NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY

Volume 2: Philippine Water Supply and Sanitation Master Plan

CALABARZON Water Supply and Sanitation Databook and Regional Roadmap

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Acronyms

AHFF	Agriculture, Hunting, Fishery and Forestry
AIP	Annual Investment Plan
AM	Assistance to Municipalities
BOD	Biological Oxygen Demand
BWSA	Barangay Water and Sanitation Association
CapEx	Capital Expenditure
CALABARZON	Cavite, Laguna, Batangas, Rizal, Quezon
CBO	Community-Based Organization
CENRO	City Environment and Natural Resources Office
CNC	Certificate of Noncoverage
DA	Department of Agriculture
DAO	Department Administrative Order
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DJF	December, January and February
DOH	Department of Health
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
EMB	Environmental Management Bureau
FA	Financial Assistance
FAO	Food and Agriculture Organization
FHSIS	Field Health Service Information System
FIES	Family Income and Expenditure Survey
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GVA	Gross Value Added
HH	Household
HUC	Highly Urbanized City
IEC	Information, Education and Communication
IP	Indigenous People
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
JJA	June, July and August
LCE	Local Chief Executive
LDP	Local Development Plan
LFPR	Labor Force Participation Rate
LGU	Local Government Unit
LHB	Local Housing Board
LSB	Local School Board
LSSP	Local Sustainable Sanitation Plan
LWSSP	Local Water Supply and Sanitation Plan
LWUA	Local Water Utilities Administration
M&E	Monitoring and Evaluation
MAM	March, April and May
MDG	Millenium Development Goals
MGB	Mines and Geosciences Bureau
MSME	Micro, Small and Medium Enterprises
NAMRIA	National Mapping and Resource Information Authority
NCR	National Capital Region
NDRRMC	National Disaster Risk Reduction Management Council
NEDA	National Economic and Development Authority
NGO	Nongovernment Office
NRW	Nonrevenue Water
NSSMP	National Septage and Sewerage Master Plan
NWRB	National Water Resources Board
O&M	Operation and Maintenance
OBS	Observed Baseline
OCD	Office of Civil Defense
OD	Open Defecation

PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAWD	Philippine Association of Water Districts
PDP	Philippine Development Plan
PEM	Philippine Environment Monitor
PENRO	Provincial Environment and Natural Resources Office
PNSDW	Philippine National Standards for Drinking Water
PSA	Philippine Statistics Authority
PSGC	Philippine Standard Geographic Code
PWSSMP	Philippine Water Supply and Sanitation Master Plan
RBCO	River Basin Control Office
RDC	Regional Development Council
RDP	Regional Development Plan
ROW	Right-of-Way
RWSA	Rural Waterworks and Sanitation Association
RWS	Rural Water System
SALINTUBIG	Sagana at Ligtas na Tubig
SDG	Sustainable Development Goals
SGLG	Seal of Good Local Governance
SMC	Septage Management Committee
SMERA	Small and Medium Enterprise Roving Academy
SMP	Septage Management Program
SON	September, October and November
STP	Septage Treatment Plant
SSF	Shared Service Facilities
SWTP	Surface Water Treatment Plant
TC	Tropical Cyclone
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
IHP	Intergovernmental Hydrological Programme
UNICEF	United Nations Children’s Fund
UTM	Universal Transverse Mercator
WASH	Water, Sanitation and Hygiene
WD	Water District
WGS	World Geodetic System
WHO	World Health Organization
WQMA	Water Quality Management Area
WRR	Water Resources Region
WSP	Water Service Provider
WSS	Water Supply and Sanitation
WSSPMO	Water Supply and Sanitation Program Management Office
ZOD	Zero Open Defecation

Units

%	percent
°C	degree Celsius
CY	Calendar Year
km²	square kilometer
km	kilometer
lpcd	liters per capita per day
lps	liters per second
m³	cubic meter
MCM	million cubic meter
mm	millimeter
mg/L	milligrams per liter
PhP	Philippine peso

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Region IV-A CALABARZON

4

Introduction

CALABARZON

Region IV-A is located southwest of Luzon, and south and east of Metro Manila.

It is bounded on the east by the Philippine Sea and Bicol Region, on the south by Verde Island Passage, and on the west by Luzon Sea.

Known by the acronym CALABARZON, Region IV-A has a total land area of 16,873.31 square kilometers (km^2). It comprises five provinces: Cavite (accounting for 9.32% of the region's land area), Laguna (11.37%), Batangas (18.4%), Rizal (7.06%), and Quezon (excluding Lucena City) (53.28%).

It has one highly urbanized city (HUC) (Lucena City in Quezon), 18 component cities and 4,011 barangays. Its regional center is Calamba (in Laguna).

The region is blessed with varied land forms, consisting of flat coastal areas, upland interior areas of slightly moderate rolling or undulating plains and hills, and mountains.

Land Classification

The region's total land area accounts for 15% and 6% of the land area of Luzon and of the entire country, respectively. About 35% is forestland and 65% is alienable and disposable land.

Forest reserves and timberland comprise 6% and 26% of its forestland, respectively. The rest are vast tracts of public land such as national parks, military, naval and civil reservation, and land for fishpond development.[1]

The region likewise has maintained a large agricultural base comprising approximately 588,500 hectares of land. This makes up 36.3% of the region's total land area. Cavite boasts about 70,500 hectares of agricultural land.

Region IV-A boasts 31 industrial estates and economic zones where there is a big supply base of semi-processed industrial raw materials.

Laguna is home to the International Rice Research Institute (IRRI), the world's premier rice research organization. It maintains its headquarters in Los Baños.

The province is dubbed the country's "automotive capital" because it is where most automotive assemblers are found. Also known as the "Silicon Valley of the Philippines", Laguna has become a powerhouse in the electronics and semiconductor industry in which famous locators (such as Samsung, Toshiba, etc) have set up business.

Batangas has the second largest international seaport in the country (next to the port of Manila). It is a tourist destination famous for its beaches and diving resorts. It is known for its pineapples (whose leaves are processed as *jusi* fabric). It is also widely known for its livestock industry, notably cattle raising, and for its native liqueurs called *lambanog* and *tuba*.

Quezon is the country's top producer of coconut products such as copra and coconut oil.

Vast tracts of land in Rizal are planted to high-value fruits such as cashew, *rambutan* and avocado. Aquaculture is a major industry in Rizal which accounts for about 56% of the total area of Laguna Lake where *tilapia*, *bangus*, and big head carp are cultured or grown commercially in fish pens.

The rich culture and history of the region have also immensely contributed to the growth of the tourism industry in the region.[3]

Economy

The 2016 CountryStat Philippines for CALABARZON reports that the industry sector has turned in the largest contribution to the Gross Regional Domestic Product (GRDP) followed by the service sector and lastly by the agriculture, hunting, fishery and forestry (AHFF) sector. The region contributed 16.8% to the country's Gross Domestic Product (GDP).[2]

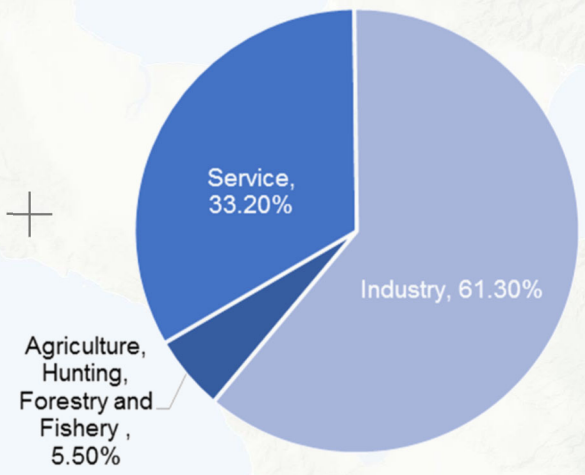

Figure 1: GRDP Contributions per Sector, 2016

Labor and Employment

CALABARZON maintains a high employment rate of 92%.[4] About 90.3% of its total workforce is in the service and industry sectors while only 9.74% works in the agriculture sector.

As of 2015, the region's Labor Force Participation Rate (LFPR) was recorded at 65%. The slow increase in the labor force can be attributed to the "mismatch" between the job market and prospective applicants' educational background, and to the lack of interest in finding gainful employment especially among children of overseas Filipino workers.[5]

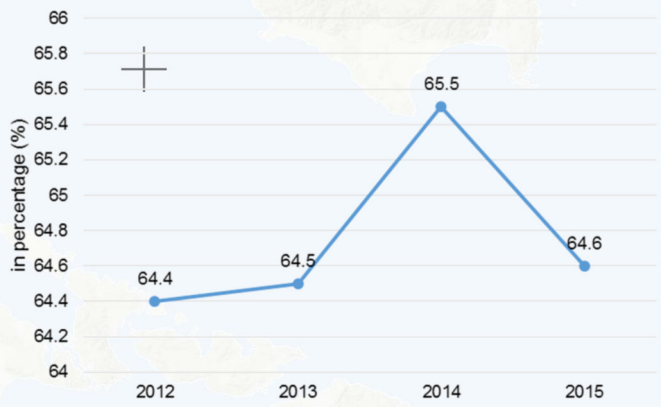

Figure 2: Labor Force Participation Rate

[1] Region IV-A Department of Environment and Natural Resources, Land Area and Classification by Province, 2005
[2] Philippine Statistics Authority, CountryStat Philippines, 2016
[3] Department of Trade and Industry, Regional Profile of CALABARZON, 2017
[4] National Economic and Development Authority Region IV-A, Regional Development Plan, 2017-2022
[5] Philippine Statistics Authority, CountryStat Philippines, 2016

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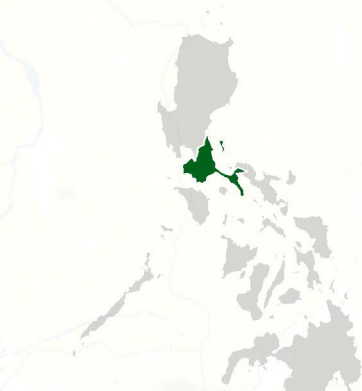
Legend

Population Density (person/ha)

- 0.0 - 1.2
- 1.2 - 2.5
- 2.5 - 4.2
- 4.2 - 7.2
- 7.2 - 11.5
- 11.5 - 19.0
- 19.0 - 35.2
- 35.2 - 73.7
- 73.7 - 178.4
- 178.4 - 3534.2



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Pila
Pagsanjan
Victoria
Magdalena
Luisiana
Sampaloc
Mauban
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QUEZON
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Rizal
Los Ba◆os
Calauan
Sampaloc Lake
San Pablo City
Tayabas City
Alaminos
Dolores
Pagbilao
Atimonan
Plaridel
Padre Burgos
Agdangan
Unisan
Gumaca
Lopez
Guinayangan
Pitogo
Macalelon
General Luna
Buenavista
Catanauan
San Narciso
Mulanay
San Andres
San Francisco
Lucena City
Sariaya
Tiaong
Candelaria
San Antonio
Lipa City
Padre Garcia
Rosario
Taysan
San Juan
Batangas City
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Silang
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Santa Rosa City
Cabuyao
General Mariano Alvarez
Carmona
Trece Martires City
Dasmari◆as
General Trias
Tanza
San Pedro
Bacoor
Imus
Kawit
Cavite City
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Tuy
Laurel
Lemery
Agoncillo
Taal lake
Mataas Na Kahoy
San Nicolas
Balayan
Calaca
Lian
Calatagan
Cuenca
BATANGAS
Alitagtag
San Jose
San Luis
San Pascual
Ibaan
Bauan

Population Density

PSA, 2015 Census

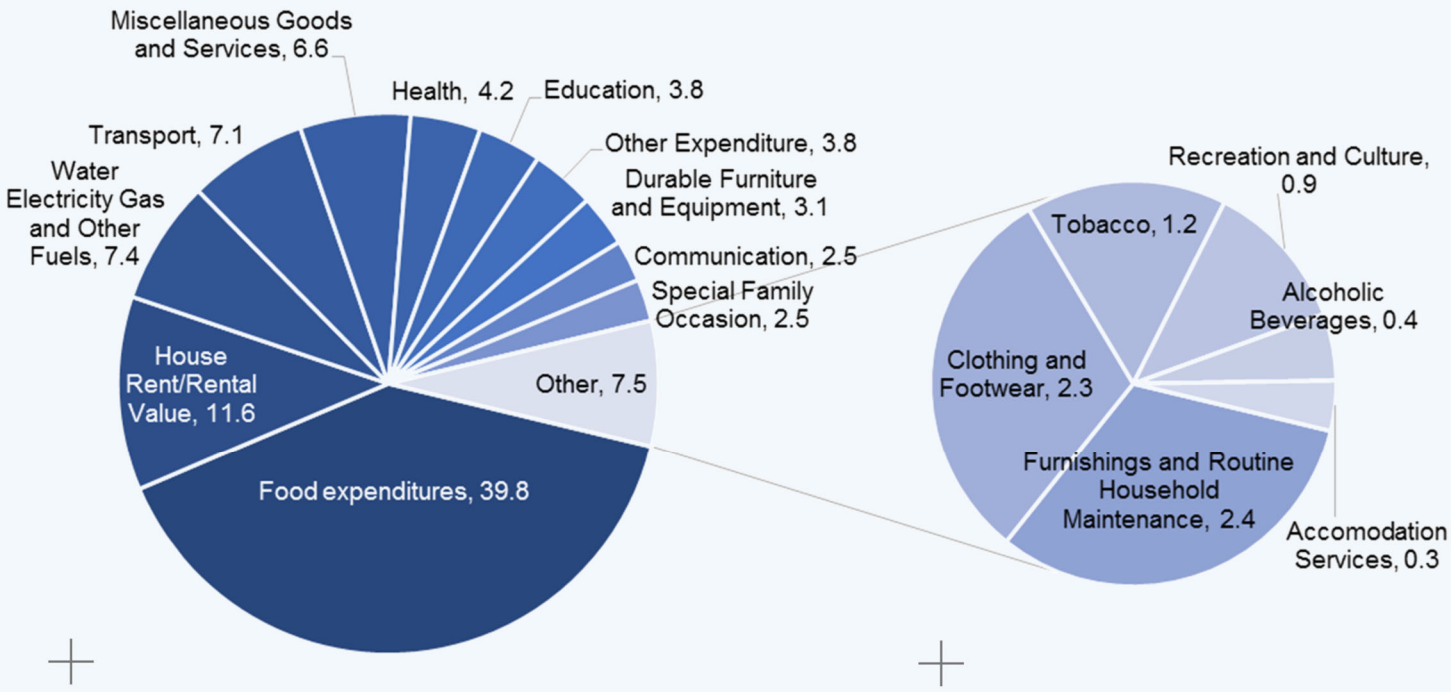

Figure 3: Distribution of Expenditure, 2015

Demography

The region had a population of 14,414,774 in the last census year (2015) accounting for 14% of the country's total population.

