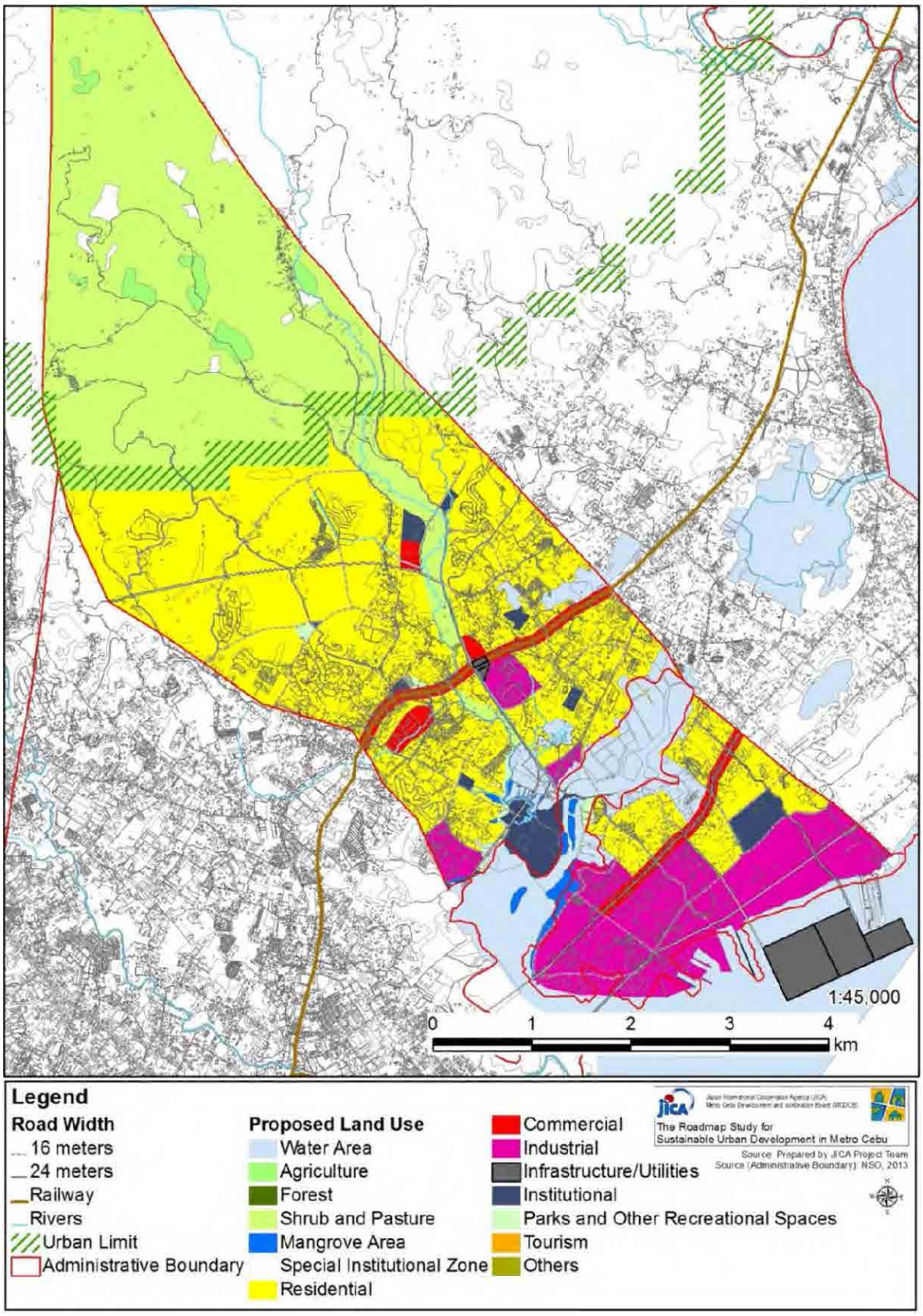
(iii) **Land Use Policy:**

- Further urbanization will occur within the suggested urban limits based on hazard land analysis.
- Industrial areas will be allocated at three barangays, namely: Tugbongan, Cansaga and Tayud (see Figure 4.4.8). Aggregated large areas for industry are allocated at Barangay Tayud, including a shipyard, warehouse and other port and shipping support facilities.
- Commercial areas will be allocated along the Cebu North Road and Tayud-Consolacion Road.
- Considerable new residential areas will be distributed particularly at Tayud and along the proposed Metro Cebu Outer Circumferential Road.
- Along Cansaga River, there are productive farm lands and massive greeneries. They will be maintained for a better urban environment. Two mangrove belts around Cansaga Bay will be preserved.
- The sites for institutional facilities, such as schools and hospitals, will be distributed taking residential areas and walking access into account. One large site of about 20 ha will be allocated at Barangay Tayud, as planned in the Consolacion CLUP.

(iv) **Infrastructure Development Policy:**

- In addition to the existing Cebu North Road and Consolacion–Tayud Road, two more roads are proposed to be constructed, namely: the Metro Cebu Circumferential Road (4-lane) to guide hillside development, and the Tayud Coastal Road (4-lane) to support the proposed Consolacion New Port.
- The Cebu Metro Central Line will be constructed at elevated level. In the municipality, Cansaga Station is proposed in front of SM Consolacion, the largest shopping mall in the municipality. One regular station square will be attached.
- The New Consolacion Port is proposed at the offshore of Barangay Tayud. The reclamation is divided into three areas: 650 m x 600 m for international container shipping, 400 m x 600 m for domestic container shipping, and 520 m x 300 m for international bulk and general cargo shipping.
- The 6.9-ha private sanitary landfill will be operational in Barangay Pulog for

the time being, located outside the suggested urban limits.



Source: JICA Study Team.

Figure 4.4.8 Draft Urban Spatial Plan for Consolacion

(e) **Cordova**

(i) **Demography:** Cordova's population was 50,400 in 2010, with an annual growth rate of 4.0% from 2000 to 2010. The Study forecasts its population to reach 121,500 by 2050, with an annual growth rate of 2.23% during the planning period of 2010–2050.

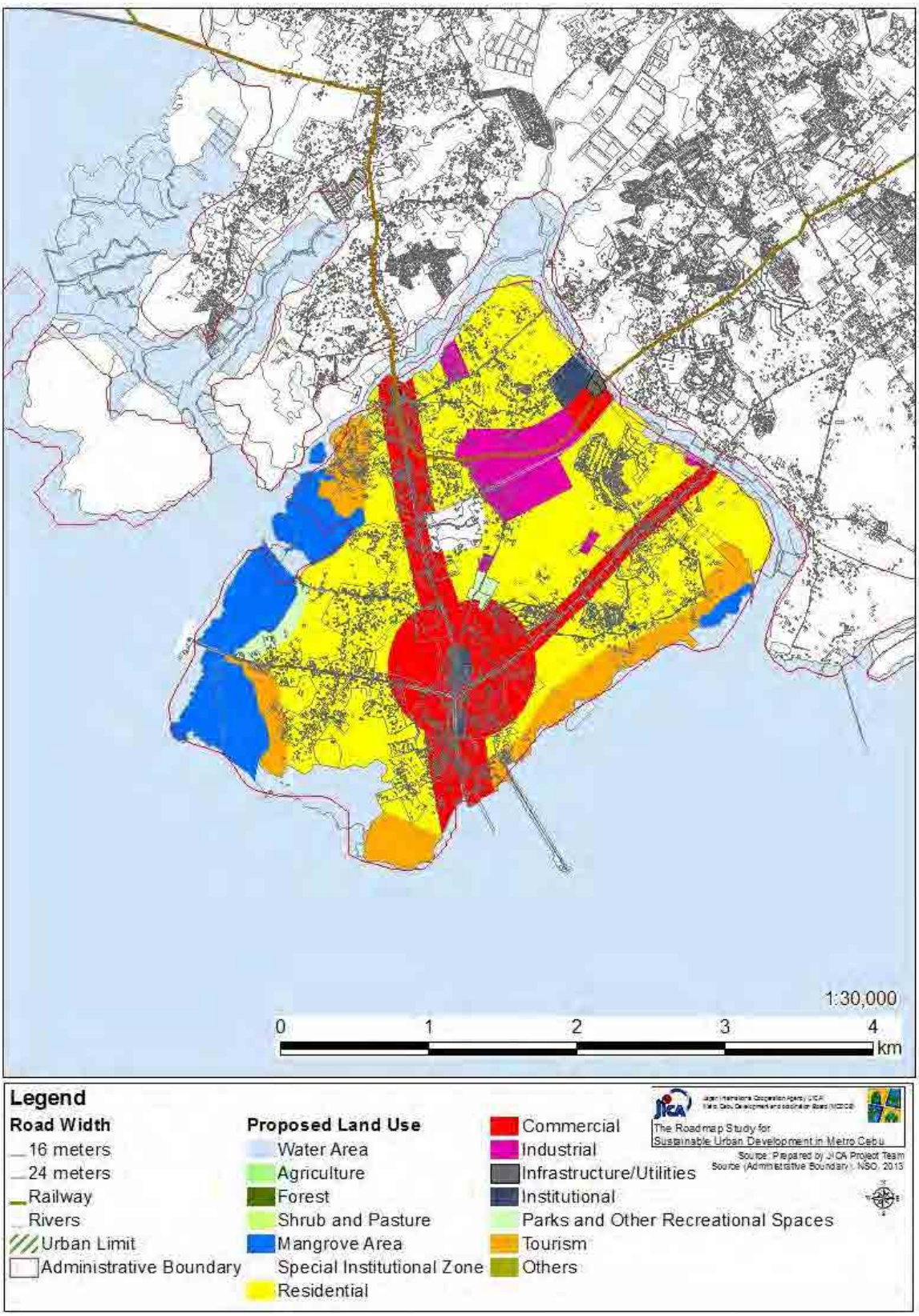
(ii) **Urbanization:** Among Metro Cebu LGUs, Cordova has the smallest territorial lands of 789.6 ha. The urbanized area covers 25.2% or 187 ha. The municipality is surrounded by water and has a flat land with maximum 3 m above sea level and less than 6% in slope. Except the very low lands, other non-urban areas totaling 369 ha are suitable for urban development.

(iii) **Land Use Policy:**

- The municipality has a policy of no manufacturing industry.
- Tourism and urban services will be promoted (see Figure 4.4.9). To address land scarcity, land reclamation will be done for tourism (50 ha).
- Commercial facilities will be allocated along trunk roads.
- There are three marine sanctuaries. Massive mangrove forests will be preserved.

(iv) **Infrastructure Development Policy:**

- Connectivity with Lapu-Lapu City and Cebu City will be improved by way of widening trunk roads with Lapu-Lapu City and constructing the third bridge with Cebu City.
- MRT Mactan Line will pass through the municipality at elevated structure where two stations are allocated.
- One septage plant will be constructed to serve Cordova as well as Lapu-Lapu.



Source: JICA Study Team.

Figure 4.4.9 Draft Spatial Plan for Cordova

(f) **Danao City**

(i) **Demography:** According to the 2010 Census, Danao City's population was 119,300, with an annual growth rate of 1.90% from 2000 to 2010. The Study projects a population of 273 thousand in 2050, with an annual growth rate of 2.09% during the planning period.

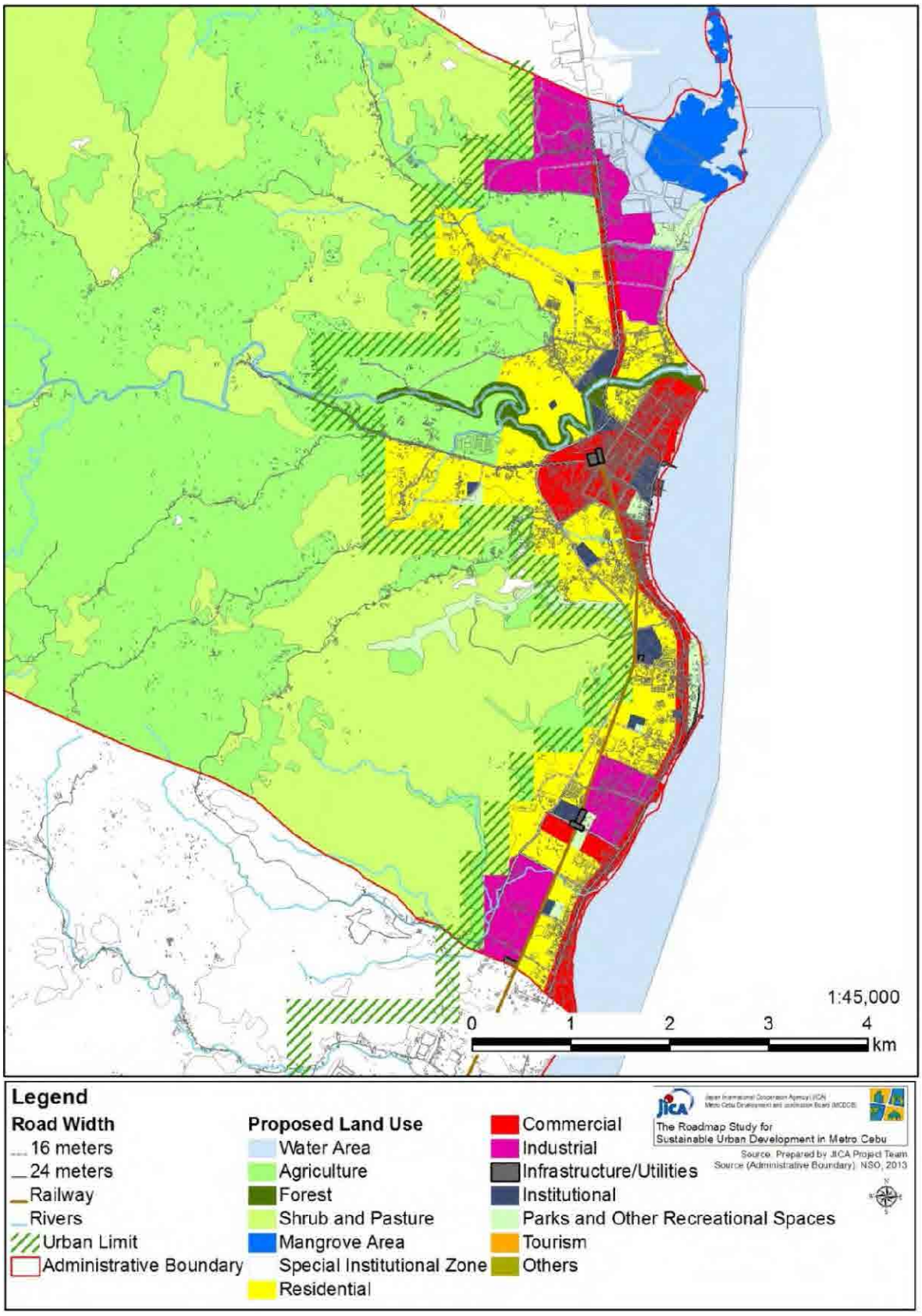
(ii) **Urbanization:** The existing urban area is 463 ha or a mere 3.2% of the city's territory. Additional suitable land for urbanization is 1,429 ha, excluding very low lands and slope lands. Danao City suffers from traffic congestion, poor public transport, inadequate dumping site, and no septage and sewerage services. The city administration is giving priority to the road network, bulk water supply system, and sewerage.

(iii) **Land Use Policy:**

- As a north growth pole of Metro Cebu, dynamic industrial and commercial development are expected in Danao City. Further urbanization will occur within the suggested urban limits. Even within the suggested urban limits, some productive farm lands will be maintained (see Figure 4.4.10).
- Besides the existing MRI Special Economic Zone (29.3 ha), two more industrial areas are proposed at (i) Barangay Dunggoan and Guinsay at the northeast of the city's territory and at the border with the Municipality of Carmen, and (ii) Barangay Maslog at the border with the Municipality of Compostela.
- New residential areas will be widely spread within suggested urban limits. Parks and institutional lands will be distributed to serve new residents.
- Commercial areas are allocated at the city center, along the Cebu North Road and around the planned rail stations.
- Two types of parks and recreational areas are allocated in the map. One is the coastline type at Barangay Guinsay, City Center and Barangay Lo-oc. The other is the hillside type, such as the Club Filipino Country and Golf Course.
- Danao River has a beautiful riverine environment and, thus, it will be preserved for city dwellers for ecotourism purposes like the Intosan Resort.
- Massive mangrove area will remain at the offshore bordering with Carmen.

(iv) **Infrastructure Development Policy:**

- The Cebu North Road will be widened to a 4-lane carriageway. The Second Cebu North Road (4-lane) will be developed up to the Carmen border partly in parallel with the Cebu North Road.
- The Cebu Metro North Line will be constructed mainly at ground level with three stations in the city. They are the Danao Terminal, Sabang and Maslog.
- A sanitary landfill site is allocated at Barangay Maslog, surrounded by the Second Cebu North Road and the boundary with Compostela.



Source: JICA Study Team.

Figure 4.4.10 Draft Urban Spatial Plan for Danao City

(g) **Lapu-Lapu City**

(i) **Demography:** The city had a population of 350,500 in 2010. The annual population growth rate from 2000 to 2010 is 4.91%, the second highest in Metro Cebu. The most densely populated barangay is Poblacion with 232 persons/ha. But others are still underdeveloped, with many empty lands and agricultural lands inside. The Study forecasts the city population in 2050 to reach 803 thousand, with an annual growth rate of 2.10%.

(ii) **Urbanization:** Since the city terrain is totally flat, 47.5% of total land area of 6,424 ha is urbanized. The remaining areas for urbanization are 2,069 ha based on hazard analysis. It is the second biggest area in Metro Cebu, next to Carcar City.

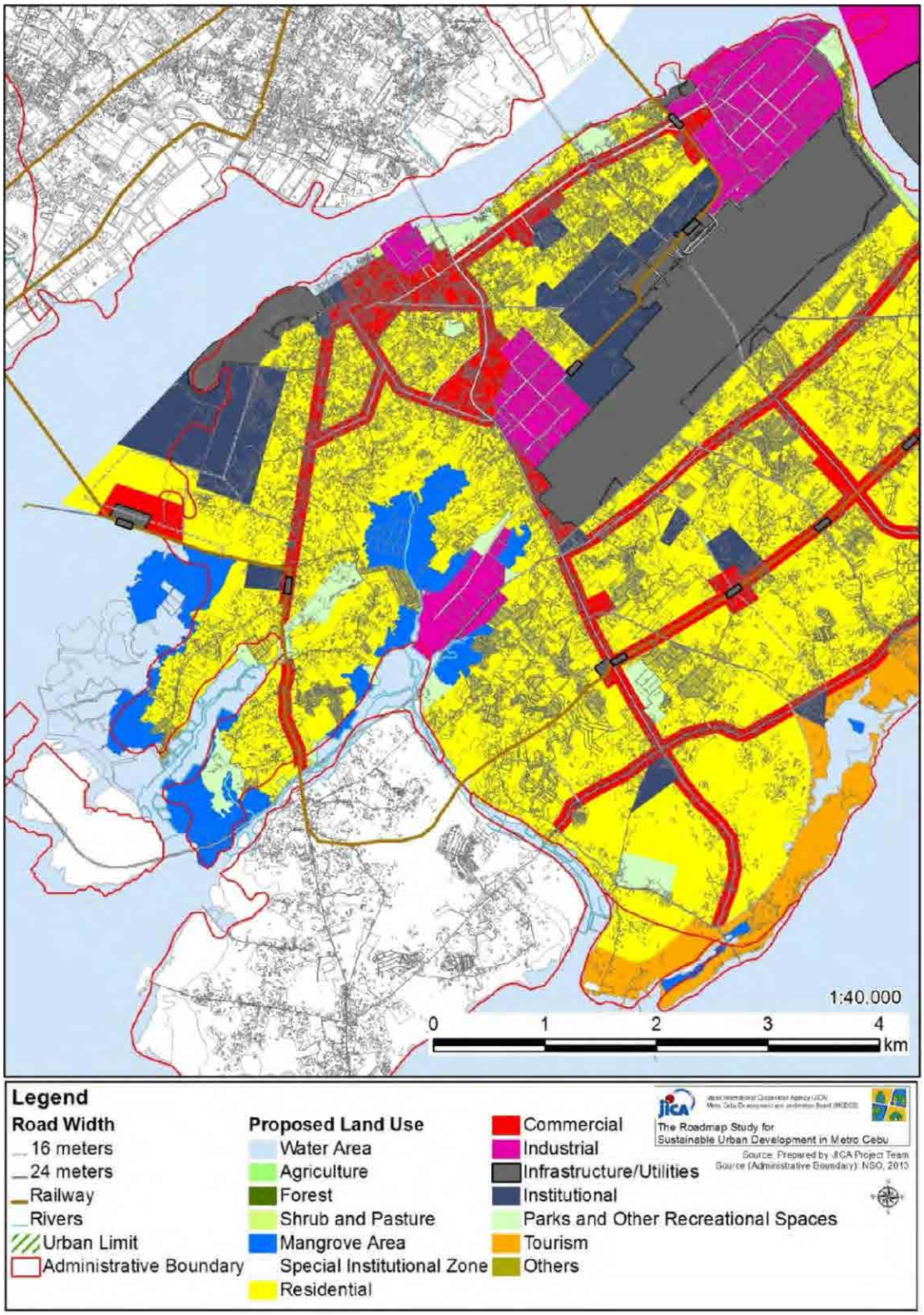
(iii) **Land Use Policy:**

- Further urbanization will occur widely, except in Poblacion, because of the still low population density on flat lands.
- Lapu-Lapu City has accumulated industrial sites along the Opon Channel and tourism facilities along Magellan Bay and the Hilutungan Channel with Olango Island (see Figure 4.4.11 and Figure 4.4.12). As a result, no mixed land uses will happen. Additional investments will be channeled accordingly.
- For commercial development, Lapu-Lapu City proposes a 100-m commercial strip along Basak Marigondon Road and part of the Mactan Circumferential Road.
- There are two reclamation projects in the city. One is the Navy-initiated project at Barangay Looc (140 ha) while the other is the Mactan North Reclamation Project (400 ha in total, covering port/logistics, infrastructure, commercial, residential and tourism).
- The sites for institutional facilities, such as schools and hospitals, will be distributed. One large recreational park is proposed at Barangay Suba Basbas.
- Some greenery open space will be preserved. Several mangrove areas around the coastline will also be preserved.

(iv) **Infrastructure Development Policy:**

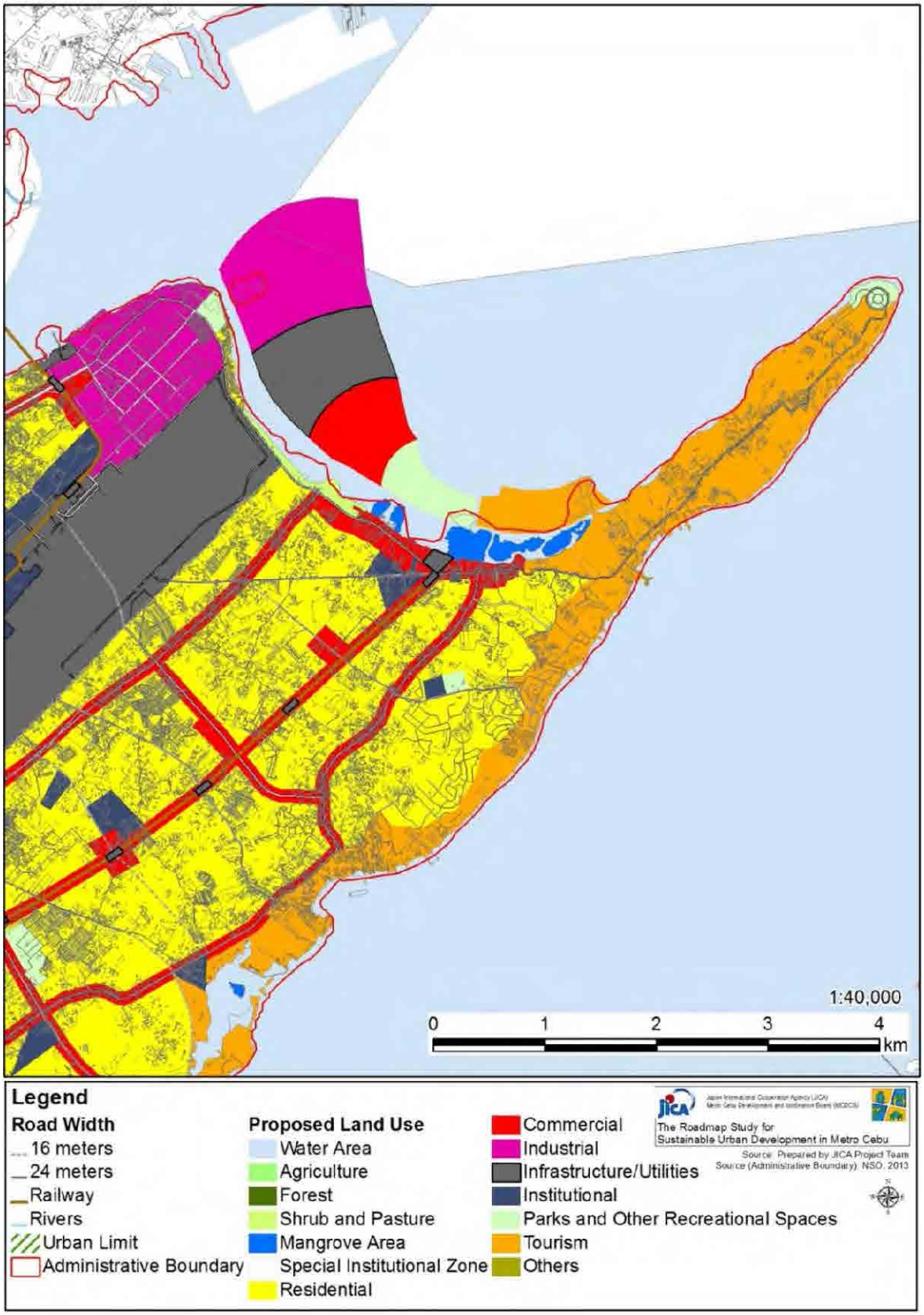
- The proposed CML-AGT Line will have four stations in the north of Lapu-Lapu City. Each station will have the following functions: MEPZ 1, MCIA Terminal 1, MCIA Terminal 2, and MEPZ 2.
- The Cebu Metro Mactan Line will be constructed at elevated level or underground. In the city, seven stations are proposed, namely: Rafael Ramos (Navy's reclamation site), Looc, Basak Marigondon, Pajac, Bankal, Casia and Mactan.
- In regard to connection with Cebu Island, two additional connections are planned: a dual-mode bridge between Mandaue City for the CML-AGT Line and vehicular traffic, and a rail tunnel or bridge for the Cebu Metro Mactan Line.

- Since MCIA could greatly disturb the local road network, one underground road to pass through MCIA is planned. More pedestrian and bicycle spaces will be allocated on the roads designated under the Green Loop during road widening. Secondary roads to trunk roads and collector roads will be configured at adequate intervals.



Source: JICA Study Team.

Figure 4.4.11 Draft Spatial Plan for Lapu-Lapu City (West)



Source: JICA Study Team.

Figure 4.4.12 Draft Spatial Plan for Lapu-Lapu City (East)

(h) **Liloan**

(i) **Demography:** Liloan is a first class municipality with a population of 100,500 in 2010. The annual population growth rate from 2000 to 2010 is 4.46%, with a particularly rapid growth observed at the barangays near Consolacion, such as San Vicente, Yati and Tayud. The Study projects that Liloan will accommodate 271 thousand inhabitants in 2050 without vast hillside development and coastal reclamation.

(ii) **Urbanization:** Liloan has an area of 5,210 ha, 924 ha or 17.7% of which is urbanized. Subdivisions are mushrooming in the urban areas. According to the Study's hazard analysis, the possible areas for future urbanization total 837 ha.Liloan has some remarkable initiatives for the environment, including Purok (roadside cleaning and greening and solid waste segregation), MRF, Liloan Central Nursery, Liloan Marine Sanctuaries, mangrove gardens, and tree planting.

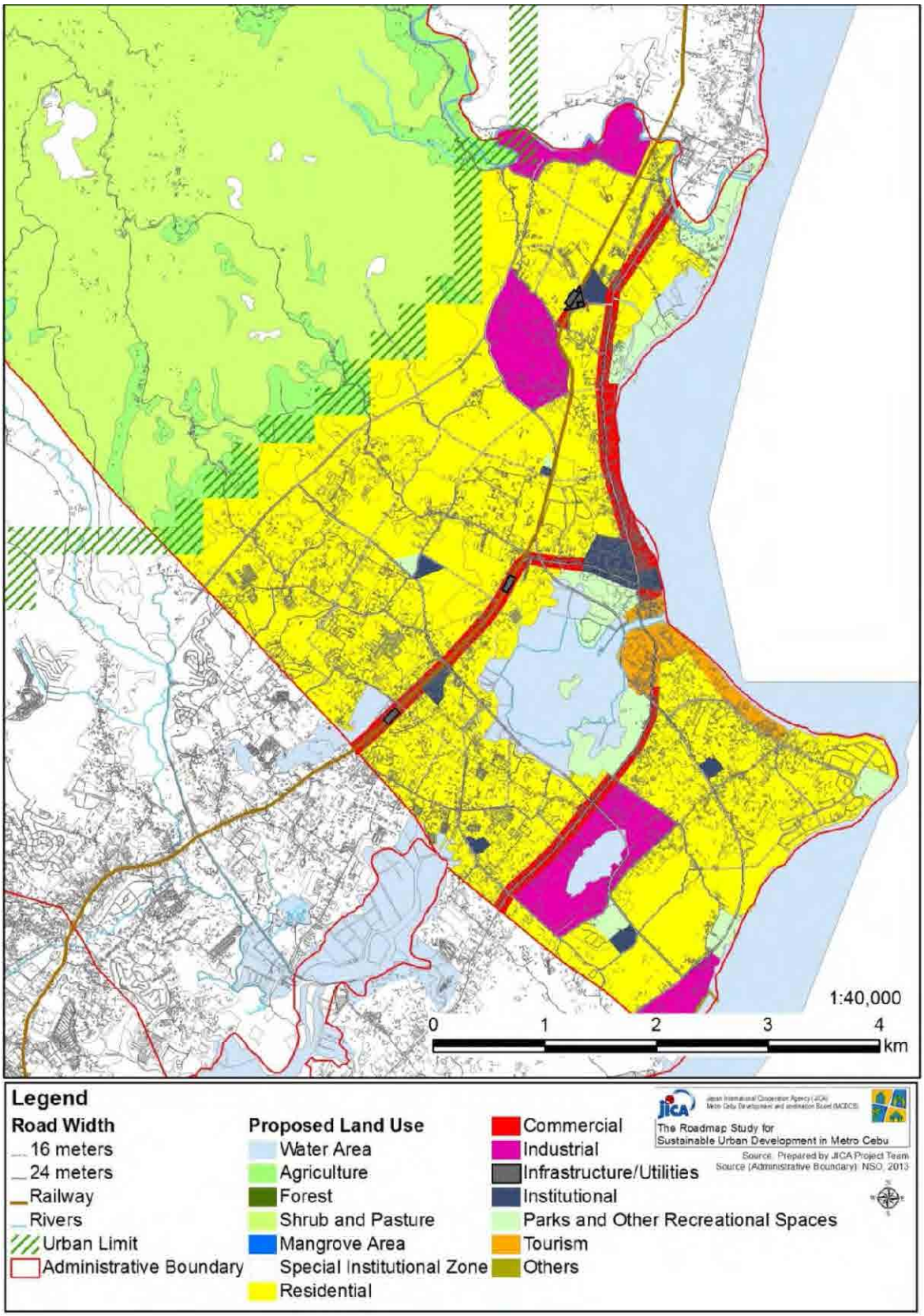
(iii) **Land Use Policy:**

- Liloan's CLUP (2009–2018) envisions the municipality to become (i) a metropolitan sub-center north of Cebu, (ii) a residential center, (iii) a retirement haven, (iv) a tourist center, and (v) a third class city by the year 2018.
- Industrial areas will be allocated at four areas in Barangay Cotcot and Calero (see Figure 4.4.13).
- Commercial areas will be allocated along the Cebu North Road, Tayud–Consolacion Road, and around the proposed rail stations.
- Considerable new residential areas will be distributed between the proposed Second Cebu North Road and the Cebu North Road, and between the Tayud–Consolacion Road and the proposed Tayud Coastal Road.
- Silot Bay (160 ha) will be preserved as open space and for tourism. Tourism development will be encouraged at coastal areas.
- The sites for institutional facilities, such as schools and hospitals, will be distributed, with due consideration to residential areas and walking access.

(iv) **Infrastructure Development Policy:**

- The Cebu North Road will be widened to a 4-lane carriageway. The Second Cebu North Road (4-lane) will be constructed in parallel with the Cebu North Road in the northern half of the municipality's jurisdiction.
- In the southern half, four trunk roads are proposed in order to mitigate traffic congestion with Consolacion. These are the two existing roads (Cebu North Road and Tayud–Consolacion Road) and two new roads (Second Cebu North Road and Tayud Coastal Road).
- The Cebu Metro North Line will be constructed at ground level with three stations in the municipality. They are from the north–Cotcot, Liloan Center and Yati.

- Secondary roads to the national highways and collector roads will be configured at adequate intervals.



Source: JICA Study Team.

Figure 4.4.13 Draft Urban Spatial Plan for Liloan

(i) **Mandaue City**

(i) **Demography:** Mandaue City had a population of 331,300 in 2010, growing at an annual rate of 2.46% from 2000 to 2010. The most densely populated barangay is Mantuyong, with 433 persons/ha in 2010. The Study forecasts a population of 506,900 in 2050, with an annual growth rate of 1.07%.

(ii) **Urbanization:** The city has a total area of 3,064 ha, 2,477 ha or 80.8% of which is urbanized. The remaining areas for urbanization lies at the border with Consolacion. According to the Study's hazard analysis, the possible areas for future urbanization is merely 157 ha. In practice, urban development pressure is very strong in the city. All the lands will be eventually developed and new urban lands will be created by means of reclamation, except in strictly preserved areas.

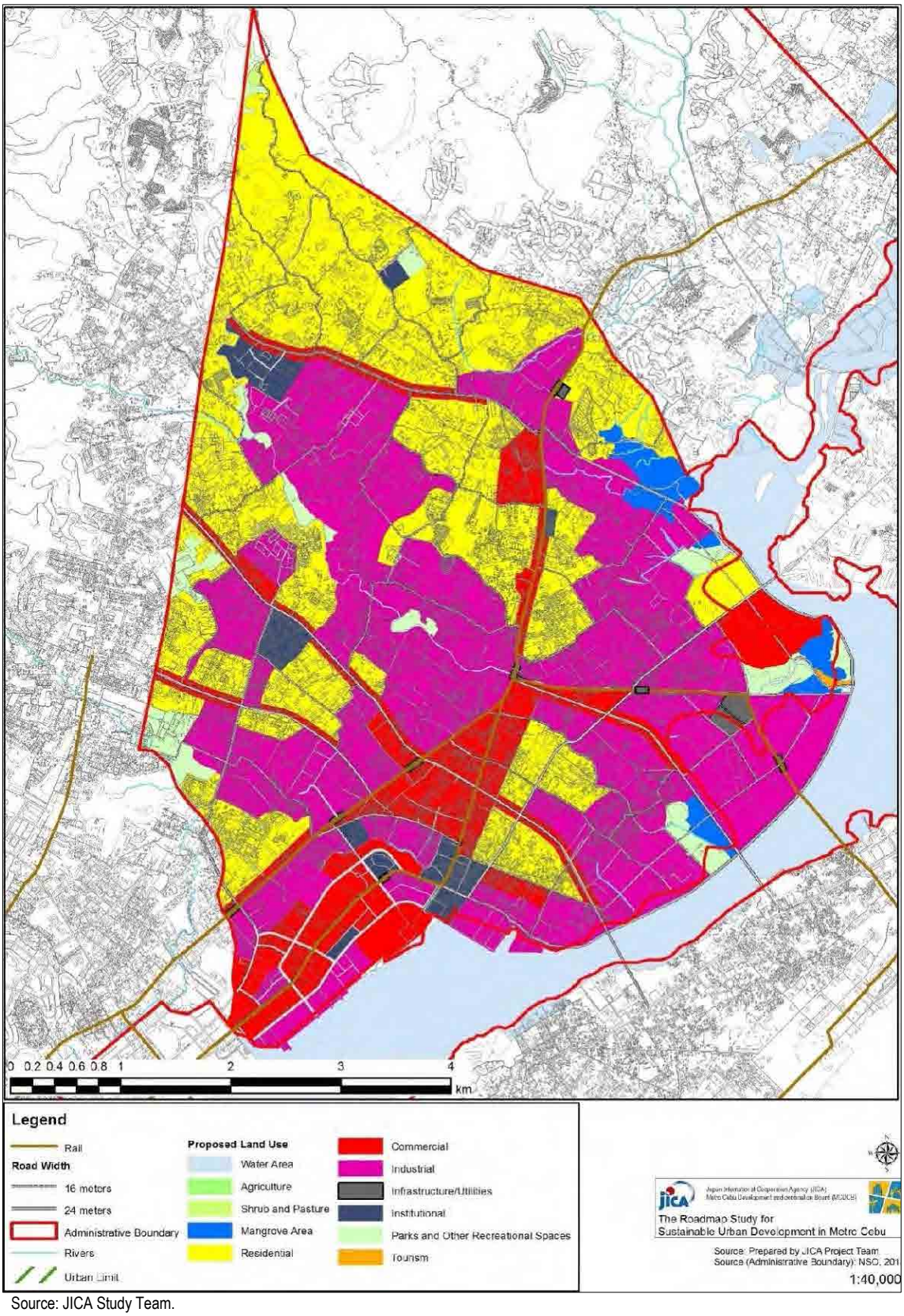
(iii) **Land Use Policy:**

- Mandaue has the largest industrial areas (925 ha) in Metro Cebu (see Figure 4.4.14). Existing industrial lands are widely spread from the coastal areas to inland. Principally, they will be maintained with some improvement measures such as green open spaces along Butuanon River and improvement of collector roads in the spatial plan.
- The city government promotes Mandaue's Global City project. It will create a reclamation site of 131 ha around the Opon Channel and the Cansaga Bay. Proposed land uses are agro-industrial, commercial, residential, tourism and mangrove park.
- The Mandaue Southpoint Reclamation Project will be completed as planned.
- Along Butuanon River, some greenery open space will be preserved.
- Existing wetlands will be converted to an eco-park (20 ha) at Barangay Cabancalan and the adjoining area of Barangay Talamban, Cebu City.

(iv) **Infrastructure Development Policy:**

- The city proposes to develop the Scenic Coastal Road (4-lane) which will guide the Global City reclamation project. A new road along Butuanon River between MC Briones and the proposed Scenic Costal Road will be developed.
- These two roads will connect with the proposed Mandaue-Lapu-Lapu Dual-mode Bridge.
- More pedestrian and bicycle spaces will be provided on the roads designated under the Green Loop project when the roads are widened.
- A CML (Cebu–Mandaue–Lapu-Lapu) AGT Line is proposed along Ouano Avenue, S. Cabahug Street, Butuanon River, and across the Opon Channel. Within the city's jurisdiction, 6 AGT stations will be constructed at elevated structures. They are: Ouano Avenue, CICC, Mandaue City Hall, Butuanon AGT Depot, Plaridel Street, and Scenic Costal Road. One AGT depot (about 6 ha) will be allocated at a swampy land of Barangay Pakna-an.

- The Cebu Metro Central Line will be constructed at elevated level or underground. In the city, five stations are proposed, namely: Jagobiao, Butuanon, Maguikay, Tipolo and Subangdaku.



Source: JICA Study Team.

Figure 4.4.14 Draft Urban Spatial Plan for Mandaue City

(j) **Minglanilla**

(i) **Demography:** According to the 2010 Census, Minglanilla had a population of 113,000 people then. The annual population growth rate from 2000 to 2010 is 3.89%. The most densely populated barangay is Pakigne, adjoining Talisay City, with 208 persons/ha in 2010. The Study forecasts that Minglanilla will accommodate 192 thousand inhabitants in 2050.

(ii) **Urbanization:** The municipality has an area of 6,560 ha, 643 ha or 9.8% of which is urbanized. The remaining areas suitable for urbanization are only 533 ha, based on hazard analysis since most of the municipal territory (86.4%) is hilly with over 18% in slope. Minglanilla identifies several development issues including rapid population inflow, traffic congestion, weak development control, poor drainage, and no sewerage and solid waste management. But it is said that there is no densely inhabited informal settlements. A typical bedroom town like Minglanilla serves mainly working people who can bear long-time and costly commuting.

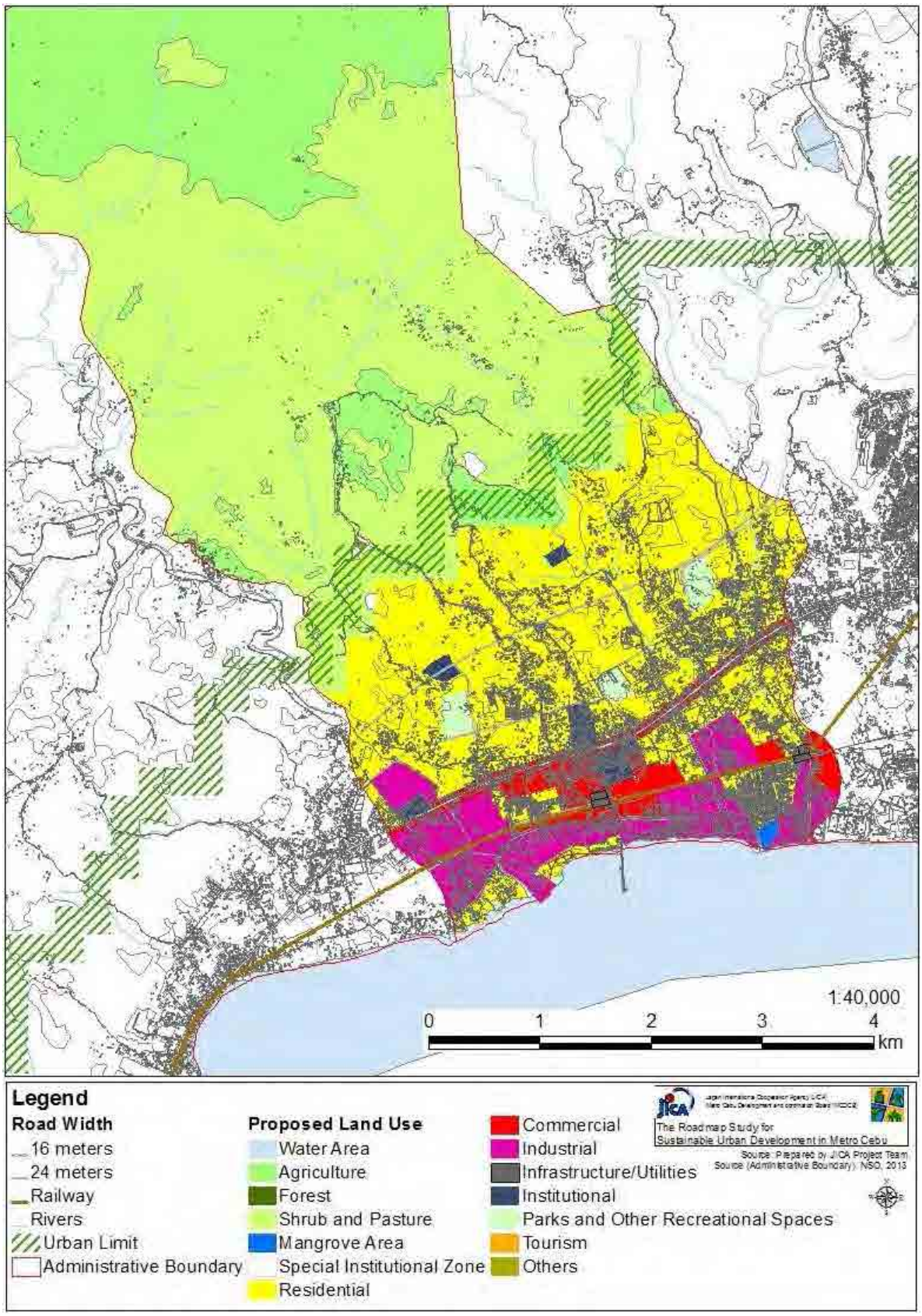
(iii) **Land Use Policy:**

- Minglanilla will develop a new municipal center with mostly municipal buildings (see Figure 4.4.15).
- New urban development will occur particularly along the proposed Second Cebu South Road and within the suggested urban limits.
- To increase employment opportunities, industrial lands will be expanded and added.
- To improve urban livability, two mid-sized urban parks (6–8 ha each) will be added.
- The sites for institutional facilities, such as schools and hospitals, will be distributed taking residential areas and walking access into account.
- The municipality is proposing a 100 ha reclamation project for port and industrial uses. Due to uncertain project environment[7], this project has not been illustrated in the draft spatial plan.

(iv) **Infrastructure Development Policy:**

- Two highways and one railway will serve inter-city traffic. The two highways are the Cebu South Road and the proposed Second Cebu South Road. One railway is the MRT South Line which plans to allocate two stations in the city, namely: Tungkil and Minglanilla Center. The MRT line will use the abundant PNR ROW with a secondary road.
- Secondary roads to the national highways and collector roads will be configured at adequate intervals.

[7] The Municipal Government has submitted a private port development plan to CPA for development approval as of November 2014.



Source: JICA Study Team.

Figure 4.4.15 Draft Urban Spatial Plan for Minglanilla

(k) **Naga City**

(i) **Demography:** Naga City had a population of 101,571 people in 2010, growing at an annual rate of 2.37% from 2000 to 2010. The highest population density is found at Barangay North Poblacion but still at a modest 215 persons/ha. The Study forecasts that Naga City will accommodate 267 thousand inhabitants in 2050.

(ii) **Urbanization:** The city has an area of 9,298 ha, of which 470 ha or merely 5.1% is urbanized. Urban development pressure has not been strong in Naga City, and there are still plenty of underdeveloped/unused lands for development. The remaining areas for urbanization are 782 ha based on hazard analysis. Naga City has recently reclaimed coastal land by several hectares for its city hall and a local port. Some industrial development have been observed along the Toledo–Naga route. The largest urban development project in Naga is the New Cebu Township (122 ha), which made large land development at upland areas in Barangay Cantao-an. The Naga Valley Industrial Park (36 ha) was officially opened in October 2014 within this project area.