There was an annual average population increase of 2.58% from 2010 to 2015. Of the five provinces in the region, Cavite had the largest population with 3.67 million while Quezon had the smallest population at 1.85 million. Lucena City's population was estimated at 266,248. Table 1 shows the distribution of the population and density per province.

The population density of the region averaged 850 persons per km^2 in 2015. Among the five provinces, Rizal had the highest density at 2,400 persons per km^2, about ten times larger than that of Quezon. The map on the left shows that a large percentage of the population of CALABARZON is concentrated in the cities as well as along the coastal areas.

The region is predominantly urban; rural dwellers account for only 10% of its population. Household size in the region averaged at 4.23 persons. (see Table 2)

Family Income and Expenditure

There are about 3,251 families in CALABARZON, with an estimated total average annual income of PhP1,013,942 and a total average annual expenditure of PhP875,400. Across all the income classes in the region, all exhibited having average expenditure lower than the average income.

A family of five has the largest income-expenditure difference, while a single-person household has the least income-expenditure difference. This shows that the former has more savings compared to other family sizes.

With respect to the disbursement patterns of the families in the region and across income levels, the 2015 Family Income and Expenditure Survey (FIES) reveals that food expenditure registered the highest among the major expenditure groups at 39.8%. Expenditure for house rental/rental value followed at 11.6% and that for water, electricity, gas and other fuels at 7.40%.

Figure 3 graphs the expenditure distribution and shows that most families spend more for their basic needs.[6]

Table 1: Population per Province/HUC, 2015

Region/Province/City	Population	Land Area km^2	Population Density Persons/km^2
CALABARZON	**14,414,774**	**16,873.31**	**850**
Batangas	2,694,335	3,119.75	860
Cavite	3,678,301	1,574.17	2,300
Laguna	3,035,081	1,917.85	1,600
Quezon (excluding Lucena City)	1,856,582	8,989.39	210
Rizal	2,884,227	1,191.94	2,400
Lucena City	266,248	80.21	3,300

Table 2: Urban and Rural Population per Province/HUC, 2015[7]

Region/Province/City	Urban	Rural	HH Size
CALABARZON	**90%**	**10%**	**4.23**
Batangas	34%	66%	4.38
Cavite	63%	37%	4.17
Laguna	72%	28%	3.95
Quezon (excluding Lucena City)	20%	80%	4.35
Rizal	93%	7%	4.41
Lucena City	90%	10%	4.43

[6] Philippine Statistics Authority, Family Income and Expenditure Survey, 2015
[7] Philippine Statistics Authority, Philippine Standard Geographic Code, 2015

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Legend

- Type I - two pronounced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September.
- Type II - no dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Minimum monthly rainfall occurs during the period of March to May.
- Type III - no very pronounced maximum rain period with a dry season lasting only from one to three months, either during the period from March to May. This type resembles Type I since it has a short dry season.
- Type IV - rainfall is more or less evenly distributed throughout the year. This type resembles Type 2 since it has no dry season.

Climate

PAGASA, 2015 Data

Climate

According to the Modified Coronas Classification, CALABARZON has three types of climate namely, Type I, Type II and Type III. Type I has two pronounced seasons, i.e., dry from November to April, and wet the rest of the year. Type II has no dry season with a very pronounced maximum rain period from December to February. Type III has no very pronounced maximum rain period with a dry season lasting only from one to three months, that is, from March to May.

Disaster Risk

Because of the region's geographical location, it is highly susceptible to typhoon- and flood-related disasters. From 2010 to 2016, several typhoons struck the region, the strongest of which was Typhoon Glenda which made landfall in the Bicol Region, CALABARZON and Metro Manila in 2014.

That year, CALABARZON recorded the highest number of disasters, i.e., 50, and the greatest number of people affected (around 1,849,000). From 2015 to 2016, however, the total number of typhoon victims decreased — 55,000 in 2015 and 179,000 in 2016.[8]

According to the Policy Notes published by the Philippine Institute for Development Studies, the region has experienced an annual average of 5 typhoons. The number of typhoons that visited this region was greater than that which crossed other regions — a total of 39 typhoons hit CALABARZON from 2007 to 2010.

Because of its topography and geomorphology, the region is moderately to highly susceptible to landslides, debris flow, and rockslides along the foot slopes of mountainous areas. The geographic setting of the region tends to contribute to the increasing number and frequency of natural disasters in the area.

Climate Change and Hydrological Hazards

The Philippines is a country at greatest risk of climate-related hazards, such as tropical cyclones (TCs), floods, droughts and sea level rise. The effects of observed changes in extreme events and severe climate anomalies include: (a) an increased occurrence of extreme rains causing floods and landslides, (b) longer and more intense droughts which cause massive crop failures, water shortages and forest fires, and (c) increased occurrence of TCs.

Global climate models, which were used to run two possible scenarios (A1B and A2), were downscaled to calculate projected Philippine rainfall. All the studies show a general increase in rainfall for 2020, 2050 and beyond. However, the models show higher variability in rainfall with increased peak rainfall during the wet season and longer dry conditions during the dry season. (Rainfall variability means changes in water supply dynamics spatially and year-to-year.)

Water supply is extremely vulnerable to changes in river flows and the rate of replenishment of the groundwater resources. Lower river flows will result in water shortages. More intense rainfall events may not necessarily mean more groundwater recharge compared to rain that is more evenly spread throughout the year. Less than average rainfall or longer pronounced dry days may affect soil porosity and vegetation, which could lead to reduced soil infiltration rates. This means less groundwater recharge. Given this scenario, more water stress will likely be experienced by 2020 and 2050.

The projected seasonal temperature increase, seasonal rainfall change and frequency of extreme events (temperatures > 35°C, days when rainfall > 300 mm and number of dry days) in Region IV-A based on the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) downscaled climate projections are shown in Tables 3 and 4. Four seasons are provided: DJF for December, January and February, MAM for March, April and May, JJA for June, July and August and SON for September, October and November. The findings of the projections were added to the observed values in the past 30-year baseline (1971-2000).

Table 3: Seasonal Projections Under a Medium-Range Emission Scenario

Seasonal Temperature Increases (in °C)	Observed Baseline (1971 - 2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
Province	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Batangas	24.2	26.5	25.9	25.6	1	1.2	0.9	1	1.9	2.2	1.8	1.9
Cavite	25.7	28.2	27.3	26.9	1	1.2	0.9	1	2	2.2	1.8	1.9
Laguna	25	27.5	27.5	26.7	0.9	1.1	1	0.9	1.8	2.1	1.9	1.9
Quezon	25.1	27.2	27.6	26.7	0.9	1.1	1	0.9	1.8	2.1	2	1.8
Rizal	25.4	27.9	27.6	26.8	0.9	1.1	0.9	1	1.9	2.1	1.8	1.9
Seasonal Rainfall Change (in %)	Observed Baseline (1971 - 2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
Province	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Batangas	24.2	26.5	25.9	25.6	1	1.2	0.9	1	1.9	2.2	1.8	1.9
Cavite	25.7	28.2	27.3	26.9	1	1.2	0.9	1	2	2.2	1.8	1.9
Laguna	25	27.5	27.5	26.7	0.9	1.1	1	0.9	1.8	2.1	1.9	1.9
Quezon	25.1	27.2	27.6	26.7	0.9	1.1	1	0.9	1.8	2.1	2	1.8
Rizal	25.4	27.9	27.6	26.8	0.9	1.1	0.9	1	1.9	2.1	1.8	1.9

Table 4: Frequency of Extreme Events in 2020 and 2050 Under a Medium-Range Emission Scenario

Province	Station	No. of Days w/ T_{max} > 35°C			No. of Dry Days			No. of Days w/ Rainfall > 300 mm		
		OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
Batangas	Ambulong	928	8010	8016	8226	6081	6049	6	14	9
Cavite	Sangley	630	1697	2733	7352	6635	6565	6	9	9
Quezon	Alabat	52	132	733	6629	7025	7042	20	58	70
	Tayabas	22	791	1434	771	4717	4668	17	9	12
	Casiguran	575	1720	2768	6893	4520	4887	23	54	57
	Infanta	350	378	1112	5903	4006	4015	22	39	34

[8] *Office of Civil Defense, National Disaster Risk Reduction Management Council*

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WGS 1984 - UTM Zone 51 N

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RIZAL

CAVITE

LAGUNA

QUEZON

BATANGAS

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Contour Map

NAMRIA

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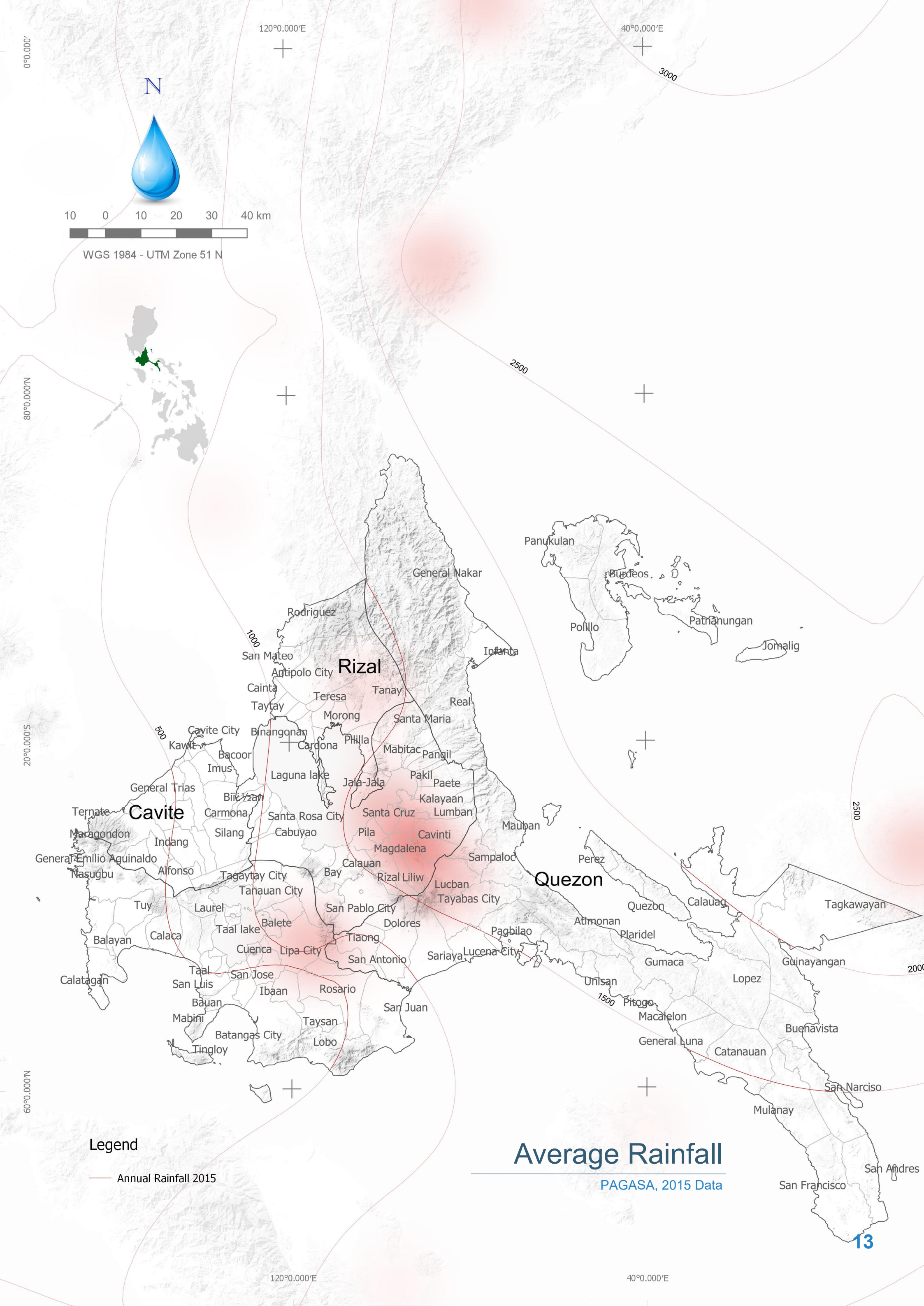
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Morong
Santa Maria
Binangonan
Cavite City
Kawit
Cardona
Pililla
Mabitac
Pangil
Bacoor
Imus
Laguna lake
Jala-Jala
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General Trias
Biñan
Ternate
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Balayan
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Lipa City
Sariaya
Lucena City
San Antonio
Gumaca
Guinayangan
Taal
San Jose
Unisan
Lopez
Calatagan
San Luis
Ibaan
Rosario
Bauan
Pitogo
San Juan
Macalelon
Mabini
Taysan
Buenavista
Batangas City
Lobo
General Luna
Tingloy
Catanauan
San Narciso
Mulanay
San Andres
San Francisco
Legend
Annual Rainfall 2015
Average Rainfall
PAGASA, 2015 Data
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WGS 1984 - UTM Zone 51 N