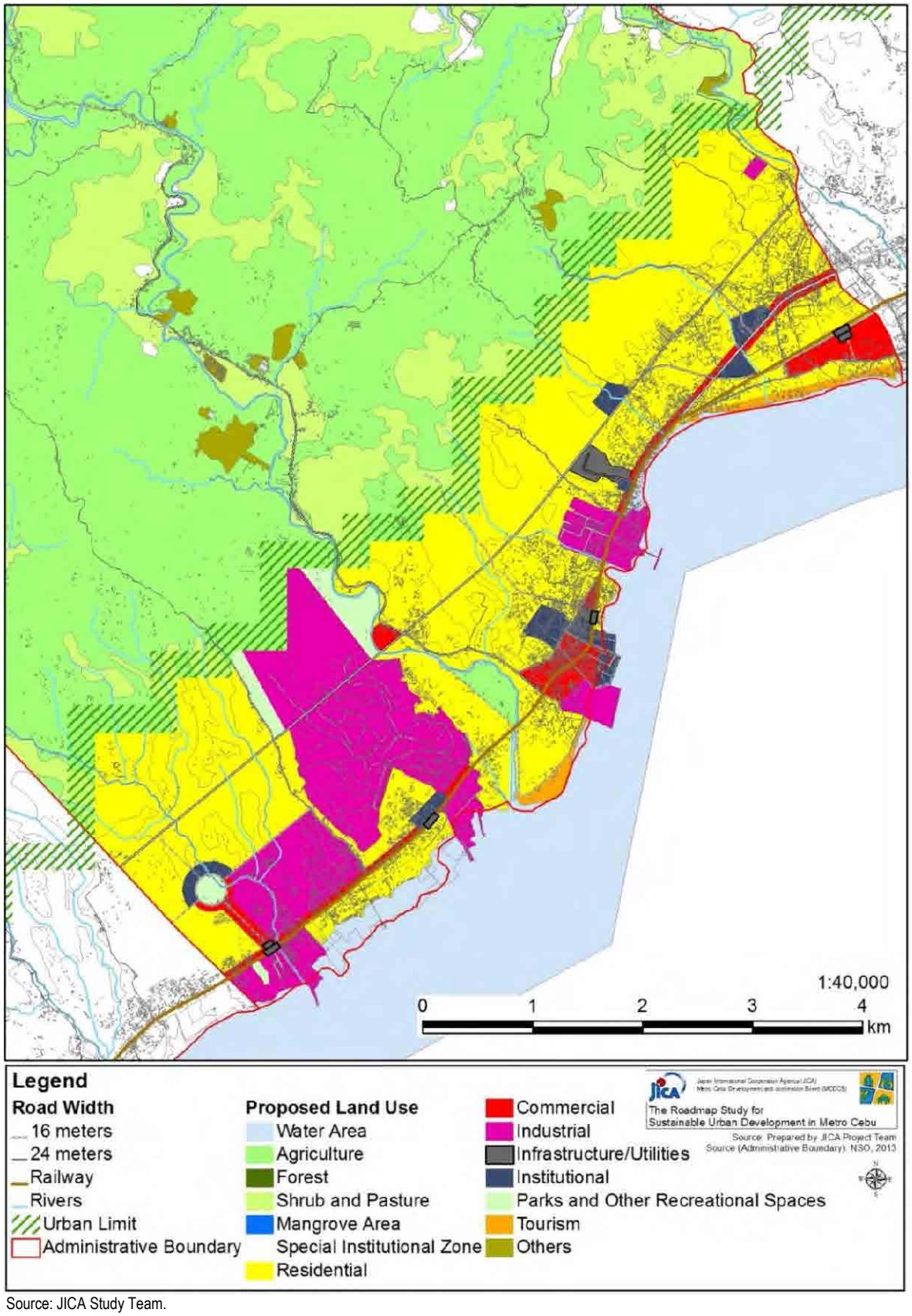
(iii) **Land Use Policy:**

- Further urbanization will occur mainly along the proposed Second Cebu South Road and within the suggested urban limits.
- As a southern growth pole of Metro Cebu, Naga City will develop spacious areas for industrialization, including (see Figure 4.4.16):
  - The town is home to Apo Cemex cement factory at Tinaan. The hinterland will be reserved forest for the factory's expanded operation.
  - The Cebu New Township project is a rather self-contained and isolated development at hilly and upland areas located beyond the suggested urban limits.
  - The Naga Special Economic Zone (30 ha) will be implemented by the Cebu Provincial Government at Barangay Tinaan and Inoburan.
  - -- Industrial lands will be developed near the proposed Inayagan rail station.
- Part of the coastline will be opened to the public as public beaches.
- The sites for institutional facilities, such as schools and hospitals, will be distributed taking residential areas and walking access into account.
- Secondary roads to the national highways and collector roads will be configured at adequate intervals.

(iv) **Infrastructure Development Policy:**

- Two highways, the Cebu South Road and the proposed Second Cebu South Road, and one railway will serve inter-city traffic. The railway is the MRT South Line which plans to allocate four stations in the city: Inayagan, Naga Center, Tinaan and Langtad.
- Naga Port at the reclamation site will be open for RO-RO shipping between

Naga and Bohol. It will work as part of the national nautical highway network.



Source: JICA Study Team.

Figure 4.4.16 Draft Urban Spatial Plan for Naga City

(l) **San Fernando**

(i) **Demography:** San Fernando had a population of 60,970 people in 2010, growing by an average of 2.37% per year since 2000. The most densely inhabited barangay is Poblacion South with only 49 persons per ha. The urbanization trend in the municipality has not been sharp. The Study projects the population of San Fernando to reach 187 thousand in 2050 without vast hillside development and coastal reclamation.

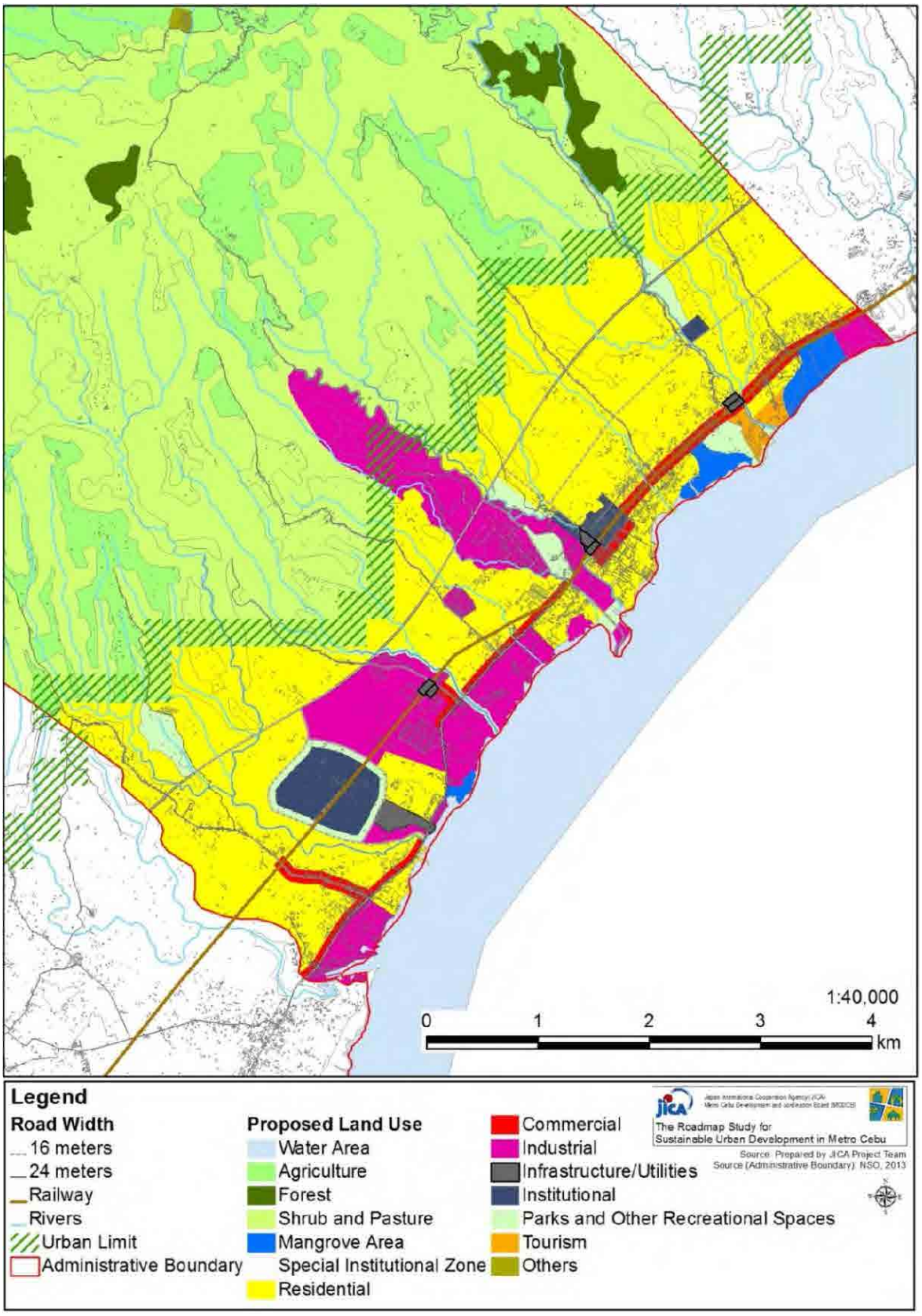
(ii) **Urbanization:** Of a total area of 7,405 ha, only 231 ha or 3.1% is urbanized. Based on hazard analysis, the possible areas for future urbanization will expand to 832 ha or 360% of the existing urban area.

(iii) **Land Use Policy:**

- Orderly urbanization will be realized in line with road and rail development and land use zoning system where the suggested urban limits deserve importance.
- Taiheiyo Cement Philippines Inc. has the largest factory at the center of San Fernando. In addition, industrial areas will be allocated at both the borders and around the proposed Balud Station.
- The municipal CLUP (2011–2020) envisions that San Fernando will become the Educational/Institutional Learning Center for Cebu-South. The proposed sites with green buffer zones is illustrated at Greenhills (see Figure 4.4.17).
- Commercial areas will be distributed along the Cebu South Road and around the proposed rail stations.
- New residential areas will be allocated between the Cebu South Road and the proposed Second Cebu North Road. Since there are limited flat lands, new residential areas will largely lie on the undulations of the landscape. Some greenery open space will be designed at steep valleys.
- Tourism facilities will be further accumulated around the proposed San Isidro Station.
- Some essential mangrove areas will be preserved.

(iv) **Infrastructure Development Policy:**

- The Cebu South Road will be widened to a 4-lane carriageway. The Second Cebu South Road (4-lane) will be constructed in parallel with the Cebu South Road at 1–2 km intervals.
- The Cebu Metro South Line will be constructed at ground level with four stations in the municipality. They are, from the north: San Isidro, SF Center, Balud and Greenhills.
- Secondary roads to the national highways and collector roads will be configured at adequate intervals.
- The CLUP shows a proposed port. However, the port function is not indicated although port types and designs are quite different to meet specific shipping needs. Therefore, the draft spatial plan has deferred showing this facility for the meantime.



Source: JICA Study Team.

Figure 4.4.17 Draft Spatial Plan for San Fernando

(m) **Talisay City**

(i) **Demography:** Talisay City was home to 200,800 people in 2010. The annual population growth rate from 2000 to 2010 is 3.09%. In this period, population increase was significant in Maghaway, Biasong and Lawaan which are located rather far from Cebu City. The most densely habituated barangay is Tangke, located along the coastline, with 1,189 persons/ha in 2010. The city will accommodate 363 thousand people in 2050.

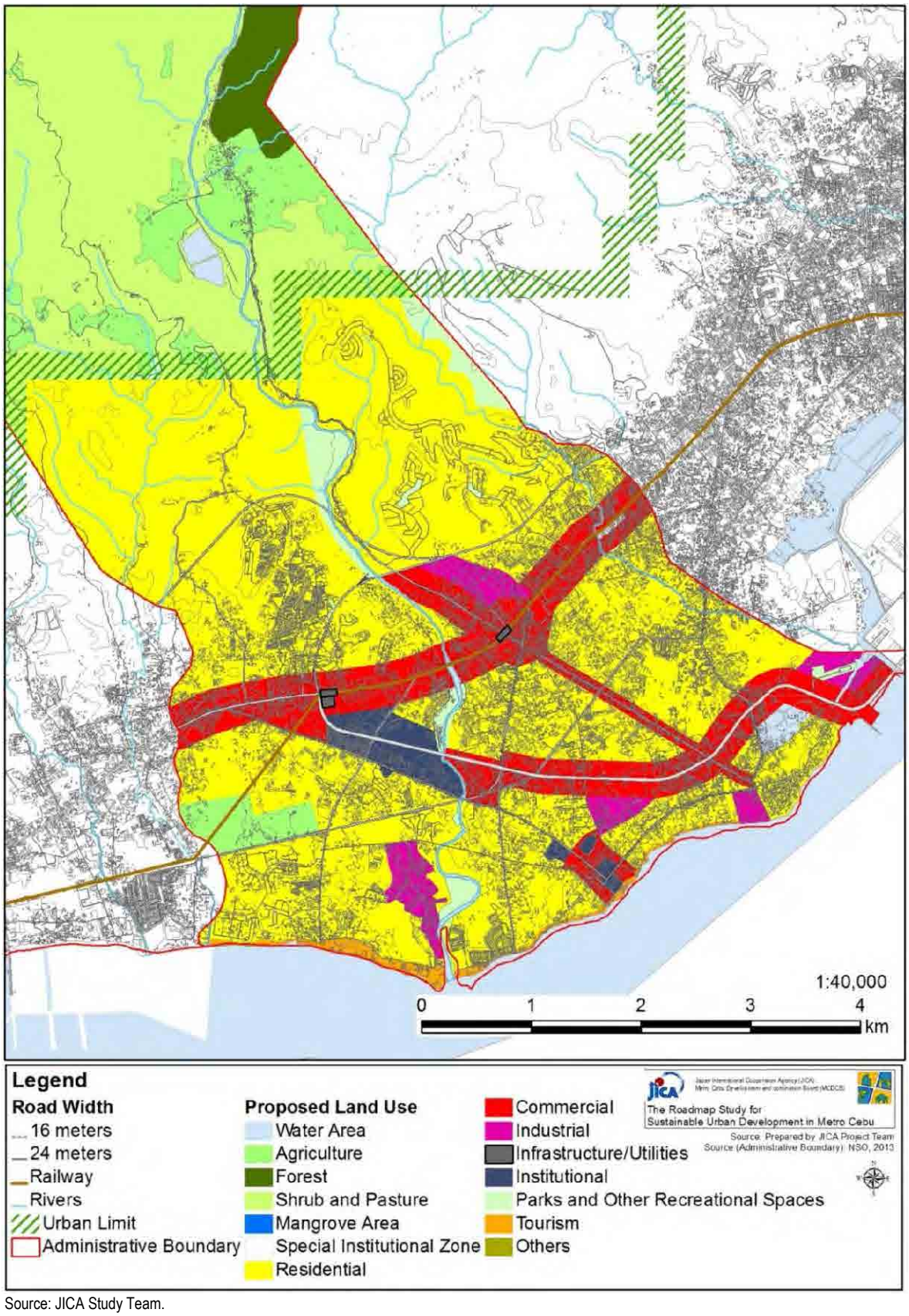
(ii) **Urbanization:** Some 1,194 ha or 27.3% of Talisay's total land area of 4,370 ha is urbanized. The remaining areas for urbanization are only 520 ha, based on hazard analysis. Talisay is another bedroom city for Cebu City. Most of the urban uses are residential and commercial. Industrial lands are 8 ha only. The city is now linked to Cebu City via the new South Coastal Highway (6-lane) from Lawaan, opened in 2004. This has brought some recent inward investment in the form of subdivisions, some hastily planned and plagued by problems. The new city hall is located along the highway. Further urbanization will occur at mainly two areas: (i) the hillside area along the proposed Metro Cebu Outer Circumferential Road, and (ii) the border area with Minglanilla.

(iii) **Land Use Policy:**

- Orderly urbanization will be promoted up to the suggested urban limits. However, productive farm lands at Barangay Mohon will be preserved (see Figure 4.4.18).
- Mananga River is the longest river in Cebu. The riverine environment will be improved by means of open space and greenery at three areas: the valley surrounded steep mountains, the riverside open space between South Cebu Road and South Coastal Road, and the pocket area near the river mouth.
- To be a more balanced town than just a bedroom city, several industrial sites will be allocated.
- The sites for institutional facilities, such as schools and hospitals, will be distributed taking residential areas and walking access into account.
- Part of the coastline will be open to the public as public beaches.

(iv) **Infrastructure Development Policy:**

- The Metro Cebu Outer Circumferential Road will be constructed to guide urban development at the upper areas.
- The Cebu Metro Central Line will be constructed at elevated level or at ground. In the city, two stations are proposed, namely: Tabunok at the largest commercial district in the city, and Mohon at the intersection of the Cebu South Road and the South Coastal Highway.



Source: JICA Study Team.

Figure 4.4.18 Draft Spatial Plan for Talisay City

4.5 Tools to Realize the Spatial Plan

4.62 The spatial plan, which depicts future land use zones that incorporate infrastructure development, is commonly not regarded as an approved plan in the Philippines. As such, the Metro Cebu Spatial Plan will not work as a statutory document unless the following measures will be critically done:

1) Sharing and Use of Spatial Plan

(a) First, it is imperative that the Metro Cebu Spatial Plan be recognized as an urban development guiding document among the LGUs and relevant central government agencies in Metro Cebu.

(b) The Metro Cebu Spatial Plan is made on the existing land use map at the scale of 1:10,000, which indicates existing building conditions. Administrative routine works will be established to immediately understand existing conditions and future development based on the spatial plan.

(c) A more environmentally sensitive development plan is necessary to undertake urban development on more vulnerable sites against landslide, flood, etc. Effective Land Use Control Guidelines will be prepared to conserve environment-sensitive areas and guide land development activities to proper land uses, based on the potential and hazardous land assessment.

2) Development Permit in Accordance with the Spatial Plan

(a) Generally speaking in the Philippines, private urban investment does not contribute to infrastructure development at a satisfactory level.[8] Issuing development permits in accordance with the spatial plan will guide private developers to direct their contribution of roughly 30% from their development lands for roads, parks and public facilities.

(b) Subdivision development has a large share in residential development in the country. In many cases, a subdivision is planned to just connect to the nearby trunk road and, thus, a subdivision developer does not contribute to the local road network at all. Luxury subdivisions are likely to develop gated areas. It is important to guide a subdivision developer to contribute to local development based on the spatial plan as a condition to getting a development permit.

(c) A developer who demonstrates desirable urban development based on the spatial plan should be rewarded by way of relaxation of development control, such as addition to floor area ratio (FAR) as a bonus, and priority development of roads and public facilities around a project site.

3) Human Resource Development for Using and Revising the Spatial Plan

(a) Regular updating of existing conditions and planning contents is necessary in spatial planning. For areas where urbanization is acute, like Metro Cebu, it is suggested that existing conditions be updated every five years and planning contents every ten years. An update manual with human resource development is important to enable such continuous updating.

[8] In Japan, land readjustment projects have supplied around 30% of all urban areas where project contribution covers roads and other lands for infrastructure and public facilities. Even in each building activity, permission is necessary. Sometimes, permission is conditional such as building setback to widen a front road in accordance with a respective city plan.

(b) The spatial plan can be effective for wider areas when its GIS is utilized for planning rather than just as a printed document alone. GIS usage provides a greater benefit particularly for LGUs. It is suggested that the necessary training be provided for handling GIS database of the spatial plan.

(c) The Metro Cebu Spatial Plan cannot be managed by only 13 LGUs' efforts for the regular updating and the advocacy among all development entities. A metropolitan platform must work. This role is expected to be lodged with the MCDCB or its future organization.

4.6 Summary of Sub-Roadmap Projects

1) Short-Term

- Utilize the Metro Cebu Spatial Plan in the administration services for trunk infrastructure development at a metropolitan level, local infrastructure and public facilities and land use zoning at the LGU level. (2015–2017)
- Develop effective Land Use Control Guidelines to conserve environment-sensitive areas and guide land development activities to proper land uses. For instance, the guidelines control urban development at hazardous areas such as steep slope lands over 18% and vulnerable low lands below 2 m from the sea level. One unified guidelines for Metro Cebu will be produced. (2015–2017)
- Facilitate “Urban Greening Program” to create an urban green network integrating with all available greening resources in every development undertaking, including greenery thoroughfares, urban disaster prevention parks, skywalks, rainwater permeable parking space, wastewater reuse, riparian environment improvement, etc. Although those greening works will be implemented over the roadmap period, some good practices will be achieved in the short term. (2015–2020)

2) Medium- to Long-Term

- Complete the “Green Loop” for comfortable road space for all users at the core metropolitan area in line with related infrastructure projects such as greenery thoroughfares, spacious pedestrian/bicycle space on the two new Cebu-Mactan bridges, intersection improvement for the safety of pedestrian/bicycle. (2021–2030)
- Provide human resource development programs to utilize and update the Metro Cebu Spatial Plan. In this connection, urban development monitoring will be done every five years while update of spatial plans by every ten years, e.g., 2025, 2035 and 2045. All the LGUs are encouraged to participate in the training programs. MCDCB will establish a Technical Research Unit so as to manage the consolidated spatial plan database of Metro Cebu, provide training programs and support LGUs to monitor and update their spatial plans. (2021–2050)
- Structure a Mega Cebu Spatial Skeleton where transit-oriented development (TOD) is promoted for compact urbanization. All roads within Metro Cebu are regarded as urban roads with sufficient sidewalks. (2021–2050)
- Facilitate beautification projects of major rivers and revitalize rivers and riparian zones,including relocation of informal settlements. (2021–2050)

Table 4.6.1 Sub-Roadmap Projects for Urban Structure and Land Use

Terms	Projects
Short-Term	• Utilize Metro Cebu Spatial Plan in the various administration services in relation to infrastructure and land use zoning (2015–2017) • Develop effective Land Use Control Guidelines (2015–2017) • Facilitate urban greening measures (2015–2020)
Mid to Long-Term	• Complete 'Green Loop' (2021–2030) • Provide programs to utilize and update Metro Cebu Spatial Plan (2021–2050) • Promote rail and TOD for compact city, wide pedestrian space at roads (2021–2050) • Improve riverine environment (2021–2050)

Source: JICA Study Team.

5 SUB-ROADMAP FOR HIGHWAY NETWORK AND URBAN TRANSPORT

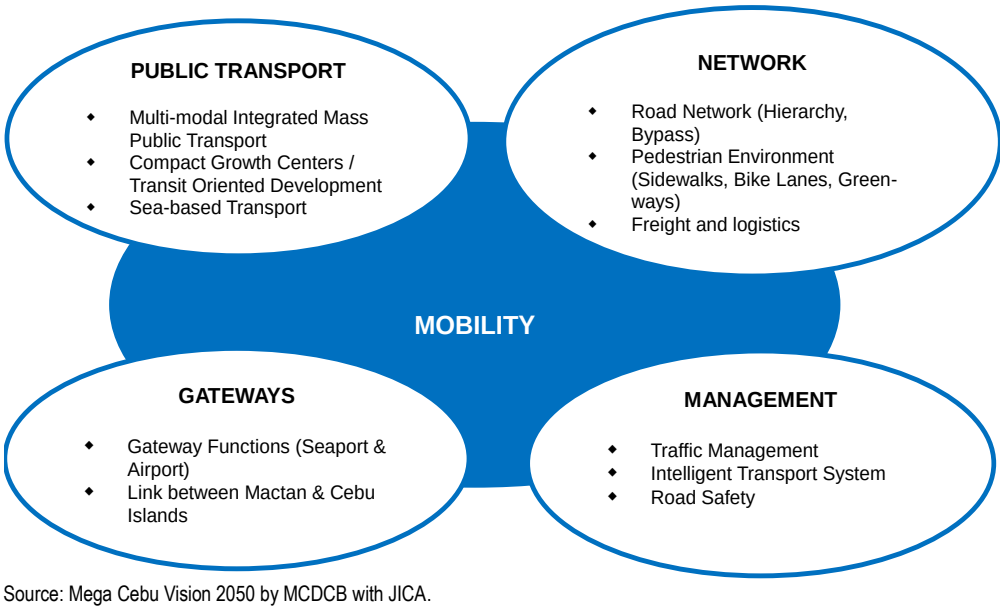
5.1 Introduction

5.1 This sub-roadmap aims to show how to enhance mobility in Metro Cebu, which is one of the four strategies in the Mega Cebu Vision 2050. In the vision statement, "mobility" means ensuring accessible and efficient movement within and to/from Metro Cebu through an integrated and sustainable transport system, encompassing the four elements of Network, Public Transport, Gateways and Management (see Figure 5.1.1).

5.2 In this chapter, "mobility" has been elaborated as follows:

(a) **Network:** Short- to long-term road networks are proposed in Section 5.2 "Highway Network" with some strategic planning considerations, including regional road network, Metro Cebu Circumferential Road, and Mactan Link. Sidewalks, bike lanes and greenways are potent tools to create favorable pedestrian environments. These measures have been featured in Section 4.3 "Greening Measures in the Urban Area" and Section 5.3 "Mitigation Measures of Bottlenecks." For freight and logistics, new coastal roads are proposed in Tayud, Consolacion and other areas.

(b) **Public Transport:** Several mass transit systems are proposed, such as BRT, LRT and MRT in an integrated network in Section 5.3 "Public Transport." Development of these mass transit systems may bring about profound changes in Metro Cebu's urban structure. It enables more compact urban development around stations. Such distinguishable features have been illustrated in Section 4.4 "Metro Cebu Spatial Plan." There is a possibility that sea-based transport could work for urban transport, as discussed in Section 5.5 "Coastal Shipping in Urban Commuting."



Source: Mega Cebu Vision 2050 by MCDCB with JICA.

Figure 5.1.1 Mobility and Associated Elements

(c) **Gateways:** Economic and social activities in Metro Cebu are firmly supported by MCIA and Cebu Port. Although gateway location planning is outside of the Study's scope, it is implicitly understood that MCIA will be further expanded such as the third terminal and/or the second runway without relocation. Part of Cebu Port's functions, particularly

container handling, will be transferred in order to decongest port operation and attract larger container ships. While there are some ideas for port site selection, the Study tentatively sets a new container port at Tayud, Consolacion since only an engineering study has been prepared for the site so far. An additional Mactan road link is discussed in Section 5.2 as an important constituent of Metro Cebu's highway network.

(d) **Management:** Advanced traffic management is elaborated in Section 5.6. Mitigation measures are planned at daily congested intersections and road sections in Section 5.4. Better traffic management and grade separation of congested intersections will contribute a great deal to road traffic safety.

5.2 Highway Network

1) Strategic Planning of Highway Network

(1) Regional Road Network

5.3 Three layers of regional road networks are incorporated into the highway network of Metro Cebu, as follows:

(a) **Cebu Island Circumferential Road**

5.4 This is a 512 km road project. The project includes a new link between Aloguinsan and Barili and the widening and rehabilitation of the existing roads (see Figure 5.2.1). Within Metro Cebu, the existing national roads (2-lane/4-lane) work as part of the island circumferential road. They will be widened or vertically modified in line with increasing traffic demand.

(b) **Cebu Trans-Axial Highway**

5.5 Cebu Province promotes the Trans-Axial Highway Project which traverses the main island from north to south, 300 km long (see Figure 5.2.2). The project will open up the mountainous areas of Metro Cebu. Since the alignment is considerably distant from urban areas in Metro Cebu, the Trans-Axial Highway will not work as a bypass for urban traffic.

Source: DPWH.

Figure 5.2.1 Cebu Island Circumferential Road

Source: Cebu Province.

Figure 5.2.2 Cebu Trans-Axial Highway

(c) **Cebu Island East-West Roads**

5.6 There are two national roads connecting Metro Cebu with the western seaboard of Cebu Island, namely: the Naga–Toledo road (35.3 km) and the Transcentral Highway from Cebu City to Balamban (40.5 km).

- **Naga–Toledo Road**

5.7 It is necessary to improve and rehabilitate the Naga–Toledo Road. A climbing lane will be added on steep road sections. The road sections are divided into the following (see Figure 5.2.3):

- Toledo to Cantabaco: 17.4 km;
- Cantabaco to Naga: 17.9km; and
- Cantabaco to Talisay: 23.1 km (Secondary Road).

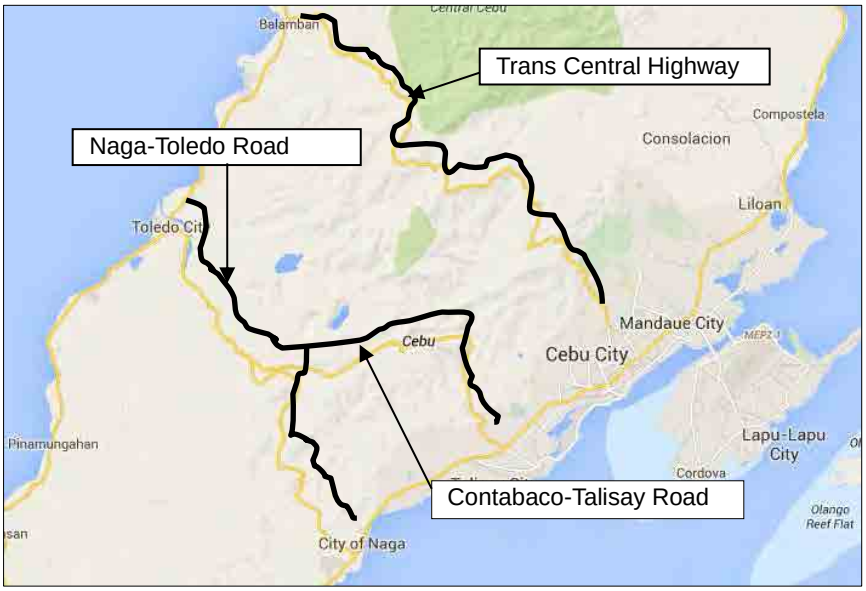
5.8 The Cantabaco–Talisay Road is also an east-west link of Cebu Island and is a very important access between Cebu City and Toledo City through Talisay. However, this route is narrow. People currently using the Naga–Toledo route even take a detour. Once improved, travel time from Cebu City to Toledo City will be drastically improved.

5.9 Since the Naga–Toledo Road is designated as a part of the

North-South Backbone Road Network[1], Naga Port is required to smoothly connect between RO-RO ships and road vehicles. Currently, reclamation for port development has been done. On the other hand, Toledo City has a RO-RO port for daily service with San Carlos, Negros Island. The roads between RO-RO ports must be prepared in good condition for 24-hour travel of trucks and container trailers.

- **Transcentral Highway (Cebu City–Balamban)**

5.10 The Transcentral Highway is the east-west link from Cebu City through the central mountainous area to Balamban at western Cebu Island, with a total length of approximately 40.5 km. This highway's pavement condition consists of 5 km of concrete and 35.5 km of gravel in steep slope and currently unsuitable for vehicles. There are seven bridges that need to be replaced to improve traffic flow. Therefore, this highway should be improved to become passable for vehicle traffic and to promote the western seaboard development of Cebu Island.



Source: JICA Study Team using Google Map as base map.

Figure 5.2.3 Cebu Island East-West Roads

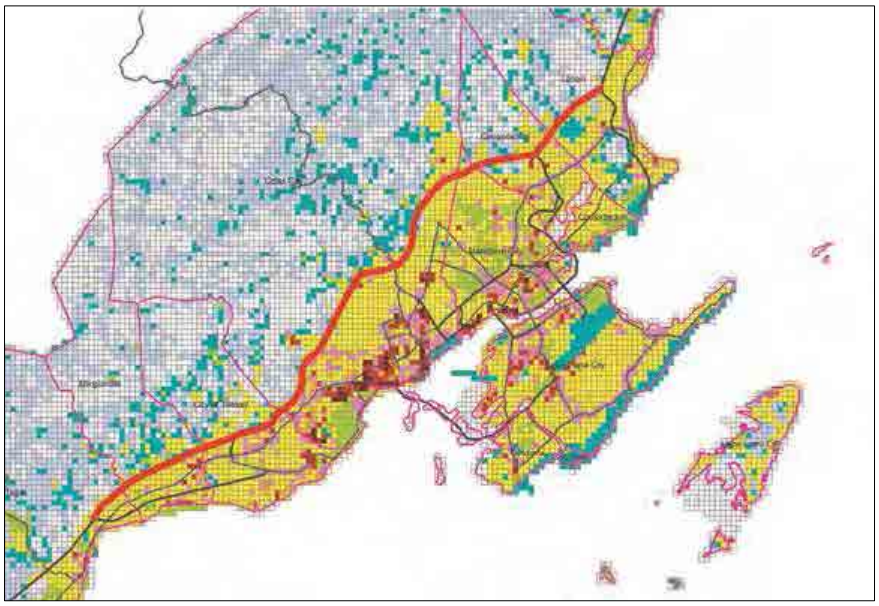
(2) Metro Cebu Outer Circumferential Road

5.11 This road project has been discussed since 1992 under the MCDP's consultancy services. Originally, the project has two objectives: to divert urban traffic and to promote urban development. Due to hilly terrain, it is difficult to design the road alignment particularly the intersections with radial roads.

5.12 The Study has drawn the road alignment where future urban areas would be in 2050. It intends to structure urban areas, guiding orderly urbanization and controlling upland development above the road.

5.13 As a result, the proposed road alignment is designed from Liloan to Minglanilla, 39.5 km long, based on the grid analysis for future urban areas (see Figure 5.2.4).

[1] Otherwise known as the Nautical Highway Network System, it is a combination of roads and RO-RO shipping routes, 5,151km in total.



Source: JICA Study Team.

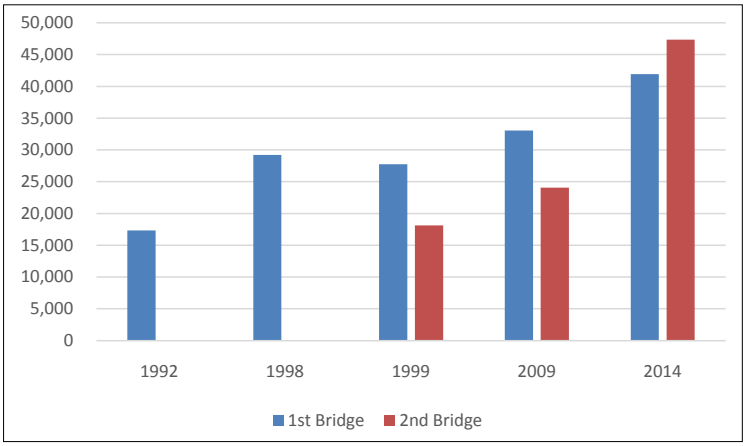
Figure 5.2.4 Metro Cebu Outer Circumferential Road and Future Urban Areas

(3) Mactan Link

(a) Traffic Trend

5.14 There are two bridges serving inter-island traffic between Cebu and Mactan. The First Mactan Bridge (the old bridge) opened in 1972 with a 2-lane carriageway while the Second Mactan Bridge (the new bridge or Marcelo Fernan Bridge) started its operation in 1999 with a 4-lane carriageway. Both bridges are toll-free.

5.15 The traffic survey conducted in early 2014 shows that this is the first time that more traffic on the new bridge was observed compared to the old bridge in terms of PCU (passenger car unit), as illustrated in Figure 5.2.5. Since vehicular traffic on the old bridge has reached its capacity, it is expected that only the new bridge will absorb additional traffic in the coming years. But around 2020, it is highly possible that the new bridge will experience congestion.



Source: Years 1992, 1998 and 1999 by JICA Project Evaluation Report.
Year 2009 by JICA-DPWH High Standard Highway Study.
Year 2014 by JICA Roadmap Study.
Unit: Passenger Car Unit (PCU).

Figure 5.2.5 Trend in Cebu–Mactan Link Traffic

(b) **Review of IDI Report**

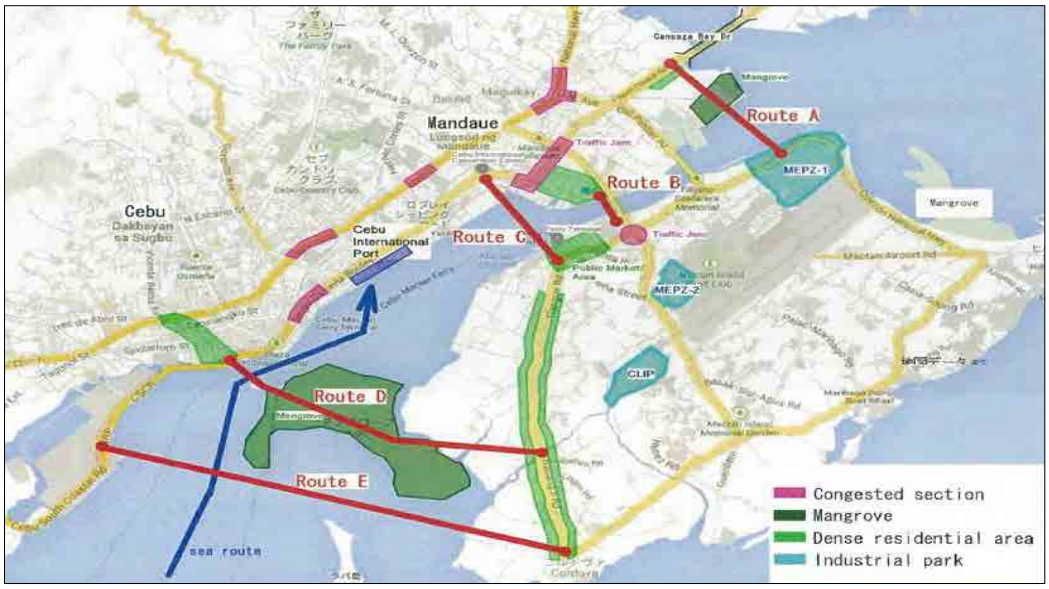
5.16 The Infrastructure Development Institute (IDI) of Japan conducted a field survey in August 2013 and produced a report in January 2014.[2] The IDI report selected five alternative routes for the Third Bridge and compared them from mainly a physical condition viewpoint (see Figure 5.2.6).

5.17 The Study reviewed the IDI report from the following points (see Table 5.2.1):

(i) Updated the alternative routes when more concrete project preparation has been done. Particularly, JST has amended the project formation for Route A as reported in the Interim I Report in April 2014 while Metro Pacific Tollways Corp. showed its interest to construct and operate a toll bridge along Route D[3];

(ii) Estimated the traffic demand in 2030 on the alternative routes and on the existing road network of Metro Cebu; and

(iii) Reviewed the alternative routes, particularly infrastructure design and social acceptance among local stakeholders.



Source: IDI Report 2014.

Figure 5.2.6 IDI Bridge Alternatives

[2] The Preliminary Study Report for the Construction of the Third Bridge over the Mactan Channel in Metro Cebu, Cebu Province (January 2014).

[3] At the MCDCB-RPOD Executive Committee meeting on June 10, 2014.

Table 5.2.1 Comparison of Bridge Alternatives

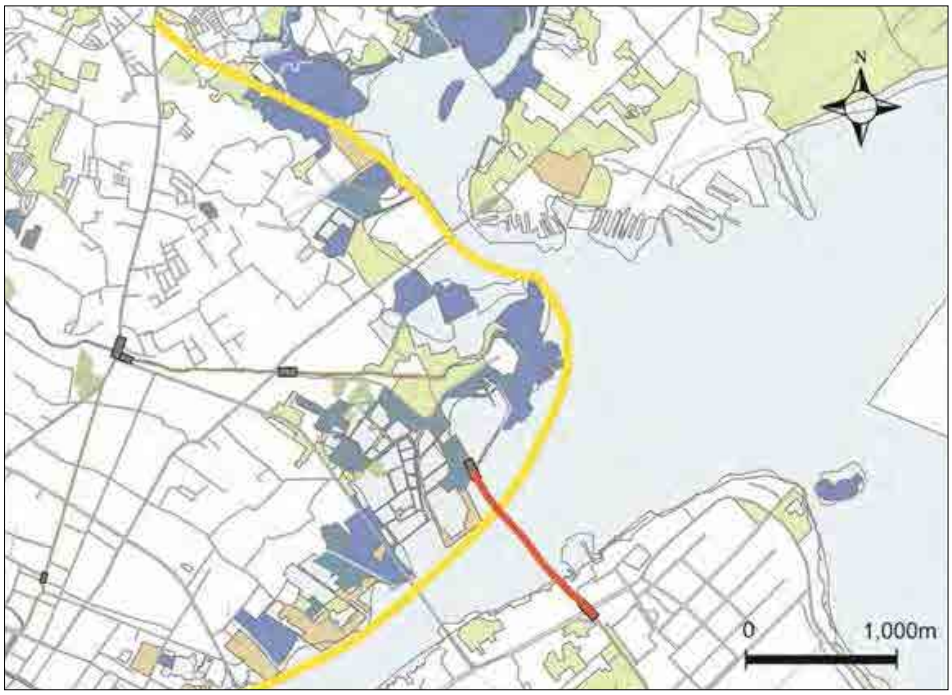
Route	A	B	C	D	E
Main Bridge (m)	420	340	340	710	1,220
Approach Bridge (m)	3,000	2,200	3,400	10,000	9,650
Channel Width (m)	800	360	1,100	500	1,600
Height Restriction (m)	45	45	45	140	165
No. of Lanes	6 (2 for AGT)	4	4	4	4
Structure Type	Steel Box Girder	Extra Doused	Extra Doused	Cable-stayed	Cable-stayed
Construction Cost (PHP billion)	9.6 (incl. 3.2 for rail)	7.9	11.1	33.1	40.0
No. of Buildings to be Relocated	10 houses, 1 office/factory (Lapu-Lapu)	110 houses, 10 offices/factories (Mandaue); 40 houses, 2 offices/factories (Lapu-Lapu)	109 houses, 38 offices, 4 schools, 5 shopping malls/markets (Lapu-Lapu)	280 houses, 20 offices/factories (Cebu City); 30 houses, 3 offices/factories (Cordova)	30 houses, 3 offices/factories (Cordova)
Natural Environment	Mangrove habitation at Mandaue	Negligible	Negligible	Mangrove habitation at Cordova	Mangrove habitation at Cordova
Expected Traffic in 2030	30,700 PCU	-	47,400 PCU	32,400 PCU	-
Local Acceptance	Highly Supportive	Negative	Negative	Supportive	No concern
Remarks	Dual-mode bridge (road and AGT) is proposed.	Approach roads have 4 lanes at both sides		A private toll operator has shown an interest on bridge only	
Evaluation by JST	Recommendable	Rehabilitation or replacement of the existing bridge rather than new bridge	Difficult to implement	Conditional	Not Recommendable

Source: JICA Study Team based on IDI Report 2014, Field Survey and Stakeholders' Interview.

(c) **Impact Analysis on Natural and Social Environments**

(i) **Route A at Cansaga Bay, Mandaue City:** The approach road is part of the Scenic Coastal Road which will be built on viaducts to minimize its impact on the natural environment, particularly the mangrove habitation (see Figure 5.2.7). No resettlement will be required along the route. Mandaue City has a long-term plan for a global city along Cansaga Bay.

(ii) **Route A at Lapu-Lapu City:** The dual-mode bridge will have a ramp at Quezon National Highway which has the widest carriageway (6-lane) in Mactan Island (see Figure 5.2.8). However, the existing road from the coastline to the ramp (270 m long) is too narrow to allow the elevated structure to stand. It must be widened through land acquisition.



Source: JICA Study Team.

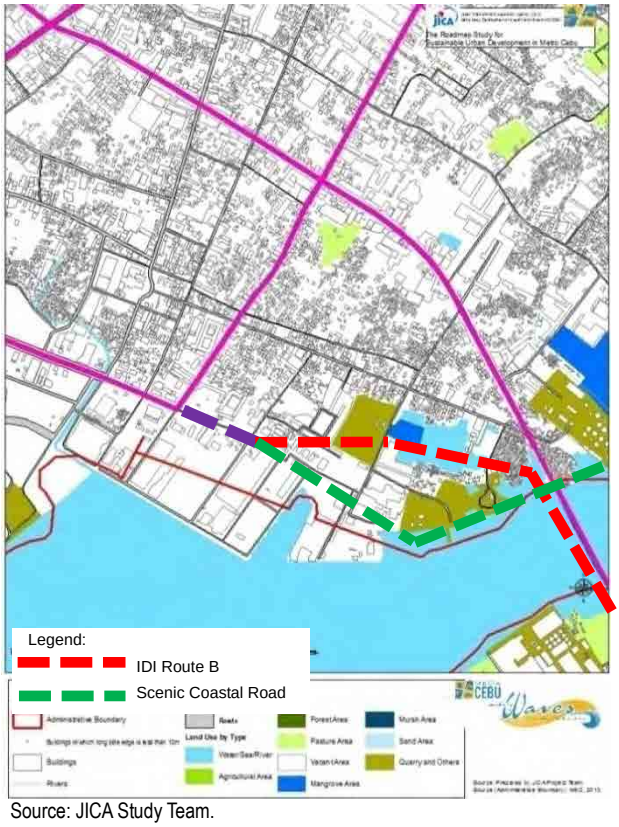
Figure 5.2.7 Alignment Plan of Dual-Mode Bridge and Scenic Coastal Road

Source: JICA Study Team.

Figure 5.2.8 Approach Bridge Alignment to Lapu-Lapu Ramp

(iii) **Route B at Mandaue City**: Since there is no existing road section of 1.0 km, all ROW must be acquired. Sensitive social considerations are necessary with a lengthy negotiation period. The alignment is partly the same with the proposed Scenic Coastal Road (200 m) on the extension of Ouano Avenue (see Figure 5.2.9). It is considered a planning conflict to be resolved with Mandaue City.

(iv) **Route B at Lapu-Lapu City:** The approach bridge will be built on the existing road around the First Bridge. Road congestion will be severe but no other tangible social and natural environmental issue is observed.



Source: JICA Study Team.

Figure 5.2.9 Route B at Mandaue City

(v) **Route C at Mandaue City:** The proposed bridge has one ramp at a vacant lot in front of the Cebu International Convention Center where Mandaue City intends to procure the land for a new city hall, expo and transport hub (see Figure 5.2.10). It must pass over the superblock of Taft Property (Gaisano Country Mall's developer) which is likely to be a complex of shopping mall, high-rise residential tower and business center. The firm's attitude as to negotiation for part of the air rights to allow the bridge to pass over is crucial.

(vi) **Route C at Lapu-Lapu City:** The Virgen de la Regla Church (National Shrine) stands near the proposed bridge alignment and the church's associated four schools would be affected (see Figure 5.2.11). Since the approach bridge structure (21 m) is much wider than the existing road (P. Rodriguez St., 4-5 m in width), the roadside lands must be acquired and the school buildings must be partly demolished. The opposite site is San Miguel's industrial property. Availability of its land is unknown.

5.18 A similar problem would happen due to imbalance between the narrow surface road (G.Y. de la Cerna St., 6–12 m) and the proposed approach bridge (21 m) in front of Lapu-Lapu Public Market. According to the IDI proposal, another 1.3 km approach bridge will extend to the First Bridge ramp site. As it covers a long stretch, the affected lots and buildings are numerous.

5.19 From a bridge planning viewpoint, however, such a long approach bridge is better than none. Currently, one-way traffic management is done in front of the public market so as to cope with traffic congestion. Allowing tens of thousands of vehicles on such a narrow road without an adequate approach for the bridge would be chaotic.

Source: JICA Study Team.

Figure 5.2.10 Route C Alignment Plan

Source: JICA Study Team.

Figure 5.2.11 Virgen de la Regla Church Area and the Approach Bridge Alignment

(vii) **Route D at Cebu City:** The IDI report indicates that there are some hundreds of buildings from the proposed bridge to Cebu South Road, approximately 1.2 km.

(viii) **Route D at Cordova:** The approach bridge will be built over a large mangrove area and will affect around 30 houses which stand along the Mactan Circumferential Road (Tiangue Road).

(ix) **Route E at Cebu City:** Tourism development is planned at Kawit Point. The proposed bridge must be coordinated with the plan and its developer. At the site, development has not been fully realized.

(x) **Route E at Cordova:** (the same as Route D).

(d) **LGUs Attitude Towards Bridge Alternatives**

5.20 Four LGUs are directly affected by the five bridge alternatives. These are Mandaue City, Lapu-Lapu City, Cordova Municipality and Cebu City. Their attitude

towards the new bridge shows local acceptability and, thus, it is considered a decisive factor for implementation (see Table 5.2.2).

5.21 Except for Cordova, three city administrations have not indicated a new bridge in their development plans (i.e., the CLUPs). JST has identified their attitude towards the new bridge alternatives based on the results of interviews with city administrators and city planning officers and MCDCB as well as the group meetings held by JST.