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Legend

Safe Drinking Water (%)

- 1-77
- 78-89
- 90-95
- 96-98
- 98-100

General Nakar
Rodriguez
San Mateo
Antipolo City
RIZAL
Cainta
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Mataas Na Kahoy
Agoncillo
Tuy
Lian
Calaca
Balayan
Lemery
Lipa City
Tiaong
Candelaria
Dolores
San Antonio
Sariaya
Lucena City
Tayabas City
Pagbilao
Atimonan
Plaridel
Padre Burgos
Agdangan
Unisan
Gumaca
Lopez
Pitogo
Macalelon
General Luna
Quezon
Calauag
Guinayangan
Tagkawayan
Buenavista
Catanauan
San Narciso
Mulanay
San Andres
San Francisco
QUEZON
Cuenca
BATANGAS
Alitagtag
San Jose
Padre Garcia
Calatagan
San Luis
San Pascual
Ibaan
Rosario
Bauan
Taysan
San Juan
Mabini
Batangas City
Lobo
Tingloy

60°0.000′N

Access to Safe Drinking Water

PSA, 2015 Census

120°0.000′E

40°0.000′E

WSS Sector Status

Access to Safe Water

About 92% of CALABARZON had access to classified water sources in 2015.[9]

This figure is equivalent to around 2,998 households (HHs) out of the total 3,251 HHs. About 60.84% of households have Level III service connection in their own homes while 10.24% utilize Level II connections which are shared with the community. Access to Level I service comprises 28.92%.

Safe sources of water under this category include tubed and/or piped deep/shallow wells (which users themselves own or share with the community), and protected springs, rivers, streams, etc.

The region's access to safe water is higher than the national average of about 4.51%. In terms of access per level of service, CALABARZON's numbers do not differ significantly from the national figures — there is a difference of only around 10%-15%.

Table 5: National and Regional Access to Water Supply[10]

Level of Service	National	CALABARZON
Level III	44.1%	60.84%
Level II	11.2%	10.24%
Level I (Safe Sources)	32.4%	21.13%
Subtotal (Safe Sources)	*87.7%*	*92.21%*
Level I (Unsafe Sources)	12.3%	7.79%
Total	100.0%	100%

Figure 4 shows the percentage distribution of the region's various water sources.

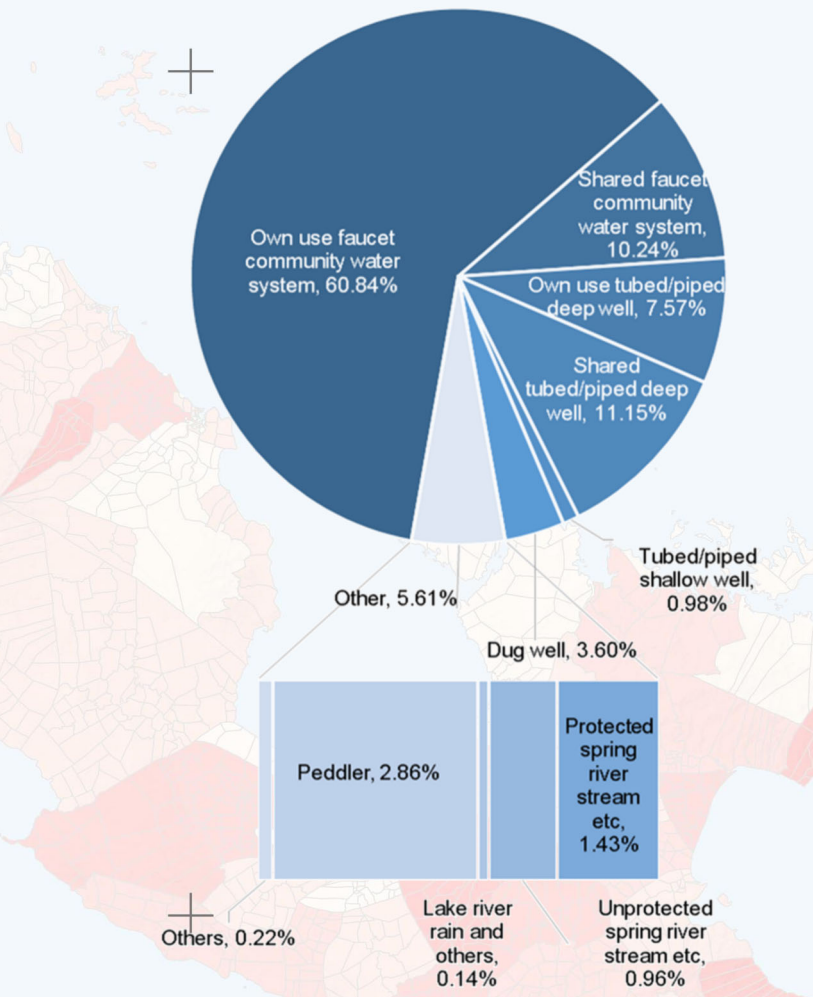


Figure 4: Main Sources of Water Supply, 2015

Table 6 shows safe water access in 2015 at the provincial level.

Table 6: Access to Water Supply per Province/HUC[11]

Region/Province/City	Access to Safe Water Supply
CALABARZON	**88.5%**
Batangas	92.0%
Cavite	74.9%
Laguna	90.9%
Quezon	95.0%
Rizal	94.8%
Lucena City	100.0%

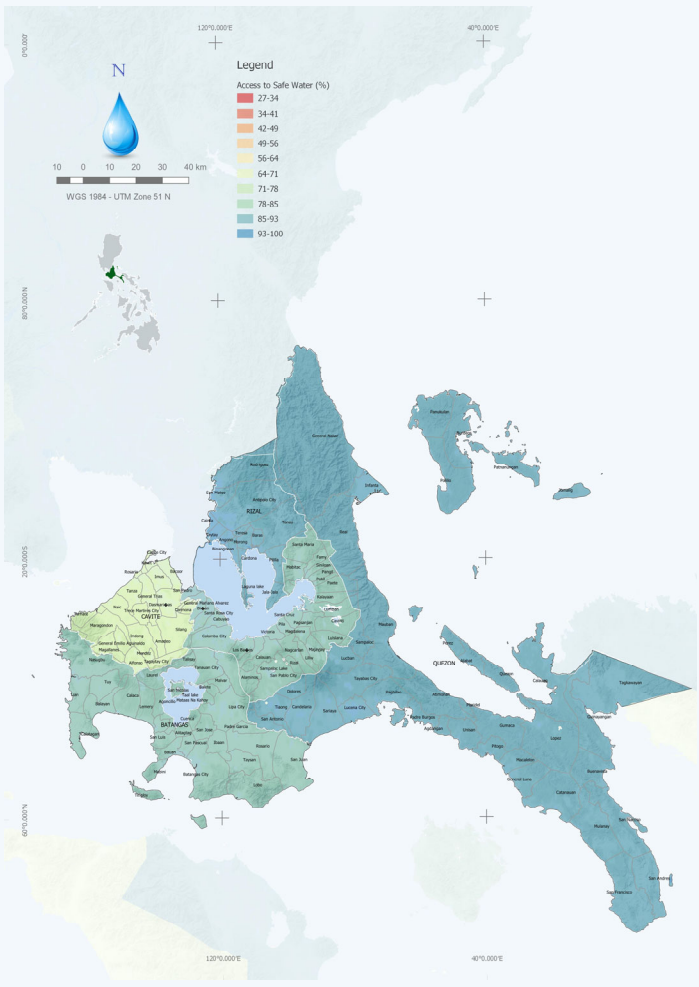


Figure 5: Provincial Access to Safe Water

Drinking Water

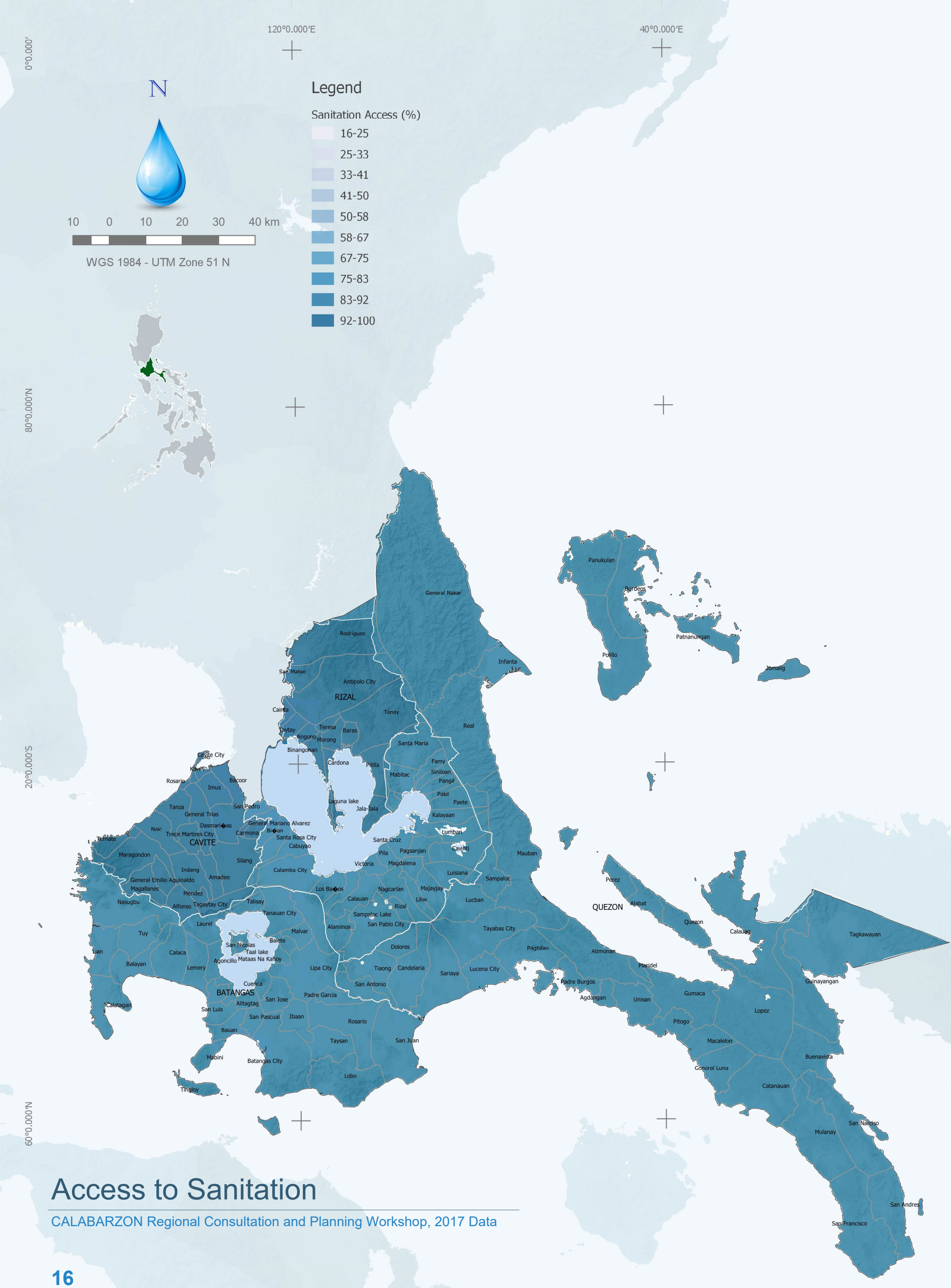
In terms of access to safe drinking water, the Philippine Statistics Authority (PSA) has released data up to the municipal level based on the latest 2015 Census. The classification of sources for drinking water is the same as that for sources of safe water with the addition of bottled water.

As of 2015, 95% of the population of Region IV-A has access to drinking water from improved and safe water sources. Of the region's total population, 36% drinks bottled water.

About 60% of Cavite's population drinks bottled water — the highest among CALABARZON's provinces followed by Laguna at 47%. Quezon registered comparatively lower access to safe drinking water at around 84%.

The map on the left shows the extent of access to safe drinking water at the municipal level

[9] Philippine Statistics Authority, Family Income and Expenditure Survey, 2015
[10] Ibid.
[11] Based on CALABARZON provinces' first-hand data on access to safe water (gathered during the regional consultation and planning workshop)



Access to Sanitation

CALABARZON Regional Consultation and Planning Workshop, 2017 Data

Access to Sanitation

CALABARZON has become a rapidly growing region owing to the continued growth of its industry and services sector. This has greatly contributed to the increase in demand for sanitation services.