Table 5.2.2 LGUs Attitude Towards New Bridge Alternatives

LGU	Route A	Route B	Route C	Route D	Route E
Mandaue City	VV	XX	X	-	-
Lapu-Lapu City	VV	X	XX	V	-
Cordova	-	-	-	VV	-
Cebu City	-	-	-	V	-

Source: JICA Study Team.
Note: VV- Highly Supportive, V-Supportive, XX – Strongly Negative, X-Negative.

(i) **Mandaue City:** The city administration promotes "Global City" development at the Cansaga Bay Area. The Scenic Coastal Road is designed to facilitate such bay area development. Mandaue supports Route A since it may provide a synergistic effect to the Cansaga Bay area development. On the other hand, Route B must address land acquisition and resettlement issues on a large scale. The alignment of Route B also conflicts with the plan of Mandaue's Scenic Coastal Road. Route C designs to place a ramp at the South Point reclamation area. But the area is at the final stage of development and, therefore, new large infrastructure such as a bridge across the Mactan Channel is not advisable.

(ii) **Lapu-Lapu City:** The city administration supports Route A for mainly two reasons. One is to disperse traffic convergence points at Mandaue City. The other is to promote the North Mactan reclamation area (300 ha). In the same sense, the city does not support a new 4-lane bridge at Route B which may collect too much traffic. The idea of adding two lanes to the old bridge is acceptable. It will use the existing access road (4-lane) and affect a few houses to be resettled. The city strongly opposes Route C which must bring about serious and large-scale land acquisition and resettlement along the existing narrow roads under the proposed 2 km approach bridge. The development, which degrades the environment of the Virgen de la Regla Church (National Shrine), cannot be allowed. Finally, the city supports Route D, which will contribute to a balanced Mactan development, particularly the southern part, and alleviation of traffic via Mandaue City.

(iii) **Cordova:** The municipality has eagerly promoted the Third Bridge project between Cebu City and Cordova for a long time. Cordova must work for environment protection at the shallow reefs and mangroves along Route D. Due to limited houses to be affected by the project, local acceptance is considered high.

(iv) **Cebu City:** The city administration has also supported the Third Bridge project along Route D. Depending on the ramp site, the project may tackle huge land acquisition and resettlement concerns. Therefore, social acceptance of the project is still uncertain.

(e) **The Study's Suggestion on Additional Cebu–Mactan Linkage**

5.22 Based on the review, Route A at the north is recommendable. Both Mandaue City and Lapu-Lapu City support this route. If a dual-mode bridge for road and rail is constructed, it is possible to draw the shortest alignment to the airport terminal from among the bridge alternatives. There are mangrove habitations at the Mandaue side but the city administration intends to develop a water park partly for mangrove preservation.

5.23 In order to meet traffic demand, two road bridges will be necessary. As another bridge, Route D is recommended with some conditions. The route will be able to promote a balanced Mactan Island development. A private toll operator has shown interest in constructing and operating a new toll bridge but it is uncertain who will construct the connecting approach bridge or causeway of at least 6 km long. There are widespread mangrove habitations at Cordova and numerous buildings to be relocated at Cebu City.

5.24 Route C is expected to serve the largest traffic demand from among the alternatives but the bridge length over the channel is long and, thus, costly. The lands at both ends have already been built up and urbanized. It is hard to introduce a large infrastructure, such as a bridge, at this time. In particular, the Poblacion in Lapu-Lapu City is a historical and densely built-up area where Route C extends its approach bridge of 1,700 m above the narrow existing roads. Development impact on Virgen de la Regla Church (National Shrine) will be serious and many roadside buildings such as schools and commercial buildings must be demolished or modified. Therefore, social acceptability of this route is rated low.

5.25 Another infrastructure concern must be given to the old bridge. It started operation in 1972 and it has been structurally damaged. Immediately after the Third Bridge is open, the old bridge will have to be fully rehabilitated or replaced with a new one.

5.26 Finally, bridge management must consider bus and mass transit in order to control increasing vehicular volume. Currently, people movement on the two bridges are done by private and low capacity transport modes, e.g., jeepney (41%), motorcycle (19%), car (17%), and taxi (8%). More buses are necessary between Cebu and Mactan islands. For punctual and high-standard passenger service, a rail-based transport such as AGT is desirable particularly for airport access. It is noted that a dual-mode bridge concept can reduce bridge construction cost and save bridging space and land acquisition cost.

5.27 With the abovementioned suggestions, the road link of Cebu–Mactan islands will attain the envisioned mobility and competitiveness up to the year 2050.

2) Metro Cebu Road Network

5.28 The Metro Cebu Land Use and Transport Study (MCLUTS) in the early 1980s produced the first entire road network plan for Metro Cebu. Its implementation was done by DPWH and MCDP using Japan's ODA loan in the 1990s. However, there have been a lot of backlogs in the implementation of many projects.

5.29 In the 2000s, progress of metropolitan planning and implementation was lagging further. In the early 2010s, though, two important documents were produced. One is the

JICA-assisted DPWH High Standard Highway Master Plan Study in 2010 while the other is MCDCB's road network project list submitted to DPWH for the year 2014 budgeting. In the latter case, MCDCB served as a platform for participating LGUs to compile a Metro Cebu proposal.

5.30 The Study has proposed road projects for three time frames: short-term until 2020, mid-term until 2030, and long-term towards 2050, taking into consideration the two documents, and the results of the study-related workshops and other MCDCB meetings.

(1) Short-Term Projects(see Table 5.2.3)

(a) **Cebu–Mactan Link Bridge:** Dual-Mode Bridge including Scenic Coastal Road Phase-1

5.31 In order to strengthen the local road network around Cansaga Bay and Mactan Strait, Mandaue City proposes the Scenic Coastal Road. Along the road, the city intends to promote reclamation with urban development and preserve mangrove forests as waterparks. The section between the Second Mandaue–Mactan Bridge and the Cansaga Bay Bridge of the Scenic Coastal Road can offer a diversion route between North Cebu Province and Mactan Island, particularly between the new Consolacion container terminal and Mactan EPZ I and II. Therefore, part of the Scenic Coastal Road is considered as an important access road to a new bridge.

5.32 MCIA will construct a new airport terminal under a PPP scheme and the existing and new terminals will handle over 10 million passengers in 2020. Airport use is deemed more affordable for time-conscious people. Therefore, it is suggested that a new bridge be designed which will have a vehicle carriageway and railway substructure.

5.33 Taking the aforementioned into account, the most suitable alignment is about 1 km north from the Second Bridge. This alignment is not new since the JICA-assisted DPWH masterplan of high standard highway in 2010 planned a new bridge on the same alignment. The dual-mode bridge of road and rail is a new concept.

5.34 The Dual-Mode Bridge will utilize a combination of road and AGT system. The AGT system will be connected from MCIA via Mandaue to the Cebu CBD. The road will be connected from the industrial area of Lapu-Lapu City in Mactan to Mandaue's Scenic Coastal Road and also with the Cebu North Coastal Road.

(b) **Road Widening for Arterial Roads**

5.35 The arterial roads covered by the project are initially identified in MCLUTS. To date, the following are the unimplemented projects:

(i) Guadalupe Road (from M. Velez to Guadalupe);
(ii) Arch. Reyes Ave. (from Gorordo to M.L. Quezon);
(iii) Cebu North Road (from M.L Quezon to Rizal St.);
(iv) F. Jaca St. (from Cebu South Road to Talisay);
(v) Tagunol Highway (from Inayawan to Mambaling);
(vi) Talisay Distributor (from Tabunok to San Roque);
(vii) Lapu-Lapu Link (from Lapu-Lapu to Mactan East-West);

(viii) Extension of Arterial Road (H. Cortes St. from F. Cabahug to M.L Quezon and from H. Abellana St. to Canduman); and

(ix) Mactan North South Road.

Table 5.2.3 Short-Term Road and Bridge Projects (until 2020)

No.	Project Name	Project Area	Length (km)	Cost (PHP Mil.)
1	Dual-Mode Mactan Bridge and Mandaue Scenic Coastal Road	Lapu-Lapu City via Mandaue Scenic Coastal Road	3.8	15,569
2	Road Widening	Arterial Roads, mainly unimplemented projects from MCLUTS, including among others: Guadalupe Road (from M. Velez to Guadalupe), Arch. Reyes Ave. (from Gorordo to M.L. Quezon), Cebu North Road (from M.L Quezon to Rizal St.), F. Jaca St. (from Cebu South Road to Talisay), Tagunol Highway (from Inayawan to Mambaling), Talisay Distributor (from Tabunok to San Roque), Lapu-Lapu Link (from Lapu-Lapu to Mactan East-West)	-	4,264

Source: JICA Study Team.

(2) Medium-Term Projects (2021–2030)

(a) Metro-Cebu Outer Circumferential Road

This Metro Cebu Outer Circumferential Road is one of the important cores of the Metro Cebu Road Network Plan. The road would traverse from Liloan, starting from the proposed Second Cebu North Road, then will traverse around the urban edges of Consolacion, Mandaue City, Cebu City and Talisay City and connect to Minglanilla at the proposed Second Cebu South Road. It will have a total length of approximately 39.5 km and will have a 4-lane roadway and a 20 m wide ROW.

(b) Metro Cebu South Link Coastal Road from Cebu City to Carcar

5.36 The proposed Second Cebu SouthLink Coastal Road would connect from Veco Pardo at the proposed Outer Metro Cebu Circumferential Road passing through the seaside of existing South Road of Talisay, Minglanilla, San Fernando to Carcar. The ROW at Minglanilla is using an abandoned railway property and this property is available now. The proposed road length is approximately 35 km and it will have a 4-lane roadway and a 20 m wide ROW.

(c) Metro Cebu North Link Coastal Road from Consolacion to Danao

5.37 The Cebu North Coastal Road would connect from after Cansaga Bay Bridge at Consolacion passing through the right side of the existing national highway to Liloan and crossing the national highway (using rapid construction method for minimized traffic congestion during construction at existing national road), after this point passing through the left side of the national highway at Compostela up to Danao. This road will serve as an arterial bypass of the north link at each congestion area. Construction of this road will be in two phases.

- Phase-1 will divert from the Mandaue Scenic Coastal Road to Tayud, Consolacion via the proposed second Cansaga Bay Bridge and pass through the coastal side of the existing Tayud –Consolacion National Highway to Liloan. Since it mainly serves the proposed Consolacion container port, the proposed road length is approximately 8 km with a 6-lane roadway and a 30 m wide

ROW as a national highway.

- Phase-2 is the crossing point of the national highway at Liloan passing through the hillside of the national highway at Compostela up to Danao. The proposed road length of Phase-2 is approximately 18 km.

(d) **Cebu–Mactan Link Bridge: Cebu–Cordova Link Bridge**

5.38 Apparently, the Cebu-Cordova Link Bridge with causeway plan between Cordova reclamation area and Cebu City is being studied seriously by a private company for a possible unsolicited proposal via PPP. The distance between the proposed dual-mode bridge and this Third Bridge is approximately 10 km.

5.39 The proposed Third Mactan Bridge would connect from Cebu Coastal Road at Ermita, Cebu City to Shell Island of Cordova (see Figure 5.2.13). The proposed bridge length is approximately 520 m. From Shell Island to Sudtunggan in Cordova, it will connect by causeway and viaduct to this access road with a length of approximately 8 km and with a 4-lane roadway.

5.40 This link will serve as a bypass from the southern area of Metro Cebu to Mactan to reduce traffic congestion at Cebu City and also to accelerate development at the southern part of Mactan Island. This link bridge is also an important part of the Metro Cebu Road Network Plan and is part of the Cordova Vision.

5.41 Before project implementation, there are some conditions to prepare a doable plan, including an entire project financing plan covering both bridge and causeway, a mangrove preservation plan along the causeway, and a socially acceptable bridge connection plan at Cebu City.

5.42 Table 5.2.4 summarizes the proposed medium-term program for roads and bridges in Metro Cebu.

Source: Metro Pacific Investment.

Figure 5.2.12 Proposed Third Mactan Bridge (Cebu–Cordova Link Bridge)

Table 5.2.4 Medium-Term Road and Bridge Projects (2021–2030)

No.	Project Name	Project Area	Length (km)	Cost (PHP Mil.)
1	Metro Cebu Outer Circumferential Road	Minglanilla–Liloan	39.5	15,561
2	Second Cebu North Road	Consolacion–Liloan–Compostela–Danao	18.5	3,380
3	Second Cebu South Road	Talisay–Minglanilla–Naga–San Fernando–Carcar	35.0	7,980
4	Third Cebu Mactan Bridge include Approach Causeway of Cordova side	Cebu City C. Padilla to Cordova (Part of Green Loop Plan)	10.0	16,880
5	Talisay–Naga Coastal Road (ex PNR)	Brgy. Lawaan, Talisay–Minglanilla New Center– Brgy. Colon, Naga	7.1	1,315
6	Tayud Coastal Road with the Second Cansaga Bay Bridge	Mandaue–Brgy. Tayud, Consolacion–Brgy. Poblacion, Liloan	8.9	3,262
7	Rest of Mandaue Scenic Coastal Road (2 sections)	Ouano Ave.–the Second Bridge, Cebu North Road–Cansaga Bay Bridge	5.4 in total	4,834
8	Airport Underpass Road	The Second Bridge–MCIA–Brgy. Pajak, Lapu-Lapu	2.7	2,438
9	Mactan MRT Avenue (incl. 1 bridge)	Brgy. Dapitan, Cordova–Brgy. Mactan, Lapu-Lapu	8.6	2,244

Source: JICA Study Team.

(3) Long-Term Projects (2021–2030)(see Table 5.2.5)

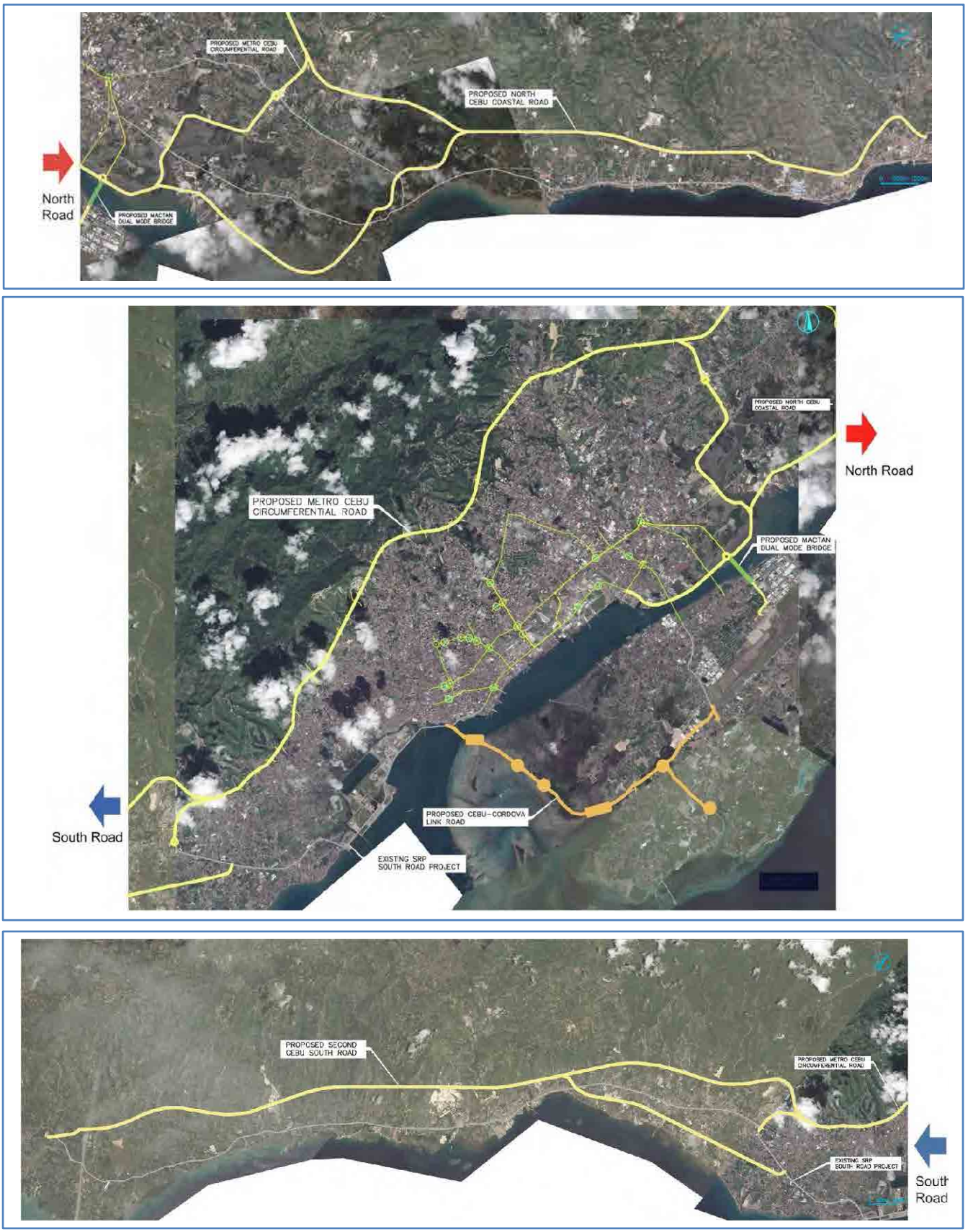
(a) Metro Cebu Coastal Expressway

5.43 The proposed Metro Cebu Coastal Expressway will be an elevated toll road possibly from Danao through Metro Cebu North-South Coastal Road to Carcar using the existing road ROW, 79 km long in total. This road will be constructed at congested road sections even after all the proposed short- to medium-term road projects are implemented. It is difficult to identify the exact road sections during the distant future planning period (2031–2050). This project will apply the PPP scheme and DPWH will be the implementing agency.

Table 5.2.5 Long-Term Road and Bridge Projects (2031–2050)

No.	Project Name	Project Area	Length (km)
1	Mega Cebu Coastal Expressway	Danao to Carcar	Part of 79.00

Source: JICA Study Team.



Source : JICA Study Team.

Figure 5.2.13 Major Road and Bridge Projects in Metro Cebu

5.3 Mitigation Measures for Traffic Bottlenecks

1) Intersections to be Improved

5.44 Simultaneous with the hierarchical road network development, certain measures are necessary to mitigate traffic congestions at particular bottleneck areas. The Study Team placed GPS tracking devices on 296 taxis for several days to gauge travel speeds on roads in Metro Cebu. Results identified traffic congestion on road links and intersections where vehicles can only run at less than 10 km/hour. The Study finally assessed 10 very congested intersections as the first priority and another 10 congested intersections as the second priority (see Figure 5.3.1). Although traffic congestions were reported at many road sections particularly intersections in Metro Cebu, daily traffic congestions were observed only in Cebu City and Mandaue City.

5.45 For intersection improvement, some important data must be analyzed first. They include inflow and outflow traffic volumes by direction, signal pattern and geometric design at a surveyed intersection. When the signal pattern and/or geometric design is not suitable for traffic flow, they must be modified. If such minor modifications may not work well, capital-intensive measures such as land acquisition and grade separation like flyover and underpass will be considered.

5.46 The 20 intersections identified as traffic bottlenecks are all located on trunk roads where further substantial traffic increase is expected in the future. It is obvious that just minor modifications of traffic signal and geometric design will not solve bottlenecks. Various measures must be undertaken.

Source: JICA Study Team.
Note: Red Circle–First Priority, Blue Circle–Second Priority.

Figure 5.3.1 Congested Intersections for Improvement

2) Improvement Plan for Traffic Bottlenecks

5.47 The 20 congested intersections and their connected roads will be improved by the following measures starting from less capital-intensive and less time-consuming measures:

(i) Modification of geometric designs and traffic signals;

(ii) Area traffic control;

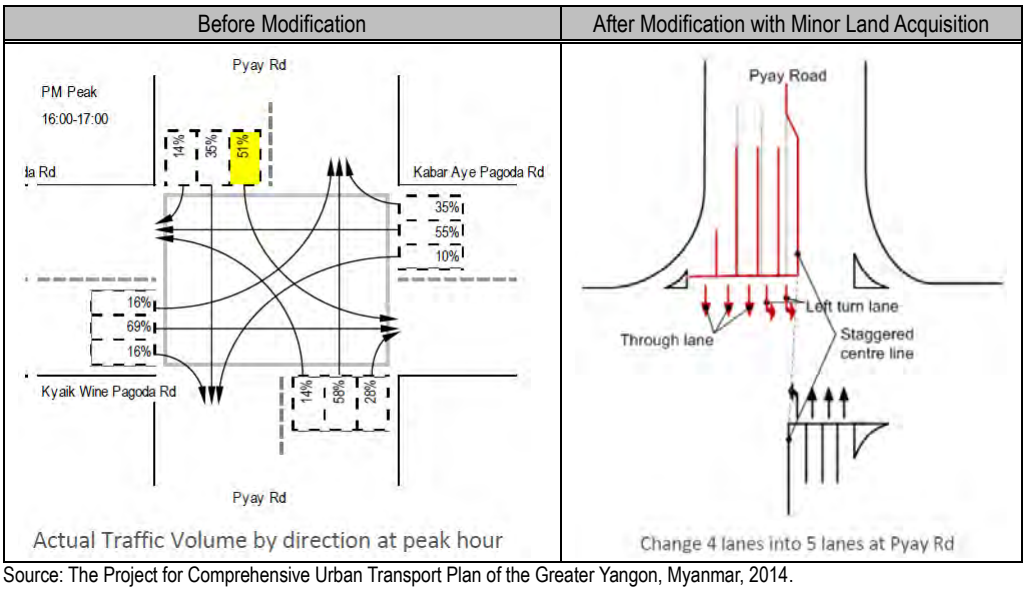
(iii) Grade separation; and

(iv) Road widening.

(1) Modification of Geometric Designs and Traffic Signals

5.48 This is the quickest impact traffic management measure among the applicable measures. First, traffic volumes by direction, traffic signal pattern and intersection design are surveyed. After traffic engineering analysis, more suitable traffic signal and intersection design is proposed to meet actual traffic flows.

5.49 For example, if traffic congestion is mainly attributed to a small turn-right traffic capacity to meet actual demand, an additional turn-right lane may alleviate the congestion (see Figure 5.3.2). Extended green signal to the turn-right lane can expect a similar effect. Minor land acquisition such as corner lots to make a flared intersection enables further smooth traffic flows.



Source: The Project for Comprehensive Urban Transport Plan of the Greater Yangon, Myanmar, 2014.

Figure 5.3.2 Example of Intersection Geometric Design Modification

(2) Area Traffic Control

5.50 MCDP Phases 1 and 2 cover the installation of traffic signals at 69 intersections. However, it is not a synchronized signalization system. Synchronized signalization allows for a smooth drive along arterial roads in the urban areas.

5.51 Today, only Mandaue City controls traffic signals at major intersections at the city's traffic control center. Such an area-wide traffic control system will be expanded in Metro Cebu.

5.52 Area Traffic Control (ATC) is a popular system to control the traffic flow through synchronized traffic signals, message signboards, and lane control signals. In order to effectively control the traffic flow, traffic flow on real time must be surveyed by camera and detector devices and analyzed at a traffic control center (see Figure 5.3.3).

5.53 Such ATC service will cover all the major intersections in Metro Cebu. The 20 congested intersections must be prioritized.

Source: roadtraffic-technology.com.

Figure 5.3.3 Concept of Area Traffic Control

(3) Grade Separation

5.54 The intersections will be vertically improved by flyover or underpass (see Table 5.3.1 and Figure 5.3.4) using the rapid construction method, a Japanese advanced technology which can be applied to steel box and steel deck slab type bridges and steel pier when constructing the superstructure and substructure. It enables the shortest construction duration and minimizes impact on road traffic.

5.55 To enjoy greater development impact, continuous grade separation is considered at the following couple of intersections in the same serial project:

(i) Tunnel along intersections No. 6, No.7 and No.18 (General Maxilom Avenue);

(ii) Elevated road along intersections No. 9 and No. 19 (N. Bacalso Avenue); and

(iii) Elevated road along intersections No. 14 and No. 15 (Ouano Avenue).

5.56 When the proposed flyover has a 4-lane carriageway, road widening of 3 m each will be done at both sides.

5.57 Individual drawings of grade separation are provided in ***Appendix 5A***.

Table 5.3.1 Summary of Intersection Improvement

No.	Location	Type	Length (m)	Const. Cost (PHP 000)	ROW Cost (PHP 000)	Remarks
1	A. C. Cortes Ave. cor. Jose L. Briones	Flyover	460	324,800	136,640	
2	Juan Luna Ave. cor. Cardinal Rosales Ave.	Underpass	390	394,400	88,000	
3	M. J. Cuenco Ave. cor. Juan Luna Ave.	Flyover	475	374,240	139,800	
4	Juan Luna Ave. cor. A. Soriano Ave.	Underpass	460	461,600	68,800	
5	Gen. Maxilom Ave. cor. M. J. Cuenco Ave.	Flyover	510	360,000	148,840	
6	Gen. Maxilom Ave. cor. Gorordo Ave.	Underpass	930	952,800	88,000	Combine Nos. 6, 7, 18
7	Gen. Maxilom Ave. cor. M. Gotianuy St.					
8	Gen. Maxilom Ave. cor. Juana Osmeña St.	Underpass	410	413,600	88,000	
9	Osmeña Blvd. cor. N. Bacalso Ave.	Flyover	800	633,280	219,600	Combine Nos. 9, 19
10	V. Sotto St. cor. C. Arellano Blvd.	Flyover	480	357,120	141,520	
11	M. C. Briones St. cor. UN Ave.	Flyover	470	343,360	139,080	
12	A. C. Cortes Ave. cor. S. B. Cabahug St.	Underpass	440	442,400	68,800	
13	M. C. Briones St. cor. A. S. Fortuna St.	Flyover	420	317,760	104,920	
14	Ouano Ave. cor. Conrado D. Seno St.	Flyover	700	601,280	195,200	Combine Nos. 14, 15
15	Ouano Ave. cor. E. O. Perez St.	Flyover				
16	Archibishop Reyes Ave. cor. Juan Luna Ave.	Underpass	480	480,800	88,000	
17	Cardinal Rosales Ave. cor. Mindanao Ave.	Underpass	380	384,800	88,000	
18	Gen. Maxilom Ave. cor. Rahmann St.	Underpass	-	-	-	
19	Del Rosario cor. Leon Kilat St.	Flyover	-	-	-	
20	Colon St. cor. Leon Kilat St.	Underpass	500	500,000	68,800	
Total			8,305	7,342,240	1,872,000	

Source: JICA Study Team.

Underpass

Source: SRP Report

Flyover

Source: Kosaka Intersection Construction Report in Japan

Figure 5.3.4 Examples of Underpass and Flyover

(4) Road Widening

5.58 When congestion occurs not only at intersections but also on the road itself along a considerable distance, road widening is a fundamental solution. The Study has identified the following six critical road sections, 7,305 m in total (see Table 5.3.2, Figure 5.3.5, and Figure 5.3.6). It is suggested that the existing 4-lane road with a ROW of 16 m be widened to a 6-lane road with a ROW of 30 m, adding vehicular lanes, widening sidewalks, or adding bicycle lanes.

(i) Imus Ave.–M.J.Cuenco Ave.–Lopez Jaena St.–M.C. Briones St. (between North and South Road);

(ii) General Maxilom Ave.; and

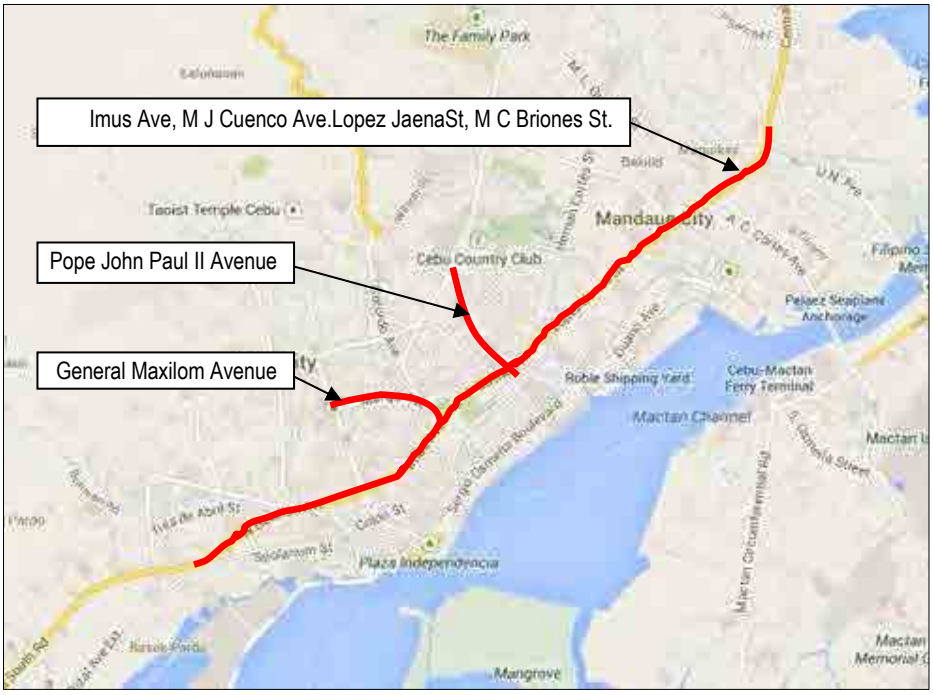
(iii) Pope John Paul II Ave.

5.59 It is suggested that the proposed road widening be done in line with the construction of the MRT Central Line.

Table 5.3.2 Road Improvement with Widening

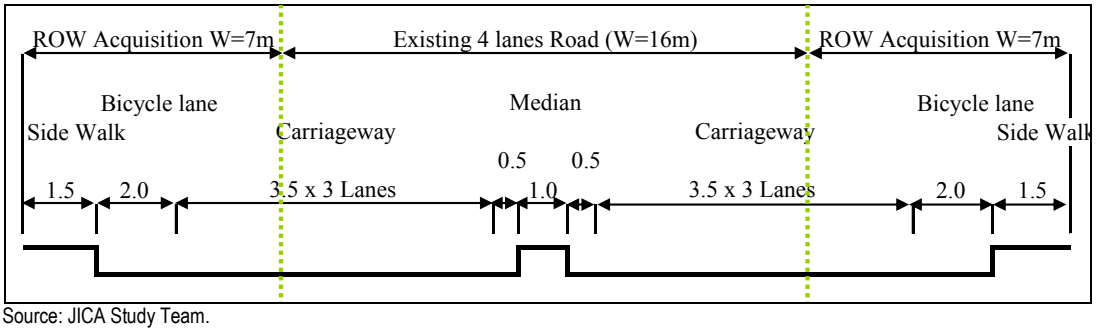
No.	Location	Length (m)	Construction Cost (PHP 000)	ROW Cost (PHP 000)
1	Imus Ave.	770	64,680	169,400
2	M. J. Cuenco Ave.	540	45,360	118,800
3	Lopez Jaena St.	2,125	178,500	467,000
4	M.C. Briones St.	1,210	101,640	266,200
5	General Maxilom Ave.	1,360	114,240	299,200
6	Pope John Paul II Ave.	1,300	109,200	286,000
Total		7,305	613,602	1,606,600

Source: JICA Study Team.



Source: JICA Study Team.

Figure 5.3.5 Proposed Road Widening along Congested Intersections



Source: JICA Study Team.

Figure 5.3.6 Road Section Plan after Road Widening

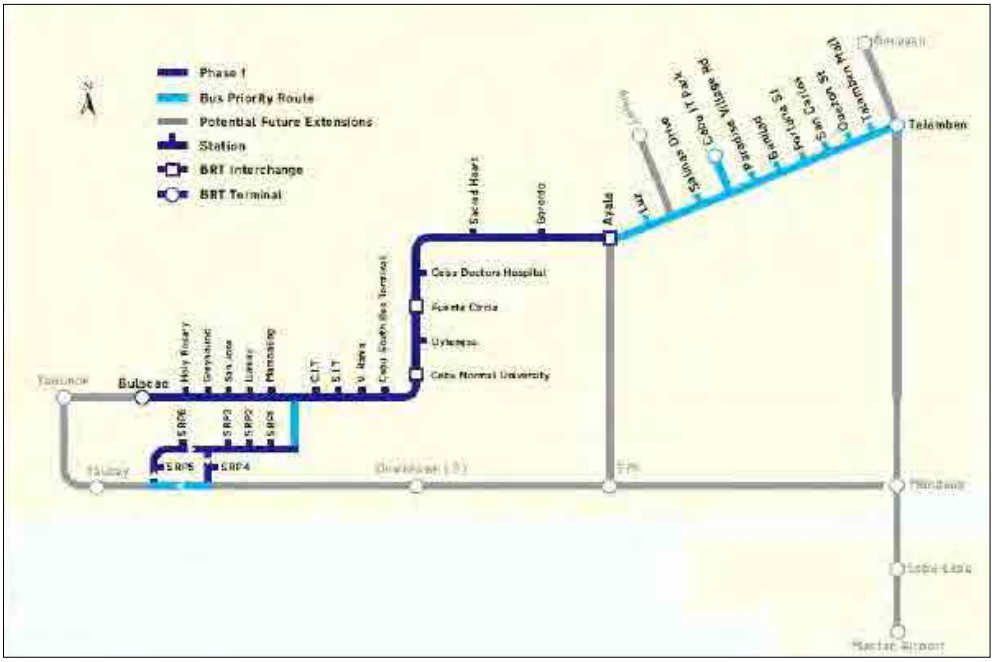
5.4 Public Transport

1) Two Scenarios

5.60 There are two basic possibilities on the development of Metro Cebu public transport, differentiated by choice of technologies. One assumes a purely road-based transit system, while the second includes the rail option.

5.61 Because of geography, its urban development has been confined to a narrow strip of coastal areas. It is an urban spatial structure that a rail transit planner would have dreamt of. In fact, Metro Cebu can be characterized as a paratransit-dependent city on a rapid growth path of motorization constrained by low investments in road infrastructure. A couple of urban rail projects were advocated since the 1990s but none has been realized yet. Today urban transport enjoys innovative technologies and services but their application is not observed in Metro Cebu.

5.62 Under such situation, Cebu City has been promoting the BRT system. The World Bank supported the feasibility study for the Cebu City BRT project in 2012. The NEDA Board approved the project in May 2014 (see Figure 5.4.1). DOTC is currently undertaking the detailed design and has announced that a bidding for the project will be scheduled in the second quarter of 2015.



Source: Cebu BRT Feasibility Study, World Bank, September 2012.

Figure 5.4.1 Proposed BRT Lines

5.63 The Cebu City BRT Project affects other urban transport development movements and possibilities, which include an expanded BRT network within Cebu City and no choice for rail and BRT network extension to neighboring cities.

5.64 In order to prepare a sub-roadmap for public transport, the Study has analyzed and compared two scenarios after the Interim I Report. Scenario One (see Table 5.4.1) is to maximize the road network for use of the BRT, buses and paratransit such as jeepneys and tricycles. Scenario Two (see Table 5.4.2) is to introduce urban rail as a main public transport mode to be supported by road-based public transport services.

(1) Scenario One

5.65 As the bus and BRT expand, existing jeepneys and multi-cabs will be relocated to secondary routes. The para-transit modes will act as feeders to the BRT stations and serve areas of the metropolis where the roads are narrow (≤ 3 lanes). At the tertiary or barangay/village levels, tricycles will operate in areas where walkability is not attractive or conducive.

5.66 In parallel with the re-structuring of the paratransit modes and expansion of the BRT lines, the vehicles will be replaced with low-to-zero emission models. It is anticipated that battery technologies would have been developed to such a degree that they become economically-viable and mainstream by 2030. The shift will also be an occasion to upgrade the standards and quality of existing vehicle platforms into low-floor, high-ceiling designs with passenger convenience and comfort in mind. This is in concert with the global campaign to reduce the carbon footprints of cities and urban transport.

5.67 Beyond 2030, the roadmap will be driven by more advanced technological developments. The public transport system will become part of a wired and "intelligent city" where scheduling and deployment can be coordinated by increasing use of computers. Common ticketing and electronic payments across all modes (BRT, bus, paratransit) will become a system-wide reality. The beginnings of such integration are already apparent today elsewhere in the world and in Metro Manila.

5.68 It is unclear whether "autonomous vehicles" (driverless) would be viable on or before 2050. The likelihood is high that this would be a reality on light vehicles such as cars and paratransit.

5.69 One variant of this road-based scenario is the use of trams, or street-level trains, instead of BRT. This option has emerged because of the prospective agreement of the Department of Science and Technology (DOST) and the Cebu City government to test a prototype road-train system, or a Philippine version of the tram. The narrow roads of Metro Cebu will not permit the simultaneous existence of BRT and tram on major roads (where the widest is 6 lanes for two directions).

Table 5.4.1 Indicative Roadmap for Scenario One

Scenario One	Present Situation	Target Situation 2030	Target Situation 2050
Route Coverage and Configuration	Cebu City-centric route structure; dominated by PUVs with some inter-urban buses. Tricycles as feeder service.	A more dispersed route network. Buses on trunk routes; PUVs on secondary routes and narrow roads.	Busways upgraded into BRT lines; PUVs converted into modern design and battery-powered.
Operating Business Model	Atomized and fragmented. PUVs compete with each other. Drivers hired on "boundary system."	Coordinated deployment by corridor or groups of transit operators must be in place.	Bus and PUV operators are paid on service delivered; Common E-ticketing system and system-wide scheduling.
Key Success Factors	Many enterprising small-scale investors, willing to navigate under soft rules.	Strong political leadership at city level, cooperation among 13 LGUs.	A Metro-wide Transport Authority enabled by smart technologies.

Source: JICA Study Team.

(2) Scenario Two

5.70 This scenario assumes the occurrence of any of the following: (i) the BRT Project fails to take off, (ii) the project gets implemented but falls short of its promised throughput in excess of 300 thousand passengers a day; or (iii) the threshold limit of capacity is reached for the BRT sooner due to road congestions.

5.71 Scenario Two assumes that a rail-based mass transit system gets built in Metro Cebu before 2030. To avoid reduction in road capacities, the rail system should be elevated (or underground in some sections). With early project preparation, it can become operational as early as 2020. Capacity of the system can be expanded in response to growing demand through a combination of extension of tracks, addition of railcars, and shortening of headways. It will also not require forced relocation of existing PUVs, hence, will be more politically acceptable.

5.72 Similar to Scenario One, bus and PUV operations will be restructured to permit coordinated ticketing and scheduling. The rate of change from fossil-based vehicles to low-emission vehicles (LEV) or zero-emission vehicles (ZEV) will depend on continuing decline in cost of batteries and government policies. Beyond 2030, further improvements in ICT technologies will drive progress.

5.73 Reforms of bus and PUV operations are desirable, but not necessary, under Scenario Two; but mandatory or essential under Scenario One. The road-only alternative is very demanding institutionally but less capital-intensive. In contrast, the road-and-rail scenario is capital-intensive but tolerant of weak institutions.

Table 5.4.2 Indicative Roadmap for Scenario Two

Scenario Two	Present Situation	Target Situation 2030	Target Situation 2050
Route Coverage and Configuration	Same as in Scenario One	One rail-based Mass Transit line in operation; Buses on other truck routes; PUVs re-deployed to feeder routes.	A hierarchical route network with rail, bus, and PUVs operating as a family of transit modes.
Operating Business Model	Same as in Scenario One	Coordinated deployment by corridor or groups of road-based transit operators desirable.	Autonomy in the operations and maintenance of rail transit; Common E-ticketing for rail and bus is desirable.
Key Success Factors	Same as in Scenario One	Establishment of a local rail transit entity; Support from LTFRB on other modes is helpful.	Funding support for the capital costs, plus appropriate PPP modality to ensure sustainability.

Source: JICA Study Team.

(3) Success Factors and Limitations of Road-Based Public Transport Services

5.74 BRT is ranked highest on the hierarchy of road-based public transport. But BRT has broadly four critical success factors, as follows:

(a) Existence of a strong political will (bold leadership at city level) to champion the priority of BRT in allocating dedicated lanes and bus stops on the designated routes. On the other hand, private car owners will agree to the diminution of their available road space along the BRT routes;

(b) The removal and relocation of current paratransit providers such as jeepneys on the BRT routes;

(c) Construction of more flyovers or grade interchanges to increase road capacities, not only for public transit but also for other vehicles since the BRT route is designated on narrow roads such as 4-lane or 6-lane carriageways (see Figure 5.4.2);

(d) Willingness of the adjoining LGUs with Cebu City to implement the above three factors in order to extend BRT routes to their jurisdictions.

Source: DOTC.

Figure 5.4.2 Image of Cebu City BRT

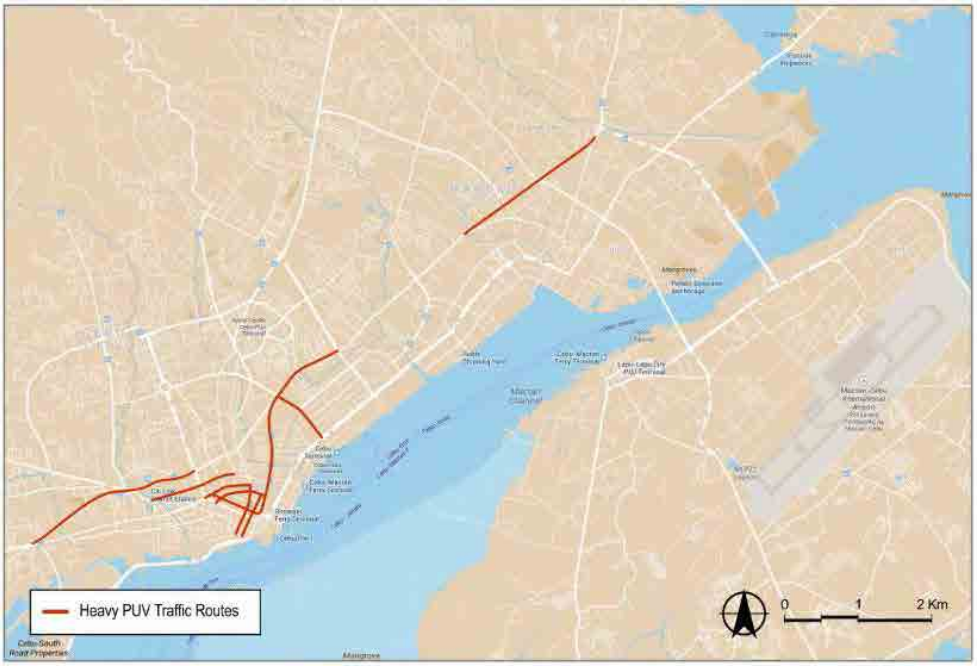
5.75 With those combined efforts to promote BRT services, however, Scenario One in Metro Cebu has to face limitations. For instance, the following limitations of BRT are foreseen in relation to operation capacity and length:

(a) **Capacity:** The Cebu City BRT project has a designed capacity of 4,500–5,400 passengers/hour/direction according to the FS report in 2012. Other cities' experiences show that BRT's capacity is more or less 3,000 passengers/hour/direction without overtaking lanes and with intersections on a route. It should be noted that huge numbers of PUVs are observed on some streets in Metro Cebu. The numbers of PUV frequency may exceed the capacity of the Cebu City BRT on 10 street sections. For example, more than 6 PUVs per minute are counted on N. Bacalso Avenue, an aggregated capacity of 5,400 passenger seats/hour/direction. Even in the opening year, the Cebu City BRT may not serve all the passengers to be shifted from PUVs on N. Bacalso Avenue.

(b) **Route Length:** Since an average BRT service speed is around 25 km/hour if it runs without overtaking lanes and with intersections on a route, the BRT's practical route length is 20 km or so. In the case of Metro Cebu, there are more than 70 km from Danao City to Carcar City. Obviously, it is too long for a BRT to serve. Inter-city rail must come in such a route. BRT is suitable to provide feeder service to inter-city rail as long as access road to a rail station is wide enough.

5.76 In relation to high frequency of PUVs, the Study has identified 10 existing roads which serve large PUV traffic over 5,000 passenger seats/hour/direction (see Figure 5.4.3).

5.77 One solution to shift from such high frequency of PUVs to a BRT system is to expand its capacity like the BRT in Seoul, Korea which reportedly manages 5 buses/minute/direction. Because of limited availability of road space, Metro Cebu cannot hope to reach the capacity of Seoul. Accordingly, the introduction of a rail mode of transit (MRT, LRT) may come sooner rather than later for Metro Cebu.



Source: JICA Study Team based on LTFRB data and traffic survey results.

Figure 5.4.3 High Frequency Road Sections of PUV Service (Over 5,000 passenger seats/hour/direction)

(4) Rail in Metro Cebu's Future

5.78 This study concludes that Scenario Two is inevitable for Metro Cebu to realize its Mega Cebu Vision 2050. The Cebu BRT will not add to capacity on the north-south transport spine but simply replace less efficient modes (jeepneys and multi-cabs) with the more energy-efficient bus. Future expansion of BRT will be constrained by at-grade traffic such that headways of less than two minutes would induce traffic jams on other parts ot the urban road network.

5.79 There are local factor conditions that will favor Scenario Two, such as the following:

(a) Public transport is not considered a responsibility of LGUs, unlike in European and North American cities. Thus, none of the LGUs in the country own or operate public transport assets. The providers of public transport services are 100% private (with the exception of railways), which is good in some way but also a weakness. The infrastructure to make these services user friendly and convenient (such as bus sheds/stops) are rare. The hands-off posture by LGUs arises from the fact that the franchising of transport providers is a national function, except for tricycles.

(b) The climate in public sector agencies is not hospitable to professionalism. Thus, government-owned and operated corporations like the Metro Manila Transit Corporation, the Philippine National Railways (PNR), the Light Rail Transit Administration (LRTA), and MWSS–which all started on good footing--eventually succumbed due to political interference.

(c) Land use planning and control is very weak, and will remain so for a very long time. Although LGUs are required to enact their own CLUPs and corresponding ordinances, these are considered suggestions rather than prescriptions to be followed seriously. A large property developer can always get an exemption from zoning ordinance, if that is

an obstacle. Thus, one can see the phenomenon of high-rise high-density buildings accessed by narrow public roads designed for low-density dwellings. On the other hand, the many poor who cannot afford decent housing locate where they can regardless of zoning or building restrictions. Transport and urban planners often assume (or wish) that land use controls would minimize road-side frictions and concentrate around transit stations–something nearly impossible to effect in the Philippines.

(d) The road network of Metro Cebu was planned, designed and built with cars and PUVs in mind. The concept of a busway, or roads meant for public transit, have only entered very recently into the planning calculus of highway engineers. Majority of the roads in Cebu were built a long time ago, expanded on as need basis. Thus, there is no road hierarchy nor a pronounced network of primary and secondary roads.

(e) The railway solution will entail huge subsidies from the national government, as evidenced by the rail lines in Metro Manila. This is because the economic benefits of faster travel is not captured at the farebox, compounded by the political expediency to keep fares static. On the other hand, LGUs do not have the resources to provide the financing gap that railway investments would need. Therefore, a rail-based transit system can only emerge in Metro Cebu with funding support from the national government.

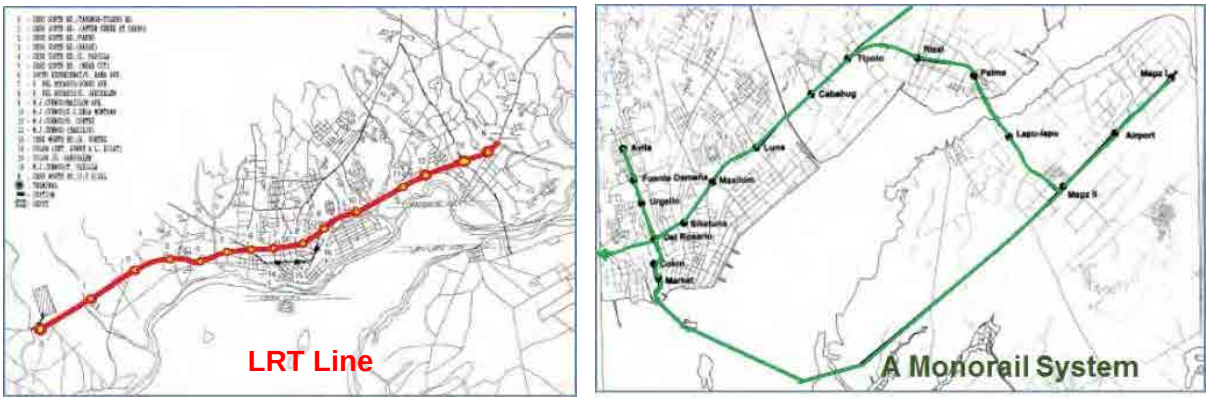
(f) In Metro Cebu, local politics have constrained inter-LGU movements of public utility vehicles as well as metro-wide collaborations. Cebu City, for example, enacted an ordinance banning PUVs from nearby localities to use city streets.[4] It was also reported that the pilot BRT line could not be extended into another city because of the latter's objection to it. If other LGUs would adopt similar tactics, it would force unnecessary transfers which are counter-productive to efficient transit operations, make route restructuring problematic, and disrupt the evolution of a seamless metro-wide public transport system. If intended as a vehicle reduction scheme to reduce traffic congestion, then such a move should target cars rather than PUVs.

2) Policy of Rail-based Public Transport Services

(1) Urban Rail System to be Introduced by Mid-2020

5.80 Candidate urban rail lines can be extracted from past studies on Metro Cebu transport. These are shown on Figure 5.4.4. Although outdated, these alignments are not expected to differ much from what will eventually come out of a detailed feasibility study because of the linear configuration of the urban development of Metro Cebu and the island connection between Cebu and Mactan.

[4] "21B Drivers Asked Cebu City to Lift Ban", Sunstar Cebu (16-Aug 2013).



Source: JICA Study Team.

Figure 5.4.4 Urban Rail Lines from Past Studies in the 1990s

5.81 The Study explored early implementation opportunities of urban rail by the mid-2020s through the following planning works:

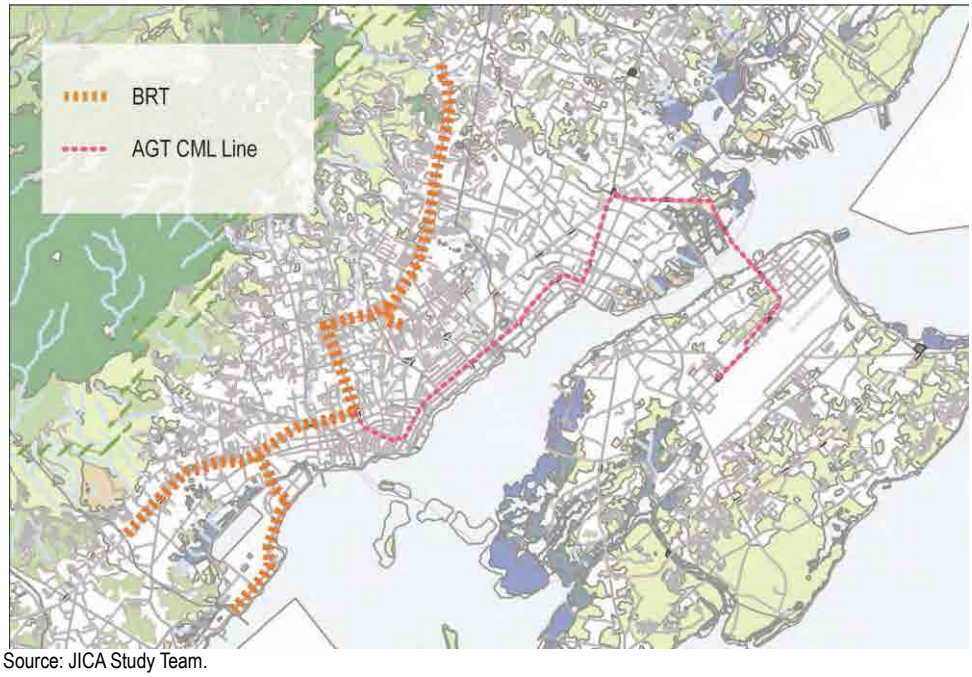
(a) **Necessity of Urban Rail System:** This was analyzed together with road congestion conditions in the central areas of Metro Cebu and the performance of road-based public transport services within such congested areas.

(b) **Route Alignment:** Since it is the first urban rail in Metro Cebu, route alternatives were prepared taking a potential local market into account. Suitable urban rail users may encompass airport passengers, commuters to business parks/IT parks, visitors to large-scale shopping malls, and orderly developed subdivision dwellers. Ridership and rail engineering studies have been undertaken on the selected route (refer to Figure 5.4.5).

(c) **Urban Rail System:** A medium-capacity urban rail system was analyzed such as the AGT-type which is suitable for a ridership of 5,000–15,000 passengers/ hour/ direction.[5]

(d) The project implementation method and institutional arrangements for construction and operation were likewise studied.

[5] In the Study, the counterpart personnel participating in the learning visit to Yokohama observed the AGT line, namely Kanazawa Seaside Line in Yokohama City.



Source: JICA Study Team.

Figure 5.4.5 Idea of Urban Rail Alignment (in the Case of Cebu City Center - Airport)

5.82 A 10-year public transport development roadmap is shown on Table 5.4.3. This assumes that the BRT project will proceed, and the institutional issues get resolved to allow smooth implementation and system expansion. As a complementary measure to ensure successful introduction of the BRT, a preparatory study to re-design the route structure of PUVs should be conducted as early as possible.

Table 5.4.3 Public Transport Roadmap, 2015–2024

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1. PUVs										
Route Preparatory Study	■									
Public Consultations		■								
Implement Route Re-structuring			■	■	■					
Study on Fleet Modernization						■				
Implement Fleet Change							■	■	■	
2. BRT and Bus										
Eng'g Design BRT 1	■									
Construct Busway Infra		■	■							
Acquisition of ROW		■								
Commercial Operation				▥	▥	▥	▥	▥	▥	▥
Expansion of BRT System						■	■	■	■	■
3. Urban Rail (Earliest Case)										
Feasibility Study	■	■								
Detailed Eng'g Design		■								
Construction			■	■	■					
Commercial Operation						▥	▥	▥	▥	▥
4. Institutional Reforms										
Study LGU Ordinances on Transport and Traffic (T&T)		■								
Harmonize T&T Ordinances of 13 LGUs			▥	▥	▥					
Formation of T&T Authority				■						

Source: JICA Study Team.

5.83 It is recommended that a detailed feasibility study of urban rail be commenced

in 2015 so that it becomes operational by year 2020. This will provide a backup plan for Metro Cebu, in the event that the BRT implementation gets sidetracked.

5.84 Another immediate and important task is the re-design of the PUV route network and its implementation. It is a crucial prelude to the operation of the BRT in 2018.

5.85 On the institutional aspect, it is envisaged that a Transport and Traffic Authority for Metro Cebu be organized to handle the metro-wide traffic signaling system, regulate road and rail public transport, and serve as the asset owner of the BRT and MRT systems. This would entail legislation.

(2) MRT System to be Completed by 2050

5.86 Figure 5.4.6 indicates a recommended inter-city rail system by plausibly MRT, carrying over 20,000 passengers/hour/direction. Low-income households who cannot afford the high land prices in the urban core (Cebu City and Mandaue City) are expected to spill over the outer LGUs. Hence, they will require a mass transit system that can guarantee shorter traveling times which only a MRT can provide. At present, the major traffic magnets/nodes are in Cebu City. The future urban structure of Metro Cebu should promote the emergence of satellite nodes, such as Naga and Carcar in the south and Danao in the north. The eventual south and north termini of the MRT line can be at these nodes, which can be determined in a subsequent feasibility study.

5.87 It should also be noted that the proposed MRT Central Line overlaps with BRT Line 1 on the Cebu South Road/N.Bacalso sections. The premise is that the capacity of the BRT will be insufficient to address the demand from the south localities (Minglanilla, Naga, San Fernando, and Carcar) which have a total population of more than 380 thousand (15% of Metro Cebu) in 2010 and 1,047 thousand (21% of Metro Cebu) by 2050. When the MRT line opens, the BRT service can be relocated to the Cebu South Coastal Road, which was the original recommendation of the 2011 Public Transport Strategy Study. In regard to route extension to Mactan Island, long-term demand, except for the urban rail connecting with the airport, will be examined to check project viability.

5.88 The Study undertook the following planning tasks:

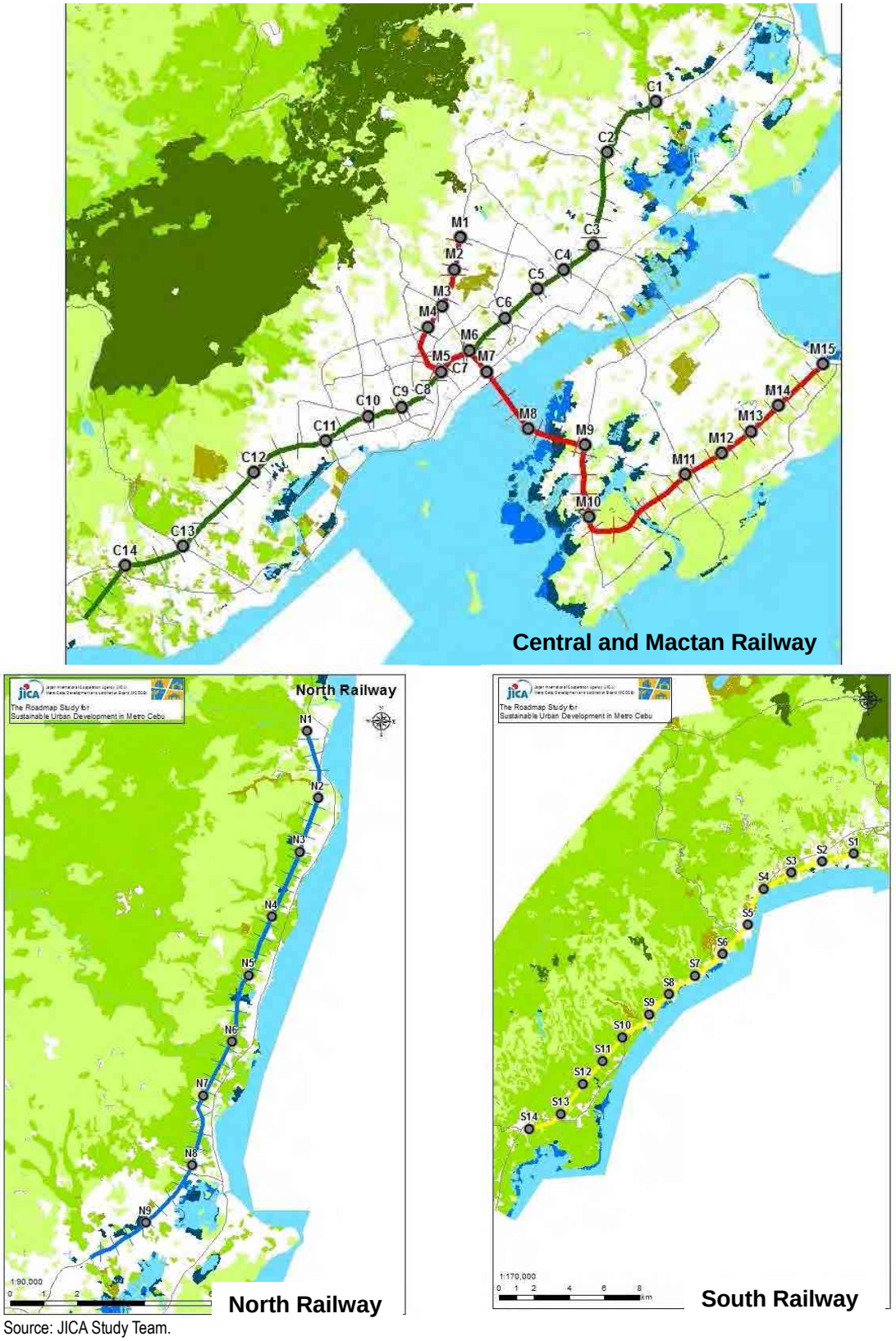
(a) **Route Alignment:** An inter-city rail alignment was studied together with a metropolitan land use plan so as to promote urban growth along the coastline. The proposed route will be divided into some phases taking demand and construction cost into account. The draft spatial plan includes the following MRT lines with a total route length of 96.6 km and 50 stations (see Figure 5.4.6):

  (i) MRT North Line (Danao City–Liloan: 24.7 km);
  (ii) MRT Central Line (Consolacion–Talisay City: 21.2 km);
  (iii) MRT South Line (Minglanilla–Carcar City: 29.2 km); and
  (iv) MRT Mactan Line (Cebu City–Lapu-Lapu City: 21.5 km)

(b) **Railway System: A suitable system for Metro Cebu was studied such as MRT carrying some hundred thousand passengers per day with an adequate role sharing with the proposed urban rail.**

(c) The project implementation method and institutional arrangements for construction

and operation were also studied.



Source: JICA Study Team.

Figure 5.4.6 MRT Lines for Metro Cebu

3) Policy on Public Transport Terminals

Although bus use in Metro Cebu is still limited, a public transport terminal is a good tool to

increase bus patronage. It has been demonstrated by the Cebu South Bus Terminal and the Cebu North Bus Terminal, both of which were constructed by MCDP in the 1990s. Today, the two terminals still take an important role. In other areas, Danao City has a public transport terminal and Lapu-Lapu City has a jeepney terminal, both at city center areas or *Barangay Poblacion*.

Carcar City envisions a new city center that includes a public transport terminal which is designed to serve city route buses within Metro Cebu and long-distance buses to the west coast and south coast of Cebu Island. The Study has conducted a pre-feasibility study on the terminal project.

When the Carcar public transport terminal is ready, city route buses from the central area of Metro Cebu will end at Danao Terminal at the north and Carcar Terminal at the south. If city buses extend their routes to Mactan Island, the Lapu-Lapu Jeepney Terminal will be converted to a public transport terminal.

The Cebu North Bus Terminal (0.6 ha) currently suffers from land scarcity. After terminal management is transferred from Cebu City to Mandaue City in 2021, the terminal will be expanded.

4) Convenient Urban Transport Services

The Study intends to restructure Metro Cebu from a highway network only to a hybrid network of highway and rail in the future. In the future network, the bus/minibus/jeepney will take a feeder role.

The proposed rail network consisting of MRT and LRT has 110 stations. Compact and convenient transit-oriented development (TOD) will be promoted around rail stations. Station squares (see an example from Yokohama City in Figure 5.4.7) are designed at most of the suburban stations where bus/minibus/jeepney are expected to develop various convenient networks for the people living in surrounding areas.

Source: JICA Study Team.

Figure 5.4.7 Center-Kita Station Square, Yokohama City

5.5 Coastal Shipping in Urban Commuting

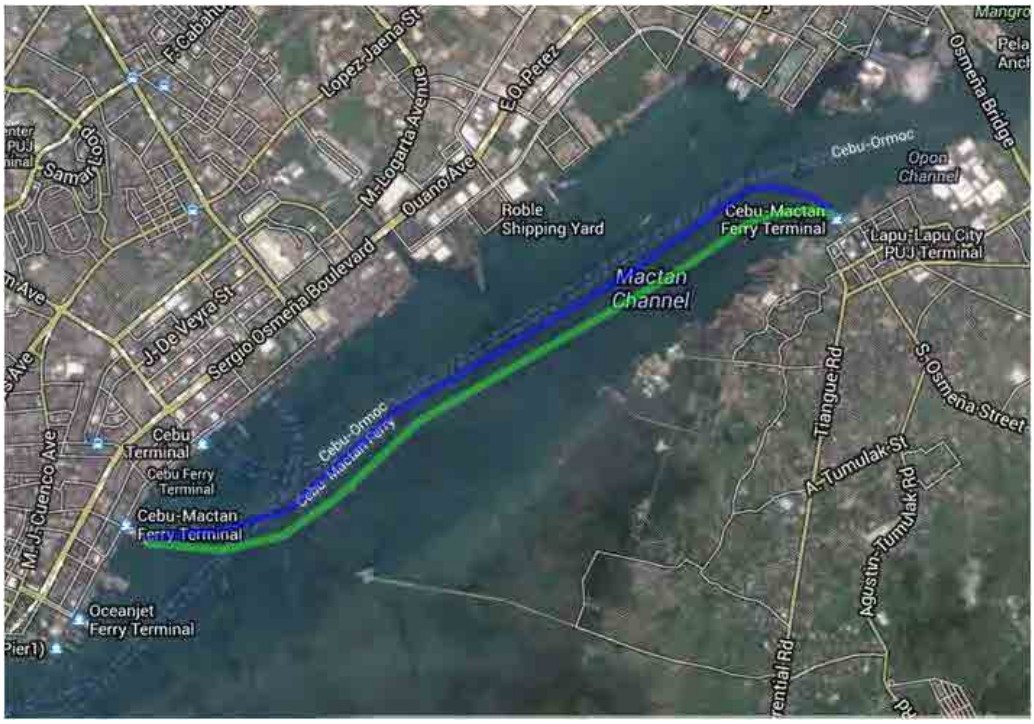
1) Current Services and Citizens' Expectations

5.89 In the past, ferry services between Mactan and the Cebu mainland were thriving. That was because of the absence of a bridge. When the bridge got built (now Osmeña Bridge) and later followed by the construction of the Fernan Bridge, cross channel ferry services dwindled.

5.90 Now, there is only one left, provided by Metro Ferry Shipping. Its terminals are in Muelle Osmeña wharf in Lapu-Lapu City to Pier 3 in Cebu City (see Figure 5.5.1).

5.91 The company uses seven ferry boats of different sizes that operate from 6:00 am to 10:00 pm, although the latter hours are reportedly irregular. Travel time is claimed to be 20 minutes, but waiting time at the terminal takes longer. The smaller boat can transport 112 passengers while the bigger vessels can accommodate 312 passengers. No official statistics are available, but traffic is said to average 6,000 to 8,000 passengers per day, with the highest number occurring on Mondays.

5.92 The fare is PHP14.00 for regular fare for a one-way trip, PHP12.00 for students and senior citizens, and PHP8.00 for children. The company is surviving without any government subsidy.



Source: JICA Study Team.

Figure 5.5.1 Route of Cebu Ferry

5.93 In a survey of Metro ferry passengers conducted in 2011, it was found that more than 90% are originating from Cebu/Mandaue and Lapu-Lapu City. In other words, the origin and destination points are a short distance away from the terminals.

5.94 Generally speaking, ferry operators face difficulty in competing with road-based public transport services in terms of the following aspects:

(i) Plenty of short hops, every one kilometer or less (which is uneconomical for the ferry to do);

(ii) Desired frequency of 5 minutes or less (which a ferry service must assign smaller vessels, but which would then be uneconomical);

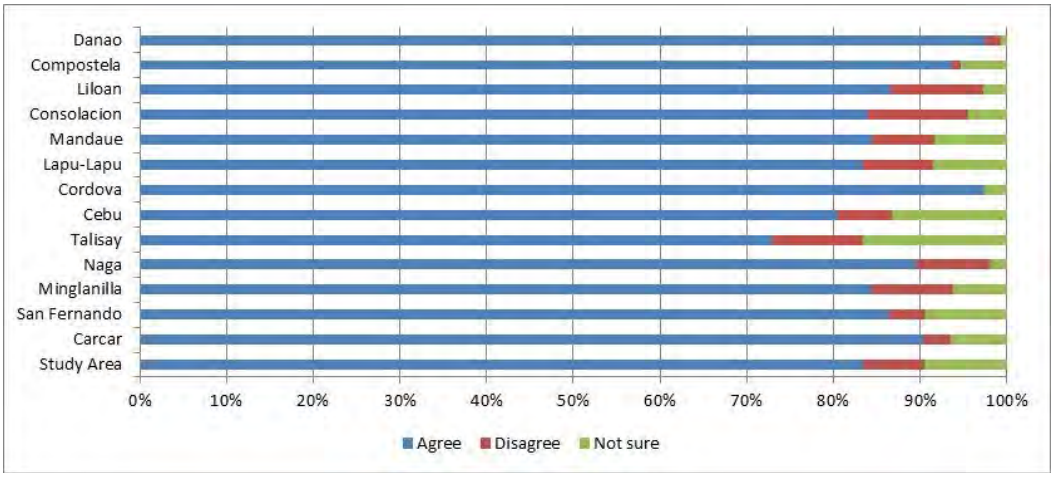
(iii) Fares on PUVs are so low, as to be unviable to a ship operator;

(iv) Rapid motorization where households aspire for car/motorcycle ownership reduces public transport's role in commuting; and

(v) Shipping is more vulnerable to weather conditions, such as strong wind and high tide,

than road vehicles when providing scheduled services.

5.95 On the other hand, the results of the HIS in the Study clearly show that most of the respondents agreed with the improvement of water transport, implying a dilemma between hard shipping business environments and people's expectations (see Figure 5.5.2).



Source: JICA Study Team, HIS 2014.

Figure 5.5.2 Opinion Polling for the Improvement of Water Transport

2) Lessons from the Pasig River Ferry

5.96 The case of the Pasig River Ferry is instructive for Metro Cebu. It has undergone three attempts at revival, all ending in failures. There is no reason why the latest (4th) attempt, which started in June 2014, will be an exception.

5.97 In the 1990s, a shipping company, Magsaysay Lines, started operating from Guadalupe (in Makati) to Escolta (in Manila), or a route of 15 km. Stations were basic river-side sheds. After one year, it folded for lack of patronage, aside from the difficulties of navigating through water lilies, garbage and other debris clogging the river.

5.98 In 1996, another ferry service was launched. The Starcraft Ferry deployed 30 units of catamaran-type boats with a seating capacity of 30 people. It was an improvement over the first (e.g., airconditioned to shield passengers from the foul smell of the river). In addition, it fielded smaller vessels (12 passengers). The route stretched from Bambang in Pasig City down to Escolta in Manila (a total of 16.2 km). Like its predecessor, the Starcraft Ferry only lasted for a year and ceased operations in 1997.

5.99 With government financial support and a loan from ADB, a third attempt was launched by DOTC and inaugurated on February 14, 2007 by then President Gloria Macapagal-Arroyo. A private group, Nautical Transport Services Inc. (NTSI), was given the contract to operate and maintain the ferry service. Starting with five stations (Escolta, PUP, Sta. Ana, Hulo and Guadalupe), the system expanded to 14 stations after one year. Unlike the previous two attempts, this one used 10 boats of bigger capacity (~150 passengers) and had stations with passenger amenities such as toilets, ticketing system, waiting seats and security guards. At its peak, the ferry had 17 stations and 2 lines. The first line was the Pasig River Line which stretched from Plaza Mexico in Intramuros, Manila to Nagpayong station in Pasig City. The second line was the Marikina River Line which served the Guadalupe station in Makati City up to Santa Elena station in Marikina City. With a wider reach, patronage started to pick up to the point that the operator NTSI considered purchasing more boats. This service had the support of the Pasig River Rehabilitation

Commission (PRRC).

5.100 Throughout its entire operation, the ferry service changed its trip schedules several times, in the hope of attracting more patronage. Each boat had 30-minute, 1-hour, 2-hour and 3-hour trip intervals depending on the time of the day. Rush hours tended to have shorter boat intervals while off-peak hours tended to have longer boat intervals. This was done to maximize the efficiency of each boat and to reduce fuel consumption. By January 16, 2011, the service ceased operations, but not the debt obligations (PHP180.87 million) to ADB and the blame finger-pointing. As of 2010, the PRRC had booked losses amounting to PHP94 million for the operation of the ferry stations. Some groups put the blame on the operator's use of six 150-seater boats instead of 18 50-seater vessels, which of course, meant lower frequency of trips and longer waiting hours for passengers. Others point at the obstacles to efficient navigation on the river.

5.101 In desperate search of a way out of mounting public complaints about the worsening traffic congestion of Metro Manila, the Metro Manila Development Authority (MMDA) decided to re-open the service in June 2014, using the assets acquired by DOTC and left behind by NTSI.

5.102 Before the 1990s, coastal shipping re-emerged in Manila Bay, first using hydrofoils, and later fast craft. They operated on a point-to-point service, connecting Manila to Cavite and Zambales. Both eventually stopped operating for being non-viable.

3) Lessons from Other Asian Cities

5.103 Bangkok emerged as a city supported by a vast network of waterways. Many of these rivers (or klongs) have been paved over as the metropolis abandoned its Venice-like origin and transformed itself into a bustling megacity. The transformation led to a decline of its once-dominant water transport system. Urban commuters have shifted to cars, buses, and rail transit. However, two types of water transport remain–on the Chao Praya River which caters mostly to tourists, and the Khlong Saen Saep Express Boat service (on concrete-lined canals). The 18-km route is served by 100 boats of 40-50 seats, and operates from 5:30 am to 8:30 pm daily. Prices are THB8-20, depending on distance travelled. The service carries about 60,000 passengers per day.

5.104 Ho Chi Minh City (formerly Saigon) has a history similar to Bangkok, with its many riverways that criss-crossed the City. Ferry service within the city has dwindled as more roads and bridges got built over the years. The use of hydrofoil to ferry passengers along the Saigon River between the city and the coastal city of Vung Tau (a tourist destination 125 km away) is still in operation, but is threatened by the construction of an expressway.

4) Conditions of Coastal Shipping to Serve for Commuters

5.105 In order to provide coastal shipping service to commuters in Metro Cebu, support from the public sector is a prerequisite, likely including pier/terminal development, subsidy for ferry procurement, and navigational aids for night-time operation.

5.106 Favorable to a shipping business environment are more congested roads which force longer vehicle travel time for commuters.

5.107 The HIS results indicate that more than 90% of respondents agree with the improvement of water transport at Danao City, Compostela, Cordova, Naga City and Carcar City which are located far from the central areas of Metro Cebu (i.e., Cebu City and Mandaue City) and, thus, local residents may be forced to put up with longer commuting

time. As a last resort under the situation that road and rail development would lag behind their schedule, coastal shipping is worth studying for commuter use.

5.6 Advanced Traffic Management

1) Introduction

5.108 Traffic management complements other major interventions to address the gaps between transportation supply and demand. Expansion of the highway and public transport networks in Metro Cebu is not likely to be adequate to achieve a satisfactory level of service, considering budgetary and other constraints. There will be corridors or areas that require additional attention, say, through traffic management.

5.109 At present, traffic management in Metro Cebu is handled by the individual cities and municipalities. There is no government authority that is responsible for metro-wide concerns. Of course, pursuant to the Local Government Code, responsibility for traffic management within the boundary of the city or municipality rests with the concerned LGU.

5.110 A survey was undertaken to ascertain the kind of traffic management organization that exists in each of the LGUs within Metro Cebu, as well as the program that it implements. Results indicate that only Cebu City has a suitable organizational set-up to perform transport planning and traffic management in a comprehensive manner. A separate unit, called City Traffic Operation and Management or CITOM for short, has been in existence for more than three decades. In other cities, most units that exist focus on enforcement. Transport planning and traffic engineering functions are handled, albeit inadequately, by established units such as the City Engineer's Office (CEO) and the City Planning and Development Office (CPDO), or by enforcement units.

2) Proposed Strategy

5.111 This Study identified traffic management measures to deal with traffic concerns at the metro-wide level. These should be carried out at a later date once alternative highway network improvements and mass transit systems would have been tested. Routes and/or areas that will remain to be congested, notwithstanding transport network expansions, would be dealt with through traffic management.

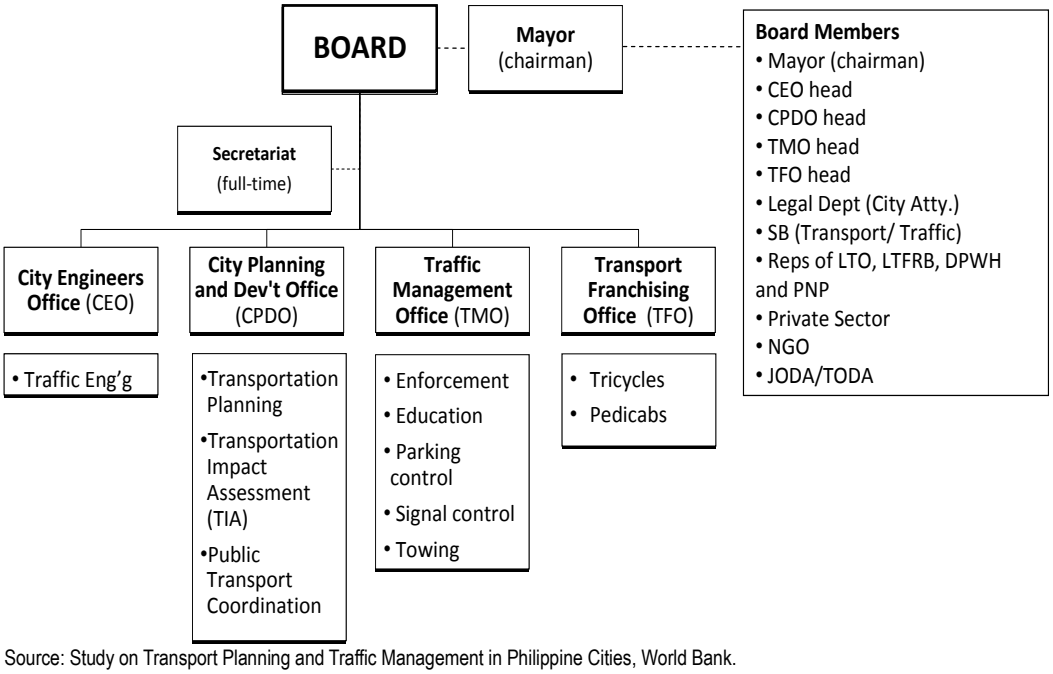
5.112 Irrespective of the outcome of transportation network testing and evaluation, the main strategy is to reorganize each city within Metro Cebu to effectively handle transport planning and traffic management. This strategy reinforces the recommendation of the World Bank-funded Study on Transport Planning and Traffic Management in Philippine Cities to institute organizational reforms in each Philippine city. The proposed organizational reform is described in the next section.

5.113 Other components of the proposed strategy are the institutionalization of the Traffic Impact Assessment (TIA) and the passage of a traffic code or ordinance. These will be elaborated in the following sections as well.

3) Proposed Transport Planning and Traffic Management Institutional Set-up in Each City

5.114 Consistent with the recommended reforms of the aforementioned World Bank-funded study, it is proposed that three new units be created in each city, namely: Transport Planning and Traffic Management Board, Board Secretariat, and Traffic Management Office. In addition, the CEO and the CPDO will be vested with additional

functions. The proposed set-up is shown in Figure 5.6.1.



Source: Study on Transport Planning and Traffic Management in Philippine Cities, World Bank.

Figure 5.6.1 Proposed Set-up at LGU Level

5.115 The CEO, CPDO and TFO are existing offices. The functions of the proposed Board will be as follows:

(i) Review and approve all transport and traffic management plans prepared by the various offices of the city government;

(ii) Cooperate with sectoral committees mandated to review and approve the transport sector components of the City's CLUP and CDP;

(iii) Coordinate, monitor and evaluate the planning and implementation of the city's transport and traffic management plans;

(iv) Review and approve the annual work programs and budgets of offices charged with the planning and implementation of transport and traffic management plans;

(v) Develop and prescribe internal operating rules and procedures; and

(vi) Perform other related functions.

5.116 The Board will be assisted by a Secretariat which will perform the following functions:

(i) Serve as the technical arm of the TPTM Board in performing the latter's functions;

(ii) Provide administrative services; and

(iii) Provide management information services.

5.117 The functions of the new TMO will be as follows:

(i) Formulate and implement a traffic education program;

(ii) Assign personnel to control traffic at intersections and other locations requiring such control;

(iii) Enforce traffic rules and regulations; and

(iv) Operate towing units, if applicable.

5.118 The following traffic engineering functions will be added to the CEO's functions:

(i) Prepare traffic engineering schemes;
(ii) Install and maintain traffic signals, traffic signs, road markings and other devices;
(iii) Recommend ordinances in support of traffic management schemes; and
(iv) Help review TIA reports particularly as to the traffic impacts of proposed projects.

5.119 Finally, the following functions will be added to existing functions of the CPDO:

(i) Provide inputs to the preparation/updating of the CLUP;
(ii) Prepare/update public transport network;
(iii) Coordinate with LTFRB in the adoption of the city's public transport network, and with public transport operators in the provision of facilities like terminals and waiting areas and in the filing of franchise applications for new/amended routes;
(iv) Evaluate TIA Reports;
(v) Appear in the hearings of LTFRB to ensure that the issuance of franchises is consistent with the plans of the city; and
(vi) Evaluate requests for variances from the zoning ordinance that are likely to have a significant transportation impact.

5.120 It may be noted that the abovementioned functions make references to the TIA. Part of the recommended institutional reforms is the passage of an ordinance institutionalizing the TIA. Cebu City has an existing ordinance. Other cities in Metro Cebu are well advised to follow the example set by Cebu City.

5.121 The TIA system will ensure that large development projects do take into account traffic impacts and formulate and implement mitigating measures to deal with adverse impacts. This will be made as a precondition for the issuance of the development permit.

5.122 While the above proposal is written for cities, there is no reason why the same would not apply to municipalities should circumstances warrant, i.e., existence of traffic problem areas and capability of the LGU to institute reforms.

4) Traffic Code or Ordinance

5.123 A model Traffic Code has been drafted as part of the JICA-funded "The Study on the Formulation of Small-Scale Traffic Improvement Measures for Metro Manila." This may be adopted by the cities and municipalities within Metro Cebu as other LGUs have done. A few adjustments would be needed.

5.124 The rationale behind the model traffic code is that RA 4136, the law that governs traffic management in the country, is rather old with some obsolete and missing provisions. The code has been designed to complement the law. It supplements RA 4136 with provisions on:

(i) traffic signals;
(ii) general driving rules;
(iii) rules pertaining to traffic schemes;
(iv) one-way streets;
(v) parking zones and fees;

(vi) operation of non-motorized transport; and

(vii) rights and obligations of pedestrians.

5.125 The main body of the model traffic code requires minimum adaptation inasmuch as local traffic schemes are made part of Appendices. In case of updating, only the appendices would have to be revised. At present, the appendices of the model code have provisions for one-way streets, prohibited left turns, No U-turn locations, parking zones, and streets with limited truck bans. Appendices may be added as necessary to include other traffic schemes such as "Jeepney Only" lanes and box intersections.

5) Initial Traffic Management Measures

5.126 The approved BRT Project has traffic management components, consisting of intersection optimization, parking management and area traffic control. These should address the short- to medium-term need for relief from severe traffic congestion in certain areas. The rehabilitation and upgrading of the ATC is long overdue. Due to defective components, the ATC is no longer functioning well as a demand responsive system of traffic control.

5.127 The following four intersections have been identified for optimization under the BRT Project:

(i) Osmeña Blvd./Colon St.;

(ii) V. Rama Avenue/M. Velez St.;

(iii) M. J. Cuenco Avenue/J. Luna Avenue; and

(iv) Gorordo Avenue/Salinas Drive.

5.128 On the other hand, this Study has likewise identified four intersections for improvement, as mentioned in its Interim I Report. They are:

(i) J. Luna Avenue/Cardinal Rosales;

(ii) J. Luna Avenue/M. J. Cuenco Avenue;

(iii) Gen. Maxilom Avenue/M. J. Cuenco Avenue; and

(iv) Gorordo Avenue/Arch. Reyes Avenue.

5.129 Should supply-side management no longer be adequate, it may be necessary to resort to demand-side management measures such as traffic restraint as applied in Metro Manila. However, the number coding form of traffic restraint does not appear to be effective according to Cal (2013).[6] Cal said that results of a survey indicate that a significant proportion of motorists avoid the number coding scheme by buying another vehicle, effectively worsening the situation inasmuch as other members of the family would use the extra vehicle outside the banned days.

5.130 The electronic road pricing as a form of traffic restraint appears to be worthy of consideration. It may be developed as a PPP project because it has a revenue generation component. Its successful application has been proven in Singapore. It is worth considering should supply-side management measures fail to address congestion in certain routes/areas.

[6] Plenary Talk on "Smarter Mobility" given by Dr. Primitivo Cal at the 2013 International Conference on Smarter Cities, Manila, 14–15 November 2013.

5.7 Summary of Sub-Roadmap

1) Short-Term Projects (until 2020)

(a) Conduct a Master Plan and FS on the mass transit system (BRT/LRT/MRT) development for Metro Cebu. (2015–2017)

(b) Implement the Cebu City BRT Project. Associated efforts will be done to reorganize bus/PUV services, modernize and environmentally improve road-based public transport fleets. (2015–2017)

(c) Conduct an FS on Area Traffic Control (ATC) for Metro Cebu. (2015–2017)

(d) Repair major intersection signals and introduce a synchronized signalization system by traffic control center covering major intersections in Metro Cebu. (2018–2020)

(e) Widen arterial road ROW (especially unimplemented MCLUTS projects) together with widening of sidewalks and bicycle lanes. (2018–2020)

(f) Construct the Carcar Public Transport Terminal. (2017–2020)

(g) Construct a dual-mode bridge between Mandaue City and Mactan North. Necessary measures will be taken for the dilapidated First Mactan Bridge in line with the new bridge construction. (2018–2020)

2) Medium-Term Projects (2021–2030)

(a) Construct and operate the CML-AGT Line serving Metro Cebu's core area (Cebu City, Mandaue City and Lapu-Lapu City). (2018–2021)

(b) Construct the Metro Cebu Circumferential Road, the Second Cebu South Road and the Second Cebu North Road in order to establish a bypass to the existing national highways and guide new urban development. (2021–2030)

(c) Construct a new road bridge between Cebu City and Mactan South. (2021–2030)

(d) Continuously improve congested intersections by grade separation and road widening connecting congested intersections. (2021–2030)

(e) Construct and operate the MRT Central Line stretching from Consolacion to Talisay City. (2021–2030)

(f) Revitalize the abandoned PNR ROW from Talisay City to Naga City for road and railway. (2021–2030)

(g) Complete the Mandaue Scenic Coastal Road and the Tayud Coastal Road as an access road to the Consolacion new port. (2021–2030)

(h) Strengthen the road network of Mactan Island by means of a new airport tunnel road and a new MRT avenue. (2021–2030)

(i) Construct secondary roads and collector roads in accordance with the Metro Cebu Spatial Plan by means of public works and private developers' contribution through issuance of development permit. (2021–2030)

(j) If urban traffic would be seriously clogged due to delayed highway and railway development, a commuter service by ferry could be provided as a last resort.

3) Long-Term Projects (2031–2050)

(a) Complete the Metro Cebu MRT system including the MRT North Line, the MRT South Line and the MRT Mactan Line. (2031–2050)

(b) Develop bus/minibus/jeepney routes using MRT/LRT station squares and promote TOD around stations so as to form compact and convenient urban areas. (2031–2050)

(c) Continuous construction of secondary roads and collector roads in accordance with the Metro Cebu Spatial Plan by means of public works and private developers' contribution through issuance of development permit. (2031–2050)

(d) Construct a toll skyway over congested road sections regardless of the abovementioned efforts. (2031–2050)

Table 5.7.1 Sub-Roadmap for Urban Transport and Highway Network

Term	Projects
Short-Term	• MP and FS on mass transit system (BRT/LRT/MRT) development for Metro Cebu (2015–2017) • The Cebu City BRT Project, reorganization of bus/PUV routes (2015–2017) • FS on ATC for Metro Cebu (2015–2017) • A synchronized signalization system covering major intersections by TCC (2018–2020) • Carcar public transport terminal (2018–2020) • RROW widening with wide sidewalks and bicycle lanes (2018 – 2020) • A dual-mode bridge between Mandaue City and Mactan North (2017–2020)
Medium-Term	• Construction and operation of the CML-AGT Line (2018–2021) • Urban fringe roads (the Metro Cebu Circumferential Road, the Second Cebu South Road and the Second Cebu North Road) (2021–2030) • A new road bridge between Cebu City and Mactan South (2021–2030) • Continuous improvement of congested intersections (2021–2030) • Construction and operation of the MRT Central Line (2021–2030) • Revitalization of the abandoned PNR ROW for road and railway (2021–2030) • Completion of the Mandaue Scenic Coastal Road and the Tayud Coastal Road (2021–2030) • Strengthening of the Mactan Island Road Network (2021–2030) • Construction of secondary roads and collector roads in accordance with Metro Cebu Spatial Plan (2021–2030) • Introduce ferry commuter service (when urban traffic is seriously clogged)
Long-Term	• Completion of the remaining MRT lines (2031–2050) • Promotion of bus/minibus/jeepney and TOD around MRT/LRT stations (2031–2050) • Continuous construction of secondary roads and collector roads in accordance with Metro Cebu Spatial Plan (2031–2050) • Construct toll skyway (when necessary)

Source: JICA Study Team.

6 SUB-ROADMAP FOR WATER SUPPLY AND DISPOSAL MANAGEMENT

6.1 Introduction

6.1 Since the economic boom in the Philippines in the 1990s, Cebu's landscape has undergone a huge change. Rapid urban development was accompanied by the degradation of the watersheds, the conversion of agricultural land into housing subdivisions and golf courses, and potential urban districts transformed into shopping malls. Rapid population growth took place with corresponding demand for mobility, livability through green development, water security and requirement for other basic services. The Mega Cebu Vision 2050 was then formulated as an integrated development planning to steer Metro Cebu on a sustainable growth path.

6.2 The vision of water supply and disposal issues were elaborated under the "Liveability" vision of the Mega Cebu Development Strategy 2050. It sets out to "realize liveable communities for everyone by providing a healthy and comfortable living environment with basic urban services and disaster-resistant infrastructure through environmentally sustainable practices, such as conservation of natural resources, utilization of untapped/ renewable energy, and recycling resources." It further elaborates the provision of 24-hour safe water supply, efficient drainage and sewage system, and accessibility to public amenities (parks, coastal areas, etc.) for the basic services as well as the improvement of resilience from natural disasters such as flooding.

6.3 Accumulated past reports, plans and laws[1] were reviewed to set the direction for the holding of forums and stakeholder meetings during this Study. Two forums were conducted.[2] These were attended by the MCDCB members (composed of representatives from LGUs and private sector), the Metro Cebu Water District (MCWD), NEDA, DENR, and DPWH. A meeting was also held with the National Water Resources Board (NWRB). MCDCB prioritized the Mananga II Dam Project for increasing water demand in Metro Cebu and establishing the septage plants for improving sanitation.

6.4 While confirming the various issues related to water supply and water disposal, this Sub-roadmap, after consultation with stakeholders, focused more on the water supply, stormwater and sanitation. The detailed study on the proposed bulk water supply project is elaborated in the Technical Note of Development of Mananga II Dam Project.

6.5 Due to frequent flooding, enormous economic losses are currently being experienced by Metro Cebu. Considering the urgency of formulating a drainage master plan for Metro Cebu, the MCDCB through its Resolution No. 1 (s.2012) requested the DPWH PMO-Flood Control and the Sabo Engineering Center (now called Flood Control Management Office) for assistance in the preparation of an Integrated Drainage Plan for Metro Cebu. The major findings of the JICA Study on the Flood Control for Rivers in the Selected Urban Centers (1995) and other master plan of flooding in Cebu (2006) and Mandaue and other cities were reviewed in elaborating the sub-roadmap for stormwater management.

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[1] Clean Water Act (Republic Act 9275, 2004), Code on Sanitation (Presidential Decree 856, 1975), NSSMP : National Sewerage and Septage Management Program.

[2] The First Water Forum is conducted in July 2, 2014, and the second one in October 15, 2014 in the Provincial Capitol Building of Cebu Province.

6.2 Water Supply Management

1) Current Water Supply Situation in Metro Cebu

(1) Mandated Institutions

6.6 The mandate on water supply is embodied in RA 198 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

6.7 At present, the supply of water in various areas in Metro Cebu is managed and operated either by the LGUs or by the Water District (WD) that holds the franchise over the area. Eight out of the 13 LGUs of Metro Cebu are served by MCWD. In the far south, the Carcar Water District (CWD) is supplying Carcar City. The rest are served by the LGU-operated system. The institutions managing the water supply in the respective LGUs are summarized in Table 6.2.1.

Table 6.2.1 Institutions Managing the Water Supply Distribution System

N	LGUs	Water Provider	Demand Coverage (%)	Remarks
1	Danao City	Danao Waterworks (LGU)	40	LGU
2	Compostela	MCWD / Community Water associations	26	Water district
3	Liloan	MCWD / Community Water associations / Communal water systems	48	Water district
4	Consolacion	Same as Liloan	50	Water district
5	Cordoba	MCWD/ Private water vendors	29	Water district
6	Lapu-Lapu City	MCWD / Private water providers (such as MRII)	29	Water district MRII**supplies bulk water to MCWD
7	Mandaue City	MCWD/ Community Water associations / Private water providers	36	Water district
8	Cebu City	MCWD Community Water associations / Private water vendors	57	Water district.
9	City of Talisay	MCWD/ Communal water systems/ Community Water associations/ MABWASCO/ Helpmate	47	Water district Cooperative Private
10	Minglanilla	MIWASCO (cooperative), Abejo, Helpmate	-	Cooperative Private
11	City of Naga	Abejo	-	LGU through Private Operation
12	San Fernando	San Fernando Waterworks	-	LGU Helpmate (no data provided)
13	City of Carcar	Carcar City Water District	39	Water district

Source: MCWD, Water for All Cebuanos, Water Resources Management Action Plan for Central Cebu (2005–2039), 2006.
Notes: Highlighted part is MCWD service area. Some information were gathered from respective LGUs.
*Mactan Rocks Industries.

6.8 MCWD's share of the commercial water consumer market is merely 10% (see Table 6.2.2). In addition, approximately 38% of their residential consumers fall under a subsidized water tariff due to the low consumption volumes of no more than 10 m^3. MCWD then faces difficulty in expanding their service area.

Table 6.2.2 Features of MCWD's Service Area

Feature	No.	%
1. Population in the MCWD service area	Total: 2,191,848	
of which MCWD served	1,222,727	55.8
2. Number of service connections	Total: 154,919	
Residential	151,524	97.81
Commercial/ Industrial	2,968	1.92
Government	191	0.12
Communal	116	0.07
Subdivisions/ Condominiums	120	0.08
3. Consumption by Consumer Type	Total :137,451 (m^3)	
Residential	123,383 (m^3)	89.8
Non-Residential	14,068 (m^3)	10.2

Source: MCWD.

(2) Existing Water Sources

6.9 The present water supply of the Metro Cebu area mainly comes from groundwater sources extracted from the coastal aquifer that stretches from Liloan to the southern part of Cebu City. It is estimated that close to 98% of the supply is from groundwater sources. Surface water accounts for only a small fraction of 2%. In 2013, the total water supply in the MCWD service area was nearly 209,000 m^3/day (see Table 6.2.3). For the non-MCWD service areas, water supply yielded a total of 5,541 and 12,732 m^3/day for the northern and southern areas, respectively.

6.10 Within the MCWD service areas, more than 25,000 wells were surveyed but, as of 2014, MCWD owns only around 123 wells that are operational. Several dozen production wells are operated by private bulk water suppliers. Many of the commercial and industrial establishments have their own deep wells that supply their needs. On the whole, consumers have dual sources, i.e., one from the water district, and the other from their own deep well source. According to MCWD, a preliminary survey done for Lapu-Lapu and Mandaue reveals that there are already more than 15,000 shallow wells.