About 88% of the region's population has access to improved sanitation.

PSA's 2015 FIES has reported that in terms of improved sanitation, CALABARZON had wider access as compared to the national average but had a more limited access to basic sanitation when compared to the national percentage. The regional percentage with regard to open defecation was lower than the national percentage (open defecation being a proxy indicator for the absence of toilet facilities).

Table 7: National and Regional Access to Sanitation[12]

Sanitation Coverage	National	CALABARZON
Improved Sanitation	73.77%	88.03%
Basic Sanitation	19.96%	9.20%
Unimproved Sanitation	2.04%	0.38%
Open Defecation	4.23%	2.39%
Total	100.0%	100.0%

Table 8: Access to Sanitation Facilities per Province/HUC[13]

Region/Province	HHs with Sanitary Toilets	HHs with Complete Basic Sanitation Facilities
CALABARZON	**93.36%**	**81.72%**
Batangas	89.31%	65.45%
Cavite	94.26%	89.05%
Laguna	88.27%	80.84%
Quezon	84.50%	55.89%
Rizal	135.76%	116.86%
Lucena City	78.07%	77.42%

The minor discrepancy between Tables 6 and 7 with respect to totals and averages highlights the difficulty of reconciling the definition of sanitation coverage under the Millennium Development Goals (MDG) and a more stratified and specific access definition under the Sustainable Development Goals (SDG). Table 7 reflects data per the new definitions prescribed by the SDG. Table 8, on the other hand, reflects data under the MDG, where the percentage of households with complete basic sanitation facilities is a subset of the percentage of households with sanitary toilets.

Categorization of the facilities as per SDG definitions is as follows:

Improved Sanitation	▪ Water-sealed sewer septic tank (exclusive use)
Basic Sanitation	▪ Water-sealed sewer septic tank (shared) ▪ Water-sealed other depository (exclusive use) ▪ Water-sealed other depository (shared) ▪ Closed Pit
Unimproved Sanitation	▪ Open Pit
Open Defecation	▪ Other Means ▪ None

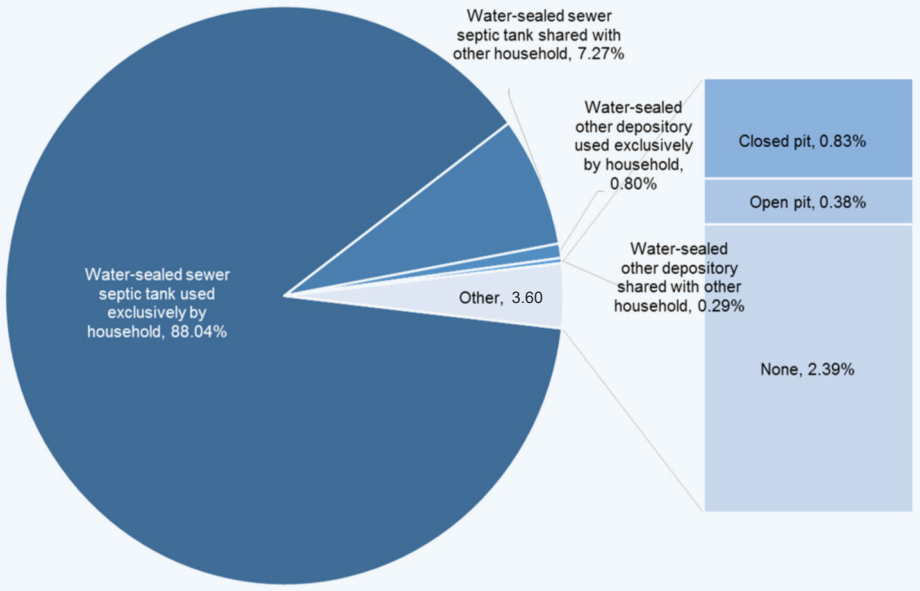


Figure 6: Percentage of Households with Access to Sanitation Facilities

Figure 6 shows the percentage per type of sanitation facilities CALABARZON households have access to. Sanitation facilities (as shown in said figure) represent the initial stages of the sanitation ladder in the region.

While one of the main objectives of the Philippine Development Plan (PDP) is to achieve universal access to sustainable sanitation by 2030, SDG 6.2 highlights the need to broaden the definition of sanitation access, that is, to include safely managed and improved sanitation through the treatment of wastewater or fecal sludge on-site or off-site.

Data on access to sanitation at the provincial level in CALABARZON were gathered during the regional consultation and planning workshop. The map on the left shows the extent of access to sanitation of the provinces in the region.

Figure 7, on the other hand, shows the few existing septage treatment plants in the region. One is located at Bai, Laguna. It was constructed by EnviroKonsult in partnership with the local governments of Laguna. This initiative demonstrates that the soft components of a sanitation project are as important as its hard infrastructure components. It showcases a modular technology, where the vital mechanical parts can be relocated.

Another septage treatment plant is expected to operate in Lipa City, Batangas.

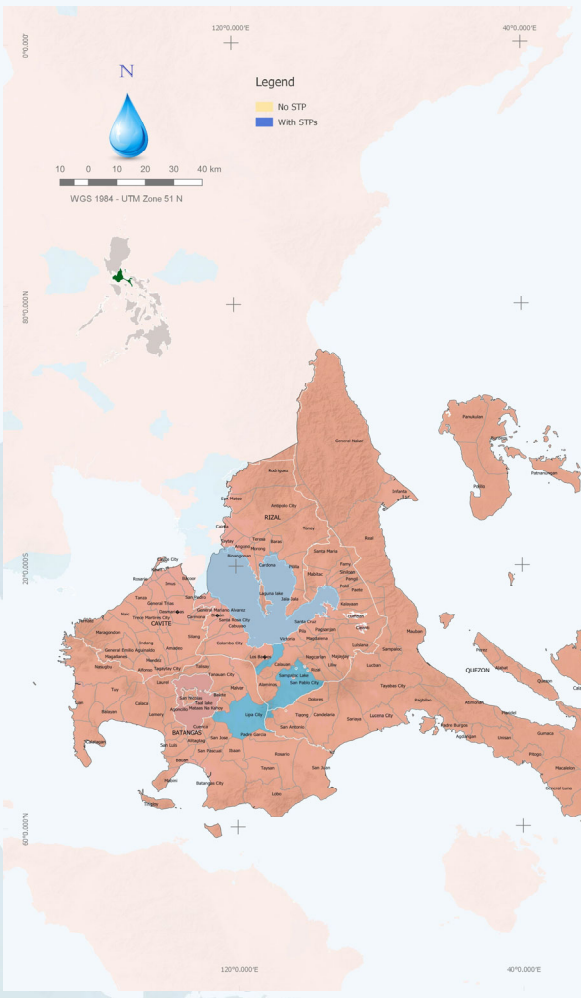


Figure 7: Existing Septage Treatment Plants[14]

[12] Philippine Statistics Authority, Family Income and Expenditure Survey, 2015
[13] Department of Health, FHSIS Annual Report CY 2015
[14] Based on CALABARZON provinces' first-hand data on access to safe water (gathered during the regional consultation and planning workshop)

120°0.000'E

40°0.000'E

0°0.000'

Cagayan Watershed

N

Legend

Water Bodies

Major River Basin

Agno River Basin

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

80°0.000'N

Pampanga River Basin

Bataan Watershed

20°0.000'S

Pasig-Marikina River Basin

60°0.000'N

CALABARZON Rivers and Tributaries

DENR, NWRB, NAMRIA

120°0.000'E

40°0.000'E

Water Resources

CALABARZON ranks 2nd among all administrative regions with the least water resources potential.

The region's water resources potential totals 2,611 million cubic meters (MCM)/year, taking up only about 1.8% of the country's total.

The water resources potential of an area is divided into groundwater and surface water. Groundwater potential is estimated at 473 MCM/year while surface water potential is estimated at 2,138 MCM/year. Annual rainfall in the region averages 1,700 mm/year.

These figures are based on the estimation of the potential of the country's water resources regions (WRR) (see National Databook). The WRRs do not necessarily coincide with the boundaries of the administrative regions. These hydrological boundaries are defined by their physiographic features and homogeneity in climate.

WRR 4 straddles two administrative regions — CALABARZON and MIMAROPA.

Surface Water

Two major river basins are found in CALABARZON namely, Pampanga River Basin and Pasig-Marikina-Laguna River Basin. Tables 9 and 10 show a description and the scope of each river basin.

Table 9: Pampanga River Basin Characteristics

Pampanga River Basin[16]	
Area	10,434 km^2
River Classification	Class A/C
Scope	
Pangasinan	Region I
Nueva Vizcaya	Region II
Nueva Ecija	Region III
Tarlac	Region III
Pampanga	Region III
Bulacan	Region III
Aurora	Region III
Zambales	Region III
Bataan	Region III
Rizal	Region IV-A
Quezon	Region IV-A
Uses	Domestic, Municipal, Agricultural, Aquaculture, Livestock, Energy, Industrial, Recreation and Others

Table 10: Pasig-Marikina-Laguna River Basin Characteristics

Pasig-Marikina-Laguna River Basin[17]	
Area	4522.7 km²
Watershed	3651.5 km²
Lake	871.2 km²
River Classification	Class A/C
Scope	
National Capital Region	NCR
Bulacan	Region III
Rizal	Region IV-A
Laguna	Region IV-A
Cavite	Region IV-A
Uses	Domestic, Municipal, Agricultural, Aquaculture, Livestock, Energy, Industrial, Recreation and Flood Control

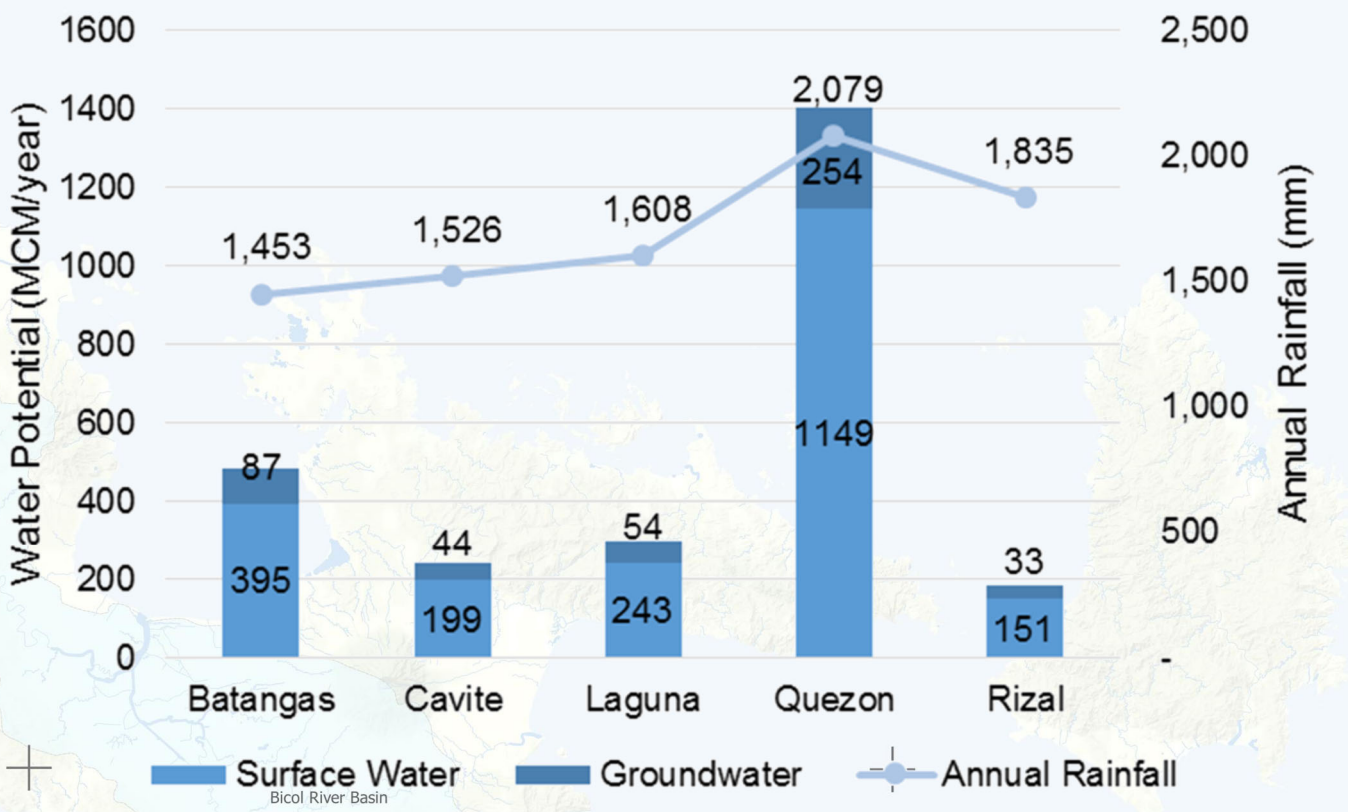


Figure 8: Water Resources Potential and Annual Rainfall[15]

[15] *JICA Master Plan on Water Resources Management in the Philippines, 1998; NWRB; PAGASA Rainfall Data; FAO*
[16] *River Basin Control Office, Pampanga River Basin Master Plan, 2011*
[17] *UNESCO-IHP, Catalogue of Rivers for Southeast Asia and the Pacific—Volume V, 2004, Accessed from http://hywr.kuciv.kyoto-u.ac.jp/ihp/riverCatalogue/Vol_05*

120°0.000'E

40°0.000'E

0°0.000'

80°0.000'N

20°0.000'S

60°0.000'N

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Legend

- Extensive and Highly Productive Aquifers
- Fairly Extensive and Productive Aquifers
- Fairly Extensive and Productive, Aquifers with High Potential Recharge
- Fairly to Less Extensive and Productive Aquifers with Low to Moderate, Potential Recharge
- Local and Less Productive Aquifers
- Rocks with Limited Potential, Low to Moderate Permeability
- Rocks with Limited Potential, Low to Moderated Permeability
- Rocks without Any Known Significant, Groundwater Obtainable through Drilled Wells
- Lake

Groundwater Availability Map

MGB

20

Groundwater

Groundwater conditions are controlled by geology, topography, and the structure of the groundwater basin. The structure of the groundwater basin consists of distribution and hydrogeological conditions such as the aquifer structure and aquicludes, the physical characteristics of the formations as per transmissibility and storage coefficient and chemical characteristics of groundwater. These factors need be defined in relation to the possible development depth and overall development potential.