Table 6.2.3 Existing Water Sources and Actual Production in Metro Cebu, 2013

Sources	Actual Supply (m^3/day)	Share (%)
A. MCWD Service Area	**209,252**	**92**
Groundwater	173,183	76.1
Surface water	3.080	1.4
Bulk supply (Private supplier)	28,108	12.4
Desalination (Mactan Rocks)	4,881	2.1
B. Non-MCWD Service Area	**18,273**	**8**
[1] Northern Areas-Danao	5,541	2.4
Southern Areas	12,732	5.6
[2] Minglanilla (MIWASCO)	2,690	1.2
[3] Naga (Abejo)	1,200	0.5
[4] San Fernando (LGU)	1,271	0.6
[5] Carcar (Water District)	7,571	3.3
Total Rated Production (m^3/day)	**227,525**	**100.0**

Source: MCWD Databook.
Notes: [1] Danao Waterworks, [2] MIWASCO, [3] Naga Planning, [4] San Fernando, [5] Carcar Water District.

Buhisan Dam

Tisa Water Treatment Plant

Source: JICA Study Team.

Figure 6.2.1 Buhisan Dam Built 100 Years Ago and Tisa Water Treatment Plant

6.11 Surface water is supplied by the Buhisan Dam which is processed by the Tisa Water Treatment Plant (see Figure 6.2.1). The dam was constructed more than 100 years ago and 60% of its capacity is silted. It is currently supplying 4,500 m^3/day to MCWD, but it is closed three months a year for maintenance dredging. The Tisa Water Treatment Plant applies a slow sand filter treatment process mostly used with a capacity of 10,000 m^3/day and a rapid sand filter treatment process used for emergency with a capacity of 5,000 m^3/day. The composition of the sand filter for the slow sand filter treatment, however, is uncertain and the pressure of backwashing for the rapid sand filter treatment is insufficient. The detention time of flocculent settling basin on the hillside is too short.

6.12 In 1997, the development and operation of the Jaclupan Weir Dam (Mananga I Dam) in Talisay City augmented the supply by another 30,000 to 36,000 m^3 per day. This surface water source (now categorized as groundwater) recharges the well gallery in Jaclupan Valley, which is then extracted to supply water to the system. In the MCWD databook, Jaclupan is considered a groundwater source and only the Buhisan Dam is considered to be surface water source (see Figure 6.2.2).

Source: JICA Study Team.

Figure 6.2.2 Jaclupan Weir Dam in Mananga River-Talisay City

6.13 The private water suppliers are actively developing sources in Metro Cebu and supplying the water districts in LGUs and/or directly to the communities. At present there are six major private suppliers under contract with MCWD (see Table 6.2.4).

Table 6.2.4 Private Bulk Water Supply Based on Contract, 2013

Bulk Water Supplier		Actual Supply (m^3/day)- 2013			Water Source
		To MCWD	To LGU	Direct to Consumer	
1	Mactan Rocks Industries	4,881	-	12,700	Desalination (see Figure 6.2.3)
2	Foremost	4,169	-	7,300	Groundwater
3	Abejo	18,011	1,200	-	Groundwater
4	BC Homes	2,247	-	-	Groundwater
5	PWRI Talamban	2,136	-	-	Groundwater
6	PWRI Banawa	1,546	-	-	Groundwater
Total		32,989	1,200	20,000	

Source: MCWD and private sector suppliers.
Note: The capacity is based on Contract (volume to supply) by MCWD.

6.14 The 35,000 m^3 per day from Manila Water as an upcoming new supplier (not listed in the table above) is expected to be realized in 2015. The City of Danao will also supply bulk water to MCWD in the future, which is expected to reach 20,000 m^3 per day in 2020.

Source: JICA Study Team.

Figure 6.2.3 Desalination Plant of Mactan Rocks Industries

6.15 Some of the private entities also supply directly to industries and residences particularly those that are not covered by the LGU or the water district, or those that desperately lack the water pressure. The private water companies also distribute water to consumers with high purchasing power and commercial users as long as they are permitted by NWRB to exploit groundwater. Among the areas supplied by the private bulk water suppliers are the Mactan Ecozone 2 (MEZ-2) in Lapu-Lapu City, SRP, and some hotels and resorts in Mactan Island. In the upland barangays, barangay water works systems and/or water cooperatives are operating and managing the water distribution system.

(3) MCWD's Water Supply Potential and Consumption

(a) Service Coverage

6.16 MCWD's franchise area covers eight LGUs, namely: Compostela, Liloan, Consolacion, Mandaue, Lapu-Lapu, Cordova, Cebu City and Talisay. Within these areas, the level of coverage varies significantly as shown in Table 6.2.5.

Table 6.2.5 Service Coverage of the Existing Water System, 2013

	LGUs	Demand Coverage (in %)	Estimated Number of Connections in 2013; Residential	Estimated Population Served
1	Compostela	26	968	7,640
2	Liloan	48	7,310	57,696
3	Consolacion	50	8,280	65,350
4	Cordoba	29	1,774	14,002
5	Lapu-Lapu City	29	12,548	99,035
6	Mandaue City	36	24,354	192,220
7	Cebu City	57	87,720	692,350
8	Talisay City	47	11,965	94,434
Total			154,919	1,222,727

Source: MCWD Databook/Communications, 2013.
Note: The estimated population served includes the secondary and tertiary connections which are around 7.89 times the number of connections.

6.17 Cebu City has the highest coverage at 57%, while the Municipality of Compostela has the lowest at 26%. The data provided by MCWD showed that around 60% of the population (approximately 1.22 million) within the service area is being served, which includes indirectly serviced consumers, meaning those purchasing MCWD water from the connected consumers with a total of 154,919 connections. Those communities that are not served by MCWD are areas that are not reached by the pipe network such as those located in the upland barangays. Table 6.2.6 shows the types of service connections and the daily consumption for years 2008 to 2013.

Table 6.2.6 MCWD Population Covered, Number of Connections and Water Consumption, 2008-2013

	Parameters	Year					
		2008	2009	2010	2011	2012	2013
1	Population in the area of responsibility	1,870,407	1,731,492	1,945,013	1,973,410	2,150,979	2,191,848
2	Population served	1,018,671	1,040,162	1,047,287	1,095,519	1,176,242	1,222,727
4	Percent of population served (%)	54.46	60.07	53.84	55.51	54.68	55.79
5	Number of service connections	120,737	124,092	131,680	138,082	145,506	154,919
	• Residential	117,051	120,461	128,228	134,646	142,102	151,524
	• Commercial/ Industrial	3,264	3,240	3,062	3,032	2,994	2,968
	• Government	170	167	176	186	186	191
	• Communal	201	172	142	139	125	116
	• Subdivisions/ Condominiums	51	52	72	186	99	120
6	Consumption (m^3/day)	119,790	120,567	123,121	129,463	138,923	146,063

Source: MCWD Databook 2008–2013.

(b) **Per Capita Consumption**

6.18 The per capita consumption is estimated based on daily consumption of residential connection and the estimated population served (i.e., population served is equal to the number of residential connections x 5.1 persons). Table 6.2.7 shows the residential consumption and the number of connections for the years 2010 to 2013.

Table 6.2.7 Estimated per Capita Consumption, 2010-2013

	2010	2011	2012	2013
Annual residential consumption (m^3)	38,144,632	40,029,465	43,122,483	45,034,813
Daily residential consumption (m^3)	104,506	109,670	117,821	123,383
Number of connections	128,228	134,646	142,102	151,524
Liter per capita consumption per day (lpcd)	160	160	163	160

Source: MCWD.
Note: Estimated number of people per connection is 5.1.

(c) Commercial / Industrial Consumption

6.19 The commercial and industrial consumption are segregated in the MCWD record and has reflected the annual consumption and the number of connections. There are challenges, however, in the projection of future demand due to the reclassification of meter tagging resulting in the data that do not show any trend. Despite this challenge, the water consumption of commercial and industrial establishments can be approximated to be around 11% to 15.5%. Table 6.2.8 gives the record of commercial / industrial consumption recorded over the last four years.

Table 6.2.8 Commercial/ Industrial Consumption and its Ratio with Domestic Consumption, 2010-2013

	2010	2011	2012	2013
Annual commercial / industrial consumption (m^3)	4,742,001	6,210,374	5,001,296	5,134,885
Daily commercial/industrial consumption (m^3)	12,992	17,015	13,702	14,068
Daily domestic consumption (m^3)	104,506	109,670	117,821	123,383
Daily total consumption (m^3)	117,498	126,685	130,893	137,451
Percentage (commercial to total)	11.06	13.43	10.47	10.23

Source: MCWD Databook.

6.20 According to the MCWD Knowledge Center, the apparent decline in the percentage ratio of commercial to domestic is due to the reassignment of commercial tagging of a subdivision to residential. In the future demand projection, it is assumed that the commercial demand will be at 12.5% to 15% of domestic consumption.

(d) Non-Revenue Water (NRW)

6.21 From the production and billed record of MCWD, the non-revenue water (NRW) shows that it is decreasing from 30.8% in 2010 to 25% in 2013 (see Table 6.2.9). This reduction in NRW is a major savings in the total water supply system.

Table 6.2.9 Recorded Non-Revenue Water of MCWD, 2010-2013

Parameters	2010	2011	2012	2013
Total annual production (m^3)	63,177,659	65,694,432	68,650,892	71,149,588
Total billed consumption (m^3)	43,718,477	47,253,961	50,845,912	53,313,003
Non-revenue (m^3)	19,459,182	18,440,471	17,804,980	17,836,585
% NRW	30.80	28.07	25.94	25.07

Source: MCWD Databook 2010 to 2013.

(e) MCWD's Future Plan for Bulk Water

6.22 MCWD plans to increase the volume of supply to the service area in three ways: (i) through the supply of bulk water from private suppliers, (ii) management of non-revenue water, and (iii) by its continuing groundwater exploration outside

the critical aquifer areas. A summary of these immediate sourcing and supply is given in Table 6.2.10.

Table 6.2.10 Future Water Supply Sources

Unit: m^3/day

Sources	2014	2015	2016	2017	2018	2019	2020
Manila Water (Carmen Water)	18,000	35,000	35,000	35,000	35,000	35,000	35,000
Danao					10,000	10,000	20,000
Suba Desalination Plant		7,000	7,000	7,000	7,000	7,000	7,000
Pit-os	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Cabangcalan	5,000	5,000	5,000	5,000	5,000	5,000	5,000
HA 3 bulk			15,000	35,000	35,000	35,000	35,000
In-House (2, 3, 4)	7,200	7,200	7,200	7,200	7,200	7,200	7,200
In-House 1		2,100	2,100	2,100	2,100	2,100	2,100
In-House A						15,000	15,000
Total	36,200	62,300	77,300	97,300	107,300	122,300	132,300

Source: Communication/Technical meeting with MCWD on projected water sources in 2014.
Note: The Carmen water source is ongoing and will be completed in 2014.

6.23 The last two sources at Nivel Hills are floated to potential privatized bulk water suppliers but no definite source has been identified yet.

- Carmen Water

  6.24 The completion of the Carmen bulk water supply (see Figure 6.2.4) was expected to be realized within 2014 and delivery will be 18,000 m^3/day to MCWD. In 2015, the capacity will be increased to 35,000 m^3/day. Thus, the supply will meet the needs for the next four to five years.

Source: JICA Study Team.

Figure 6.2.4 Carmen Weir Completed in 2013

- Surface Water in Danao

  6.25 MCWD has an existing Memorandum of Understanding with the City of Danao to supply bulk water up to 20,000 m^3/day. Based on the program of MCWD, this project should start soon and delivery of the expected output will be by 2018.

(4) Non-MCWD Water Supply Potential and Consumption

(a) Northern Areas–Danao City

- Water Supply System

  6.26 Danao Water System (see Figure 6.2.5) is managed and operated by the LGU under its Waterworks Division, a division of the local government

whose main task is to manage, operate, maintain and collect fees from the concessionaire. The waterworks is operational.

- Service Coverage

6.27 The present coverage of the waterworks distribution system is serving around 9,148 households which are only around 47% of the total households of the City.[3] It is currently serving 14 out of 42 barangays, the rest are supplied by the Barangay Waterworks System and by communal shallow wells and/or springs. The present consumption is 5,541m^3 per day.

Source: JICA Study Team.

Figure 6.2.5 Pumping Station of Danao Water System / Danao River Source in Brgy. Ibo

6.28 Presently, the supply is taken from four springs and 14 deep wells. The number of unserved households is 4,377 (19.3%). In the mountain barangays, artesian wells, deep wells, rainwater and streams (mostly those located in mountain barangays) are used.[4] For the 19.3% who are not served by the district, jetmatic pumps and deep well pumps are provided for their use.[5]

- Potential Water Sources

6.29 Danao City has an abundant water supply since its periphery passes the Danao Tangon River, Lusaran River, KotKot River and Cagat–Guinsay River. The major drainage outlet is the Tangon River that has an average width of 4–8 m and it is the tributary of small numerous streams and rivers upland. It empties into the adjoining sea and never runs dry even during the summer months. The combined outflow of the four major rivers during a heavy downpour is reported to reach a big volume of water. The river water source in Brgy. Ibo, Danao City is located around 5 km upstream.

(b) **South Cebu LGUs**

- Institutions and Service Coverage

6.30 The southern LGUs of Cebu, which are not covered by MCWD, consist of the municipalities of Minglanilla, San Fernando, and the cities of Naga and Carcar. These areas are supplied by LGU-operated water systems, or the water district in the case of Carcar City. The City of Naga runs their water system through a private vendor Abejo Water Corporation. The summary of the management of these systems is given in Table 6.2.11.

[3] Danao City Health Data 2013.
[4] Danao CLUP – Infrastructure/Utilities page 7.
[5] Danao CLUP – Infrastructures/Utilities page 170.

Table 6.2.11 Water Suppliers in the South

N	LGU	Water Supplier	No. of Connections	Estimated Consumption (m^3/day)	Remarks
1	Minglanilla	MIWASCO (cooperative)	3,706	2,690	Cooperative
2	City of Naga	Abejo	a)1,478	a)1,200	LGU through private operation Other bulk supplier is also operating in some barangays
3	San Fernando	LGU and Helpmate	1,520	1,271	Municipal water system Private
4	City of Carcar	Carcar City Water District	10,861	7,571	Water district 12 out of 15 barangays are served
Total			17,565	12,732	

Sources: LGU, Water District and MIWASCO
Note: a) An estimate from Planning Office and Waterworks Division.

6.31 In the City of Naga, the LGU Waterworks Division is supplying water to seven barangays. Pertinent data are shown in Table 6.2.12.

Table 6.2.12 Inventory of Pumping Stations in City of Naga

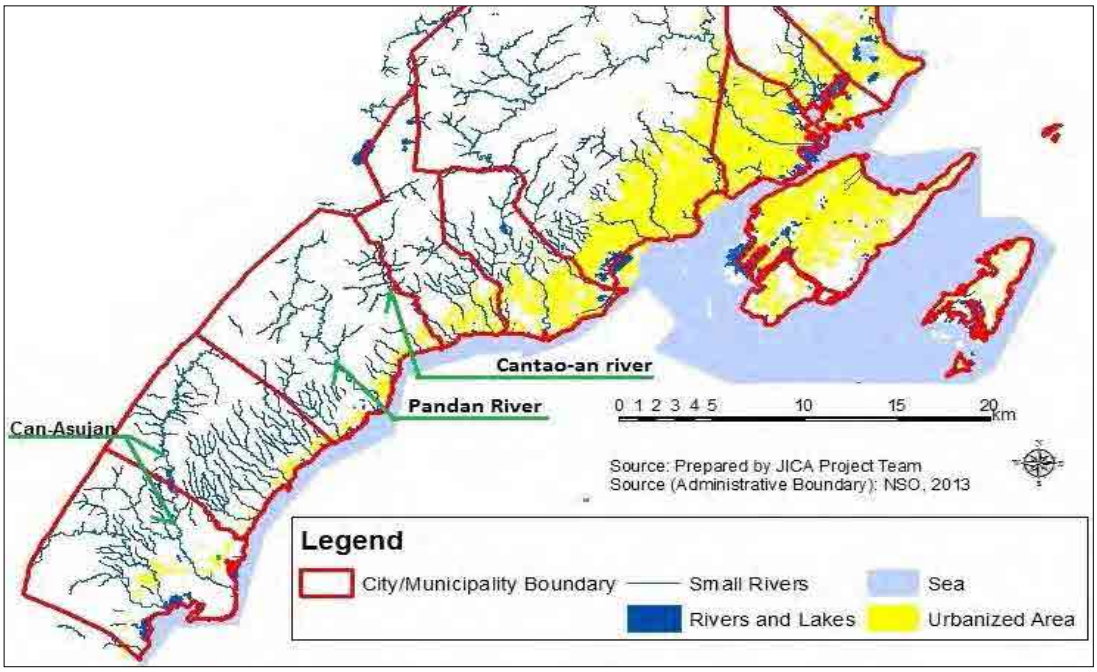
Pump Station No.	Location	Pump Capacity (hp)	Pump Station No.	Location	Pump Capacity (hp)
1	West Poblacion	10	4	Barangay Tangke	2
2	North Poblacion	10	5	Barangay Tangke	2
3	West Poblacion	10	6	Barangay Tangke	5
			7	Barangay Inoburan	5

Source: Septage Management Program – City of Naga, 2013.

- Water Potential

6.32 During the stakeholders meeting and interviews with the water managers (both LGUs and Carcar Water District), it was indicated that there are potential sources (mainly groundwater) which can be tapped from the area. However, there is no study that provides an estimate of the capacity of the sources. It is simply assumed that an additional production well will produce additional volume without considering the impact on groundwater resource and possibility of salt water intrusion.

6.33 River water source is a possibility in the future but will require further study. One of these rivers is the Can-asujan River which is also currently tapped by an irrigation project of the National Irrigation Administration (NIA). Other potential river sources are the Pangdan River and Cantao-River in the Naga–Minglanilla area.



Source: JICA Study Team.

Figure 6.2.6 Water Potential in the South

(c) Per Capita Consumption in Non-MCWD Area

6.34 The per capita consumption of MCWD coverage area is estimated to be around 159 liters per capita per day (lpcd). This is based on the estimated population served per connection. In the northern and southern areas, the per capita consumption is also estimated.

6.35 Assuming a similar population served per connection, the estimated per capita consumption for the northern and southern areas is given in Table 6.2.13.

Table 6.2.13 Per Capita Consumption for Northern and Southern Metro Cebu

Areas	Daily Consumption (m^3/day)	No. of Connections	Estimated Consumption Liters per Capita per Day
Northern Area	5,541	9,148	119
Southern Area	12,732	17,56517,578	144
Minglanilla	2,690	3,7063,719	142
Naga	1,200	1,478	159
San Fernando	1,271	1,520	164
Carcar	7,571	10,861	137
Total Metro Cebu	18,273	26,71326,726	

Source: Information obtained from respective agencies (LGU and Water District), based on available data, Septage management program-City of Naga, 2013.

(5) Summary of MCWD and Non-MCWD Water Potential

6.36 To summarize, the existing water sources and potential sources in Metro Cebu rely heavily on groundwater sourcing and small water impounding systems. Additional sources of MCWD depend to a greater extent on the private bulk water suppliers. The sources currently identified by MCWD and private bulk water suppliers, and future supply volume are summarized in Table 6.2.14.

Table 6.2.14 Existing Water Sources and Future Supply with MCWD, 2013-2020

N	Source	2013	2014	2015	2016	2017	2018	2019	2020
A. Production (1+2+3) (m^3/day)		209,252	245,452	271,552	286,552	306,552	316,552	331,552	341,552
1	Existing Supplied Water	176,263	176,263	176,263	176,263	176,263	176,263	176,263	176,263
	Existing Groundwater	173,183	173,183	173,183	173,183	173,183	173,183	173,183	173,183
	Existing Surface water	3,080	3,080	3,080	3,080	3,080	3,080	3,080	3,080
2	Bulk water- On Contract	32,989	32,989	32,989	32,989	32,989	32,989	32,989	32,989
2.a	Foremost (Talisay)	4,169	4,169	4,169	4,169	4,169	4,169	4,169	4,169
2.b.1	Abejo–(South)	4,812	4,812	4,812	4,812	4,812	4,812	4,812	4,812
2.b.2	Abejo–(North)	7,833	7,833	7,833	7,833	7,833	7,833	7,833	7,833
2 b.3	Abejo–(Lahug)	2,216	2,216	2,216	2,216	2,216	2,216	2,216	2,216
2.b.4	Abejo–Guadalajara	2,660	2,660	2,660	2,660	2,660	2,660	2,660	2,660
2.b.5	Abejo–Kabajar	490	490	490	490	490	490	490	490
2.b.6	Abejo–Quijada								
2.c	BC Homes	2,247	2,247	2,247	2,247	2,247	2,247	2,247	2,247
2.d.1	PWRI Talamban	2,136	2,136	2,136	2,136	2,136	2,136	2,136	2,136
2.d.2	PWRI Banawa	1,546	1,546	1,546	1,546	1,546	1,546	1,546	1,546
2.e	Mactan Rocks (Desalination)	4,881	4,881	4,881	4,881	4,881	4,881	4,881	4,881
3	Proposed Bulk Water		36,200	62,300	77,300	97,300	107,300	122,300	132,300
3.a	Carmen Bulk Water		18,000	35,000	35,000	35,000	35,000	35,000	35,000
3.b	Danao						10,000	10,000	20,000
3.c	Suba Desalination			7,000	7,000	7,000	7,000	7,000	7,000
3.d	Pit-os		6,000	6,000	6,000	6,000	6,000	6,000	6,000
3.e	Cabangcalan		5,000	5,000	5,000	5,000	5,000	5,000	5,000
3.f	HA 3 bulk				15,000	35,000	35,000	35,000	35,000
3.g.1	In- House (2, 3, 4)		7,200	7,200	7,200	7,200	7,200	7,200	7,200
3.g.2	In-House 1			2,100	2,100	2,100	2,100	2,100	2,100
3.g.3	In-House A							15,000	15,000

Source: MCWD, 2014.

6.37 On the other hand, relevant information of the potential sources outside MCWD service areas is not available, particularly on the capacity and quality. Some of these rivers that might be tapped, including the rivers listed in Table 6.2.15.

Table 6.2.15 Non-MCWD Water Potential

	Non-MCWD Service Areas	Potential Sources	Catchment Area (km^2)	Estimated Yield (m^3/day)
A	Northern Area	Danao River	25	20,000 year 2018
B	Southern Area			
	Carcar	1. Can-asujan River	-	Not known/ also used for irrigation
	Naga	2. Pandan River	22	Not known
	Naga–Minglanilla	3. Cantao-an River	-	Not known

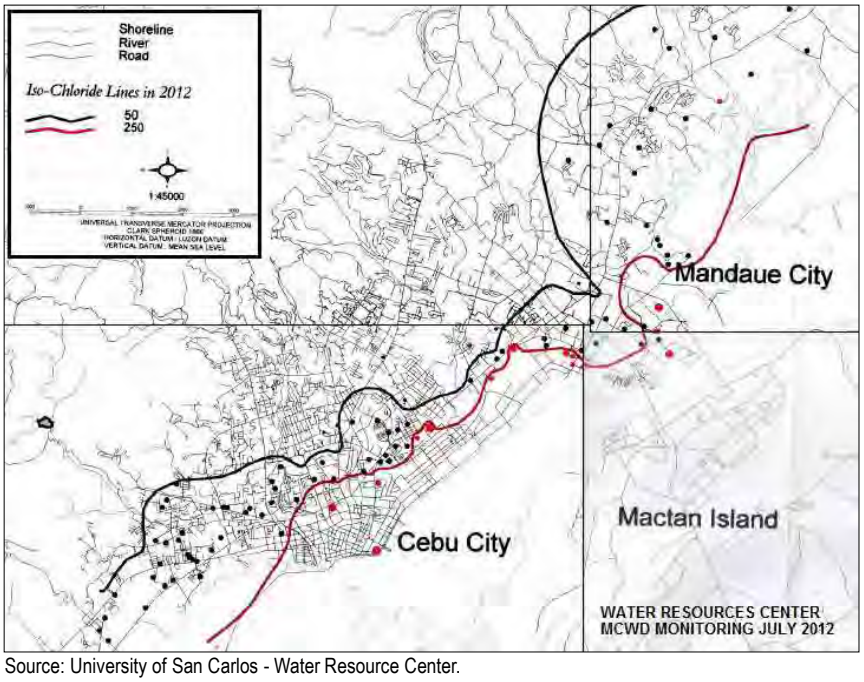
Source: JICA Study Team.
Note: Area is estimated based on Google Map.

(6) Issues and Concerns

(a) Salinity Intrusion

6.38 Water supply for the Greater Metropolitan Cebu relies heavily on groundwater sources. It is estimated that more than 25,000 wells are located along the coastal aquifer. The unregulated extraction of water has resulted in salt water intrusion. For the last 30 years, the University of San Carlos-Water Resource Center has been monitoring the conductivity level along the coast. Figure 6.2.7

shows the progression of saline wedge into the inland. At present, the 250 mg/L TDS is approaching Fuente Osmeña Circle. Without control of groundwater extraction, salt water contamination will affect the MCWD well in Talamban Area. Looking deeper into the issue of salinity intrusion is a more urgent issue related to the control of water extraction. With more than 25,000 wells, it seems that control of groundwater extraction is a daunting task considering that there are only less than 1,000 wells that are registered. However, this seemingly insurmountable task can be slowly addressed by balancing supply and demand.



Source: University of San Carlos - Water Resource Center.

Figure 6.2.7 Salinity Map of Metro Cebu Water

(b) **Nitrate and E. Coli Contamination**

6.39 Monitoring conducted by the City Health Office indicated contamination of groundwater from domestic sewage. This is due to the lack of a septic tank system and/or proper design and construction/operation of the same. More of this is explained in Section 6.4 Wastewater.

(c) **Peripheral Urbanization in Watershed Areas**

6.40 While it is true that the watershed is declared a protected area and, as such, development is restricted to selected uses, the natural growth of development is inevitable. The growth is also encouraged due to road access.

(d) **Harmonization of Efforts on Watershed Management**

6.41 There are several agencies and organizations working towards the management and the ecological condition of the watershed area. They include, among others, the Protected Area Management Board (PAMB), the Central Cebu River Basin Council (CCRBC), the LGUs within the jurisdiction and some People's Organizations (POs) such as Mag uugmad Foundation. DENR, as part of its mandate, regulates and monitors the activities and ensures conformance to the initial protected area plans. Reforestation is also done to restore the condition of the watershed areas. Since water is the critical parameter in the watershed area, it

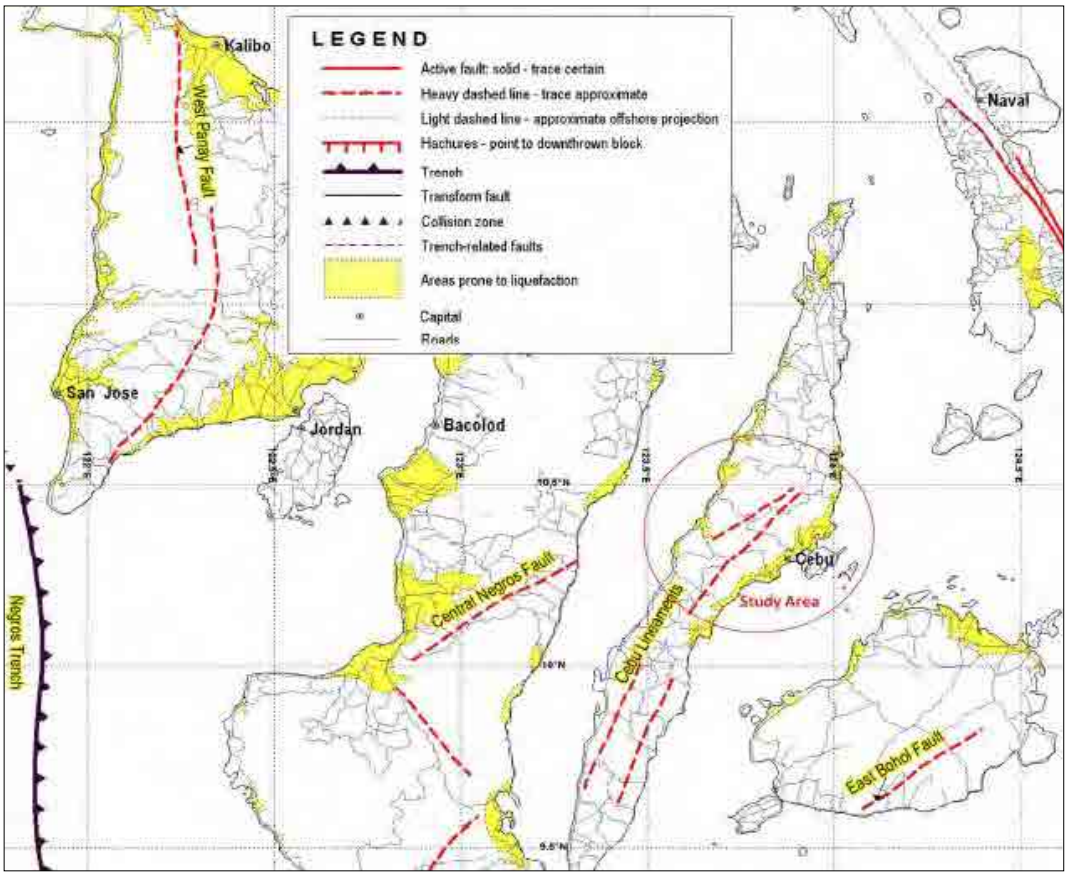
is, therefore, necessary to harmonize these efforts and initiative so that all sectors will work towards the same goal, i.e., for the protection of the watershed area that will consequently protect and improve the natural water cycle.

(e) **Active Faults in Cebu**

6.42 A review of the previous studies noted the issues concerning the faults in Cebu Province that pass through or near the location of proposed dams. A map from PHIVOLCS (see Figure 6.2.8) shows parallel faults generally trending northeast-southwest. The two faults of interest are located on the northern end of the island which cut through the watershed areas of Luyang, Lusaran, Kotkot, Mananga and Malubog Rivers. Initial mapping done by PHIVOLCS (Tungol and Borna, 1996) described the fault as follows:

(i) **Lutac–Jaclupan Fault:** The Lutac–Jaclupan active segment appears as several northeast-trending right-lateral strikeslip with rupture length of about 5 km stretching from Manduang to Toong. Recent fault movement is manifested by offset creeks in the Manduang–Tapol–Jaclupan area and offset banks of the Mananga River in the Jaclupan–Toong area.

(ii) **Cantabaco Fault:** The two potentially active fault traces of the Cantabaco Fault are marked by two sharply defined sub-parallel creeks that trend westerly from Mananga River. Recent activity along the mapped traces is inferred from sharply linear ridges and valleys.



Source: PHILVOLCS.

Figure 6.2.8 Fault Lines in Cebu Province

2) Projected Water Demand

6.43 The projected water demand is mainly based on the population of the study area at a given time in the future. Consequently, the commercial and industrial demand is also projected based on a certain percentage to the domestic demand. A ratio of commercial/ industrial and institutional demand (government) is also considered.

(1) Projected Population

6.44 The projected population in Metro Cebu will reach around 4.9 million in 2050 (estimated by JST). The breakdown of the population for each of the LGUs is shown in Table 6.2.16. The population within the MCWD area comprising the cities of Cebu, Mandaue, Lapu-Lapu, Talisay, Cordova, Consolacion, Liloan and Compostela is around 80% of the entire metropolis for the year 2010. This share will decrease to around 75% in the year 2050. Still, it is expected that the bulk of the water demand will continue to be concentrated in these eight LGUs.

Table 6.2.16 Projected Population in the Metro Cebu Area, 2020-2050

City / Municipality	Population x 1000				
	2010	2020	2030	2040	2050
City of Carcar	107.32	156.94	186.41	215.32	243.81
Cebu City	866.17	967.31	1,086.67	1,205.44	1,323.63
Compostela	42.57	63.13	77.53	91.86	106.13
Consolacion*	106.65	155.25	196.61	238.18	279.8
Cordoba	50.35	57.56	68.36	79.1	89.79
Danao City	119.25	176.12	212.16	247.75	283
Lapu-Lapu City	350.47	445.6	544.53	642.96	740.92
Liloan	100.5	153.35	192.81	232.39	271.98
Mandaue City	331.32	391.72	461.85	531.63	601.08
Minglanilla	113.18	169.31	211.09	252.9	294.64
City of Naga	101.57	152.22	184.44	216.35	248
San Fernando	60.97	88.92	107.69	126.27	144.69
City of Talisay	200.77	236.43	279.67	322.7	365.52
Metro Cebu	2,551.10	3,213.87	3,809.83	4,402.86	4,992.99
(a) MCWD Coverage	2,048.81	2,470.36	2,908.04	3,344.28	3,778.85
(b) Non-MCWD Area					
> Northern Area	119.25	176.12	212.16	247.75	283
> Southern Area	383.04	567.39	689.63	810.84	931.14

Source: JICA Study Team.

(2) Conditions and Assumptions for per Capita Consumption and Commercial/ Industrial Demand

6.45 In Table 6.2.17, the estimated per capita consumption of each of the areas and the commercial/industrial demand are calculated based on the MCWD Databook in 2014. For purposes of future projection, assumptions given in Table 6.2.16 are adopted for the three areas: MCWD area, northern and southern areas.

Table 6.2.17 Per Capita Consumption for the Respective Areas and Commercial/ Industrial Demand

Components	Per Capita Consumption	
1. Domestic	2000–2030	2040–2050
MCWD	160	160
Northern Area	150	160
Southern Area	150	160
2. Commercial/Industrial demand to Domestic (%)	12.50	15.50

Source: JICA Study Team.

6.46 In the northern area, the present average per capita demand is 119 lpcd, while that in the southern area is 144 lpcd. For purposes of future projection, it is assumed that both north and south demand will be estimated using 150 liters/capita/day for the years 2020 and 2030. This then will increase to 160 liters/capita/day for the years 2040 to 2050.

6.47 In the case of commercial/ industrial demand, data for the last three years of MCWD showed that the ratio of commercial/ industrial is around 12.5 to 15.5%. With this fluctuation, it is assumed that the ratio will be tagged at 12.5% and increased to 15.5%.

6.48 In addition, government buildings also consume around 2% of the total residential consumption amounting to an average of 2,770 m^3 over the last four years. The same ratio will be used for the projection.

(3) Summary of Projected Water Demand from 2020 to 2050

6.49 The summary of projected domestic water demand for the Metro Cebu area covers those not connected with the water system, as shown in Table 6.2.18. It is noted that around 75% to 78% of the total water demand is within the MCWD service areas.

Table 6.2.18 Projected Domestic Water Demand within Metro Cebu, 2020-2050

City / Municipality	Water Demand (m^3/day)				
	Per Capita Consumption	2020	2030	2040	2050
City of Carcar	150/160	23,541	27,961	34,451	39,010
Cebu City	160	154,770	173,867	192,871	211,781
Compostela	160	10,102	12,405	14,698	16,980
Consolacion*	160	24,840	31,458	38,108	44,768
Cordoba	160	9,210	10,937	12,656	14,366
Danao City	150/160	26,417	31,823	39,640	45,280
Lapu-Lapu City	160	71,296	87,124	102,874	118,547
Liloan	160	24,536	30,850	37,183	43,517
Mandaue City	160	62,675	73,896	85,061	96,172
Minglanilla	150/160	25,396	31,664	40,463	47,142
City of Naga	150/160	22,833	27,667	34,616	39,679
San Fernando	150/160	13,339	16,154	20,203	23,151
City of Talisay	160	37,829	44,748	51,633	58,484
Metro Cebu		506,785	600,555	704,457	798,878
(a) MCWD Area		395,258	465,286	535,084	604,616
(b) Non-MCWD Area		111,526	135,270	169,373	194,262
Northern Cebu		26,417	31,824	39,640	45,280
Southern Area		85,109	103,446	129,733	148,982

Source: JICA Study Team.
Note: The per capita consumption of 150/160 means that 150 liters/capita/day is used for 2020 and 2030, while 160 liters/capita/day is used for 2040 and 2050.

6.50 Projecting the commercial and industrial demand was done separately by area for the northern, central and southern areas of Metro Cebu. The results were then summed up as the total projection scenario for the metropolis (see Table 6.2.19).

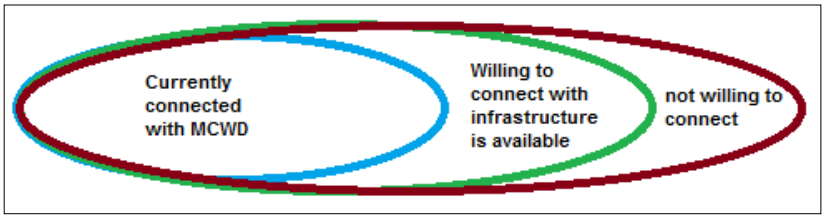
Table 6.2.19 Total Demand Including Commercial / Industrial and Government, 2020-2050

City / Municipality	Water Demand (m^3/day)			
	2020	2030	2040	2050
A. Central (MCWD Area)	452,570	535,079	620,698	707,400
Residential	395,258	465,286	535,084	604,616
Commercial (12.5% to 15%)	49,407	60,487	74,912	90,692
Government (2%)	7,905	9,306	10,702	12,092
B. Northern Cebu / Danao	29,587	35,641	44,397	50,714
Residential	26,417	31,823	39640	45,280
Commercial (10%)	2,642	3,182	3,964	4,528
Government (2%)	528	636	793	906
C. Southern Cebu	95,322	115,860	145,301	166,860
Residential	85,109	103,446	129,733	148,982
Commercial/ Industrial (10%)	8,511	10,345	12,973	14,898
Government (2%)	1,702	2,069	2,595	2,980
Total	574,479	686,580	810,396	924,974

Source: JICA Study Team.
Note: Commercial and industrial demand in the southern parts of Cebu is assumed at 10% of the domestic consumption, while the government demand is assumed at 2%.

(4) Niche Water Demand

6.51 Since not all domestic and other sectors are willing to buy or patronize the supply from water providers, it is necessary to estimate the niche demand. The niche demand is defined as the estimated water demand in an area which includes those who are willing to connect to the water service provider when the infrastructure is available. This means that the niche demand is only a certain percentage of the total estimated demand in the study area. This is depicted in the figure below.



Source: JICA Study Team.

Figure 6.2.9 Illustration of Niche Demand and MCWD Coverage

6.52 MCWD expressed that their projected niche demand is hoped to reach 80% of the total service area. Table 6.2.20 presents the estimated percentage of coverage.

Table 6.2.20 Assumed Projected Level of Connection, 2020-2050

City / Municipality	Level of Connection / Willingness to Connect (%)				
	2014	2020	2030	2040	2050
City of Carcar	39.00	50.00	55.00	65.00	75.00
Cebu City	57.00	60.00	65.00	75.00	80.00
Compostela	26.00	30.00	40.00	50.00	60.00
Consolacion*	50.00	55.00	65.00	75.00	80.00
Cordoba	29.00	35.00	45.00	55.00	80.00
Danao City	40.00	50.00	60.00	70.00	80.00
Lapu-Lapu City	29.00	35.00	45.00	55.00	80.00
Liloan	48.00	55.00	65.00	75.00	80.00
Mandaue City	36.00	40.00	50.00	60.00	80.00
Minglanilla	17.00	25.00	35.00	45.00	55.00
City of Naga	9.00	20.00	30.00	40.00	50.00
San Fernando	12.50	20.00	30.00	40.00	50.00
City of Talisay	47.00	55.00	65.00	75.00	80.00

Source: JICA Study Team.
Note: The target level of connection is set by MCWD; Non-MCWD area is assumed.

Table 6.2.21 Total Niche Domestic Water Demand, 2020-2050

City / Municipality	Total Water Demand (m^3/day)			
	2020	2030	2040	2050
City of Carcar	11,771	15,378	22,393	29,257
Cebu City	92,862	113,014	144,653	169,425
Compostela	3,031	4,962	7,349	10,188
Consolacion*	13,662	20,447	28,582	35,815
Cordoba	3,224	4,922	6,961	11,493
Danao City	13,209	19,094	27,749	36,224
Lapu-Lapu City	24,954	39,206	56,581	94,838
Liloan	13,495	20,052	27,888	34,814
Mandaue City	25,070	36,948	51,037	76,938
Minglanilla	6,349	11,082	18,209	25,928
City of Naga	4,567	8,300	13,847	19,840
San Fernando	2,668	4,846	8,081	11,575
City of Talisay	20,806	29,086	38,724	46,787
Metro Cebu(Mega)	235,667	327,337	452,054	603,123
MCWD Coverage	197,103	268,637	361,775	480,297
Northern Area	13,209	,	27,749	36,224
Southern Area	25,355	39,606	62,531	86,601

Source: JICA Study Team.
Note: Niche demand = projected demand of those connected + those who are willing to connect.

6.53 It can be seen above that the projected total demand of MCWD is around 197,000 m^3 in 2020 and will double in 2050. Also, the demand in the northern area (Danao City) is projected to triple in 2050. A similar trend is seen in the southern parts of Metro Cebu.

Table 6.2.22 Total Niche Demand within the Metro Cebu Area, 2020-2050

Projected Year	2020	2030	2040	2050
A. MCWD Coverage	225,683	307,590	423,276	561,948
• Residential	197,103	268,637	361,775	480,297
• Commercial/ Industrial	24,638	33,580	54,266	72,045
• Government	3,942	5,373	7,235	9,606
B. Non-MCWD Area				
Northern Area	14,794	21,385	31,079	40,570
• Residential	13,209	19,094	27,749	36,2244
• Commercial/Industrial (m^3/day) - 10%	1,321	1,909	2,775	3,6224
• Government - 2%	264	382	555	724
Southern Area	28,397	44,359	70,035	96,993
• Residential	25,355	39,606	62,531	86,601
• Commercial/Industrial (m^3/day) - 10%	2,535	3,961	6,253	8,660
• Government - 2%	507	792	1,251	1,732
Grand Total	268,874	373,334	524,390	699,511

Source: JICA Study Team.

(5) Required Production

6.54 The required production to meet future demand is equal to the water demand of the area plus the non-revenue water. The non-revenue water is projected to decrease from 20% to 12% within the MCWD area. This assumption is based on the reduction of NRW from 30% to 25% over the last five years, which MCWD hopes to reduce further within the next 30 years. With this assumption, the required water production was calculated as shown in Table 6.2.23.

6.55 The non-revenue water in the northern and southern areas are assumed based on the actual situation. The northern area has a high NRW at present and is still facing challenges in resolving this issue. Hence, it is assumed to be around 30% for the year 2020 and reduced by 5% every 10 years thereafter. With this value, the target is assumed to be 30% in 2020 and reduced to 15 % in 2050. In the southern part of Metro Cebu it is assumed to be 25% in 2020 and 12% in 2050.

Table 6.2.23 Required Production in Respective Areas, 2020-2050

	Year			
	2020	2030	2040	2050
A. MCWD Area				
1. Total niche demand (m^3/day)	225,683	307,589	423,277	561,948
2. NRW	20.00%	17.00%	15.00%	12.00%
Total required production (m^3/day) in MCWD	282,104	370,589	497,972	638,577
B. Non-MCWD Area				
1. Northern Area				
Total niche demand (m^3/day)	14,794	21,385	31,079	40,570
NRW	30.00%	25.00%	20.00%	15.00%
Total required production (m^3/day)	21,134	28,513	38,849	47,729
2. Southern Area				
Total niche demand (m^3/day)	28,397	44,359	70,034	96,993
NRW	25.00%	20.00%	15.00%	12.00%
Total required production (m^3/day)	37,863	55,449	82,393	110,220
Total Required Production (m^3/day) in Metro Cebu	341,101	454,551	619,214	796,526

Source: JICA Study Team.

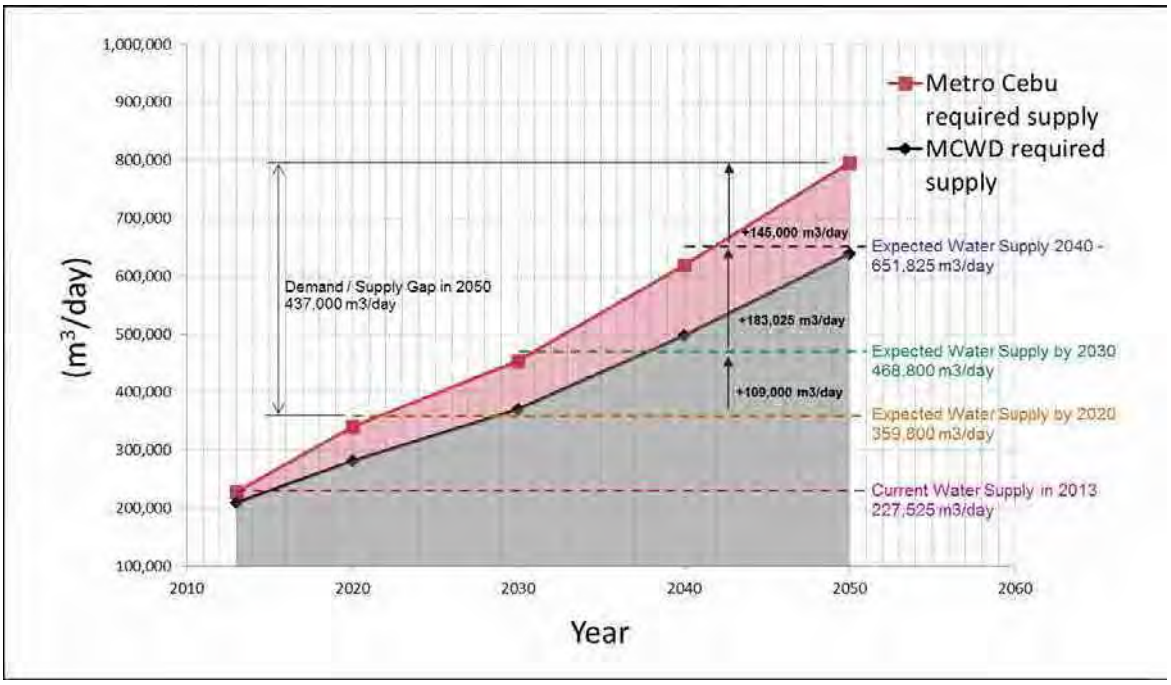
(6) Balancing Supply and Demand

6.56 The difference between required production water (demand) and existing supplied water potential (supply) is the requirement for a new water source. Required production water for MCWD and Metro Cebu is shown in the Table 6.2.24. Based on this, the supply of water will be sufficient to meet the demand in 2020. However, in 2030, the supply of water will fall short of the demand for MCWD and Metro Cebu areas. Figure 6.2.10 shows water demand and required future water supply capacity at each planning term (short-term, medium-term, long-term).

Table 6.2.24 Supply and Demand Balance for MCWD and Metro Cebu, 2020-2050

	MCWD Area	2020	2030	2040	2050
1	Required supply (m^3/day)	282,104	370,589	497,972	638,577
2	Supply (m^3/day)	341,552	341,552	341,552	341,552
3	Surplus/Deficit (m^3/day)	59,448	-29,307	-156,420	-297,025
	Metro Cebu Area	2020	2030	2040	2050
1	Required Supply (m^3/day)	341,101	454,551	619,214	795,526
2	Supply (m^3/day)	359,825	359,825	359,825	359,825
3	Surplus / Deficit (m^3/day)	18,724	-94,726	-259,389	-436,701

Source: JICA Study Team.



Source: JICA Study Team.