In addition, the extent of groundwater availability in any given area also depends on its surface area and the amount of precipitation it receives. Furthermore, it is also tied to groundwater storage which is estimated based on the type and class of aquifer present in a study area (see Table 11).

Table 11: Aquifer Classes Based on MGB Aquifer Types

Aquifer Class	MGB Aquifer Type	Estimated Yields (Boreholes Unless Stated)
Major Aquifer (Highly permeable)	Intergranular: extensive and highly productive	Mostly 50-100 lps
	Fractured: fairly extensive and productive (aquifers with high potential recharge)	3-50 lps, spring yields up to 1000 lps
Minor Aquifer (Variably permeable)	Intergranular: fairly extensive and productive	About 20 lps
	Intergranular: local and less productive	Mostly 2-20 lps
	Fractured: less extensive and productive	Well yields up to 3 lps
Non-aquifer (Negligibly permeable)	Rocks with limited groundwater potential	Yields mostly less than 1 lps
	Rocks without any significant known groundwater	Yields mostly less than 1 lps

CALABARZON is predominantly underlain by the minor aquifer class (specifically local and less productive aquifers). Quezon's western part and the region's other provinces are underlain by non-aquifer areas that have limited groundwater potential.

Water Use

As of 2017, water use in the region based on awarded water permits amounted to about 29,529 MCM annually. A large volume thereof — about 19,343 MCM (or 66%) — was allocated for power generation and nonconsumptive use. The remaining 10,186 MCM was reserved for consumptive use (see Figure 9).

The industrial sector consumes the greatest volume of water among all the sectors with 37% allocation. The domestic sector consumes 30.8% while the irrigation sector consumes only 24.8%.

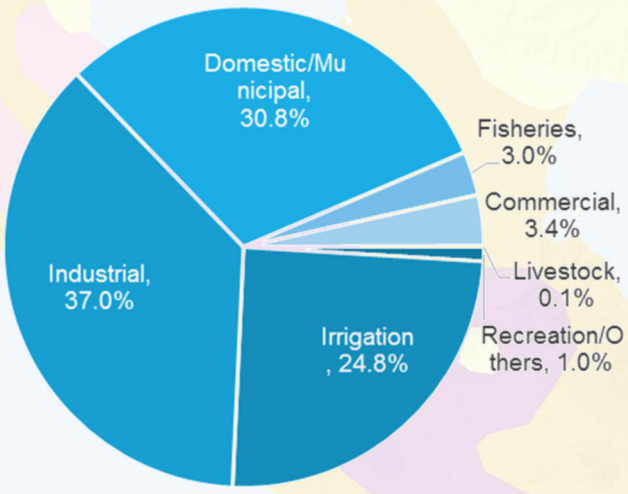


Figure 9: Consumptive Water Use, 2017[19]

Water Availability, Water Stress, and Water Scarcity

Hydrologists typically assess scarcity by looking at the population-water equation. An area is experiencing water stress when annual water supplies drop below 1,700 m^3 per person. When annual water supplies drop below 1,000 m^3 per person, the population faces water scarcity, and below 500 m^3 'absolute scarcity.' (UN Water, n.d.)[18]

Water availability per capita is computed by comparing the region and provinces' water potential against the 2015 population (see Table 12).

CALABARZON has a per capita water availability of around 214 m^3/year — a figure way below said threshold. According to the standards given, Region IV-A is already experiencing absolute water scarcity.

Table 12: Water Availability per Province

Province/ Region	Water Availability (m^3/capita/yr), 2015
Batangas	179
Cavite	66
Laguna	98
Quezon	661
Rizal	64
CALABARZON	**214**

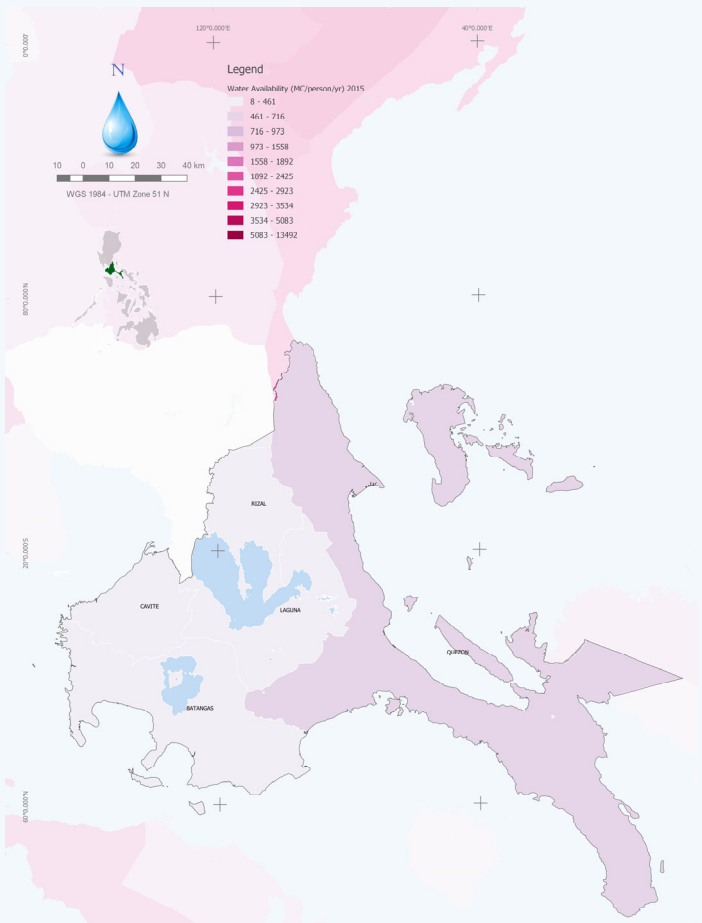


Figure 10: Water Availability Map, 2015

[18] *Managing Water Report under Uncertainty and Risk, UN World Water Development Report 4 (Volume 1)*
[19] *National Water Resources Board's List of Water Permit Grantees, 2017*

Demand

Population Projection

Population projection is important in estimating the future water and sanitation demand of a study area. It is a study of a recorded pattern of past population growth that seeks to establish future trends.

Employing PSA's 2010-based population projections which were adjusted to conform with the actual 2015 population, the future population of the region and its provinces has been projected. By 2045, CALABARZON's population would have grown to 23,323,049.

Water Supply and Demand

Water demand projection is fundamental to water supply feasibility studies and preliminary engineering design. It also serves as an important tool in the preparation of master plans, considering the future needs of a growing population. In general, total water demand is equal to the sum of the domestic, commercial, industrial, institutional, and unaccounted-for water.

In projecting water demand, the unit consumption used was 120 liters per capita per day (lpcd) for an urban population, and 60 lpcd for a rural population. In the National Capital Region (NCR) and other HUCs, 150 lpcd and 80 lpcd were used for urban and rural populations, respectively.

Computation for water demand at the household level, in particular, was primarily based on the degree of urbanization of a barangay.

Water demand projections were conducted based on the estimated projected population. By 2022, 2030, and 2040, the total water demand of the region is projected to reach 868 MCM/year, 1,033 MCM/year, and 1,212 MCM/year, respectively.

Water Demand vs. Water Resources Potential

The water demand of the industrial, business and domestic sectors in the region is expected to significantly increase in the near future. The efficient use and management of available water resources, therefore, must be ensured to promote universal access to stable and steady water supply.

Comparing the projected water demand (1,212 MCM/year) to the water resources potential of the region (2,611 MCM/year), it has been observed that the water potential far exceeds the region's projected water demand up to 2045. However, the fact that the region is experiencing water scarcity concludes that the utilization of the region's water resources is not being maximized.

It must also be noted that the projected water demand for the region does not include that of its agricultural sector, which consumes the largest volume of water among all industry sectors. What appears to be abundant may be less once the agriculture sector uses its "share". It is estimated that agriculture takes up about 75% to 80% of the total consumptive use of water in the country.

Proper water management is imperative to control possible demand shifts. Approaches to water resources management may include utilization and proper use of existing water resources.

To enable the region to reach its full groundwater and surface water potential, however, the issue of mining activities in the region (adversely affecting its water resources and watersheds) and the impact of climate change have to be immediately addressed. This initiative is expected to ensure sustainable sources of water supply for domestic and industrial use.

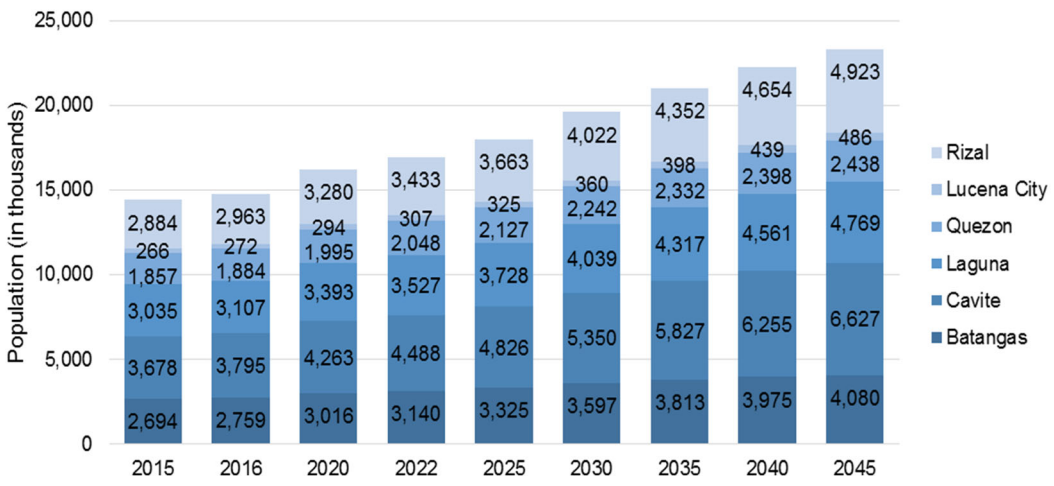


Figure 11: Projected Population

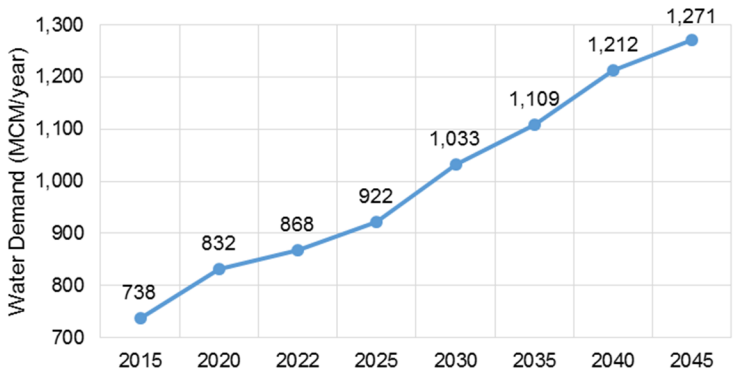
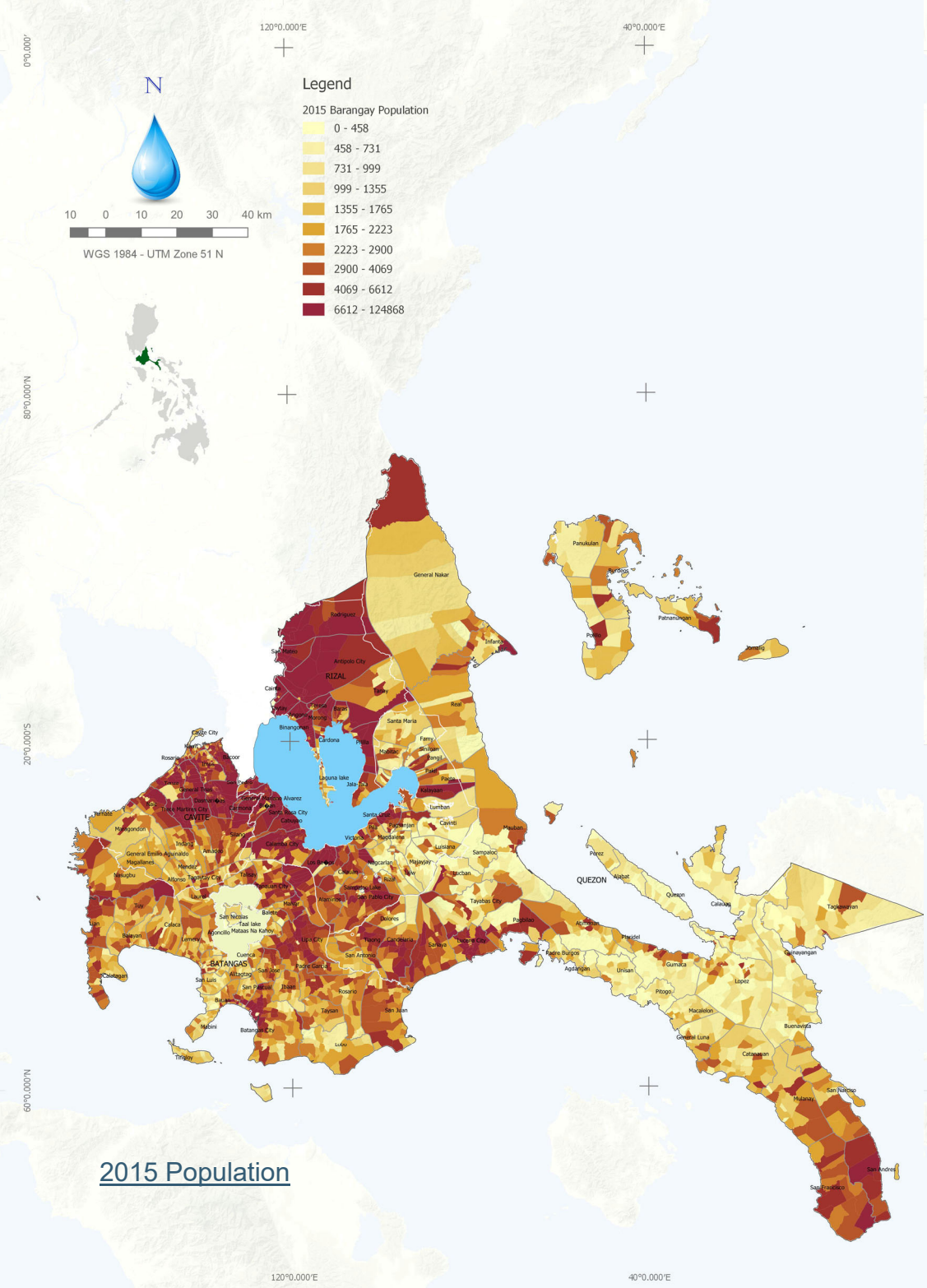
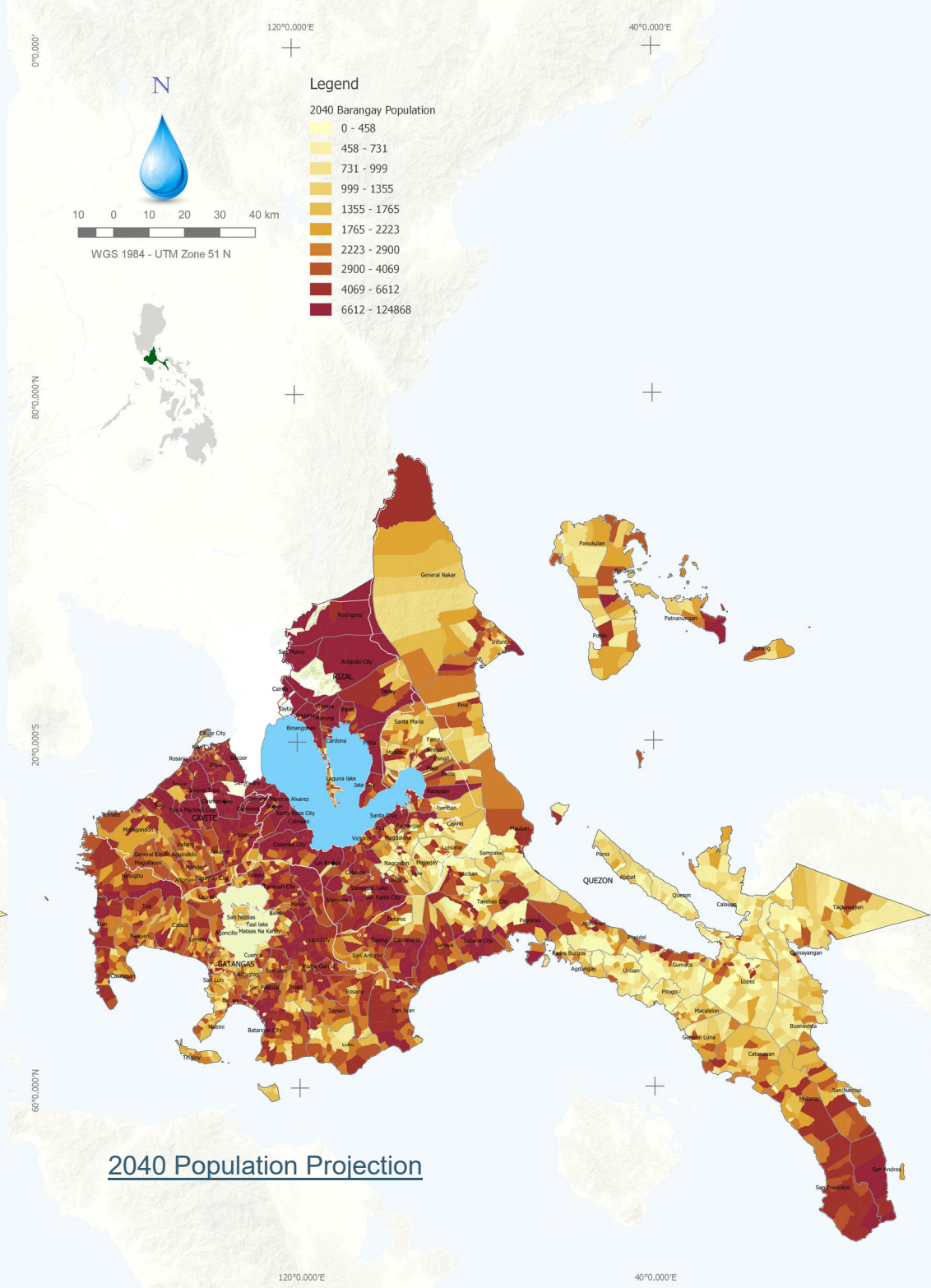