Figure 6.2.10 Future Water Demand for MCWD and Metro Cebu and Required Water Supply Capacity in the Short, Medium and Long Term

3) Water Supply Capacity Expansion

(1) Surface Water

6.57 Based on the projected water demand discussed in the previous section, new water sources will have to be developed to meet the projected water requirement. Identified sources in the previous studies are the dams in Mananga, Kotkot, Lusaran, Malubog, and the existing Carmen. These are shown in Figure 6.2.11 and described hereafter.

Table 6.2.25 Potential Surface Water Supply

N	Surface Water Sources	Catchment Area, km^2	Firm Yield (m^3/day)
1	Mananga Dam	72.7	68,000 (Bechtel)
2	Kotkot Dam	40.0	56,000 (Water Remind)
3	Lusaran Dam	66.0	55,000 (Water Remind)
4	Malubog Dam	59.7	100,000 (Aqua-Atlas)
5	Danao Dam	25.0	-
6	Pandan River	22.0	-
7	Can-asujan	-	-

Source: Urban Water Supply and Sanitation Project, ADB, 2011.

(a) **Mananga Dam**

6.58 The Mananga II Dam will be located approximately at coordinates of 10°19'23.97"N and 123°47'57"E. It lies within Cebu City but its impounding area also covers a portion of Talisay City. A feasibility study was conducted by Bechtel International (2001) which made a comparison with the hydrologic study done by Electrowatt (1991). The study of Mananga Dam was also revisited by Water Remind Study in 2006. Important parameters are listed in Table 6.2.26. From the latest study done, the dam will have a height of 73 m, an impounding area of 83 ha, a projected yield of 68,000 m^3 per day, and will cost around PHP2.12 billion to build.

Source: JICA Study Team.
Note: Carmen Weir is established and operational.

Figure 6.2.11 Location of Water Sources

Table 6.2.26 Relevant Information on Mananga II Dam

	Parameters	Old Proposal (ADB / Electrowatt)	Bechtel International	Water Remind Study
		1991	2001	2006
1	Dam Height (m)	76	76	73
2	Impounding Area (ha)	150	-	83
3	Capital Cost (PHP)	-	2.12 billion	2.39 billion
4	Firm Yield (m^3/day)	-	68,000	77,000

Source: Mananga II High Dam and Treated Bulk Water Supply Project, 2001; Water for Cebuanos – Excerpt from Water Remind Study, 2006.

Source: JICA Study Team.

Figure 6.2.12 Location of Proposed Mananga Dam

(b) **Lusaran Dam**

6.59 The Lusaran Dam was first investigated by Kampsax-Kruger/ LAHMEYER International and the Local Water Utilities Administration (LWUA) in 1977. In the 2006 study, the proposed dam height is 63.3 meters and an impounding area of 203 ha, giving an expected yield of 109,000 m^3per day and is estimated to cost PHP2.35 billion (see Table 6.2.26). It is located at Brgy. Lusaran, downstream near the confluence of Boco Bobo River and Balamban River. Subsequent review was done by ADB in 2011.

Table 6.2.26 Relevant Information on Lusaran Dam

	Parameters	Kampsax-Kruger (1977)	Water Remind Study (2006)
1	Dam Height (m)	63.3	47.4
2	Impounding Area (ha)	206	147
3	Capital Cost (PHP billion)	2.35	2.24
4	Firm Yield (m^3/day)	109,000	108,000

Source: Water for Cebuanos – Excerpt from Water Remind Study 2006.

(c) **Kotkot River Dam**

6.60 In the Water Remind Study, there are two variations of Kotkot Dam, namely: the 25 m and 19 m dam. The estimated yield is around 56,000 m^3 per day for the 25 m dam and 52,000 m^3 per day for the smaller dam. The impounding area is estimated to be around 225 ha (ADB, 2011). The capital cost is around PHP875 million.

(d) **Malubog Dam**

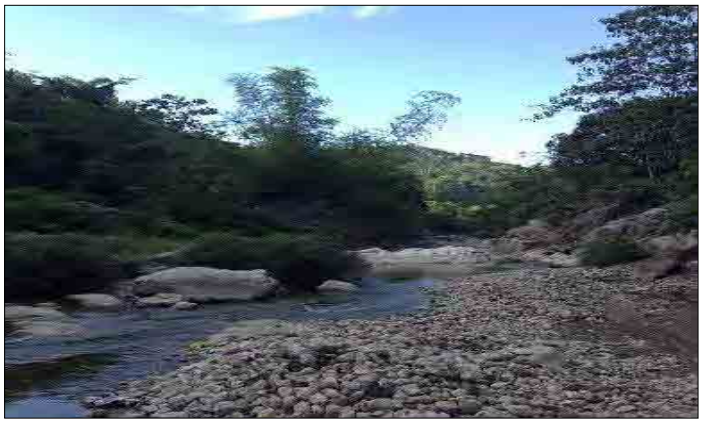
Source: JICA Study Team.

Figure 6.2.13 Malubog Dam Showing Intake

6.61 Aqua-Atlas proposed to develop the Malubog Dam to supply MCWD with an estimated volume of 100,000 m^3 per day. The proposed development intends to raise the existing dam by another 4 m, divert the flow via a 12.3 km tunnel with 2.5 m diameter, and dump the water to Lagtang for treatment prior to supplying MCWD. This also requires resettlement of 25 households (in 2006). The proposed development would cost around PHP3.4 billion (estimated in 2006). The main problem considered is the construction of the tunnel with a distance of 12.3 km crossing an active fault line.

(e) **Danao River**

6.62 Danao River is one of the identified water sources for development in the northern area. The river drains into a catchment with estimated area of around 22 to 27 km^2. The City of Danao informed JST that there was an offer from a private company to develop the source to produce around 20,000 m^3 per day. Subsequently, an MOU with the MCWD Gas was signed between the City of Danao to supply the said volume. Below is a photo showing the river source at Brgy. Ibo, Danao City.



Source: JICA Study Team.

Figure 6.2.14 Proposed Dam Site in Danao River

(2) Groundwater at North and South of Metro Cebu

6.63 Groundwater sources may be explored both in the northern and southern parts of Metro Cebu. In the northern area, groundwater source may be explored from Liloan to Danao City, while on the southern portion, groundwater exploration (study) may be done from Minglanilla to Carcar City.

6.64 Carcar City included in their expansion plan the addition of groundwater wells as potential sources. However, it is not clear how much water will be extracted due to the limited data and information of the aquifer. This is a similar situation for San Fernando, Naga and Minglanilla. In Naga and Minglanilla, most of the expansion is done by a private supplier such as Abejo and Helpmate. MIWASCO (a cooperative) is also planning to expand but have limited resources to do so.

(3) Desalination

6.65 The desalination system is currently used by several establishments for their needs.

6.66 Bulk water supply is provided by MRI to MCWD in Lapu-Lapu City. Other

resorts and establishment are also using a similar system to process brackishwater for their needs. This includes Movenpick, Shangrila, Maribago Blue Waters, Imperial Palace, etc., with capacities ranging from 50 to 200 m^3 per day.

6.67 A study on desalination was done in 2005 by JBIC. From the results of the study, price of water was estimated to be approximately PHP70/m^3. This is too expensive compared to the current MCWD selling price of PHP13/m^3. Therefore, it is better for the desalination system to be considered as one of the future water sources, if found viable then.

(4) Rainwater Harvesting

6.68 In the Water Remind Study, rainwater harvesting is one of the strategies to augment water supply. In the urban residential areas, it is estimated to produce around 5,800 m^3 per day, while in the commercial and industrial establishments, approximately 2,600 m^3 per day can be harvested.

6.69 At present, most of the LGUs are now requiring new developers to construct rainwater harvesting facilities as part of their development plans. In Cebu City, an ordinance is enforced requiring the residential area to construct a cistern of 0.5 m^3 per 30 m^2 roof area, while the commercial / industrial establishments are required to have cisterns of 0.5 m^3 per 15 m^2 roof area. If harvested water is used accordingly, the demand for piped water would be reduced.

4) Sub-Roadmap for Water Supply Management

6.70 Based on Figure 6.2.10, the gap between water demand and supplied water will start after year 2020 and in 2030, 2040, and 2050 the gap will become wider at 95,000 m^3/day, 260,000 m^3/day and 437,000 m^3/day, respectively. In order to lessen this gap, construction of new water supply facilities should be started at least five years before the forecasted water demand gap occurs. Therefore, the following projects are proposed to address the forecasted demand gap.

(1) Short-Term (up to 2020)

6.71 In order to lessen the gap between water demand and supplied water in 2030, the following short-term projects are proposed.

(a) **Project for Construction of New Water Supply Facilities (Reservoirs, Pump Stations, Well Developments)**:

(i) **Background and Necessity of the Project**

6.72 Based on the JICA report on “The Study for Improvement of Water Supply and Sanitation in Metro Cebu in the Republic of the Philippines” prepared in August 2010, requirements for technical improvement of MCWD water supply facilities were proposed with the following goals for the improvement of water supply system and facilities, design concept and criteria:

- To increase water supply volume to meet water demand in 2015;
- To achieve service level above water supply situation;
- To apply gravity water supply system; and
- To establish distribution block water supply system.

(ii) **Allocation for Water Sources and Water Supply**

- Formation of Distribution Block

  6.73 With due consideration of the local demand density (2015), the location and volume of existing reservoirs, and present hydraulic capacity of distribution pipeline network in the LGU boundaries, the following 6 distribution blocks are proposed:

  - Consolacion, Liloan and Compostela (CLC);
  - Casili (Mandaue);
  - Talamban (Northern Cebu);
  - Tisa (Southern Cebu);
  - Lagtang (Talisay); and
  - Mactan (Lapu-lapu and Cordova).

- Water Demand of each Distribution Block in 2015

  6.74 Water demand of each distribution block in 2015 is estimated in Table 6.2.27, taking into consideration the 20% of NRW in 2015 and 17% of NRW in 2030.

Table 6.2.27 Distribution Block (DB) Demand (m^3/day)

Area Distribution	December 2008	2015	2030
	With NRW (30%)	With NRW (20%)	With NRW (17%)
CLC	13,701	19,261	31,943
Casili	23,491	40,323	63,858
Talamban	50,154	58,173	73.521
Tisa	52,986	60,956	75,831
Laglang	9,219	18,301	31,607
Mactan	18,836	38,136	68,104
Total	168,387	235,150	344,864

Source: JICA, The Study for Improvement of Water Supply and Sanitation in Metro Cebu (2010).

(iii) **Improvement of Water Supply Facilities**

- Well Development

  6.75 A wel development plan is conceptualized through the following procedure:

  - Present intake amounts were classified into (i) continuous production, (ii) reduced production, and (iii) abandoned according to problem analysis in qualitative and quantitative terms;
  - Present non-operating wells for stand-by and ongoing construction were suggested to be operating intake facilities in 2015 based on formality progress of MCWD;
  - Plan new development to address groundwater supply deficit with due consideration of (i) groundwater potential by predictive simulation, and (ii) site location for economical installation of raw water pipeline; and
  - New wells will be connected to reservoir economically with overall flow allotment concept.

  6.76 The number of new wells to be developed is shown in Table 6.2.28 below.

Table 6.2.28 New Well Development in the Action Plan

Distribution Block (LGU's)	Well Field (WRMU's)	Well No.	Expected Yield (m^3/day)	Abstraction by Field (m^3/day)
Casili DB	Cansaga South	9	300	2,700
(Mandaue/Cebu)	Butuanon North	16	1,000	16,000
Talamban DB	Cebu North	8	600	4,800
(Cebu)	Cebu River	20	600	12,000
	Cebu South	10	600	6,000
Total		63	-	41,500

Source: JICA, The Study for Improvement of Water Supply and Sanitation in Metro Cebu (2010).

- Reservoir Development

6.77 The required volume of reservoir, existing capacity and additional volume are calculated in Table 6.2.29.

Table 6.2.29 Proposed Reservoir Volume

Distribution Block	Daily Average Flow in 2015 (m3/day)	Volume Estimation (m^3)			
		Estimated	Existing	Additional	Proposed
CLC	19,261	4,815	5,000	-	
Casili	40,323	10,081	5,000	5,081	5,000
Talamban	58,173	14,543	5,000	9,543	10,000
Tisa	60,956	15,239	5,000	10,239	10,000
Lagtang	18,301	4,575	5,000	-	
Mactan	38,136	9,534	5,200 (MEPZ: 3,200, Pusok: 2,000)	4,334	4,000

Source:JICA, The Study for Improvement of Water Supply and Sanitation in Metro Cebu (2010).

6.78 The locations of the reservoirs are as follows:

- Casili: next to existing reservoir;
- Talamban: next to existing reservoir;
- Tisa: next to existing reservoir (within Tisa WWTP); and
- Mactan: next to existing elevated reservoir.

- Transmission Pipe

6.79 Water source is not distributed just in accordance with area-wise demand and supply-demand balance but shall be re-arranged through the water allocation via inter-reservoir transmission. Excessive water supply derived from the CLC DB is transferred to Casili DB and exportation water to Mactan Island is forwarded from Tisa and Talamban DBs through the Casili new reservoir and existing distribution pipeline. As an examination result, a volume of 11,676 m^3/day from Tisa reservoir is transferred to Talamban reservoir, in addition to the 8,891 m^3/day from Talamban well field. Then a total of 20,567 m^3/day is transferred to Casili DB reservoir. Of this volume, 20,100 m^3/day is delivered to Mactan Island through 1,000 mm-diameter pipe, two lines of 600 mm and 400 mm pipes, and the existing/planned booster pump station.

- Distribution Pipeline

6.80 The six proposed DBs can be separated by shut valves. Basically, one DB is covered by one large reservoir but some wells still inject groundwater provisionally. The small Compostela reservoir will keep supplying its own municipality. Since the existing Pusok reservoir in Mactan Island was designed as a fill and draw type, it is desirable to replace this by a gravity distribution reservoir with direct connection for transmission from Cebu Island.

- Selected Short-Term Priority Project Components

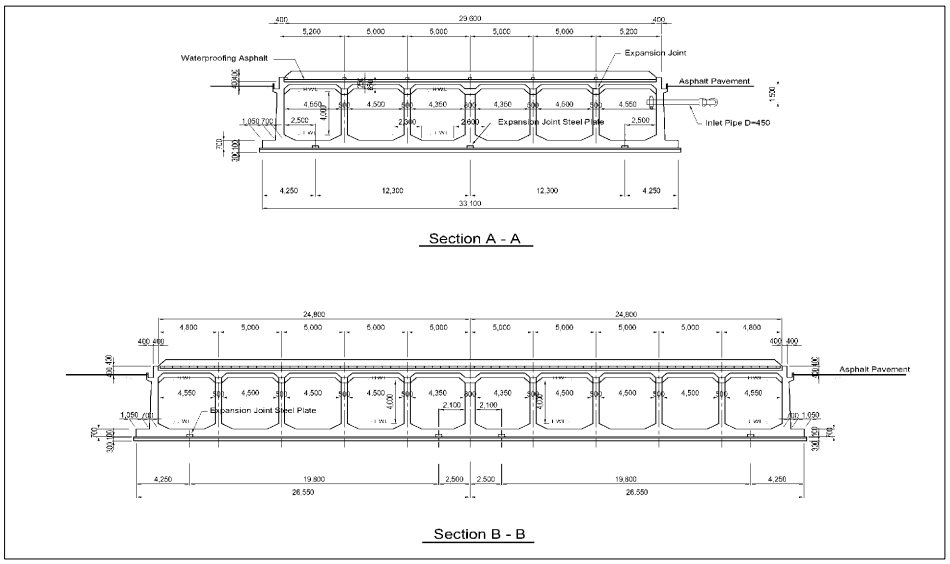
6.81 The proposed selected short-term priority project components are shown in Table 6.2.30.

Table 6.2.30 Proposed Selected Short-Term Priority Project Components

Item	Description	Unit	Quantity
1	Well Intake Facilities Construction	Well	63
2	Reservoir (V=10,000 m^3)	Site	2
3	Reservoir (V=5,000 m^3)	Site	1
4	Elevated Water Tank (V=2,000 m^3)	Site	2
5	Raw Water Pipeline (100 mm and 150 mm)	m	31,500
6	Transmission Pipeline (400 mm and 800 mm)	m	26,800
7	Inter-reservoir Pump Station	Site	2
8	Main Distribution Pipeline (300 mm to 700 mm)	m	32,200
9	Secondary Distribution Pipeline (75 mm to 200 mm)	m	37,000
10	Flow Meter installation	Site	6

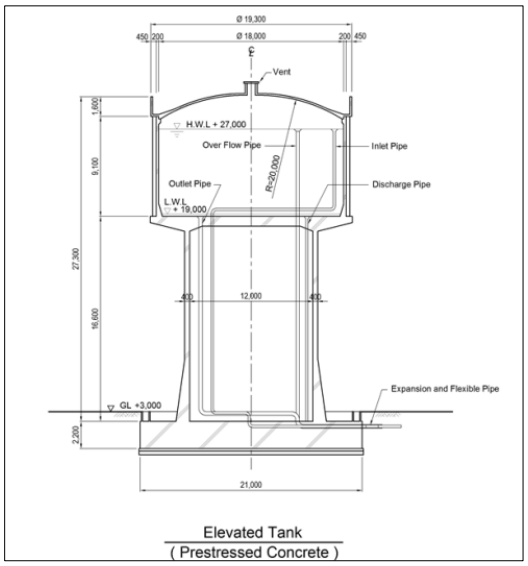
Source: JICA Study Team.

6.82 A typical reservoir (V=5,000m^3) and elevated water tank (V=2,000 m^3) are shown in the following figures:



Source: JICA Study Team.

Figure 6.2.15 Typical Reservoir (V=5,000 m^3)



Source: JICA Study Team.

Figure 6.2.16 Typical Reservoir and Elevated Water Tank

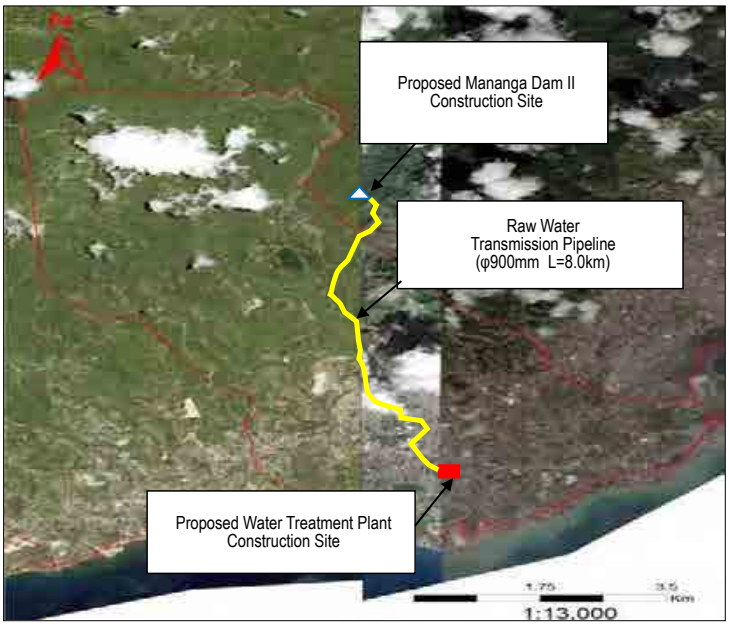
(b) Mananga II Dam

6.83 The full description of the development of Mananga II Dam Project is found in Supporting Report 3: Pre Feasibility Studies. In essence, the development of the Mananga River as a new source of water supply has been the subject of studies for the last 30 years. This Roadmap Study recommends the construction of a 76 m-high dam located 1 km upstream the river near Camp IV (Km 19) in Barangay Buot-TaupIn Cebu City (see Figure 6.2.17). This project is expected to yield 68,000 m^3 of potable water a day.

(2) Medium-Term (up to 2030) and Long-Term (up to 2050) Projects

6.84 Please see the Main Text Part II Sub-Roadmap for Water Supply for both the medium- and long-term projects.

6.85 The implementation schedule and costs of all short-term, medium-term and long-term projects are shown in Table 6.2.31.



Source: JICA Study Team.

Figure 6.2.17 Location of the Proposed Mananga II Dam Project

Table 6.2.31 Implementation Schedule and Costs of the Short-Term, Medium-Term and Long-Term Water Supply Projects

Each Term	Name of the Project	Project Cost (Million PHP)	2015	2020	2030	2040	2050
Short-Term Projects (Up to 2020)	Construction of New Water Supply Facilities	2,326					
	Mananga II Dam	4,778					
Sub-Total		7,104					
Medium-Term Projects (Up to 2030)	Kotkot Dam	7,500					
	Lusaran Dam						
	Groundwater Exploitation Study	620					
	Reduction of NRW	1,100					
Sub-Total		9,220					
Long-Term Projects (Up to 2050)	Development of Surface Water	11,220					
	Development of Groundwater						
	Construction of Desalination Plant	3,100					
	Reduction of NRW	1,100					
	Groundwater Occurrence (Recharge)	440					
	Recycling Water	1,100					
Sub-Total		16,960					
Total		34,370					

Source: JICA Study Team.

6.3 Stormwater Management

1) Current Situation

6.86 The drainage system in Metro Cebu is divided into the same categories for draining rainwater, such as (i) River, (ii) Creek, and (iii) Drainage. Oftentimes, the word drainage and sewerage are used interchangeably owing to the fact that most of the systems serve a singular purpose, i.e., conveying and discharging both stormwater and sewage from domestic (household) and commercial / industrial establishments.

6.87 Strictly speaking, the drainage system ought to convey stormwater runoff from the yards to the streets and eventually to the receiving bodies such as river and seas, while the sewerage system conveys the sewage (wastewater) from establishments.

6.88 At present, there is no regulation on the stormwater runoff treatment. This is simply collected and disposed to the nearest waterway. Meanwhile the sewage collected by sewerage line is required to pass through treatment system to meet the effluent quality requirement set forth in DENR Administrative Order (DAO) 34.

(1) Flooding Conditions

6.89 Flood has been caused by a combination of various factors, in general, such as geologic and topographic characteristics, river characteristics, and human factors.

6.90 The flood prone areas in Metro Cebu were identified by each LGU and the susceptible areas for flooding were identified by DENR. Figure 6.3.1 shows the areas that could be inundated by flood in Cebu City, as identified during the drainage master planning study.

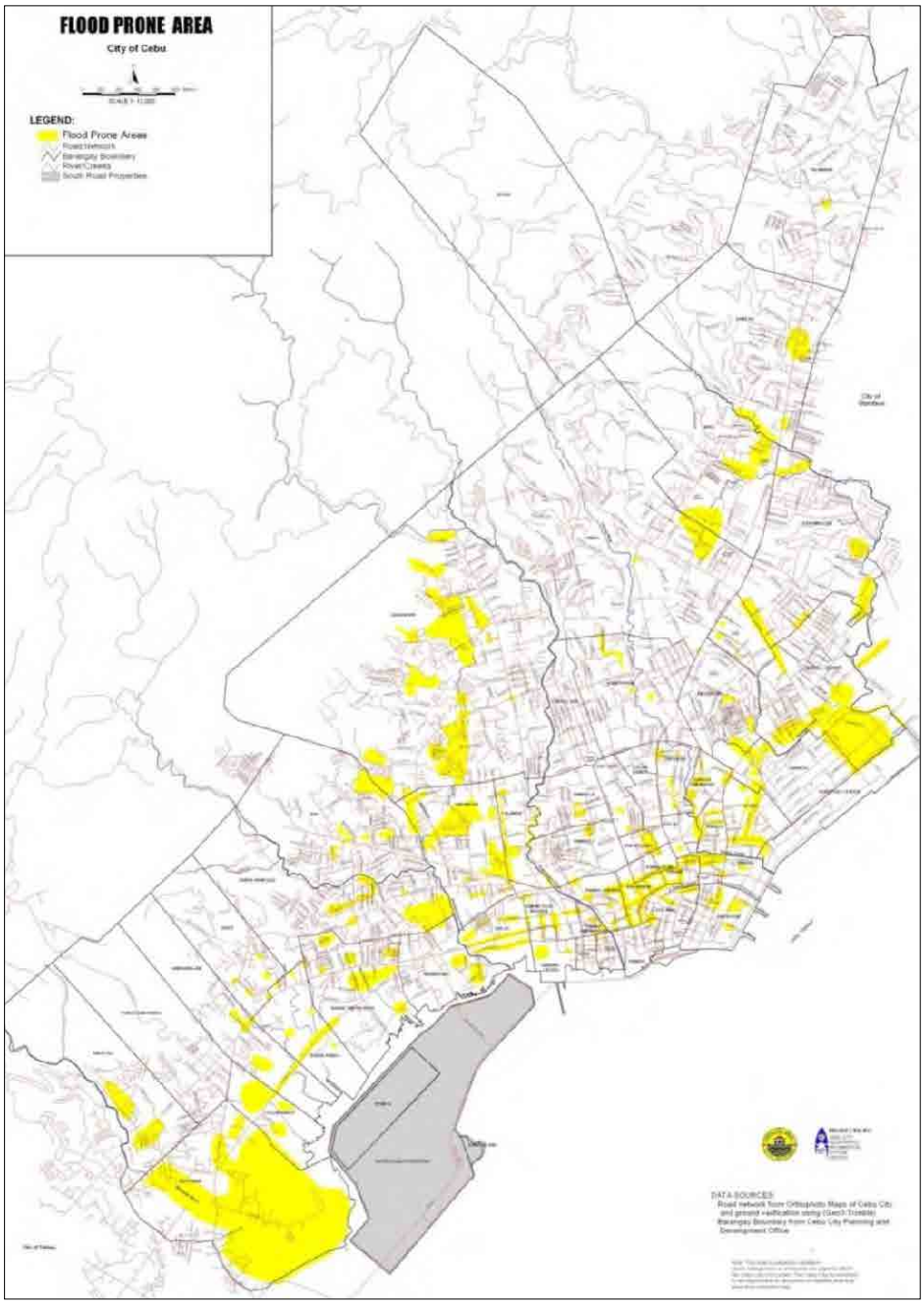
6.91 Flooding in Metro Cebu area is becoming more frequent and severe over the last five years. Areas badly affected are not only those located in low-lying areas but also places such as along A.S. Fortuna, Banilad–Talamban Road, and many other places within subdivisions.

6.92 In addition, flooding in Lapu-Lapu City is also becoming frequent as more subdivisions are built with no drainage outfall to connect to. Chances of flooding occurs when rainfall depth reaches 40 mm in an hour. It is interesting to note that on average, there will be 7 occurrences of 40 mm in an hour rainfall every year.

6.93 In Metro Cebu and northern Cebu, roads crossing rivers have been constructed so as to provide a continuous fill structure. In case of occurrence of large-scale flood, this structure may block inundated water. In particular, closed topographic features such as valley plain should be noted since the upper reaches of a fill structure causes the increase of inundation depth or a longer inundation period.

6.94 In the areas with drainage facilities such as Cebu City, Mandaue City and Talisay City, sediment or waste clogging the facilities causes inland inundation and are more likely to have protracted inundation period.

6.95 If impermeable pavements such as concrete and asphalt are increased in the future, the amount of water that can seep into the ground may be reduced, possibly leading to the increase of flood flow rate or prolong the inundation period. For this reason, attention should be paid to these factors for urbanization.Contributing human factors to flooding include lack of coordinated planning for flood management.



Source: Cebu City.

Figure 6.3.1 Flood Prone Areas in Cebu City

6.96 While the general contributing factors are known, the main causes of flooding in a specific area need to be ascertained as this could be due to many contributing factors. The general causes of flooding in Metro Cebu are categorized as follows:

(a) **Inadequate or No Drainage System:** Still a greater part of the metropolitan area does not have proper drainage lines. In Lapu-Lapu City, it is estimated that only 25% of the road network has drainage lines.

(b) **Flat Terrain Resulting in Slow Stormwater Runoff:** With a flat terrain, the stormwater builds up rapidly during high intensity-short duration rainfall, which is characteristic in the Metro Cebu area. This situation occurs in almost all areas near the coast. The frequency and severe flooding occurs along the stretch of Mandaue

to Talisay, even as far a Minglanilla to a lesser extent. With elevations of 1 to 3 meters above mean sea level, the problem is compounded during high tide.

(c) **Silted and Clogged Drainage:** As reported in the drainage master plan study, drainage that was inspected revealed that more than 50% of the drainage lines are either silted or clogged by garbage. Because of this condition, the cities usually conducts drainage clean up and desilting works prior the rainy season.

(d) **Constriction of River System:** During a survey, it was evident that many of the waterways are now constricted and/or reduced to a limited sized culvert as structures are built on top of it.

6.97 Thus, the need of an integrated drainage master planning study is necessary and, subsequently, site specific assessments will be done to formulate specific projects or programs to address flooding. At present, only the cities of Mandaue, Lapu-Lapu, Cebu, Talisay and Naga have a drainage master plan.

(2) Rivers and Creeks

6.98 Metro Cebu has several small river systems with two major rivers crossing the study area. The biggest in terms of catchment size is the Mananga River, discharging in Talisay City and Kotkot River with its estuary at Compostela Municipality.

6.99 Smaller river catchments include Butuanon River, Lahug, Subangdaku, Guadalupe River, Pandan River and Guindarohan River. There are also some creeks in the area. A summary of river and creek characteristics is shown in Table 6.3.1.

Table 6.3.1 River and Creek Characteristics

Name of River / Creek	Location (LGU)	Catchment Area (sq. km)	Length of River / Creek (km)	River Classification (DENR)
Butuanon River``	Cebu, Mandaue	58.0	8.9	Class D
Kotkot River	Cebu, Compostela		>20.0	Class A
Danao River	Danao	No data	No data	Class A & B
Guadalupe River	Cebu	19.5	8.8	Class B & C
Guindarohan River	Minglanilla	No data	No data	Class A & C
Mananga RIver	Cebu, Talisay		28.0	Class A
Lahun Creek	Cebu	7.9	5.4	-
Mahiga Creek	Cebu	10.5	5.2	-
Subangdaku River	Cebu, Mandaue	12.0	5.4	-
Kinalumsan Creek	Cebu	18.0	5.5	-
Linao River	Talisay, Minglanilla	6.6	8.2	-
Pakgne River	Minglanilla	13.5	7.7	-
Abuno River	Naga, Minglanilla	22.5	No data	-
Pandan River	Naga	42.9	No data	-
Langtad River	Naga	9.8	7.0	-
San Isidro River	San Fernando	12.6	7.8	-
Sangat River (Suba)	San Fernando	4.3	No data	-
Villadolid River	Carcar	28.29	No data	-
Pondol River	Carcar	28.29	No data	-

Source: JICA Study Team.

6.100 There are some issues regarding such rivers and creeks. One problem is the presence of informal settlements and private property owners along the riverbanks that indiscriminately dispose enormous amount of garbage into the rivers/creeks, causing obstructions to the flow of the river and creek waters (see Figure 6.3.2). A second issue

is the absence of a coherent and well-defined mandate on the management of the river system. While it is understood that the responsibility to manage is devolved to the LGUs for rivers within their jurisdiction, the overall responsibility is not clearly set among the agencies (e.g., LGUs, DPWH, DENR), and within the LGUs. In addition, specific roles of the department on river system is not clear, particularly on the regulatory and monitoring aspects. Thus, in many LGUs, the respective offices (City or Municipal Engineering, General Services and Environment Office) have duplicating and overlapping responsibilities or do not have a specific program at all for managing the rivers. The photos below show the outcome of these issues.

Source: JICA Study Team (left), MCDCB (right).

Figure 6.3.2 Current Conditions of Riverways in Metro Cebu

(3) Drainage

6.101 This report defines “drainage” as the culvert constructed of reinforced concrete (i.e., reinforced concrete pipe culvert, reinforced concrete box culvert) and “road drainage” as the culvert along the roads to drain rainwater from the roads.

6.102 Drainages are constructed only in urban areas, while road drainage is constructed in some roads. However, the capacity, diameter, and gradient of these drainage facilities are often not calculated using the actual catchment area, runoff coefficient and rainfall intensity.

6.103 The major issue regarding drainage and road drainage is the heavy siltation and clogging with garbage trash in these drainage facilities. This point to the inadequacy of these facilities to address drainage requirements and/or their lack of maintenance by the responsible departments.

Source: JICA Study Team.

Figure 6.3.3 Current Conditions of Drainage in Metro Cebu

(4) Drainage Master Plan

6.104 As previously stated, the five major cities in Metro Cebu with drainage master

plans are Cebu City, Mandaue City, Lapu-Lapu City, Talisay City, and City of Naga. These, however, are outputs of planning studies conducted in the last seven years and are not updated nor harmonized vis-à-vis the conditions of other LGUs within the catchment area. In addition, it is possible that the design consideration of one LGU may be different from the others. One particular aspect is the design storm (2, 5 and 10 years period), and the stormwater management program which adopts the non-structural measures such as land use control and the use of natural attenuating systems (natural lagoons and wetlands). The problems associated with flooding necessitates the review and harmonization of all the plans in order to attain a greater measure of success in address the flooding in the area. Therefore, an integrated drainage master plan is necessary for Metro Cebu.

6.105 The MCDCB Committee on Infrastructure Development and Planning (CIDP) prepared a report on “Drainage Infrastructure Planning and Development for Mega Cebu.” This mentions various issues and improvement of the system to address flooding. However, it lacks a technical review.

6.106 Fortunately, DPWH is going to conduct the “Metro Cebu Integrated Flood and Drainage System Master Plan” in the near future. It is recommended that this study be implemented effectively and urgently.

2) Issues

6.107 The biggest problem of stormwater management is that the technical knowledge on the actual cause of flooding is limited. Cost-benefit analysis is not done to assess the effectiveness of specific project. Hence, project prioritization is difficult to tackle.

6.108 Moreover, it is necessary to understand the actual situation. How many people have been dislocated or lost properties due to flooding? How many people have suffered waterborne diseases? What was the cost of losses incurred (properties, affected livelihoods and businesses)? How much economic loss due to congestion is caused by flooding?

6.109 The problem will only escalate further if the condition of stormwater facilities is not improved in the future, and flooding in the Metro Cebu area would become more widespread and inundation time would become longer. Moreover, if necessary laws and regulations relevant to flooding issues (e.g., expansion of informal settlements, garbage and waste disposal, dumpsite) are not improved, rivers and creeks would continue to be inefficient as stormwater conveyance systems.

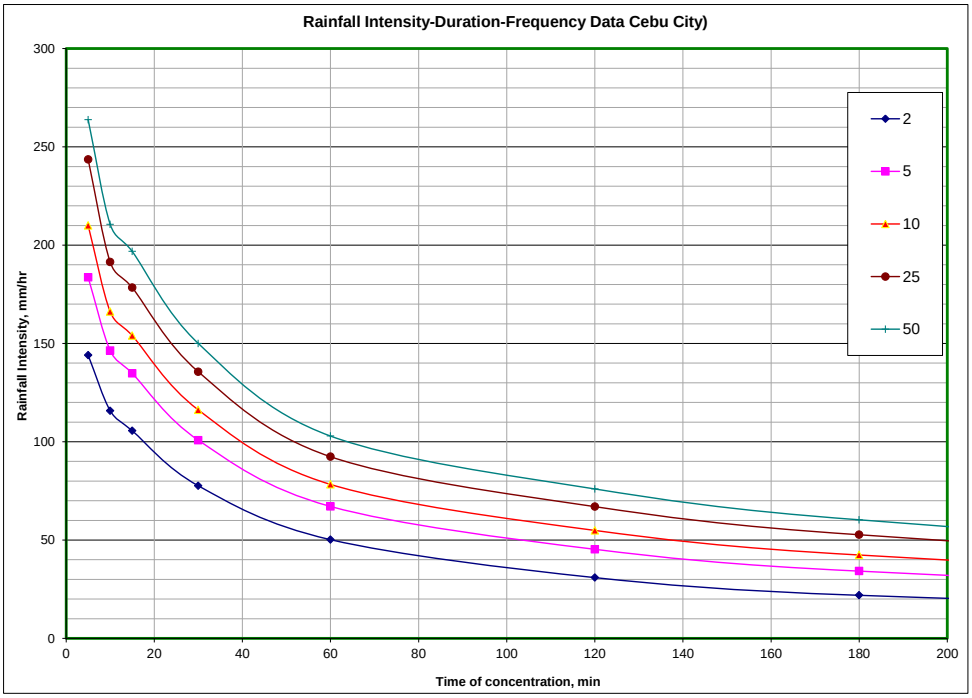
6.110 As a result, damages caused by flooding would increase and deter the LGUs’ effective functioning. Consequently, other infrastructure facilities even if improved would be ineffective and urban competitiveness, mobility and livability would be reduced.

3) Objectives

6.111 The objective of drainage planning is to analyze storms and their frequency in order to determine needed provisions for the present and the future. In this study, the return period for the storms is set at a 5-year return period on 2050. For 2030 or the medium term, the return period for the storms is set at a 2-year return period of the same order.

6.112 The intensity frequency duration curve is determined based on the local rainfall characteristics which PAGASA is monitoring. The intensity frequency duration curve

mentioned in the drainage master plan conducted by Cebu City is shown in Figure 6.3.4.



Source: Final Drainage Master Plan Preliminary Engineering Report, 2006.

Figure 6.3.4 Frequency Duration Curve

6.113 The allowable flood depth for flood prone areas is usually based on a classification of the areas according to their importance and functions. The acceptable flood depths are set according to the desired protection levels in each flood prone area. In this study, the acceptable flood depths are set as shown in the table below.

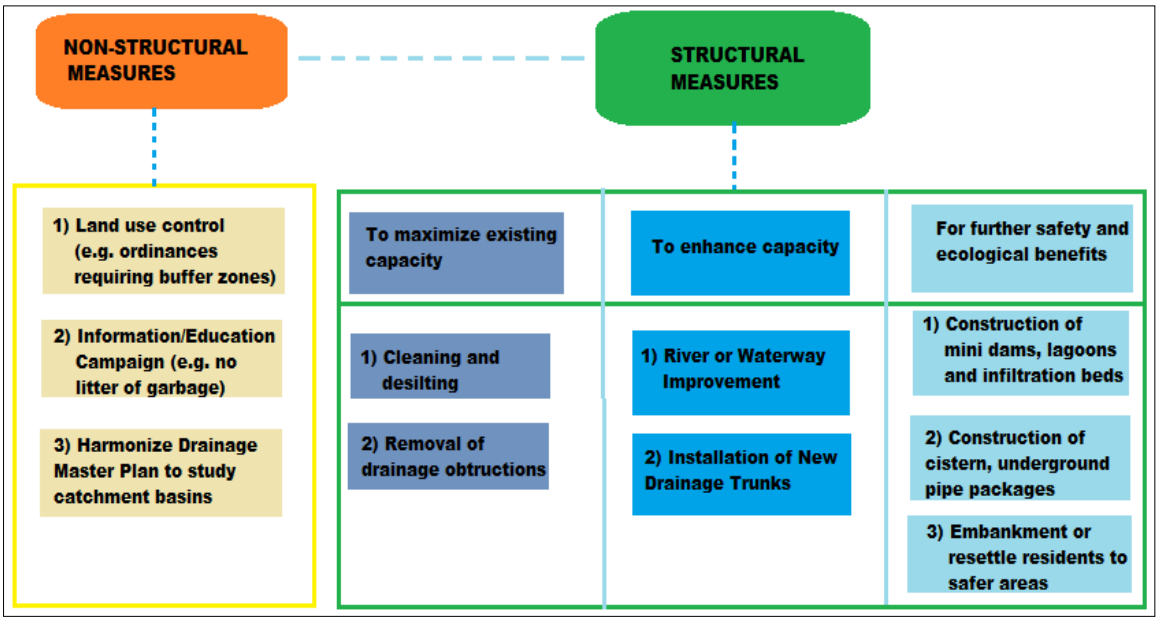
Table 6.3.2 Classification of Areas by Function

Function of Areas	Objective	Allowable Flood Depth (cm)
Protection of Life	To avoid the inundation in underground facilities where evacuation would be necessary during times of disasters	0
Protection of City Activity	To avoid the inundation in shopping districts, city hall and terminal stations.	20
Protection of Domestic Property	To avoid general domestic inundation above floor level	40

Source: JICA Study Team.

4) Sub-Roadmap for Stormwater Management

6.114 The Sub-Roadmap for Stormwater Management consists of short-term, medium-term, and long-term projects. These projects are identified and selected based on the evaluation of previous reports made by each LGU and the existing drainage system. With the ultimate goal of alleviating the flood problem, both structural measures and non-structural measures are proposed (see Figure 6.3.5).



Source: JICA Study Team.

Figure 6.3.5 Overview of Stormwater Management Projects

6.115 The most priority project is “A Comprehensive Study for a Metro Cebu Integrated Flood and Drainage System Master Plan.” There are existing drainage master plans but they are old, have not been updated, and not integrated. So, construction of new drainage pipes based on the existing master plan have risks such as flooding mitigated and addressed in one area but may simply create problems in other areas, if the whole reach of the channel is not considered.

6.116 On the other hand, existing rivers, creeks, and drainages do not take full advantage of their capacities because of garbage thrown by residents, deposited solids, and illegal occupations. Therefore, the cleaning of rivers, creeks, and drainages should be implemented.

6.117 New drainage lines should be constructed based on the new drainage master plan.

6.118 To achieve the 2050 Roadmap objectives, there are three big projects, namely: (i) Improvement of river channels (as proposed in 1995 JICA study), (ii) Construction of big scale rainwater storage facilities, and (iii) Construction of pumping facilities for river water (if necessary).

Box 1 Previous Stormwater Related Studies Which Have Not Been Implemented

JICA conducted the Study on the Flood Control for Rivers in the Selected Urban Centers in 1995. Subsequently, feasibility studies were prepared for the Cities of Ormoc and Iloilo. Consequently, the projects were then implemented through the Department of Public Highways (DPWH). In Cebu City, the study identified 5 key rivers that required major works for improvement in order to minimize flooding and protect the urban centers from losses due to seasonal floods. These rivers are the Bulacao, Kinalumsan, Guadalupe, Lahug and Subangdaku River. Below are information on the 5 key rivers**:**

N	River/Creek	Catchment Area (km)	River Improvement (km)	Remarks
1	Bulacao River	10.7	2.7	Boundary of Cebu City and Talisay
2	Kinasang-an River	17.8	4	Draining Buhisan and Monterazzas
3	Guadalupe River	16.3	4	Guadalupe
4	Lahug River	6.3	5	
5	Subangdaku River	12.6	5.5	Bounding Cebu and Mandaue

Source: JICA (1995).

In 2005, a Drainage Master Plan study was conducted by Schema Konsult Inc. for Cebu City. The study included details of existing road drainage, conducted a thorough road survey, and noted the condition of the drainage lines and site features that caused flooding. Hydraulic analysis was also conducted to determine the appropriate size of the river system and drainage system. Among the mitigation programs identified for implementation were: (i) Desilting of drainage lines particularly in the downtown areas, (ii) Construction of mini dams upstream of the catchment, and (iii) Construction of main drainage trunks in identified areas.

Similar studies were done in Mandaue City, Lapu-Lapu and Talisay City with recommendation to construct major drainage systems and clearing of the waterways, and similar works. At present, no major infrastructure works were implemented as a result of these studies to address these perennial problems, except for itinerant small drainage projects allocated to some barangays, and those implemented by DPWH on the national roads. Thus, flooding continues to be a worsening scenario in the community.

The non-implementation of these identified projects is not quite clear during the previous discussions and meetings with the cities. It seems that the cost required for implementation is always the culprit. On the other hand, the institutional plan needed to allow the program to move for the implementation particularly in dealing with the realities of relocating informal settlements along the riverbanks seem to be the bigger challenge among the LGUs. No record can be obtained to quantify how many residents will be affected along the rivers. It is noteworthy to mention that Cebu and Mandaue have started clearing some sections of rivers that are occupied by informal settlements. In particular, clearing of structures are ongoing in Mahiga River (upstream of Subangdaku). It is also worth mentioning that the DPWH has implemented several drainage projects (e.g., A.S. Fortuna) in an attempt to solve flooding and inundation of certain sections of roads. However, the program is very much confined to national roads as covered in their mandate.

There is a need, therefore, to look very closely at the recommended plans and program identified by these previous studies and implement the engineering, policy and institutional measures for a sustainable stormwater management program.

Source: JICA Study Team.

(1) Short-Term Until 2020

6.119 For the short-term program, the following projects are highly recommended for implementation:

(i) Implementation of “A Comprehensive Study for A Metro Cebu Integrated Flood and Drainage System (MCIFDS) Master Plan”;

(ii) Cleaning of rivers, creeks and drainages; and

(iii) Construction of small-scale rainwater storage facilities.

6.120 Besides the infrastructure program indicated above, the LGUs should enact laws in the form of ordinances adopting a basin-wide approach in stormwater management with common sets of planning tools and guidelines for design and implementation of such infrastructure facility. Moreover, they should adopt Metro-wide guidelines for the regulation of stormwater discharges and clearing of stormwater passageways particularly the natural waterways as stipulated in PD 1067- Water Code of the Philippines. Brief descriptions of the above projects are given below.

(a) **Implementation of "A Comprehensive Study for A Metro Cebu Integrated Flood and Drainage System (MCIFDS) Master Plan"**

6.121 The need for a MCIFDS master plan has been mentioned previously in the report. Among the reasons are as follows: the need to integrate all plans, adopt a common set of guidelines, need to upgrade (since all plans are old), and need to conduct thorough technical assessment.

- The need to identify priority project for implementation and conduct a feasibility study that will ensure justifiable economic benefits to the greater community;
- The need to develop an institutional mechanism for the Metro-wide project implementation; and
- The need for project packaging for possible funding and financing.

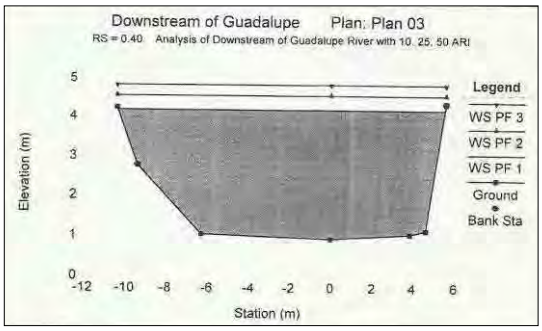
6.122 At present, DPWH has prepared the Terms of Reference (TOR) and allocated approximately PHP60 million for the conduct of the study that covers LGUs from Danao City down to Carcar City. The detailed causes of flooding are not mentioned in existing drainage master plans prepared by LGUs. Moreover, these master plans are old and have not been updated to reflect the current population growth and its urbanization. The draft TOR of this study is sufficient to address the issues of the previous master plans mentioned above.

(b) **Cleaning Rivers, Creeks and Drainages**

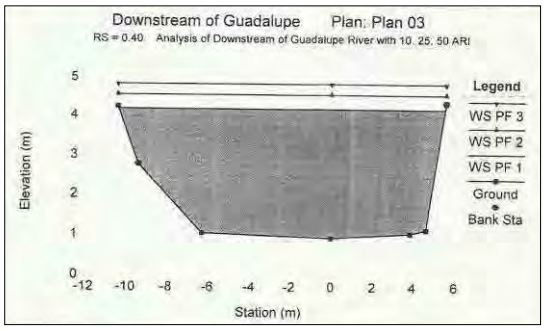
6.123 The existing capacities of rivers, creeks, and drainages are hampered due to garbage littered by residents, deposited solid wastes or garbage, and illegal housing structures. Thus, river improvement, widening, provision of embankment for protection are needed. In addition, the roadside embankment may also serve as access road of residents.

6.124 In the existing plans conducted by LGUs, though rather old, the actual river capacities are sufficient for rainwater disposal (see Figure 6.3.6).