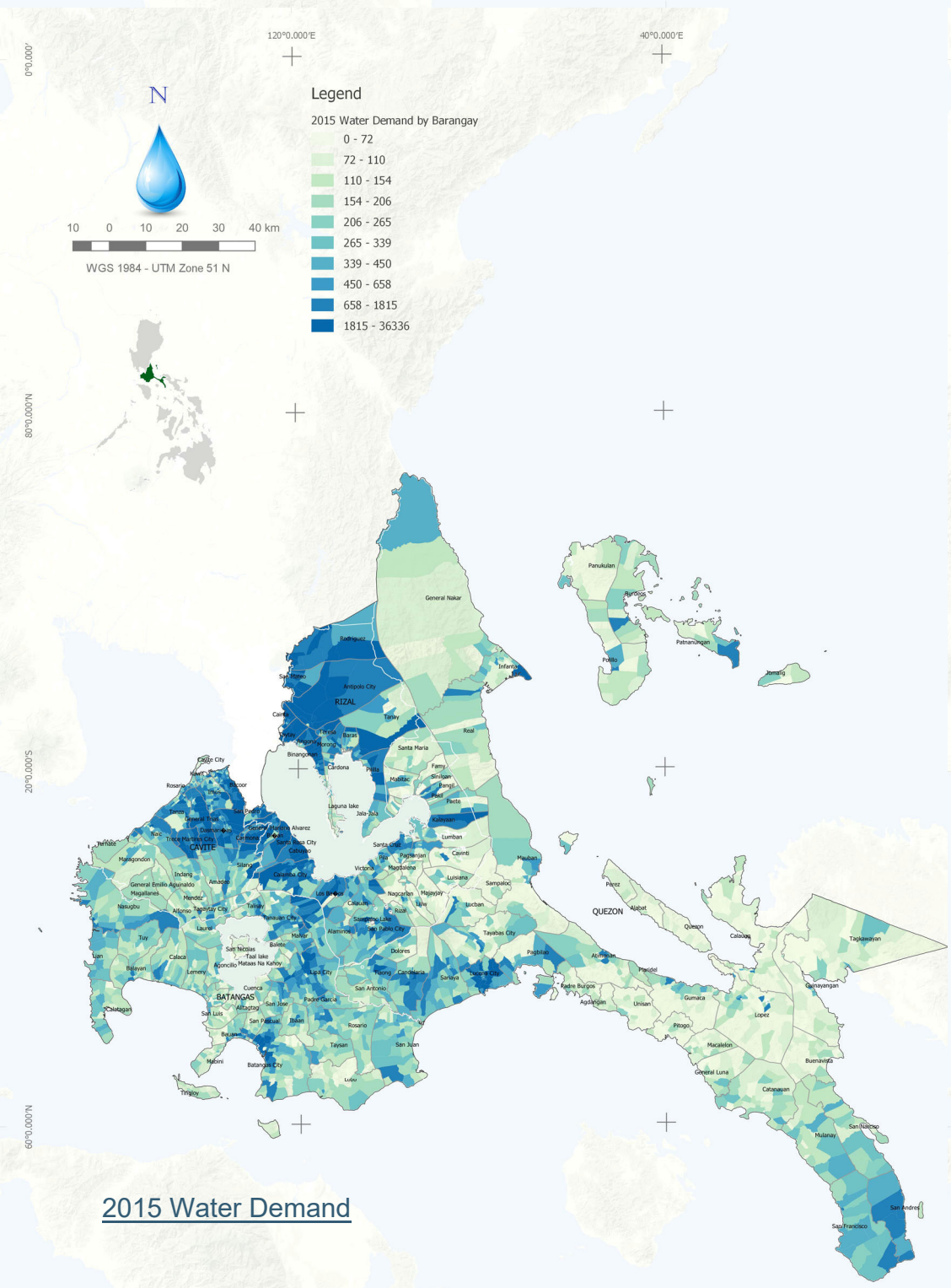
Figure 12: Projected Water Demand



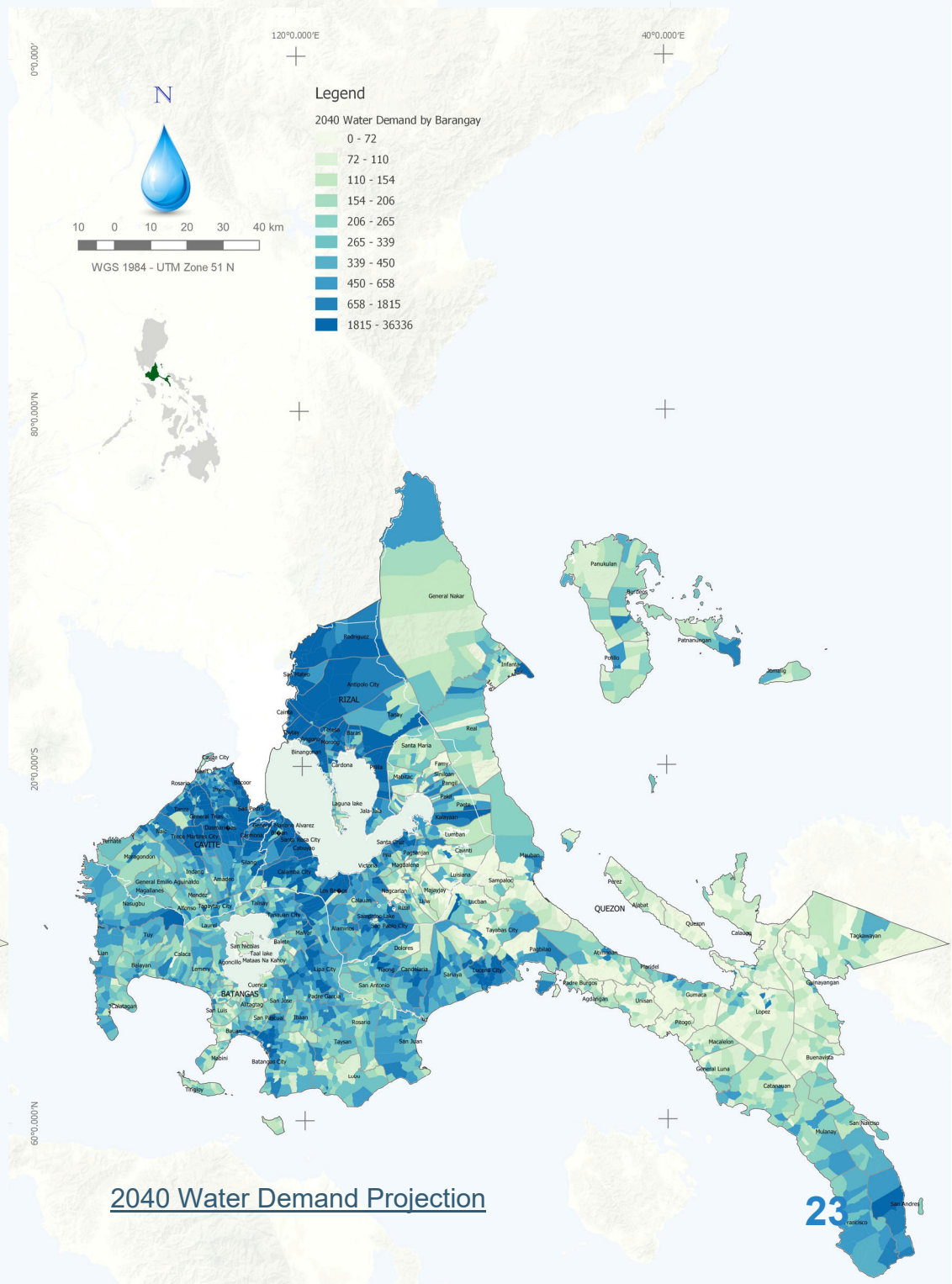
2015 Population



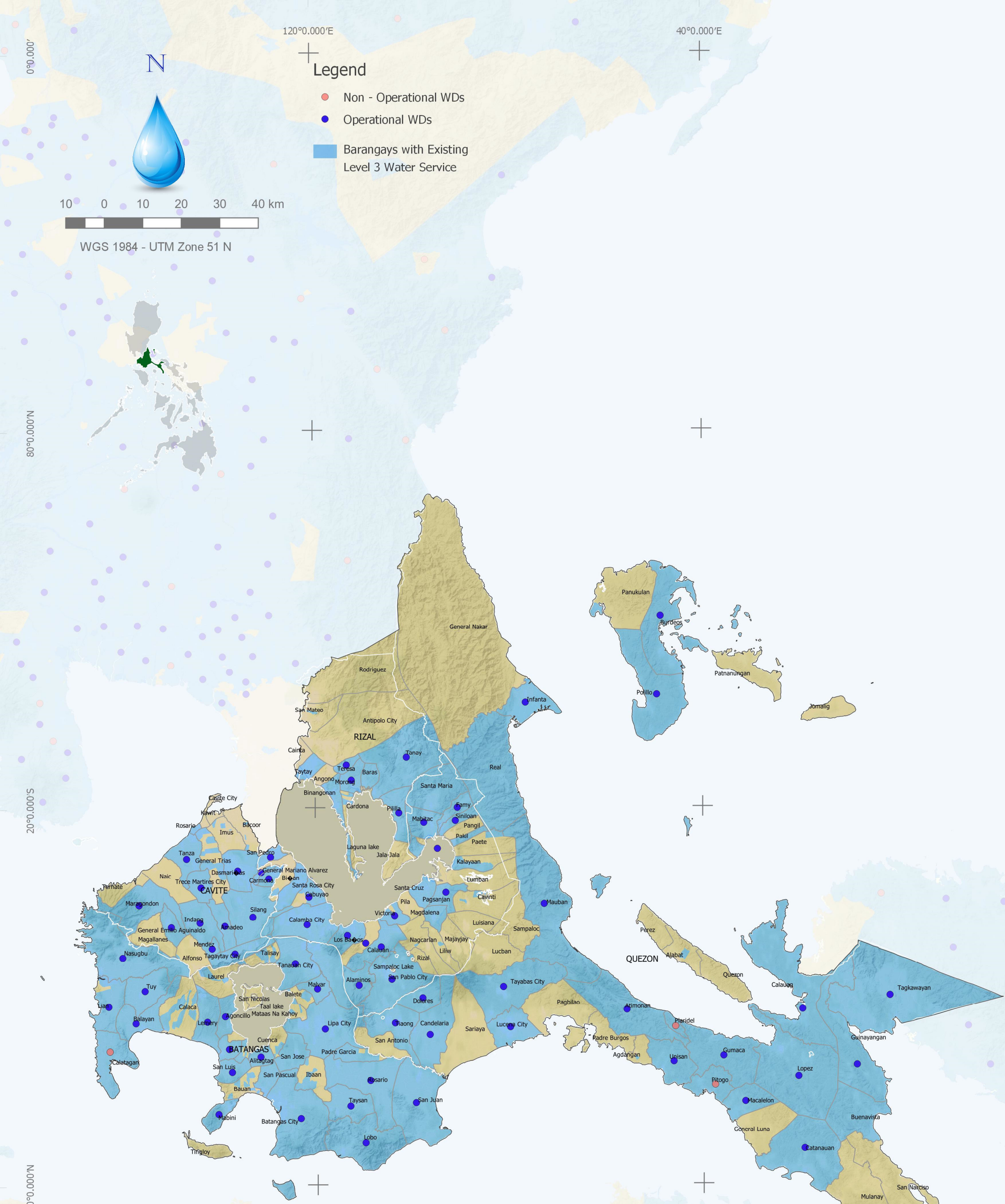
2040 Population Projection



2015 Water Demand



2040 Water Demand Projection



Water Districts and Areas Covered by Level III Service

LWUA, PAWD, NWRB Listahang Tubig, 2017 Data

WSS Infrastructure

Water service providers (WSPs) of various management types serve around 39% of the CALABARZON[20].

These management types depend on the service areas (urban and rural), the number of potential water connections, and the level of service given.

For small urban towns and rural areas, community-based organizations (CBOs) – which include rural waterworks and sanitation associations (RWSA), barangay water and sanitation associations (BWSA), and water cooperatives – operate supply systems offering services at Level II (and in some cases, Level I). As the area grows and becomes more urbanized or more densely populated, water service providers mostly comprise water districts (WDs) and LGU-run utilities providing Level III service.

Areas that do not have access to any formal level of service rely on point sources, such as shallow and deep wells.

Water Supply Service Providers

The percentage of the population having access to or being served by these WSPs does not conform with the percentage in PSA's FIES 2015 mainly because the former came from various sources[21], with the bulk of the data coming from Listahang Tubig of the National Water Resources Board (NWRB).

Although such information gives an insight into the state of the region's water utilities, it cannot be ascertained if all WSPs in the region have already registered under Listahang Tubig or are continually updating their operations data.

Water Districts

As of 2015, there are 69 WDs serving Region IV-A, 61 of which are operational and 8 are nonoperational. About 48% (or 6.9 million) of its total population is covered. Of this percentage, only 59% (4.1 million) of the population has access to water supplied by the WDs.

Cavite has the highest coverage at 80% while Quezon has the lowest coverage with only 45%.

LGU-Led Water Utilities

There are 169 LGU-led water utilities within the region covering 43 areas and serving 334,191 users or 2% of the total population.

BWSA

There are 543 BWSA utilities within the region serving 44 areas and about 2% of its total population. Quezon has 330 BWSA utilities — the highest number of water service providers. Batangas has the highest number of service users — about 90,915.

RWSA

There are 137 RWSA utilities within the region serving 154,335 people or about 1% of its total population. Batangas has the highest number of RWSAs and users of this water service.

The map on the left shows the location of operational and nonoperational WDs in the region as well as barangays provided with Level III water service by various WSPs (except WDs).

Table 13: Water Service Providers per Province

Province/Region	No. of LGUs	Type and No. of WSPs		Service Area	Population Served	
					Total	%
Rizal	14	WDs	4	298,515	145,744	49%
		LGU-led	0		-	0%
		BWSA	0		-	0%
		RWSA	0		-	0%
		Private/Others	22		123,070	4%
		Subtotal	**26**	**2,884,227**	**268,814**	**9%**
Cavite	23	WDs	12	1,807,603	1,453,350	80%
		LGU-led	13		20,680	1%
		BWSA	8		1,895	0%
		RWSA	6		6,250	0%
		Private/Others	121		317,085	9%
		Subtotal	**160**	**3,678,301**	**1,799,260**	**49%**
Laguna	30	WDs	14	1,813,923	1,031,726	57%
		LGU-led	18		136,186	4%
		BWSA	118		75,485	2%
		RWSA	3		11,250	0%
		Private/Others	62		182,525	6%
		Subtotal	**215**	**3,035,081**	**1,437,172**	**47%**
Batangas	34	WDs	19	1,753,904	923,836	53%
		LGU-led	56		84,015	3%
		BWSA	87		90,915	3%
		RWSA	99		122,910	5%
		Private/Others	148		120,929	4%
		Subtotal	**409**	**2,694,335**	**1,342,605**	**50%**
Quezon	41	WDs	20	1,254,329	560,939	45%
		LGU-led	82		93,310	4%
		BWSA	330		60,675	3%
		RWSA	29		13,925	1%
		Private/Others	97		54,285	3%
		Subtotal	**558**	**2,122,830**	**783,134**	**37%**
CALABARZON	142	WDs	69	6,928,274	4,115,595	59%
		LGU-led	169		334,191	2%
		BWSA	543		228,970	2%
		RWSA	137		154,335	1%
		Private/Others	450		797,894	6%
		Grand Total	**1,368**	**14,414,774**	**5,630,985**	**39%**

[20] Based on registered WSPs in Listahang Tubig (as of 2017)
[21] LWUA, PAWD, NWRB Listahang Tubig

120°0.000'E

40°0.000'E

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

80°0.000'N

20°0.000'S

60°0.000'N

Rizal

Cavite

Quezon

Laguna lake

Taal lake

Legend

% Open Defecation

0.000 - 0.073

0.073 - 0.146

0.146 - 0.220

0.220 - 0.293

0.293 - 0.366

0.366 - 0.439

0.439 - 0.512

0.512 - 0.586

0.586 - 0.659

0.659 - 0.732

Open Defecation

PSA, 2015 Data

Sanitation

Sanitation is the provision of facilities and services for the safe management and disposal of human waste. Without sanitation, water quality degrades, health is compromised and the environment is adversely affected.

This section discusses the link between growing water demand and its detrimental effects on water quality and public health.

Open Defecation

As defined by the Joint Monitoring Program (JMP) for Water Supply, Sanitation and Hygiene of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), open defecation is the practice by which people go out into the fields, bushes, forests, open bodies of water, or other open spaces rather than use the toilet to defecate. This can pollute the environment and cause a host of health problems.

Region IV-A's open defecation rate of 2.39% is half that of the national average. In 2015, about 344,513 people in the region were reported practicing open defecation because many areas are waterless and have no access to sanitation facilities.

The map on the left shows the areas in the region where open defecation is most prevalent.

Wastewater and Domestic Biological Oxygen Demand

A measure of the organic strength of wastes in water is biological oxygen demand (BOD), which is the rate at which organisms use the oxygen in water or wastewater while stabilizing decomposable organic matter under aerobic conditions. The greater the BOD, the greater the degree of organic pollution.

The map below shows the BOD in CALABARZON in 2015.

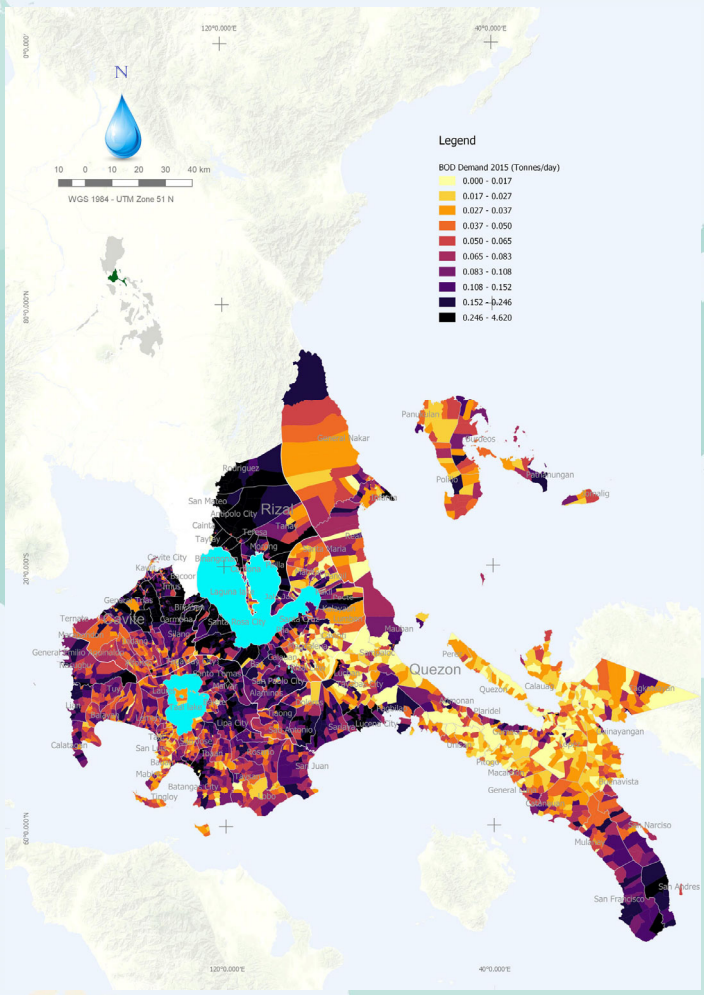


Figure 13: Biological Oxygen Demand, 2015

The industrial and agricultural wastewater generation may be estimated using the guidelines provided by the WHO Rapid Assessment of Sources of Air, Water, and Land Pollution. Estimations, however, heavily depend on sectoral data not currently available to the Consulting Team.

Industrial wastewater generated is computed by industry type and depends on the present and future annual volume of production output per type. Agricultural wastewater generation and BOD estimation, on the other hand, are based on the present and future annual number of heads of livestock and poultry produced.