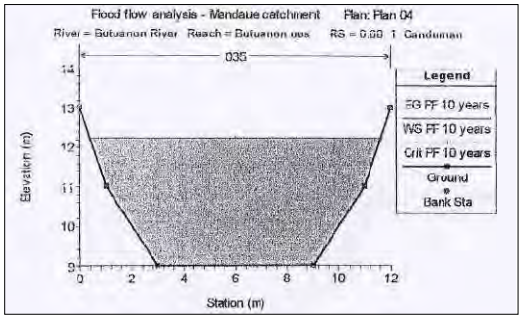
6.125 Therefore, it is surely important to immediately implement the cleaning of rivers and creeks, dredging of deposited solids of rivers, creeks, and drainages by LGUs or organizations. These measures require no special skill or machinery and would raise the inhabitants' awareness for flood prevention and engage their participation in these endeavors.



Guadalupe River



Guadalupe River



Butuanon River

Source: Flood Mitigation and Drainage Study for Cebu City and Evaluation of Mandaue City Drainage System.

Figure 6.3.6 Flood Flow in Guadalupe River and Butuanon River

6.126 To address the issue of illegal occupants along the riverbanks, the rivers should be redefined to accommodate both the dry weather flow as well as the flood flow conditions. Providing easement and gutters is among the necessary components of the project. Riverbank stabilization by means of riprap and bed stabilization is required to establish a permanent passageway.

6.127 The easement law which requires a 3-meter easement along rivers in urban areas is not implemented in a lot of places to prevent informal settlers, etc. To improve rivers, it is necessary to implement the easements. LGUs should implement the easements by removing obstructions and installing ripraps and similar works in order to improve their riverbanks.

6.128 Stormwater flows downstream and moves by the force of gravity. A velocity of flow depends on steepness of the river slope and frictional resistance. The Manning Formula is used for uniform, steady, open channel flow. The coefficient of roughness “n” depends on the condition of the river surface, alignment of river sections, and method of jointing. The Manning Formula expressed in SI metric units is as follows:

$$Q = \frac{1}{n} A R^{\frac{2}{3}} I^{\frac{1}{2}}$$

Where: *Q* = *quantity of flow, m^3/ second*
n = *coefficient of roughness depending on material*
A = *cross-sectional area of flow, square meters*
R = *hydraulic radius, meters*
I = *slope of hydraulic gradient, meters per meter*

6.129 There are some countermeasures in order to increase flow quantity of rivers, such as (i) increasing cross-sectional area of flow, (ii) increasing steepness of river slope, and (iii) lowering coefficient of roughness.

6.130 Considering the current condition of the rivers in Metro Cebu, it is difficult to increase the cross-sectional area of flow and increase the steepness of river slope. So the countermeasure of lowering the coefficient of roughness is a better solution. Therefore, installing revetment will enhance capacity by about 1.2 times compared to the river's natural state.

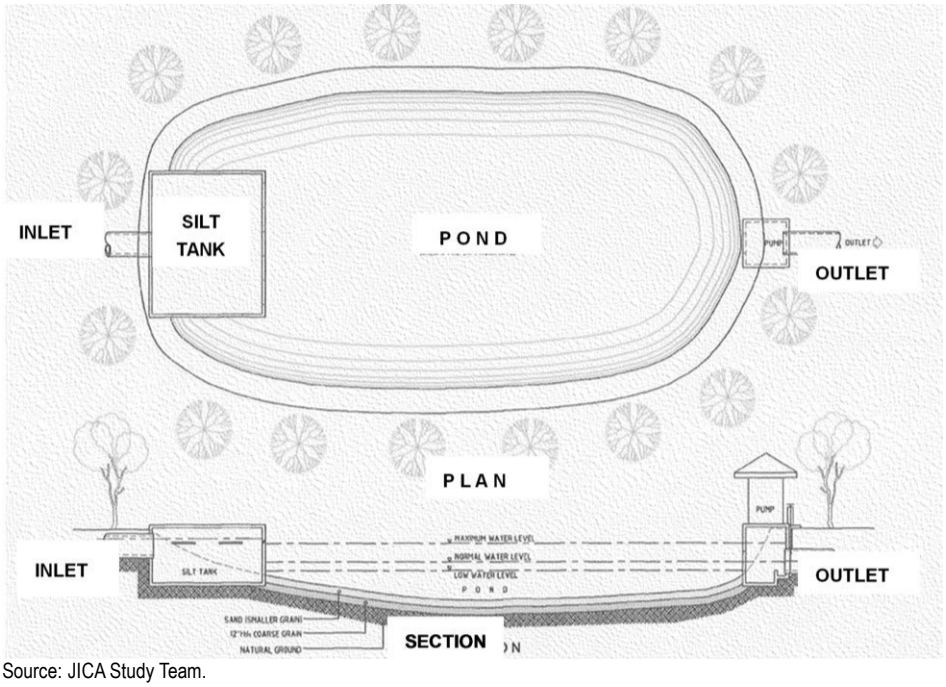
(c) **Construction of Small-Scale Rainwater Storage Facilities**

6.131 There are important measures not only to enhance flow capacity but also to reduce flow quantity. One measure to reduce the quantity of runoffs is to promote the storage of rainwater in tanks.

6.132 Utilization of rainwater at the household and commercial/ industrial levels is of primary importance to reducing the volume of runoff in the urban areas. The policy, in the form of an ordinance, should also require old establishments and residential buildings to provide the necessary rainwater storage. Technical guidelines should be provided in terms of size, location of installation, retrieval of water, etc. More so with the new establishment. Provisions of rainwater harvesting and utilization should be included in their plans and submission to the City.

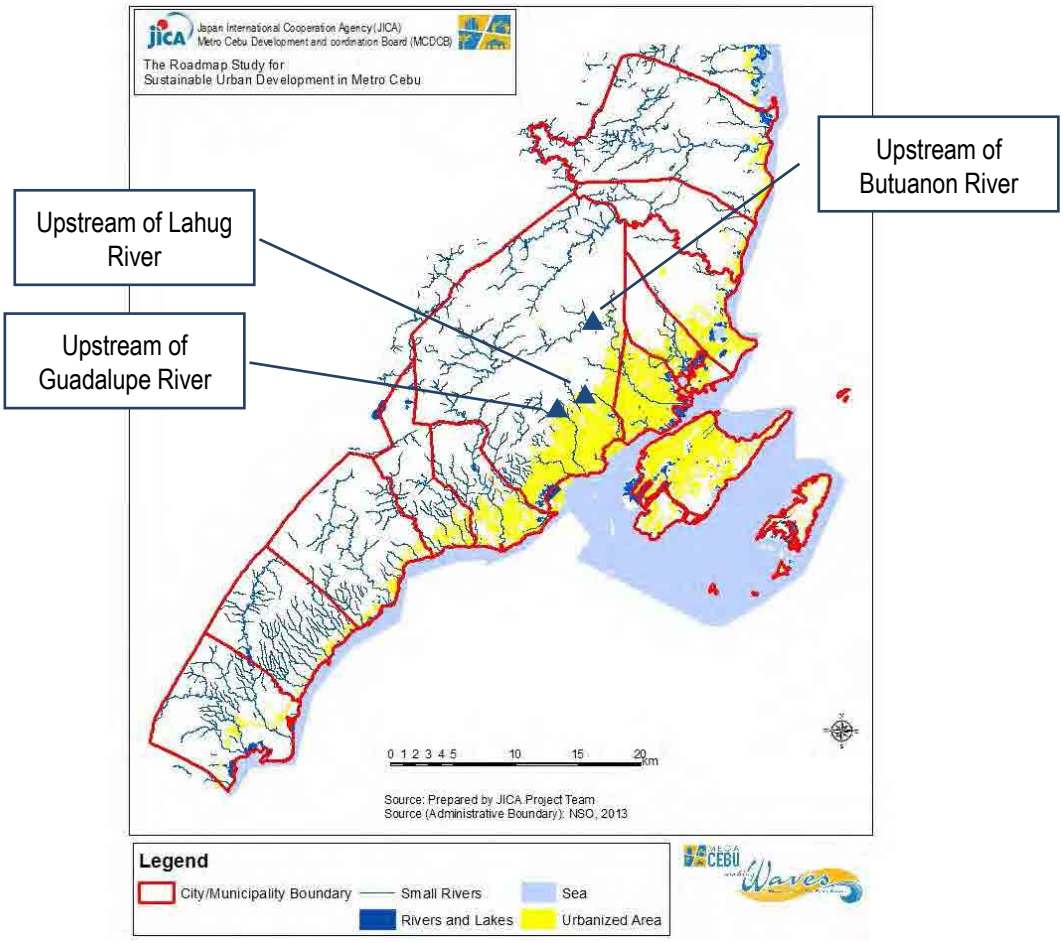
6.133 At government level, construction of mini-dams and detention basins is effective to reduce runoff quantity. A mini-dam and detention basin is a mechanism to control the release of excess stormwater from the upstream or upland barangays to downstream areas. This can be achieved by constructing mini-dams in the form of gabions, detention ponds and basins. A mini-dam will have some benefits such as the reduction of flood flow downstream, increase the recharge of groundwater, and help reduce siltation downstream. Hence, construction of mini-dams is imperative for mitigation of flood disasters.

6.134 It is mentioned in the drainage master plan of Cebu City that a mini-dam is useful for flood mitigation and also serves as a water supply for the community. However, a mini-dam to mitigate flooding has to be constructed with an outlet to ensure an outflow during fine days. As such, it cannot be used for water supply. A mini-dam and detention basin should be constructed in a manner shown in Figure 6.3.7. The proposed sites for mini-dams is shown in Figure 6.3.9. Each will have an estimated capacity of 6,000 m^3 for a total of 18,000 m^3. The total cost of the proposed structure is approximately PHP82 million (excluding the cost of lot acquisition/ ROW). This project will have the following impacts: (i) reduce flood peaks, and (ii) reduce siltation downstream. Due to high concentration of silt carried by the floods, regular desilting will be done. The silt/sand may be a source of aggregate for the construction industries. Thus, the cost for maintenance due to desilting may be minimized.



Source: JICA Study Team.

Figure 6.3.7 Image and Effect of Mini-Dam and Detention Basin



Source: JICA Study Team.

Figure 6.3.8 Proposed Sites for Mini-Dam

(2) Medium-Term Until 2030

6.135 It may be possible to achieve the 2030 objectives which eliminate short frequency floods by implementing short-term projects properly. These projects include creek and river improvement projects, provision of drainage lines to drain water from a waterlogged areas.

6.136 Meanwhile, flooding will not be totally eliminated and higher flood frequency may still be present somewhere. It is desirable to enhance safety from flooding. To this end, the following projects are recommended for the medium-term program:

- Construction of drainage facilities based on MCIFDS;
- River improvement projects--Subangdaku, Kinalumsan, and Lahug–Tejero River/Creek; and
- Embankment at inundation places in rural areas.

(a) Construction of Drainage Facilities Based on Integrated Flood Master Plan

6.137 Construction of main drainage facilities based on the IFDS Master Plan is necessary for many areas in the urban centers. Proper drainage facilities are needed to improve livability and mobility. But construction of drainage facilities focusing only on the current flooding conditions cause flooding in other areas especially downstream areas, instead of eliminating previous flooding. Thus, it should be based on the results of the integrated master plan.

6.138 Upon close examination, however, there are drainage structures that can be effected independently. These are the areas that are currently waterlogged and require drainage lines. It should be connected to bigger receiving drainage structures. The program can proceed but with technical analysis and justification.

(b) River Improvement Projects

6.139 As mentioned, the JICA study conducted in 1995 identified key rivers that required rehabilitation and improvement. The river improvement program was also corroborated in the 2005 Master Plan Study. Hence, it is recommended to implement them as part of the medium-term projects.

6.140 The project will have the following components: (i) River channel widening (sections will be identified), (ii) Riverbank and easement utilization (some sections will be used as access road depending on the viability), and greening of riverbanks, and (iii) Desilting particularly at the estuary areas.

6.141 Many sections along the rivers have existing residential houses and facilities, which would make it difficult to construct an embankment. As such, relocation of residents to safer locations should be considered and pursued.

6.142 This type of plan is effective for areas where population density is low, thus requiring lower investment cost. As this plan requires no special skill, it should be implemented by LGUs.

6.143 The projects will have multi-faceted benefits once implemented, such as (i) increase in the conveyance capacity, (ii) provision of access road along the channel for residents (if needed), (iii) cleaner and safer environment, and (iv) reduction in frequency of floods. The following are specific rivers considered for the implementation of river improvement projects:

(i) **Subangdaku River Improvement**

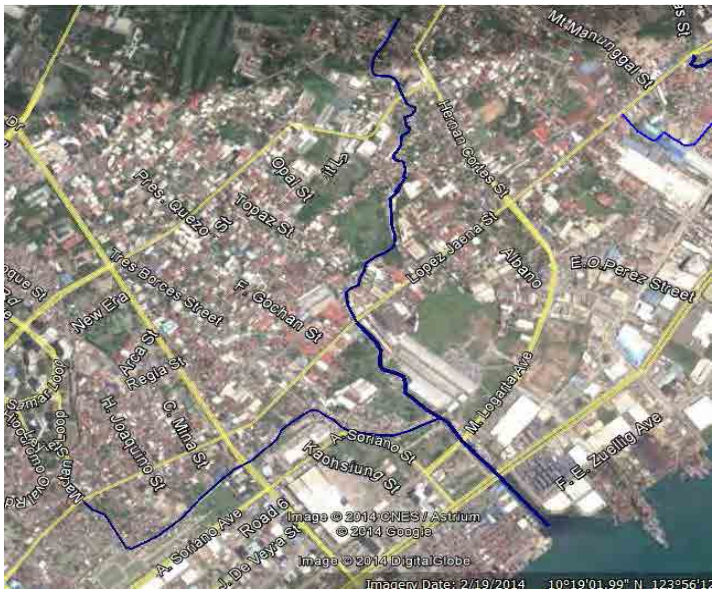
6.144 The Subangdaku River Improvement Project is proposed to increase the capacity of the river channel, allow for access along the riverbanks, and reduce the frequency of flooding along the vicinity (see Figure 6.3.9). The plan involves relocation of informal settlers along the banks from the coastline to the National Highway, widening of sections of the river, and desilting areas where silt has built up.

6.145 In order for the project to be implemented, the LGUs of Cebu City and Mandaue will have to initiate the necessary clearing of identified sections of the river. Prior to this, a feasibility study should be done to account and quantify structures. By rough estimation, the cost of the project is estimated at approximately PHP950 million, including PHP600 million of compensation cost.

(ii) **Kinalumsan River Improvement**

6.146 Similar to the work done in Subangdaku River, the Kinalumsan River (see Figure 6.3.10) needs to be widened, easement section secured, and embankments constructed to serve and protect access of residents residing along the river. Incorporated in the program is the greening to allow for a bank stabilization and ecological balance.

6.147 The plan involves relocation of informal settlers along the banks from the coastline to the National Highway, widening of sections of the river from the National Highway to upstream near Happy Valley and its tributary to Punta Princesa. Desilting of downstream areas where silt has built up will also be done. A detailed survey is needed to quantify the area, structures, and affected residents. The cost of the project is roughly estimated at around PHP540 million, including PHP300 million of compensation cost.



Source: JICA Study Team.

Figure 6.3.9 Subangdaku River and Tributaries

Source: JICA Study Team.

Figure 6.3.10 Kinalumsan River and Tributaries

(iii) Lahug River Improvement

6.148 The Lahug River (see Figure 6.3.11) has been constricted with structures and its channels reduced considerably. At the downstream portion where the slope is flatter, sediment builds up and garbage are trapped resulting in runoff overflows and degradation of water quality. In order to maximize the usefulness of the river, the following will be done:

- Desilting and cleaning of river (L=2.2 km);
- Removal of selected structures encroaching on the required size of channel (approximately 1,600 sq.m.);
- Provision of access pathway (1,600 m); and
- Construction of wastewater treatment of 2,400 m^3/day (see Sewage Program).

6.149 The estimated cost of the project is roughly PHP760 million, including PHP460 million of compensation cost.

6.150 The total cost of the proposed river improvement projects is approximately PHP2.25 billion (including compensation cost for relocation of affected households).

Source: JICA Study Team

Figure 6.3.11 Lahug River and Tributaries

(c) **Embankment at Inundation and Relocation**

6.151 In some LGUs, flooding locations were identified. Flooding occurs during heavy rainfall and during high tide. The locations of flooding areas are at the coastal areas where the ground level is comparatively low. Since pumping stations are not considered as a measure due to their prohibitive cost (i.e., construction and maintenance), it is recommended that embankments should be adopted for the development of new buildings and other facilities.

6.152 For areas with existing residential houses and facilities, it would be difficult to construct an embankment. As such, relocation of residents to safer locations should be considered and pursued.

6.153 This type of plan is effective for areas where population density is low and would, therefore, require lower investment cost. This plan requires no special skill and should be implemented by LGUs.

(3) Long-Term Until 2050

6.154 There are some big projects that can be considered in order to achieve 2050 objectives which would eliminate flooding against a 5 to 10-year return period.

6.155 Projects on the widening of rivers and creeks and construction of pumping stations can be considered. But it might be impossible to implement widening of rivers and creeks because of urbanization, overcrowding, and presence of special facilities that cannot be removed, such as a traditional church. Hence, it is necessary to conduct a detailed inventory of the river system, its conditions, river characteristics, riverbank conditions, and availability of the 3 m easement.

6.156 The construction of a pumping station is considered of low priority because the ground level is higher than the tide level. The ground level of the coastal area is about 2.0 m over, while the highest tide level in Metro Cebu is 1.8 m and high tide level is 1.54 m. Therefore, the construction of pumping stations is not considered for the

roadmap.

(a) **River Improvement**

6.157 Similar works on river improvement is proposed for long-term project implementation. These rivers include the Guadalupe River in Cebu City and Butuanon River in Mandaue City. The general program of works is similar to the previous river improvement program. For completeness, details of these projects are given below.

(b) **Guadalupe River Improvement**

6.158 The Guadalupe River is one of the key river in Cebu City with a total catchment area of 16 sq km (see Figure 6.3.12). The river stretch under consideration has a total length of 2.95 km from the coastline up to the road near Espina Village. The most critical part of the river is the 1.25 km stretch from the coastline where the possibility of runoff overflow may occur due to flat slope and the river channels are constricted. Because of sediment deposits at the estuary, the flood level also rises due to backwater effect. Several structures are also constricting the flow and the 3 m easement disappears.

Source: JICA Study Team.

Figure 6.3.12 Guadalupe River

6.159 To improve the conveyance capacity of the river, channel improvement will be needed. Specific components for the restoration and rehabilitation program are as follows:

(i) Securing of the 3 m easement particularly the stretch from the coast to the National Highway with a total distance of around 1.25 km;

(ii) Construction of the side embankment to prevent overflow;

(iii) Desilting works near the coastal area; and

(iv) Relocation/ Compensation of affected residents.

6.160 Project cost is roughly estimated at PHP680 million, including PHP430 million of compensation cost.

(c) **Butuanon River Improvement**

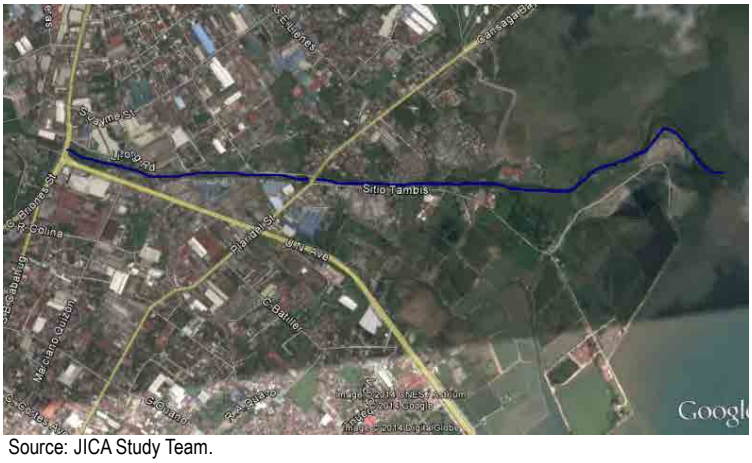
6.161 Butuanon River (see Figure 6.3.13) had been the subject of rehabilitation works in the past due to the discharge of pollutants from various industries. This program focuses on the improvement of drainage flow from the North Road (National Road) to the Mactan Channel where the river exits, with a total distance of around 3 km. Due to the flat terrain, the river meanders and becomes shallow because of siltation. As a result, the river shifts slowly to find a new route to exit to the sea. Components of the project will be as follows:

(i) Construction of embankment of around 3 km;

(ii) Construction of riprap to maintain the river route; and

(iii) Desilting of the river channel.

6.162 A feasibility study needs to be conducted to clarify the specific program for improvement and to assess the need for possible road access. Roughly, the project cost is estimated at PHP1.65 billion, including PHP1.0 billion in compensation cost.



Source: JICA Study Team.

Figure 6.3.13 Butuanon River (Downstream Part)

(d) **Construction of Large-Scale Rainwater Storage Facilities**

6.163 Rainwater tanks for each household and commercial/ industrial facility are useful but difficult to manage and are less effective. However, large-scale water storage facilities such as pipe-shaped reservoir are effective and manageable.

6.164 For the current condition, a large-scale water storage facility will only get filled with garbage and soil. This increases the maintenance cost and decreases the efficiency of the facility. So in the future plan, a large-scale rainwater storage facility will be effective when conditions are improved.

6.165 It is difficult to assume the capacity of storage facilities due to lack of detailed data. But in rough estimation, the volume of storage capacity is assumed as shown in Table 6.3.3. By implementing this measure, it can mitigate flooding against a 10-year return period precipitation. The cost would range from PHP300 million to PHP1.35 billion and operational cost would also range from PHP7.5 million/year to PHP33.8 million/year.

Table 6.3.3 Capacity of Storage Facilities (Assumption)

Catchment Area	Catchment Area (ha)	Length of River / Creek (km)	Storage Volume (m^3)	Estimated Cost (PHP million)	Operational Cost (PHP million/year)
Guadalupe River Catchment	1,950	8.8	50,000	500	12.5
Lahug Creek Catchment	790	5.4	30,000	300	7.5
Mahiga Creek Catchment	1,050	5.2	30,000	300	7.5
Subangdaku River Catchment	1,200	5.4	40,000	400	10.0
Butuanon River Catchment	5,800	8.9	135,000	1350	33.8

Source: JICA Study Team.

6.166 These storage facilities have to be constructed at the downstream areas. However, there are no spaces for such storage facilities due to rapid urbanization. Therefore, the facilities will have to be constructed as pipe-shaped storage type under roads.

(4) Schedule of Projects for Stormwater Management

6.167 Below is the summary of the sub-roadmap projects for drainage and flood control system and their implementation schedule.

Table 6.3.4 Schedule of Projects for Stormwater Management

Project	Cost (PHP) M	2015	2020	2025	2030	2040	2050
A. Short-Term Projects							
Master Planning	75						
Cleaning Rivers, Creeks, and Drainages	125						
Construction of Small-Scale Rainwater Storage Facilities e.g., Mini-dams	82						
B. Medium-Term Projects							
Construction of Drainage Facilities (Metro-wide Construction of New Drainage Trunk Facilities (40 km)	720-						
Subangdaku River Improvement Kinalumsan River Improvement Lahug River Improvement	2,250						
Embankment at Inundation Places in Rural Areas	-						
C. Long-Term Projects							
Guadalupe River Improvement Butuanon River Improvement	2,330						
Construction of Large-Scale Rainwater Storage Facilities such as lagoons, cisterns	2,850						

Source: JICA Study Team.
Note: The estimated cost is a ball park figure. Final cost will be made available after the conduct of the drainage masterplan.

6.168 The cost of the project on “Embankment at Inundation Places in Rural Areas” should be estimated after the conduct of the drainage master plan.

6.4 Wastewater Management

1) Current Situation

(1) Overview of Laws and Orders

6.169 Several Philippine laws provide the legal bases for wastewater management programs, including:

(i) Philippine Clean Water Act of 2004 (RA 9275 – Sec. 7.1.2, 7.2, 8);

(ii) Code on Sanitation of the Philippines (PD 856 – Chapter XVII);

(iii) Local Government Code of the Philippines (RA 7160 – Environmental Services Section); and

(iv) Water District Law (PD 198).

6.170 The Clean Water Act of 2004, for example, requires water utilities to provide sewerage or septage management services within five years of the law's passage. In the absence of a water utility, the LGU must provide these services, either on their own or through a service contract. In some instances, private entities may provide these services in the absence of LGU action, or in parallel with an LGU or a water utility.

6.171 Aside from the laws cited, the National Building Code of the Philippines (RA 6541) and the Revised National Plumbing Code of the Philippines also have provisions addressing proper design and operation of septic tanks and their maintenance. In all case, municipalities, regulatory officials and service providers shall apply the most restrictive language in any law, rule, or regulation when interpreting the legal requirements for sludge and septage management. For the specific acts or codes, the latest version applies.

6.172 Moreover, DOH published the "Operation Manual on the Rules and Regulations Governing Domestic Sludge and Septage" in June 2008, in order to implement appropriate septage management.

6.173 As mentioned above, there are national policy and implementing regulations requiring proper collection, treatment, and disposal of septage.

(2) Surface Water Environment

(i) The Environmental Management Bureau (EMB) has classified water bodies according to their intended beneficial usage and water quality to be maintained. Water bodies are classified into nine classes, and quality criteria have been determined by DENR. Moreover, effluent standards also have been determined by DENR, and violating or failing penalties have been set under Section 9 of the Pollution Control Law (PD 984) and/or Section 106 of the 1978 NPCC Rules and Regulations.

(ii) For reference, the water quality monitoring results of Butuanon River, Guadalupe River, Guindarohan River, and Mactan Island Beach Resorts conducted by EMB Region 7 are shown in Table 6.4.1 to Table 6.4.5, Table 6.4.6 and Table 6.4.7, respectively.

Table 6.4.1 Classification of Water Bodies

Classification	Beneficial Use	Classification	Beneficial Use
For Fresh Surface Waters (rivers, lakes, reservoirs, etc.)		For Coastal and Marine Waters	
Class AA Public Water Supply	Waters that require disinfection to meet the National Standards for Drinking Water	Class SA	Water suitable for fishery production National marine parks and marine reserves Coral reefs parks and reserves
Class A Public Water Supply	Waters that require complete treatment to meet the National Standards for Drinking Water	Class SB	Tourist zones and marine reserves Recreational Water Class I Fishery Class I for milkfish
Class B Recreational Water	Waters for primary contact recreation (e.g. bathing, swimming, skin diving, etc.)	Class SC	Recreational Water Class II (e.g., boating) Fishery Water Class II (commercial) Marshy and/or mangrove areas declared as fish and wildlife sanctuaries
Class C	Water for fishery production Recreational Water Class II (boating, etc.) Industrial Water Supply Class I	Class SD	Industrial Water Supply Class II Other coastal and marine waters
Class D	For agriculture, irrigation, livestock watering Industrial Water Supply Class II		

Source: Water Quality Management in the Philippines, Vilma T. Cabading.

Table 6.4.2 Excerpt of Water Quality Criteria for Conventional and Other Pollutants

Parameter	Unit	Class AA	Class A	Class B	Class C	Class D
pH (range)	-	6.5–8.5	6.5–8.5	6.5–8.5	6.5–8.5	6.0–9.0
Dissolved Oxygen	mg/L	5.0	5.0	5.0	5.0	3.0
5-Day BOD	mg/L	1.0	5.0	5.0	7.0	10.0
Total Suspended Solids	mg/L	25.0	50.0	Not more than 30% increase	Not more than 30 mg/L increase	Not more than 60 mg/L increase
Total Coliforms	MPN/100mL	50	1,000	1,000	5,000	-
Fecal Coliforms	MPN/100mL	20	100	200	-	-

Parameter	Unit	Class SA	Class SB	Class SC	Class SD
pH (range)	-	6.5–8.5	6.0–8.5	6.0–8.5	6.0–9.0
Dissolved Oxygen	mg/L	5.0	5.0	5.0	2.0
5-Day BOD	mg/L	3.0	5.0	7.0	-
Total Suspended Solids	mg/L	Not more than 30% increase	Not more than 30 mg/L increase	Not more than 30 mg/L increase	Not more than 60 mg/L increase
Total Coliforms	MPN/100mL	70	1,000	5,000	-
Fecal Coliforms	MPN/100mL	Nil	200	-	-

Source: DENR Administrative Order No.34.

Table 6.4.3 Excerpt of Effluent Standards

Parameter	Unit	Protected Waters		Inland	
Class AA &SA		Class A, B & SB		Class C	
OEI & NPI		OEI	NPI	OEI	NPI
pH (range)	-	Not allowed	Not allowed	6.0–9.0	6.0–9.0
COD	mg/L	100	60	150	100
5-Day BOD	mg/L	50	30	80	50
Total Suspended Solids	mg/L	70	50	90	70
Total Coliforms	MPN/100mL	5,000	3000	15,000	10,000

Parameter	Unit	Inland Waters		Coastal Waters		Coastal Waters
		Class D		Class SC		Class SD & not Classified
		OEI	NPI	OEI	NPI	NPI
pH (range)	-	5.0–9.0	6.0–9.0	6.0–9.0	6.0–9.0	5.0–9.0
COD	mg/L	250	200	250	200	300
5-Day BOD	mg/L	150	120	120	100	150
Total Suspended Solids	mg/L	2000	150	200	150	Not more than 60 mg/L increase

Source: DENR Administrative Order No.35.
Note: OEI: Old or Existing Industry; NPI: New / Proposed Industry or wastewater treatment plants to be constructed.

Table 6.4.4 Butuanon River Water Quality Physical and Chemical Characteristics (Class D)

Stn No.	Location	pH				DO				BOD				TSS			
		Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.
1	Cambogaong Bridge	6.7	8.2	7.4	6.0-9.0	0.0	1.0	0.2	3.0	42.0	223.0	93.3	15.0	25.0	324.0	79.6	Not more than 60 mg/L increase
2	Butuanon Bridge	6.4	7.5	7.0	6.0-9.0	0.0	1.0	0.3	3.0	44.0	270.0	75.6	15.0	18.0	82.0	30.0	Not more than 60 mg/L increase
3a	Tingub Bridge	7.3	7.9	7.7	6.0-9.0	0.0	4.0	2.1	3.0	5.0	59.0	16.6	15.0	9.0	262.0	28.7	Not more than 60 mg/L increase
3	Greenhills Outfall	7.4	8.0	7.7	6.0-9.0	0.0	4.0	2.2	3.0	4.0	64.0	13.5	15.0	11.0	51.0	20.0	Not more than 60 mg/L increase
4	Pilit Treasure Island	7.5	8.2	7.7	6.0-9.0	2.0	5.0	3.4	3.0	3.0	43.0	9.3	15.0	15.0	89.0	24.3	Not more than 60 mg/L increase
5	Old Pilit (HJR Outfall)	7.4	8.2	7.8	6.0-9.0	0.0	4.0	2.9	3.0	2.0	105.0	11.6	15.0	12.0	76.0	25.7	Not more than 60 mg/L increase
6	Canduman Bridge	7.6	8.2	7.8	6.0-9.0	2.0	5.0	3.8	3.0	3.0	51.0	6.3	15.0	9.0	143.0	26.8	Not more than 60 mg/L increase
7	Bacayan Bridge	7.5	8.2	7.7	6.0-9.0	2.0	5.0	3.5	3.0	2.0	16.0	5.5	15.0	17.0	119.0	38.5	Not more than 60 mg/L increase
8	Sta. Lucia Bridge	7.8	8.3	8.0	6.0-9.0	5.0	6.0	5.4	3.0	1.0	6.0	2.3	15.0	5.0	57.0	22.9	Not more than 60 mg/L increase
9	Binaliw II	7.5	8.4	8.0	6.0-9.0	4.0	7.0	5.3	3.0	1.0	7.0	2.5	15.0	4.0	68.0	19.2	Not more than 60 mg/L increase
10	CandurungPulangbato	7.8	8.2	8.0	6.0-9.0	5.0	7.0	5.5	3.0	1.0	2.0	1.7	15.0	4.0	56.0	26.2	Not more than 60 mg/L increase
11	Kalubihan, Talamban	8.1	8.2	8.1	6.0-9.0	5.0	7.0	5.6	3.0	2.0	13.0	4.3	15.0	3.0	30.0	9.3	Not more than 60 mg/L increase

Source: Water Quality Status Report 2012.

Table 6.4.5 Guadalupe River Water Quality Physical and Chemical Characteristics (Class A&C)

Stn No.	Location	pH				DO				BOD				TSS			
		Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.
1	Tupaz Bridge	7.3	7.8	7.6	6.5 - 8.5	0.0	0.0	0.0	5.0	36.0	106.0	70.8	10.0	25.0	50.0	38.0	Not more than 30 mg/L increase
2	Sanciangko Bridge	6.8	7.8	7.5	6.5 - 8.5	0.0	0.0	0.0	5.0	38.0	108.0	79.0	10.0	12.0	37.0	25.5	Not more than 30 mg/L increase
3	B.Rodriguez Bridge	7.3	7.8	7.7	6.5 - 8.5	0.0	1.0	0.5	5.0	35.0	88.0	59.3	10.0	13.0	34.0	24.0	Not more than 30 mg/L increase
4	Sandayong Bridge	7.2	7.8	7.6	6.5 - 8.5	0.0	5.0	3.0	5.0	6.0	42.0	18.0	10.0	2.0	2,433.0	65.3	Not more than 30 mg/L increase

Source: Water Quality Status Report 2012.

Table 6.4.6 Guindarohan River Water Quality Physical and Chemical Characteristics (Class D)

Stn No.	Location	pH				DO				BOD				TSS			
		Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.	Min.	Max.	Ave.	Std.
1	Abuno Bridge	7.2	8.1	7.9	6.5-8.5	4.0	6.0	5.2	5.0	1.0	4.0	2.6	10.0	32.0	558.0	183.8	Not more than 30 mg/L increase
2	Tabo-an	6.7	7.9	7.6	6.5-8.5	5.0	6.0	5.4	5.0	1.0	3.0	1.8	10.0	147.0	3,120.0	1,109.8	Not more than 30 mg/L increase
3	200 m downstream of JLR outfall	6.9	8.4	7.8	6.5-8.5	5.0	6.0	5.3	5.0	1.0	4.0	2.0	5.0	99.0	415.0	251.3	50
4	Confluence	6.8	8.4	7.9	6.5-8.5	5.0	7.0	5.6	5.0	1.0	4.0	2.0	5.0	134.0	1,070.0	350.3	50
5	Matun-og River	6.9	8.5	8.0	6.5-8.5	4.0	7.0	5.7	5.0	1.0	5.0	1.7	5.0	0.9	122.0	34.2	50
6	Cabo-an	6.8	8.4	7.8	6.5-8.5	5.0	7.0	5.6	5.0	1.0	3.0	1.9	5.0	79.0	1,704.0	415.6	50
7	Naupa River	6.7	8.5	8.0	6.5-8.5	4.0	7.0	5.4	5.0	1.0	2.0	1.6	5.0	2.0	23.0	12.0	50

Source: Water Quality Status Report 2012.

Table 6.4.7 Mactan Island Beach Resorts Water Quality Physical and Chemical Characteristics (Class SB)

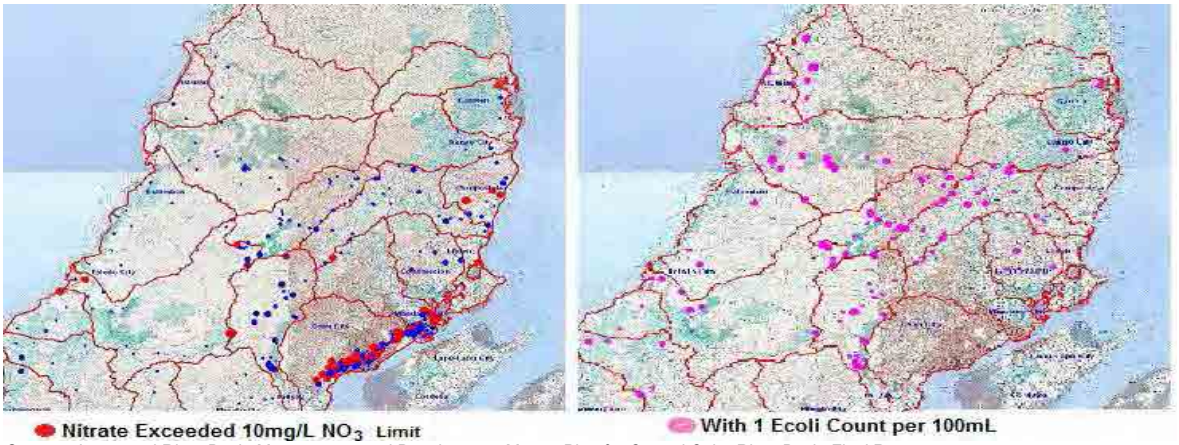
Stn No.	Location	Total Coliform				Fecal Coliform			
		Min.	Max.	Ave. (geomean)	Std.	Min.	Max.	Ave. (geomean)	Std.
1	300 m right side Cebu Marine Resort	61	16,000	1,331	1,000	40	16,000	916	200
2	Parker Beach	140	1.6E+06	1,772	1,000	92	1.6E+06	1,532	200
3	Palmera Beach	210	1.6E+06	2,349	1,000	110	1.6E+06	2,527	200
4	Palm Beach	23	24,000	2,293	1,000	23	24,000	1,557	200
5	Tonggo Beach	240	24,000	2,368	1,000	23	9,200	1,367	200
6	Hadsan Cove Resort	23	16,000	174	1,000	23	920	97	200
7	Kontiki	23	9,200	334	1,000	23	1,100	170	200
8	White Sand Resort	49	2,400	460	1,000	23	1,300	249	200
9	Maribago Blue Water	31	2,400	354	1,000	23	2,400	110	200
10	Tambuli Beach Resort	31	9,200	179	1,000	23	3,500	82	200
11	Cebu Beach Club	31	920	101	1,000	2	920	48	200
12	Portofino	9	9,200	218	1,000	7	9,200	114	200

Source: Water Quality Status Report 2012.

(3) Groundwater Environment

6.174 A large number of wells in Cebu City and Mandaue City have nitrate-nitrogen exceeding 10 mg/liter. This type of water will have harmful effects on infants. A few MCWD wells in Talamban and in Guadalupe have elevated nitrate-nitrogen levels. The elevated nitrate-nitrogen content in Cebu City and Mandaue City is attributed to anthropogenic activities due to the absence of sewerage and septage treatment. This issue can only be addressed by appropriate wastewater disposal technology.

6.175 Figure 6.4.1 shows larger red dots to indicate the high number of water samples collected in Cebu City and Mandaue City which has exceeded the 10 mg/liter NO3-N limit. The tiny blue dots means the limit has not been reached yet.



Source: Integrated River Basin Management and Development Master Plan for Central Cebu River Basin Final Report.

Figure 6.4.1 Nitrate-Nitrogen Concentration and E-coli Counts in Sampled Sources

6.176 There are high E. coli counts (shown in larger pink dots in the figure) in water samples collected and have exceeded the one count per 100 ml sample limit. Almost 90% of samples have E. coli above zero. A small number of samples have undetected E. coli (tiny blue dots on the map).

6.177 It shows that most water sources are unprotected from risk of fecal contamination in groundwater.

(4) Household Wastewater

6.178 Based on the Home Interview Survey (HIS) conducted in this Study, the wastewater treatment ratio of each LGU is shown Table 6.4.8.

Table 6.4.8 Wastewater Treatment Ratio of Household (%)

LGU	Black Water			Gray Water	
	No Treatment	Septic Tank	Sewerage	No Treatment	Septic Tank
City of Carcar	8	92	0	76	24
Cebu City	7	93	1	82	16
Compostela	1	99	0	88	12
Consolacion	3	97	0	87	13
Cordova	11	81	8	68	26
Danao City	0	100	0	98	1
Lapu-Lapu City	13	77	10	59	25
Liloan	1	99	0	91	9
Mandaue City	18	75	7	59	12
Mingglanilla	11	89	0	75	22
City of Naga	13	86	1	72	26
San Fernando	4	96	0	81	18
City of Talisay	25	71	4	63	11
Total	10	86	3	74	17

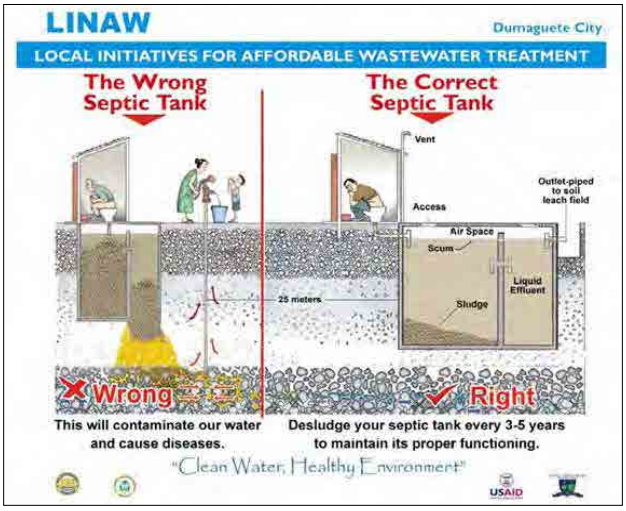
Source: JICA Study Team, HIS 2014.

6.179 In Metro Cebu, it is estimated that between 85% and 90% of the households have septic tanks for black water. The rest of the population live illegally along the rivers or seashore and discharge their wastewater into these water bodies without any form of treatment.

6.180 Even if households have septic tanks, not all septic tanks are accessible because access roads are too narrow and/or because of poor building construction practices. In other words, there are many septic tanks which are not functioning

properly.

6.181 The exact number cannot be grasped, but there are many septic tanks that do not meet the minimum requirements for standard septic tank design, as shown in Figure 6.4.2.



Source: A Rapid Assessment of Septage Management in Asia.

Figure 6.4.2 Wrong and Correct Designs of Septic Tank

6.182 The situation of septage desludging frequency is shown Table 6.4.9. As validated from data shown in the table, operation and maintenance of septic tanks has not been properly carried out. Septage desludging is conducted by private companies with prices ranging from PHP500 to PHP8,000 depending on the service providers.

Table 6.4.9 Situation of Septage Desludging Frequency (%)

LGU	Annually	Every 3 Years	Every 5 Years or More	Never	Not Sure
City of Carcar	0	4	7	40	49
Cebu City	7	4	10	51	28
Compostela	0	3	2	44	51
Consolacion	2	2	15	47	35
Cordova	1	21	55	6	7
Danao City	0	0	5	48	47
Lapu-Lapu City	5	14	9	31	41
Liloan	1	1	12	53	32
Mandaue City	5	5	19	43	27
Mingglanilla	1	0	2	46	50
City of Naga	1	0	1	40	58
San Fernando	2	8	9	33	48
City of Talisay	1	9	17	46	27
Total	4	6	11	44	35

Source: JICA Study Team, HIS 2014.

6.183 The ordinance for a septage management program is being prepared in Cebu City and in Cordova. It is mentioned that desludging of septage is a mandated responsibility for septic tank owners to undertake. Prohibited acts and penalties are also mentioned in the ordinance.

6.184 The situation of septic tank maintenance might improve after the ordinance is enforced in Cebu City, and the septage treatment facility will be constructed in Cordova by MCWD. Therefore, it is recommended that other LGUs should also prepare an

ordinance for the maintenance of septic tanks in their localities.

(5) Wastewater from Commercial and Industrial Establishments

6.185 There are many kinds of commercial, institutional and industrial establishments in Metro Cebu. Wastewater treatment for such establishments is different depending on the conditions such as scale, age, etc. Some small-scale establishments have no waste treatment facility except for septic tanks. Some large-scale establishments have their own treatment facilities (see Table 6.4.10).

Table 6.4.10 Wastewater Treatment of Large-Scale Establishments

	Name of Establishment	Wastewater Treatment Methods
Development Zone	Ayala Business Park	Activated Sludge Process
	IT Park	Constructed Wetland
Mactan Hotel Resort	Waterfront Hotel	Activated Sludge Process
	Hilton Hotel (Movenpick)	Activated Sludge Process
	Crimson Resort	Rotary Batch Contactor

Source: JICA Study Team.

6.186 Regardless of size, these establishments have no sludge treatment facility. The sludge generated from these wastewater treatment facilities are being disposed to final landfill site or anywhere.

6.187 At present, DENR requires an individual developer to install a sewage treatment plant to address the issue of wastewater. However, the disposal of sludge is still not clearly regulated and monitored.

6.188 Moreover, it is not clear who has responsibility for monitoring of effluent water quality, and how to properly monitor effluent water quality.

(6) Treatment Facility

6.189 Excluding treatment facilities of commercial and industrial establishments, there is only one waste treatment facility in Metro Cebu. This, however, is not functioning now. It was operated by the Cebu City Government and served the SM Mall and other industrial establishments. The current condition of the treatment facility is shown in Figure 6.4.3. There is no flow of wastewater and the aeration device is also not functioning. Originally, the facility was intended to treat wastewater generated within the North Reclamation area; however, only SM was connected. Over the course of time, the operation stopped due to several issues: (i) the sewer line was silted and sewage flow reduced in capacity, (ii) technical issues and cost in maintaining the facility, (iii) SM (who is the only client) constructed its own sewage treatment facility, and (iv) the sewer/drainage lines were damaged over time due to road improvement and was no longer incorporated in the centralized treatment program.

Source: JICA Study Team.

Figure 6.4.3 Current Conditions of Treatment Facility Near the SM Mall

6.190 Moreover, there is no septage treatment facility in the metropolis except for a Pilot Project of Septage Treatment undertaken by JICA and AMCON. A large volume of septage, which is not treated at the pilot plant, is left untreated and just disposed at some water bodies.

(7) Septage Management of MCWD

6.191 The Metro Cebu Septage Management Project Feasibility Study was conducted by MCWD in 2009. The study area covers the MCWD franchise area which encompasses the cities of Cebu, Lapu-Lapu, Mandaue, and Talisay and municipalities of Compostela, Consolacion, Cordova, and Liloan.

6.192 The feasibility study recommended the following:

(a) **Phase I**

- One satellite plant at Cordova with an initial capacity of 55 m^3/day; initial coverage area for served area of Mactan and pilot areas Cebu City.

(b) **Phase II**

- Construction of Central Septage Treatment Plant (SpTP) at NRP STP with capaci[t]y of 480 m^3/day;
- Construction of additional satellite plant at Liloan with a cap**ac**ity of 120 m^3/day; and
- Expansion of the existing satellite plant at Cordova to a total capacity of 150 m^3/day.

6.193 The overview of SpTP of Phase I satellite plant at Cordova is shown in Table 6.4.11. The progress of the project, at this time, is only the acquisition of land for Cordova SpTP and the preparation for the bidding.

Table 6.4.11 Overview of SpTP at Cordova

Septage Volume	55 m^3/day	
Treatment Method	• Screening • Dewatering (Screw Press) • Extended Aeration (Activated Sludge) • Chlorination	
Capital Cost	SpTP: Vehicles: Total:	PHP36.6 million PHP12.9 million PHP49.5 million
Operational Cost	SpTP: Desludging: Total:	PHP2.7 million / year PHP4.3 million / year PHP7.0 million / year

Source: USAID, Metro Cebu Septage Management Project Feasibility Study Report, 2009.

(8) Septage Management of Cebu City

6.194 The "Pilot Project on Applicability of Dewatering Equipment for Septage Management of Cebu City in the Philippines" was undertaken as part of the Japanese government's assistance to companies in developing countries in 2012. A demonstration and pilot test of the dewatering machine was conducted from mid-January to end January in 2013. The machine was verified to be effective and adaptable in dewatering septage.

6.195 JICA supported the demonstration project of dewatering septage from

November 2013 to September 2015. A septage treatment facility was constructed and operated, including the septage tank and dewatering machine at Cebu City Sewage Treatment Plant (see Figure 6.4.4). The dewatering machine has a capacity of 10 m^3/hr and filtration discharges are sent to a lagoon.

Source: JICA Study Team.

Figure 6.4.4 Pilot Plant of Septage Dewatering Facility

2) Issues

6.196 The biggest problem regarding wastewater management is the lack of wastewater treatment facilities.

6.197 The population in Metro Cebu in 2010 is projected to double, reaching 3.8 million and 5.0 million by 2030 and 2050, respectively. The river and groundwater quality will become much worse as the population grows and inadequate treatment of wastewater and poor maintenance of the septic tanks remain unchanged.

6.198 If the old types of septic tanks, which have no bottom plate, remain unchanged, the groundwater quality and the river water quality will deteriorate. Pollution of drinking water sources would become a very serious concern.

6.199 The economic losses associated with these health impacts plus losses from the fisheries, tourism, agriculture, commercial, and industrial sectors, is more than PHP77.8 billion annually in the Philippines, according to “Economic Impacts of Sanitation in the Philippines” (a study published in 2008 by the World Bank Water and Sanitation Program).

6.200 Waterside environment and living environment would continue to be degraded by wastewater. As a consequence, the livability of Metro Cebu would get worse. Its competitiveness, for example as an investment and tourist destination, would also decrease.

3) Objectives

6.201 The principal objective of wastewater treatment is to allow human and industrial effluents to be disposed properly without endangering human health or the natural environment. Therefore, the recovery of the water environment through the appropriate treatment of wastewater is necessary. This would improve the livability conditions of the residents as well as the aesthetics of the area for the large number of visitors to Metro Cebu.

6.202 Wastewater collection and treatment is necessary to reduce water pollution and threats to human health and the aquatic environment. The design of the improvements on the wastewater treatment system would need to be guided by the target percentage of the population to be served by the collection system (i.e., the wastewater treatment population

ratio).

6.203 The wastewater treatment population ratio is defined as follows:

(i) Centralized wastewater treatment plants;

(ii) On-site wastewater treatment facilities (e.g., household wastewater treatment tank); and

(iii) On-site treatment facility which have treatment capabilities comparable to wastewater treatment facilities (i.e., septic tank with 3 chambers, Eco-san Toilets).

6.204 The objectives of the wastewater treatment population ratio are set by 50% and 90% in 2030 and 2050, respectively.

4) Sub-Roadmap for Wastewater Management

6.205 The Sub-roadmap for Wastewater Management consists of proposed projects for different implementation timetables: the short-term projects until 2016, the medium-term projects until 2030, and the long-term projects until 2050.

6.206 A centralized sewerage system is a desirable solution for the current situation. But a centralized sewerage system is unlikely to be feasible across Metro Cebu in the near future because a large amount of initial capital cost and O&M cost are required, and there is no space on roads for sewerage pipes. Thus, this necessity is for the long-term period.

6.207 The more urgent project would be a proper septage management. This includes construction and operation of a septage treatment plant, conducting proper desludging of septage, and improvement of inappropriate septic tanks which has no concrete bottom and has only one chamber.

6.208 In parallel with septage management, it is necessary to mandate the construction of proper wastewater treatment facility for development areas such as subdivisions, shopping malls, industrial facilities, and some government buildings.

6.209 By these countermeasures, reduction of pollution load emissions will be achievable. The environment of river and coastal area will be improved as well.

6.210 For achieving the 2050 objectives, construction of a centralized sewerage system is necessary for highly urbanized areas in Metro Cebu.

(1) Short-Term Until 2020

6.211 Following are some of the short-term projects to achieve the 2030 and 2050 objectives:

- Construction and operation of Septage Treatment Plant;
- Improvement of inappropriate septic tanks; and
- Construction of proper wastewater treatment facility for development areas.

(a) Construction and Operation of Septage Treatment Plant

6.212 There is one septage treatment plant at Cebu City which was installed by JICA as a pilot project. MCWD and City of Naga have conducted a feasibility study for septage treatment, but the construction of plants have not been implemented as of early 2015.

6.213 On the other hand, the provision of effective sanitation services, in the midst of rapid urbanization, is a key development challenge in Metro Cebu. As the

population grows and is increasingly concentrated in urban centers, there is a corresponding increase in septage generation. Consequently, there is a need to maintain proper sanitation through septage management to protect human health, environment and economic activities that largely depend on clean water.

6.214 Therefore, construction and operation of a septage treatment plant is one of the highest priority projects. The overview of the project is given in Table 6.4.12 and Table 6.4.13.

Table 6.4.12 Septage Treatment Project for the First Stage

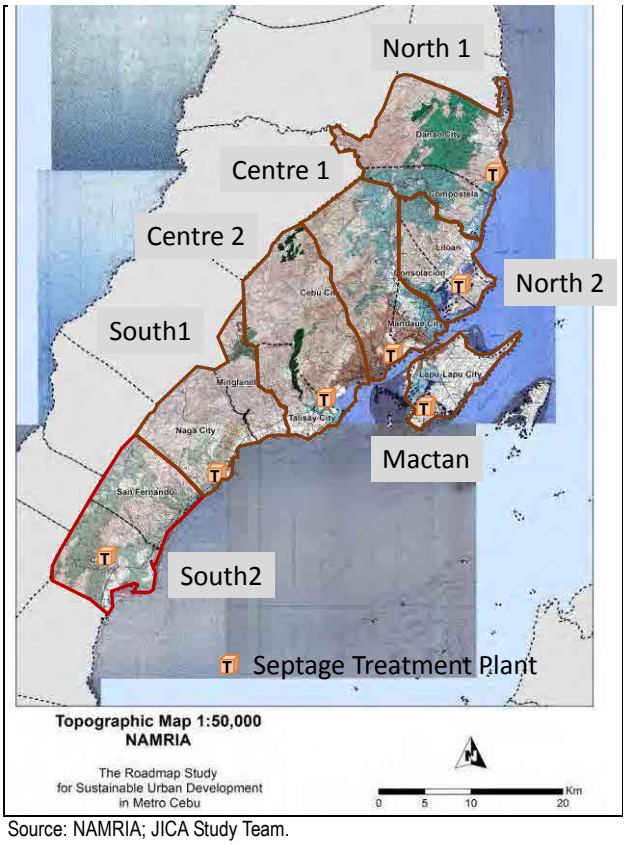
Area	Population (No.)	Households (No.)	Septage Volume (m^3/day)	Required No. of Trucks	LGU Coverage
North 1	289,689	63,446	102	7	Danao City, Compostela
North 2	389,424	87,744	141	10	Liloan, Consolacion
Centre 1	917,708	212,149	341	24	Northern part of Cebu City, Mandaue
Centre 2	910,486	201,851	324	23	Southern part of Cebu City, Talisay
Mactan	612,884	140,076	225	16	Lapu-Lapu City, Cordova
South 1	395,538	86,959	140	10	City of Naga, Minglanilla
South 2	294,100	59,765	96	8	Carcar City, San Fernando

Source: JICA Study Team.

Table 6.4.13 Projects for Replacement Stage in Year 2030

Area	Population (No.)	Households (No.)	Septage Volume (m^3/day)	Required No. of Trucks	LGU Coverage
North 1	389,126	85,231	137	10	Danao City, Compostela
North 2	551,781	124,321	200	14	Liloan, Consolacion
Center 1	1,156,341	267,523	430	30	Northern part of Cebu City, Mandaue
Center 2	1,133,891	251,156	404	28	Southern part of Cebu City, Talisay
Mactan	830,709	189,920	305	22	Lapu-Lapu City, Cordova
South 1	542,635	119,293	192	13	City of Naga, Minglanilla
South 2	388,503	78,947	127	10	Carcar City, San Fernando

Source: JICA Study Team.



Source: NAMRIA; JICA Study Team.

Figure 6.4.5 Clustering of Septage Treatment Facilities

(b) **Improvement of Inappropriate Septic Tanks**

6.215 The construction and operation of the septage treatment plant will improve the water body environment. Under the current situation, the presence of inappropriate septic tanks, which have no concrete bottoms and have only one chamber, are contaminating the water bodies including the groundwater, which is the source of potable water.

6.216 Similarly, it is very common to find septic tanks that are not easily accessible because they are built under structures or have illegal structures built over them. There are many reported cases wherein the septic tanks are not accessible for desludging since the streets or alleys leading to the houses are too narrow and cannot be reached by the vacuum tankers.

6.217 Therefore, the LGUs have to conduct investigations for septic tanks and make the effort to improve inappropriate septic tanks. Creation of a subsidy should be considered for the improvement of septic tanks.

(c) **Construction of Proper Wastewater Treatment Facility for Development Areas**

6.218 There are many development areas which have appropriate wastewater treatment facilities such as Asiatown IT Park, Cebu Business Park, South Road Properties, and other subdivisions. It is a requirement that new subdivisions have to get an ECC from DENR. Part of the requirement is the submission of a complete sewerage treatment system plan.

6.219 A proper wastewater treatment facility will have to be constructed based on

existing law[6] not only for development areas but also for large shopping malls and industrial areas.

(2) Medium-Term Until 2030

6.220 Implementation of the short-term projects are minimum measures for improving current conditions. Thus, construction of a centralized sewerage system for highly urbanized areas is necessary until 2030. On the other hand, the appropriate sanitary system is also needed for rural areas. The projects to consider in the medium term are described as follows:

(a) Construction of Centralized Sewerage System

6.221 The treatment efficiency of a septic tank is lower than that of a sewerage system, and many households treat black water only by septic tank. In other words, wastewater generated from the kitchen and bathroom is discharged to water bodies untreated. It is one of the causes of pollution in the water bodies.

6.222 From the above, even if septage management is going well, improvement of water quality will still be limited. Therefore, a new centralized sewerage system must be constructed to meet Metro Cebu's future wastewater treatment requirements.

- **Sewerage System**

6.223 A sewerage system can be classified into two categories, namely: (i) Separate System which is a system of pipes that collect only the wastewater, and (ii) Combined System which is a system where only one pipe is used both for wastewater and stormwater.

6.224 With the advancement of environmental technologies, there are several systems available for municipal wastewater treatment with varying degrees of sophistication and treatment efficiency.

6.225 A separate system and conventional activated sludge technology are recommended for Metro Cebu in terms of environmental aspects. However, a feasibility study is necessary and the system and treatment technology has to be decided considering design requirements, physical environment, cost of the system, and the socio-environmental effects.

- **Coverage Area**

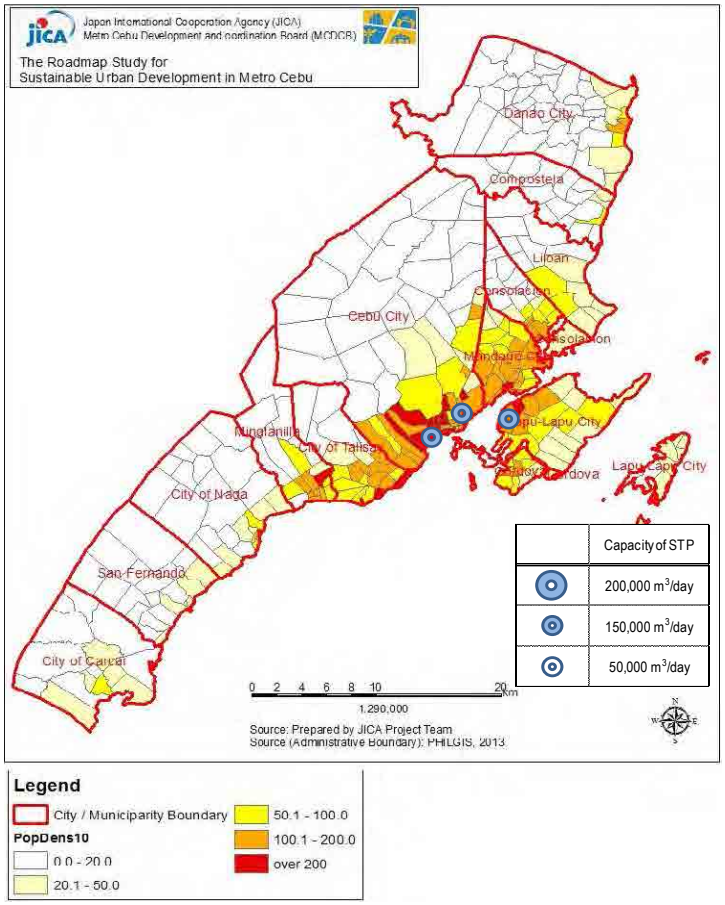
6.226 The new centralized sewerage system should cover the highly urbanized areas. The three treatment areas are shown in Table 6.4.14 and Figure 6.4.6.

Table 6.4.14 Sewerage Coverage Area in 2030

Area	Population (No.)	Volume of Wastewater (m^3/day)	Estimated Cost (PHP million)	Operational Cost (PHP million/year)	LGU Coverage
Cebu North	895,000	143,000	17,800	112	Northern part of Cebu, Mandaue
Cebu South	599,000	96,000	12,600	95	Southern part of Cebu
Lapu-Lapu	517,000	83,000	11,100	88	Part of Lapu-Lapu

Source: JICA Study Team.

[6] The Code on Sanitation of the Philippines (PD 856, 1976), Implementing Rules and Regulations of Chapter XVII of the Code on Sanitation of the Philippines.



Source: JICA Study Team.

Figure 6.4.6 Sewerage Systems Plan for 2030

(b) Promotion of Ecological Sanitation Technologies

6.227 For rural areas, a centralized sewerage system is not appropriate because of the high construction cost due to longer extension of pipes per population. Also, there are many households without septic tanks and do not even have toilets. For the households, construction of septic tanks and toilets is recommended.

6.228 For the construction of new facilities or improvement of old facilities in rural areas, it is recommended that ecological sanitation technologies such as urine diversion toilet be constructed.

6.229 The urine diversion toilet is characterized by a special seat or squat which separates the urine and fecal matter, ideally preventing any mixing of the two (see Figure 6.4.7). Urine can be collected and used in agriculture or compost production. Feces fall into the chamber below the toilet, which can either be a removable receptacle or a vault that is emptied only after long intervals of storage. This technology has been used throughout the world but is particularly prevalent in Sweden, South Africa, Germany, India, and Mexico. Urine diversion is based on the understanding that from a public health perspective, it is most important to remove the feces from the environment, whereas urine does not pose a significant risk to humans.

6.230 There are some ecological sanitation toilets near the Inayawan Sanitary Landfill. The facility has been functioning well. Therefore, promotion and

construction of the urine diversion toilet is recommended for rural areas.

Source: Center for advanced Philippine studies.

Figure 6.4.7 Urine Diverting Dry Toilet

(3) Long-Term Until 2050

6.231 In order to achieve the objective of having a wastewater treatment population ratio of more than 90% in 2050, a great deal of effort is necessary in terms of financial, technical, and awareness of residents. The needed projects are described below.

(a) Expansion of Existing Sewerage Systems

6.232 The urban area has sprawled from the existing urban area in Metro Cebu to adjacent LGUs. The population growth and population density increase will lead to an increase of pollution load.

6.233 Construction of new sewerage systems for the adjacent area with high population density is uneconomical. Therefore, expansion of existing sewerage systems is recommended in order to cover the urbanizing areas and to treat generated wastewater.

(b) Construction of New Sewerage Systems for Urban Area

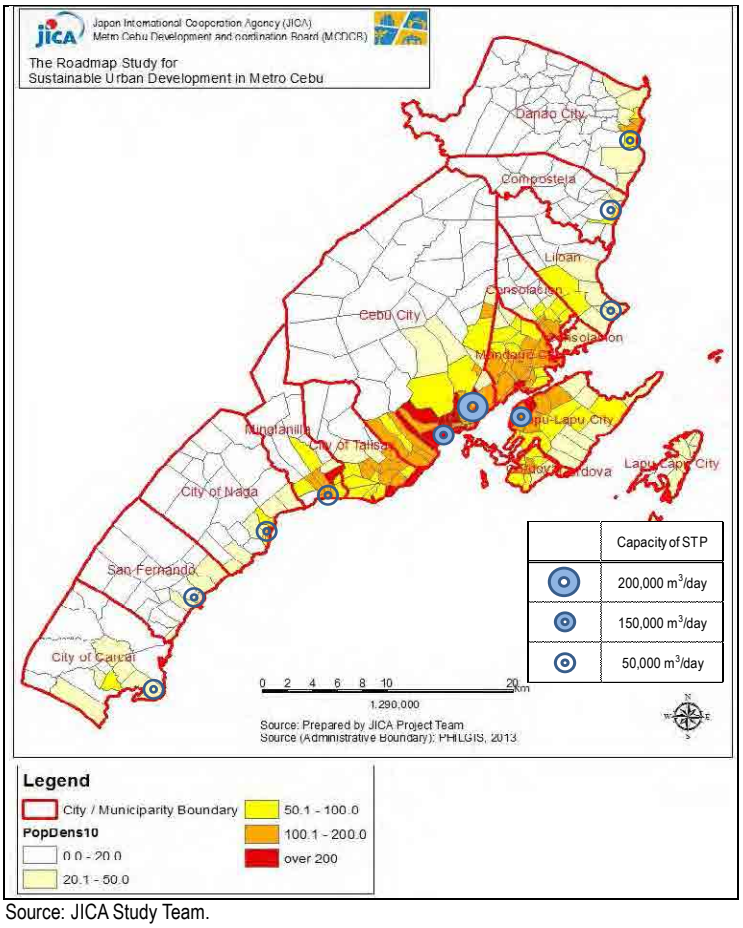
6.234 To achieve the objective, construction of sewerage systems for the urban area of each LGUs is necessary.

6.235 The future plan for sewerage systems are summarized in Table 6.4.15 and illustrated in Figure 6.4.8.

Table 6.4.15 Sewerage Coverage Area in 2050

Area	Population (No.)	Wastewater Volume ((m³/day)	Estimated Cost (M PHP)	Operational Cost (M PHP/year)	LGU Coverage
Cebu North	1,380,000	221,000	26,300	137	Northern part of Cebu, Mandaue, Consolacion
Cebu South	1,041,000	167,000	20,400	120	Southern part of Cebu, Talisay
Lapu-Lapu	789,000	126,000	16,000	106	Lapu-Lapu, Cordova
Liloan	245,000	39,000	6,000	63	Liloan
Compostela	85,000	14,000	2,700	40	Compostela
Danao	255,000	41,000	6,100	64	Danao City
Minglanilla	265,000	42,000	6,300	66	Minglanilla
Naga	210,000	34,000	5,300	59	City of Naga
San Fernando	116,000	19,000	3,300	46	San Fernando
Carcar	207,000	33,000	5,200	59	Carcar City

Source: JICA Study Team.
Note: Estimated cost of Cebu North, Cebu South and Lapu-Lapu is expansion cost only, while operational cost of Cebu North, Cebu South and Lapu-Lapu is operational cost after expansion.



Source: JICA Study Team.

Figure 6.4.8 Sewerage Systems Plan for 2050

(4) Projects for Wastewater Management

6.236 Below is the summary of the projects classified according to short-term, medium-term and long-term implementation timeframes. Indicative costs are provided, including the proposed schedule or target implementation period.

Table 6.4.16 Implementation Schedule of Sub-Roadmap Projects for Wastewater Management

Project	Cost (M PHP)	2016	2020	2025	2030	2040	2050
Short-Term Projects							
Septage Treatment Plant	1,215	■					
Improvement of Septic Tanks	-	■	■				
Construction of Proper WWTP for Development Area	-	■	■				
Medium-Term Projects							
Construction of Centralized Sewerage System	41,500		■	■			
Promotion of Ecological Sanitation Technologies	-			■			
Long-Term Projects							
Expansion of Existing Sewerage Systems	21,200				■	■	
Construction of New Sewerage Systems for Urban Area	34,900					■	■

Source: JICA Study Team.
Note: The cost of Improvement for Septic Tank, Construction of Proper WWTP for Development Area, and Promotion of Ecological Sanitation Technologies are varied depending on current situation, intention of residents and conditions of development plan.

5) Institutional Arrangements for Wastewater Treatment Projects

6.237 As stated in the Clean Water Act[7], the cities or municipalities have the primary responsibility for water treatment. However, where there are operational water districts, the responsibility is accorded to the water districts. This mandate is also explicitly stated in PD 198 or the law that created the water districts.

6.238 MCWD, being the water utility operating in Metro Cebu, shall be one of the primary agencies (in coordination or joint venture with the LGUs or other public/private agencies/firms) to provide for the establishment of the Septage Treatment Plant that would cover its service area.

6.239 While some of the LGUs would take the initiative to establish or cause to establish a sewage treatment plant within their jurisdiction, some Metro Cebu LGUs would not want such a plant within its boundaries or will not support the sewage management program which consider clustering of a number of LGUs.

6.240 The first level of intervention for community-wide wastewater treatment would be septage management services, and eventually upgraded to a sewerage system. Septage management services require lower and less lumpy investments. Current technology is such that incremental capacity upgrades can be modular, so that additional investments can be phased with the growth in demand. Moreover, septage management as shown in the table below is a cost-effective first line intervention.

[7] The Philippine Clean Water Act (RA 9275) Implementing Rules and Regulations (DAO 2005-10) contained the following provisions that provides the basis/reference for the implementation of septage projects by the LGU and water utilities:
- 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 in their area of jurisdiction through local property taxes and enforcement of a service fee system (Section 7);
- In the case of HUCs, non-HUCs and LGUs where water districts, water utilities and waterworks have already been constituted and operational, the water supply utility provider shall be responsible for the sewerage facilities and the main lines. In areas where there are no existing facilities, the LGUs, water districts or water utilities may adopt septage management program or other sanitation alternatives (Section 8.6).

Table 6.4.17 Options on Sanitation Interventions

Strategy	Pollution Reduction Potential	CAPEX Cost (PHP 000) per Household
Increase Septic Tank Use	Up to 50% (for new, properly constructed septic tanks)	5 to 10
Improve Septic Tank Design	Up to 50% (retrofit)	2 to 5
On-site Secondary	Up to 90%	20 to 40
Septage Management Program	Up to 50% (for properly constructed and improved septic tanks)	2 to 3
Separate Sewerage System	Up to 90%	90 and up
Combined (Interceptor) Sewerage System	Up to 90% (During dry weather only)	30 to 70

Source: Presentation of the Development Bank of the Philippines, June 2014.

6.241 Several feasibility studies on septage management done for water districts show that this service is financially viable.[8] Full cost recovery can be achieved with an average increase of 8-10% of the monthly water bill. The same cannot be said for the combined (interceptor) sewerage system or a separate sewerage system. The investments are so high making the tariffs exorbitant if full cost recovery is intended. Hence, for these types of interventions, a subsidy will be necessary. Presently, the National Sewerage and Septage Management Program of DPWH earmarked a fund to subsidize sewerage projects of highly urbanized cities, up to 40% of the capital cost. The fund has not been utilized yet.

6.242 The existence of MCWD and other water districts within the Metro Cebu area, offers an opportunity for septage projects to be done with administrative and operational ease. In particular, water districts have explicit mandates and existing systems, such as collection, that would make it easy to add septage management as another service line. Specifically for MCWD, its coverage of eight cities and municipalities gives it a good platform to develop a system-wide scheme. Septage treatment plants can be planned so that service areas are clustered thereby optimizing economies of scale of the facilities. LGUs within the MCWD franchise area can help make the projects' economic and environmental impact more effective if they pass ordinances requiring periodic de-sludging and retro-fitting of septic tanks to comply with the standard. This way, the water district will have a legal basis for providing the service and collecting user fees from non-customer households.

6.243 For cities and municipalities without water districts, such as Danao, San Fernando and Naga, they will be the implementing agencies. If these LGUs are proximate enough to facilities that will be put up by water districts, then they can opt to bring the sludge in the existing facilities subject to a tipping fee, thereby limiting investments to desludging trucks. Should they have constraints in user fee collection, an alternative is to recover the cost from real property taxes. An example of such a scheme is found in San Fernando, La Union (see Box 2). The LGU can adjust the real property taxes, earmark the increment for sanitation services, and collect it in a ring-fenced special account for transparent accounting of the use of the fund.

6.244 With regard to the financing and procurement strategy, a PPP arrangement has prima facie benefits. De-sludging services are already provided by the private sector. Water districts and LGUs do not have prior experience of operating septage management or sewerage services, thus may not manage the service as efficiently as a private operator. Contracts with private operators can build in incentives and penalties that will drive achievement of performance standards cost effectively.

[8] 17 feasibility studies for water districts were supported by the USAID-funded Philippine Water Revolving Fund Support Program.

Box 2 An Example of Septage Management Services Paid from Real Property Taxes

San Fernando City is one of the few cities in the country that has a Sanitation Code. When the City decided to implement septage management services, it amended the Code to include a cost recovery provision, in particular, a wastewater management fee to be added onto the Real Property Tax (RPT) bill. In other cities, the fee is added onto the water bill, but the local water district only covers about 16% of the population, eliminating this option.

The current ordinance now requires every septic tank in the City of San Fernando to be desludged every five years. A Wastewater Management Fee will be charged at the following annual rates, beginning January 2012:

1. Residential building: Six Hundred Pesos (PHP600);
2. Commercial Establishments (excluding malls): One Thousand Pesos (PHP1,000);
3. Malls and Institutions: One Thousand Five Hundred Pesos (PHP1,500); and
4. Industrial: Two Thousand Pesos (PHP2,000).

The fee will be added onto the RPT bill. Households will also be able to request an "out-of-schedule" desludging by contacting the City Environment and Natural Resources Office (CENRO) and paying a one-time fee to the City Treasurer's Office in the amount of:

1. Eight Hundred Pesos (PHP800) per household; and
2. Three Thousand Five Hundred Pesos (PHP3,500) per commercial establishment.

The ordinance includes a penalty of P5,000 for violations.

Source: USAID's Philippine Sanitation Alliance Project.

6.5 Environment and Social Considerations for Water Supply

1) Public Perception on Water Supply

6.245 The HIS results (with sampling of 1% of households of Metro Cebu) indicated that 68.9% of households in Metro Cebu mainly rely on water refilling stations for their drinking water (see Table 6.5.1). Secondary sources of drinking water are the public wells and piped water supply system. For other purpose uses, about 49.9% of households in Metro Cebu mainly utilize the piped water supply system while supplemental sources are the public wells.

Table 6.5.1 Sources of Water in Metro Cebu

Source of Water		Main Source				Supplementary Source			
		Drinking		For Other Purposes		Drinking		For Other Purposes	
		No.	%	No.	%	No.	%	No.	%
1	Piped water supply system	812	12.5	3,249	49.9	20	25.0	14	5.6
2	Public tap	234	3.6	661	10.1	11	13.8	9	3.6
3	Public well	222	3.4	1,057	16.2	24	30.0	205	82.3
4	Household's own well	96	1.5	434	6.7	1	1.3	4	1.6
5	Neighbor's well/tap	281	4.3	684	10.5	3	3.8	5	2.0
6	Bottled water	140	2.1	24	0.4	11	13.8	2	0.8
7	Water refilling station	4,488	68.9	27	0.4	8	10.0	1	0.4
8	Rain, spring, creek, canal or pond	239	3.7	378	5.8	2	2.5	9	3.6

Source: JICA Study Team, HIS 2014.

6.246 Most of the households who have a connection to the piped water supply system in Metro Cebu perceived its current service level (across five dimensions: water quantity, water quality, water pressure, hours of supply, and price) as relatively average (see Table 6.5.2).

Table 6.5.2 Satisfaction on Current Service Level of Piped Water Supply in Metro Cebu

Dimension/Area	Level of Satisfaction									
	Highly Unsatisfied		Unsatisfied		Average		Satisfied		Highly Satisfied	
	No.	%	No.	%	No.	%	No.	%	No.	%
Water Quantity	14	0.4	192	5.7	1826	54.2	1238	36.8	97	2.9
Water Quality	20	0.6	186	5.5	1845	54.8	1213	36.0	104	3.1
Water Pressure	18	0.5	162.0	4.8	1886	56.0	1191	35.4	111	3.3
Hours of Supply	28	0.8	263	7.8	1941	57.7	1026	30.5	107	3.2
Price	32	1.0	202	6.0	2308	68.8	706	21.1	105	3.1

Source: JICA Study Team, HIS 2014.

2) Stakeholder's Views on Forthcoming Water Crisis

6.247 As the previous section estimated the water supply and demand in the future, there are huge gaps foreseen between the water supply and demand. At the same time, MCWD and other stakeholders acknowledge the risk of over-dependence on groundwater as a major water source. The current water sources will no longer be sustainable due to intrusion of salt water and water contamination. In view of this, JST with MCDCB organized the 1st and 2nd Water Forums on July 2 and October 15, 2014, respectively, for discussing the following main agenda:

1st Forum Agenda	2nd Forum Agenda
(i) Update on the current supply and demand situation; (ii) How to source out the additional water supply to address the gap; (iii) Possible scenarios (PPP), institutional concerns, appropriate technologies and cost, international/ external funding requirements; and (iv) Financing Schemes.	(i) MCWD's current and future strategy; (ii) Fragmented water governance; (iii) Roles and responsibilities of water actors; (iv) Role of Central Cebu River Basin Management Councils; (v) Short-term priority projects; (vi) Institutional and financing arrangements for Mananga Dam II; and (vii) Future steps.

Source: JICA Study Team.

6.248 The participants of both forums were from MCDCB, MCWD, Cebu City, Cebu Provincial Government, NEDA, a number of private water companies, academe, and NGOs. The highlights of the discussions are given in Box 3 and Box 4.

Box 3 Highlights of 1st Water Forum (July 2, 2014)

MCWD's Presentation

(1) Confirmed the water strategy: (i) Optimization of existing sources, (ii) Reducing non-revenue water, (iii) Implementing demand management, (iv) Importing water from outside critical aquifer.

(2) MCWD showed preference on distribution to consumers (laying of pipes) but is open to partnership with bulk water supply by partners: Government in the form of Joint Venture, Private (Public-Private Partnership) on certain provisions: Mutually agreed water tariff, surface water source development, designated ejection points of MCWD, groundwater outside critical aquifer (imported).

(3) MCWD's short term plans: Reduction of system loss, Upgrading of existing distribution system (old pipes) and expansion; Adoption of computerized monitoring of the distribution system.

(4) MCWD is open to technologies to capture surface runoff/ stormwater management and recharge to reduce dependence on wells as in the case of Singapore. Alternative technologies to minimize socio-economic impact, such as a series of catchments instead of a high dam to capture rainwater/surface runoff.

(5) Open to joint venture with private sector with expertise in septage and sewerage technology as water

quality affects water availability.

Discussion on Issues / Gaps

(1) Competition with bulk water suppliers under the National Water Resources Board (NWRB) permits directly distributing to consumers in areas not covered by existing MCWD system but within the Metro Cebu service area. Water tariff is imposed based on commercial rates and distribution lines are independent on MCWD system.

(2) Subdivision developers who have their own wells can enjoy lower cost as they charge only the shared monthly power consumption and maintenance expense to homeowners.

(3) Need to inventory water sources/wells (private or LGU provided, such as in Cordova, Mandaue and Cebu City-ongoing) to regulate extraction. At present, there are many private commercial and domestic wells extracting from the same resource, i.e., the critical aquifer.

(4) The subsidized rate of MCWD for initial 10 m^3 per consumer (i.e., 85% of consumers currently applied for service) is below the cost of operation and below the current bulk water price passed on by the private water suppliers.

(5) Lack of enforcement of Clean Water Act, Solid Waste Management and Water Code–water quality affects water availability Decommissioning of some wells due to nitrate contamination from poor sanitation practices.

(6) Lack of technical capacity of MCWD to undertake septage management /desludging. Current capacity building for septage plant management is provided to Cebu City only.

Recommendations

(1) Forging collaboration to augment strength in water extraction:
   (a) Regulation - Conduct inventory of wells and create a Zoning Board for new development of condominiums and major real estate for protecting water sources;
   (b) Technical support to NWRB and the LGUs; and
   (c) Tripartite agreement with LGUs for knowledge sharing and water policy formulation.

(2) Collaboration and coordination among public and private sectors:
   (a) Private suppliers may opt to expand water source development through major infrastructure development but need to remove certain constraints: water tariff (cost recovery) and capability of MCWD to expand its distribution system; and
   (b) Demand projections should be based on standard planning parameters (MCWD, JICA and MCDCB figures to be harmonized). Various options of implementing projects though private-public partnerships: Joint venture, Build, Operate and Transfer, Build, Own and Operate needs to be explored in order to overcome the forthcoming deficit as of 2010 until 2030 within the MCWD service area and the entire Metro Cebu.

Source: JICA StudyTeam.

Box 4 Highlights of 2nd Water Forum (October 15, 2014)

MCWD's efforts on concerns regarding water sustainability in Metro Cebu:

(1) Optimizing utilization of existing resources and continually monitors for hazards; aims to reduce non-revenue water to save around 10,000 m^3 per day;

(2) Implemented demand management/ water conservation; and imported water from outside of critical aquifer from surface water of Carmen, and used desalinated water; bulk water suppliers that include LGUs beyond MCWD's service area like Danao and Carmen.

Fragmented Governance: Policy recommended:

(1) Considering that MCWD is servicing only 8 of the 13 LGUs in Metro Cebu, it is imperative to bring in the Provincial Government to fill in gaps. This set-up is consistent with MCWD's policy and the financial gaps can also be addressed.

(2) CCRBM Master Plan, which include watershed management, plans for core committee forests, development of the Mananga riparian zones, and such other programs and projects for the protection and rehabilitation of river basins. She also gave updates on their databank, which is encoding information from

different agencies and resource centers.

Importance of National Government's Commitment for Securing Bulk Water Supply:

Important for organizations to forge collaboration to augment strength in regulating water extraction and private-public collaboration for water conservation. Support from the national government is also imperative for the development of the bulk water supply.

(1) The institutional and financial arrangement for the construction of dams, specifically on the role of MCDCB and the affected LGUs. There are two options for financing, either PPP arrangement or through the national government. Financing is not an issue; the political will to implement the project is the bigger challenge.

(2) Citing the water project by Metropolitan Waterworks and Sewerage System (MWSS), a Government Owned-Controlled Corporation (GOCC) and an attached agency of DPWH, sponsored the New Centennial water supply project, the Kaliwa Dam project in Metro Manila. Metro Cebu can also use the same argument with MWSS, noting its contribution to the coffers of the government, and its project viability.

(3) Acknowledging the needed infrastructure for water for a growing metropolis, conformity and support of MCWD, MCDCB, the province of Cebu, the private sector and LGUs are urgently required.

Source: JICA StudyTeam.

3) Project for Construction of New Water Supply Facilities (Reservoirs, Pump Stations, Well Developments)

(1) Social and Economic Considerations

6.249 The item under the set of short-term projects composed of (i) well construction, (ii) reservoir and elevated water tanks, and (iii) pipelines, pump station are reviewed. With the 10,000 m^3 capacity of the reservoir, there will be much lesser adverse impacts (smaller area to be inundated and possibly, no households to be relocated and compensated). However, this has yet to be determined, as such socio-economic and environmental benefits/dis-benefits would be site-specific, primarily dependent on the exact location of the project components (small dam/weir and reservoir).

(2) Environmental Impact Assessment

6.250 While it is much less than the >25 ha reservoir and >20 mcm volume of impounded water parameter/criteria, the project (with merely 10,000 m^3 of impounded water) would still be covered under the Philippine EIS system. Thus, it will be necessary to prepare an Initial Environmental Examination (IEE) Report or Checklist and apply for an ECC from the EMB-7 Regional Office.

(3) Political, Legal and Institutional Aspects

6.251 It is presumed that these small reservoirs will be located within the Central Cebu Protected Landscape (CCPL), thus, it will be subject to the CCPL-PAMB (Protected Area Management Board) management policies and guidelines. It is critical that at this point, the updated CCPL CMP will already contain provisions that allow this water supply projects within the CCPL.

4) Mananga Dam Project

6.252 Please refer the Supporting Report 3: Pre Feasibility Studies (The Development of Mananga II Dam Project).

5) Projects Proposed Under the Sub-Roadmap for Stormwater Management

(a) Implementation of "A Comprehensive Study for a Metro Cebu Integrated Flood and Drainage System Master Plan"

6.253 Typically, the Flood and Drainage System Master Plan prepared by LGUs and DPWH are focused more on providing structural and engineering measures to address flooding and drainage issues in a particular planning area, which could have different scope and content from a stormwater management plan that will also introduce environmental, land use/landscaping and other low-impact development measures to address flooding and drainage issues. Reliance on expensive structural measures could divert the LGUs' attention away from readily implementable, low-cost and low-impact programs and projects that holistically address stormwater and flooding concerns.

6.254 An integrated plan prepared by a national agency such as DPWH could cross political boundaries and jurisdictions of LGUs, thus linking and connecting the otherwise territorial/disconnected drainage lines of respective cities and municipalities into one overall system. However, an institutional arrangement should be set-up to maintain this integrated system as there are limits to which DPWH could manage and operate within a city or municipality without crossing paths or running in conflict with local authority and jurisdictions. Besides, DPWH needs the support and cooperation of the various LGUs to efficiently run the system.

6.255 The traditional planning system relies more on being comprehensive but not necessarily proactive, integrative and coordinated. Integrated planning for flood and drainage system should not consider integration of the various LGUs political jurisdiction into one planning unit, but rather should also be integrative of the entire water loop (water cycle from catchment to sewerage and drainage). Integrated planning should also look at the various government agencies (DPWH, DENR, LGUs, NWRB, MCWD, etc.) with mandates/authority over a particular sector/segment in the water loop and how this could be harmonized to address duplicating, overlapping and conflicting bureaucratic functions.

6.256 Traditional DPWH and LGU planning and project programming typically lacks proper public consultation. It is only when a particular project component in a master plan goes into the EIA process that the public could be fully informed and participate in the planning process. However, such public participation is already late as plans and detailed design are already completed, and funding is already in the pipeline as the project is about to be implemented. Therefore, it is necessary that environmental assessment (with full public participation) should be undertaken simultaneous with the preparation of the master plan.

6.257 The Flood and Drainage System Master Plan should be subjected to a Strategic Environmental Assessment (the EIA for plans and programs) as this allows for the mainstreaming of environmental and social (with public participation) considerations at the early stages of preparation for the master plan.

(b) Cleaning Rivers, Creeks and Drainages

6.258 There are already a number of initiatives from both the government and private sectors with the objective of cleaning Metro Cebu’s rivers and creeks, which includes the establishment of a body (board, councils) tasked with the mandates of cleaning the rivers, among others, and regular/periodic physical clean-up of rivers. Some of these initiatives include the following:

- DENR DAO 2014-05 declared the Butuanon River as a water quality management area (WQMA), a move expected to boost ongoing efforts to revive the polluted water body, restore its long-term health and protect it from further damage caused by

development activities. DAO 2014-05 sets the political and administrative boundaries of the WQMA down to the barangay level for a well-coordinated implementation of a rehabilitation program for the Butuanon River, which is bordering along densely populated areas in the cities of Cebu and Mandaue.

- Cebu City's River Management Board. Ordinance No. 1784 creating the Cebu City River-Eco Park Management Commission for the purpose of developing, managing and rehabilitating the major rivers and streams within the boundaries of [Cebu] City (May 1999).
- DENR-7 "Adopt-a-River or Estero" Program to undertake clean-up and other rehabilitation activities in Butuanon and Guadalupe Rivers and their tributaries in collaboration with the private sector. The adopters may extend help or assistance in the clean-up of a river or estero by providing equipment, human power, and other resources needed to do the actual clean-up. In 2011, 11 companies signed an agreement with DENR and these are Cenapro Chemical Corporation, GreenCoil Industries Inc., Maritrans Recycler Inc., JLR Construction and Aggregates Inc., Lami Food Products Corporation, Profood International Inc., Treasure Island Industrial Corporation, Primary Homes Inc., Concrete Solutions Inc., Sunpride Foods Inc., and Cebu Holdings Inc. For 2012, it aims to seal 18 agreements with various business sectors and other LGUs.
- The Cebu River Basin Management Council, composed of both government and private stakeholders, is tasked to formulate policies, programs and projects to holistically address environmental enhancement of the river basin.
- Cebu Chamber of Commerce and Industry initiated the "Fun Run for River Clean-Up" as a mechanism for a participatory and integrated river management.
- DPWH Mahiga Creek dredging project.
- Cebu City and Mandaue City Governments' periodic dredging of its major rivers/creeks.

6.259 While the river clean-up initiatives have raised public awareness on the importance of clean rivers, the gains are not yet significantly visible as the rivers/creeks are still dirty and clogged with trash and silt. One major reason is the presence of illegal settlers and establishments not only within easements but have also encroached and constricted the waterways.

6.260 Occasional flooding of Metro Cebu's urban flood prone areas are key-triggers for government and private sector to immediately undertake river clean-up and clearing of establishments within the river easements.

6.261 While there are already sections of river/creek easements cleared of illegal settlers, these are yet very small/limited so as to significantly contribute to cleaning of the rivers/creeks.

6.262 Demolition of illegal structures within river easements and waterways are met with strong resistance from the settlers and the community. While the public and the settlers are very much aware of the risks/dangers of living along rivers and its contribution to flooding and environmental degradation, poverty, lack of resources to relocate/resettle, and absence of better alternative livelihood opportunities would make them resist demolition and fight it out to remain in such locations.

6.263 The LGUs and the national government agencies with mandates to relocate households living in danger areas such as river easements and waterways, and to provide relocation/resettlement sites and livelihood opportunities in most cases do not have the political will, capacity and resources to deliver its mandates, functions and responsibilities.

6.264 Cleaning of rivers and waterways would significantly enhance environmental amenities, but it is proven to be a difficult undertaking given the current socio-political considerations.

(c) Construction of Small-Scale Rainwater Storage Facilities

6.265 Water conservation measures such as putting-up of rainwater harvesting cisterns in buildings is already institutionalized through local and national legislations as follows:

- Cebu City Ordinance No. 1711 (January 1998), also known as the "Water Conservation and Flood Prevention Ordinance," requires contractors and developers to set up rainwater cisterns before they can obtain building and occupancy permits. The said measure requires building construction owners to provide rainwater tanks or containers for domestic use to conserve potable groundwater, in order to lessen flood occurrences. The law provides penalties for non-compliance;
- Mandaue City's proposed ordinance requiring the inclusion of reservoir (rainwater cistern) in building plans;
- Cebu Province Ordinance No. 2014-02 Implementing the Province of Cebu Green and Disaster-Resilient Building Program;
- Cebu City Ordinance No. 2103 or the Rainwater Conservation Ordinance;
- RA 6716, which requires the public works department to build rainwater collectors in each barangay.

6.266 While the legal policy and institutional arrangement to require the establishment of rainwater harvesting cisterns/tanks in residences and establishments are in place, there is generally lukewarm compliance by the general public given that water supply is very much affordable and available 24 hours daily. Implementation of the ordinance is also anemic and lax, and building permits will be issued with or without the rainwater cisterns provided for in the plans.

6.267 The construction of mini-dams and detention basins as measures for flood and erosion control could be difficult in the absence of an entity that will stand as project proponent. Most likely it is the City/Municipality and barangay LGU (where the mini-dam structure will be located) who will be responsible for the construction, operation and maintenance of the facility. But given their limited financial and technical resources, this will be the least of the LGUs' priorities.

6.268 Detention basins as rainwater collectors could be put up in each barangay if compliance to RA 6716 will be strictly implemented, as this legislation “requires the public works department to build rainwater collectors in each barangay.”

6) Septage Treatment Plant (STP) Projects

(1) Socioeconomic and Social Considerations

6.269 Protecting water resources from pollution and people from water contamination

are two of the most pressing challenges facing Metro Cebu today. The direct relationship between diseases, such as diarrhea, cholera, hepatitis and dysentery with untreated household sewage is well documented.

6.270 Groundwater is the main source of potable water in Metro Cebu. However, poor sanitation affects groundwater quality. Groundwater contamination, especially nitrate concentration, causes two particular health concerns: (i) blue baby syndrome that affects infants, and (ii) generation of chemicals called nitrosamines in the digestive tract.

6.271 The economic losses associated with these heath impacts, plus losses from the fisheries, tourism, agriculture, commercial, and industrial sectors, are assumed to be of considerable amount.

6.272 There are three main effects that are sought with the introduction of the STPs, namely: (i) decrease of water-related diseases, (ii) improvement of water quality including river and groundwater, and (iii) improvement of living environment.

(2) Environmental Impacts/Considerations

6.273 Assessments and management measures of environmental impacts is generally site-specific (i.e., the primary impact area being the area hosting the STP and the immediate surroundings as the secondary impact area). While the four municipalities/cities that will host the STP have been identified, the exact location of the STP within each LGU has yet to be determined. For the time being, the environmental issues identified by the Feasibility Study for Metro Cebu Septage Project[9] (USAID, 2009) will provide some insights/examples, namely:

(a) Issues Relating to Plant Setting:

- Presence of caverns or cavities in the sites selected considering that the underlying geologic material is predominantly limestone, which is porous;
- Possible contamination of the groundwater in case of leak, particularly in Cordova and Liloan sites;
- Shallow occurrence of groundwater;
- Failure to acquire the proposed site (i.e., Liloan site); and
- Refusal of the LGU to host the STP. No agreement has been made between the concerned LGU and MCWD; not all the LGUs are willing to host an STP.

(b) Issues Relating to Design:

- Greater potential for odor issues due to greater surface area and odors from anaerobic conditions and bio-solids;
- Flooding of STP;
- Stability of structures (earthquake resistant); and
- Ground failure (due to presence of cavities/caverns); and public safety.

(c) Issues Relating to Construction:

[9] The study area covers the MCWD franchise area which encompasses the cities of Cebu, Lapu-Lapu, Mandaue, and Talisay and the municipalities of Compostela, Consolacion, Cordova and Liloan according to the "Metro Cebu Septage Management Project Feasibility Study Report" (USAID, 2009).

- ECC compliance by contractors;
- Haphazard location of quarry areas and borrow pits in sensitive areas (change in erosion pattern);
- Landslide caused by overdevelopment; and
- Erosion and noise, air and dust pollution.

(d) Issues Relating to Operation and Maintenance:

- Degradation of water quality of receiving water bodies due to plant failure events;
- Leak of septage; and
- Accidental spillage and failure of operations.

(3) Environmental Impact Assessment

6.274 Septage volume that would be treated at the four STPs has a high of 398 m^3/day (Center-Cebu City) to a low of 68 m^3/day (South 2-Carcar City). Given the parameter for the project to be classified (see Table 6.5.3), all the four STPs that will be constructed will be required to undertake a full EIA and submit an EIS document to support their ECC application (see Table 6.5.4).

Table 6.5.3 EIA Project Type / Category

Type	Project Size Parameter	EIS	IEER or IEEC	CNC
Domestic Wastewater Treatment Facility	Quantity of wastes to be treated annually	≥5,000 m^3/ (13.7 cmd)	<5,000 m^3	<30 m^3

Source: JICA Study Team.
Note: EIS: Environmental Impact Statements, IEER: Initial Environmental Examination Report, IEEC: Initial Environmental Examination Checklist, CNC: Certificate of Non-Coverage.

Table 6.5.4 ECC Application Status

Location	ECC Status
Cebu	EMB considers the Cebu (AMCON) septage plant as a demonstration project and, therefore, will be categorized as a Non-Coverage project (no need to secure an ECC). However, an ECC will be required when it goes into commercial operations.
Cordova	Bidding is expected to take place in December 2014 according to the Bid and Awards Committee (BAC) of MCWD.
Naga	There is no EIA study for ECC application undertaken.

Source: JICA Study Team.

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