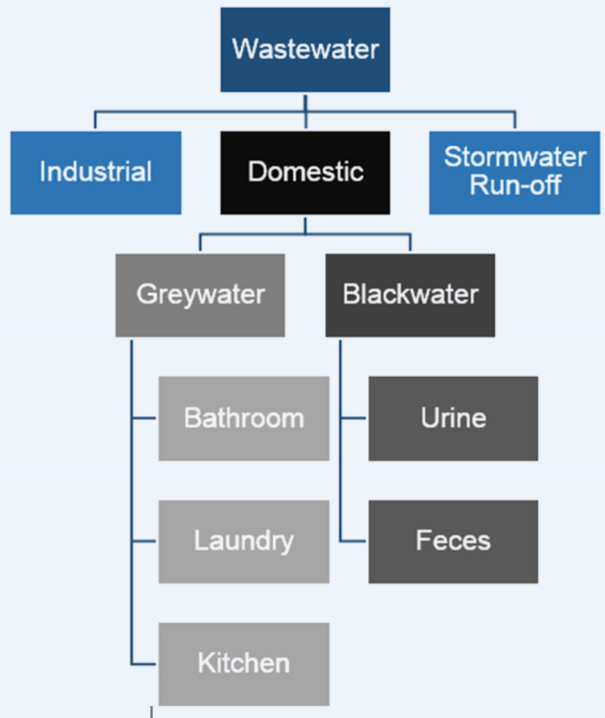


Figure 14: Categories of Wastewater

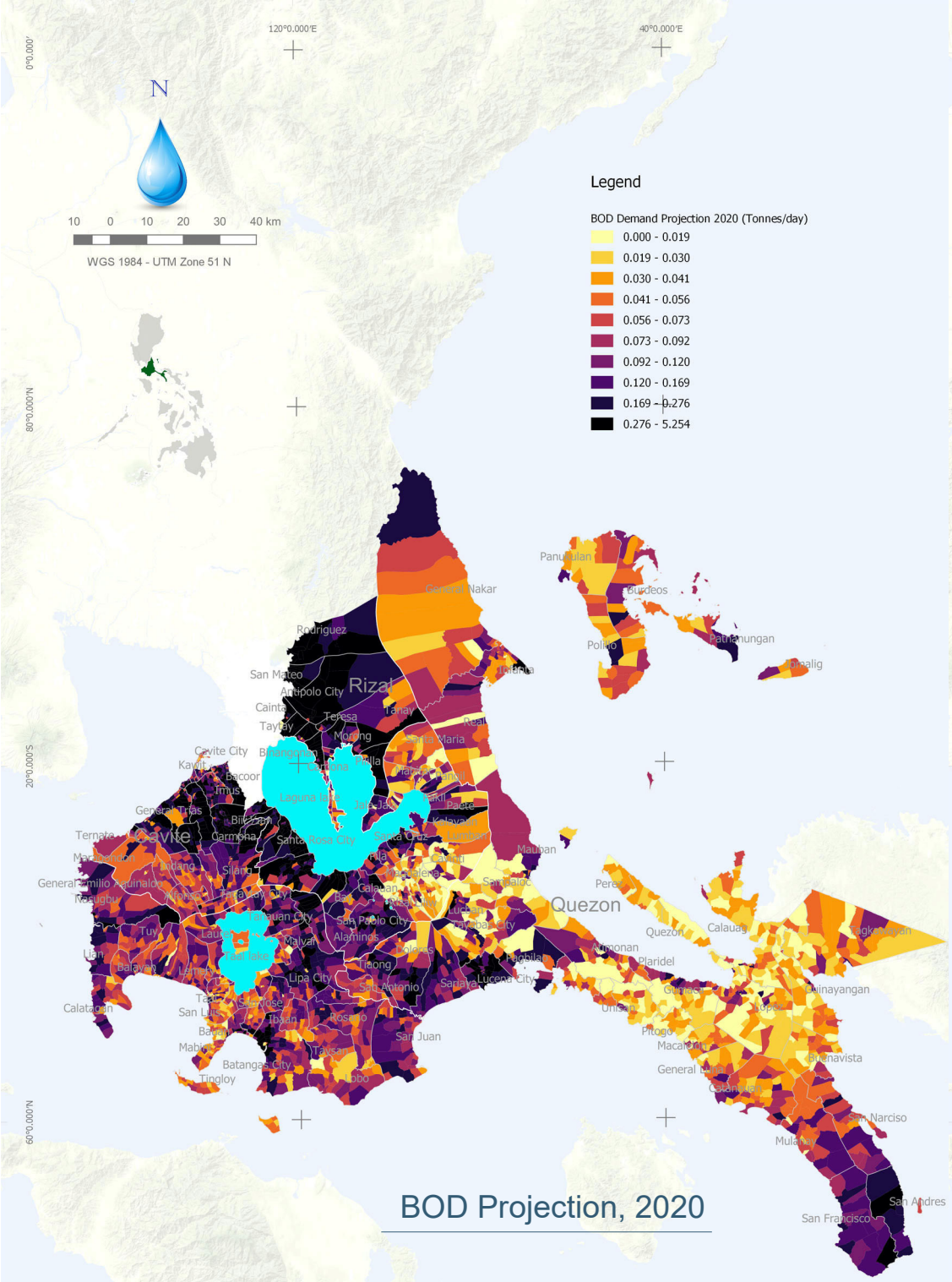
In the absence of other data, only domestic BOD can be estimated. A BOD factor of 37 grams per person per day (unit pollution load) is assumed; for highly urbanized areas, 53 grams[22] per person per day is used.

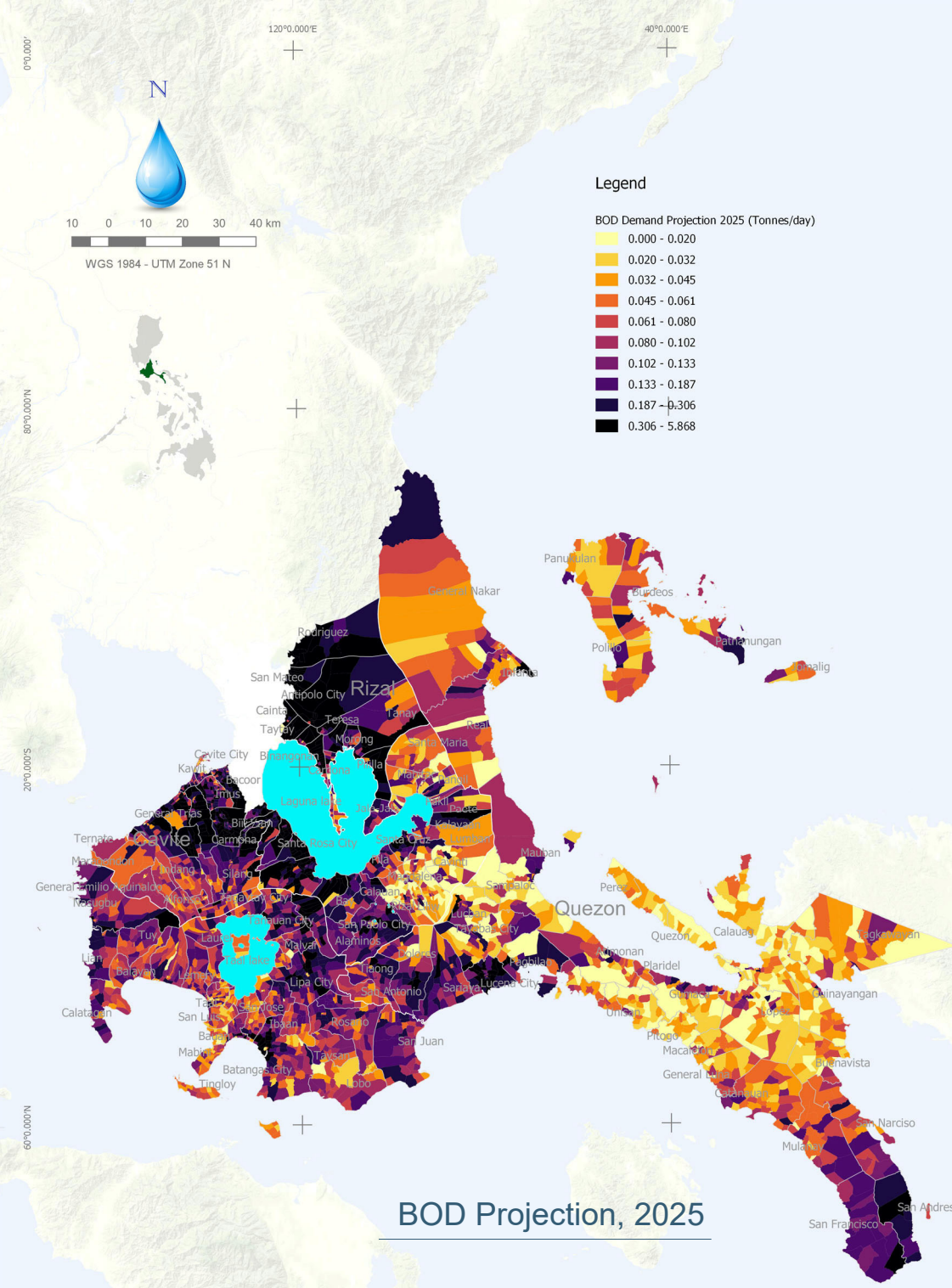
The wastewater[23] produced by each province is directly proportional to its water demand as well as its population. It is assumed that wastewater generated is 80% of the total water demand. The wastewater produced in the region in 2015 is shown in Figure 15.

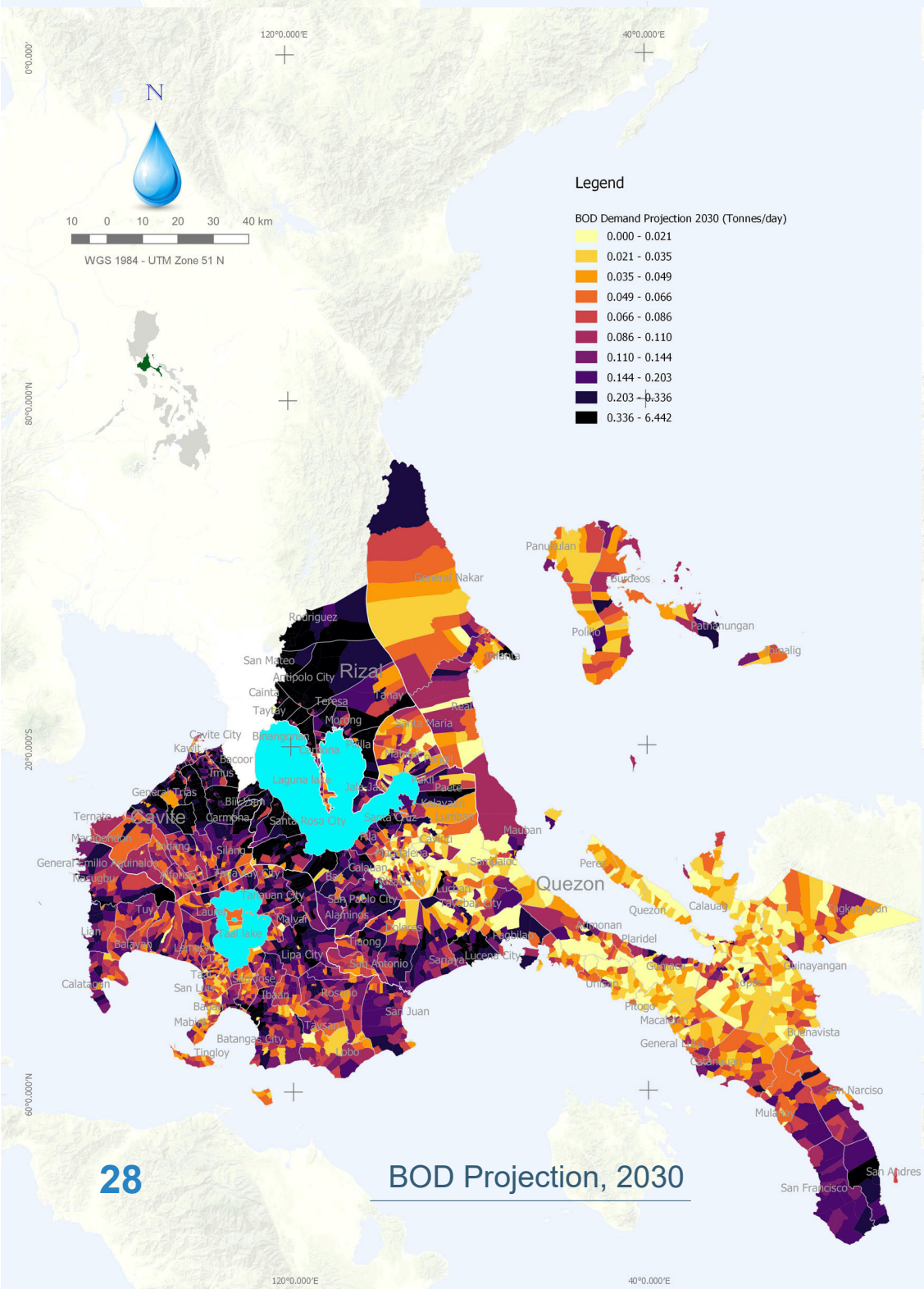
BOD and wastewater projections until 2040 are shown in the succeeding pages.

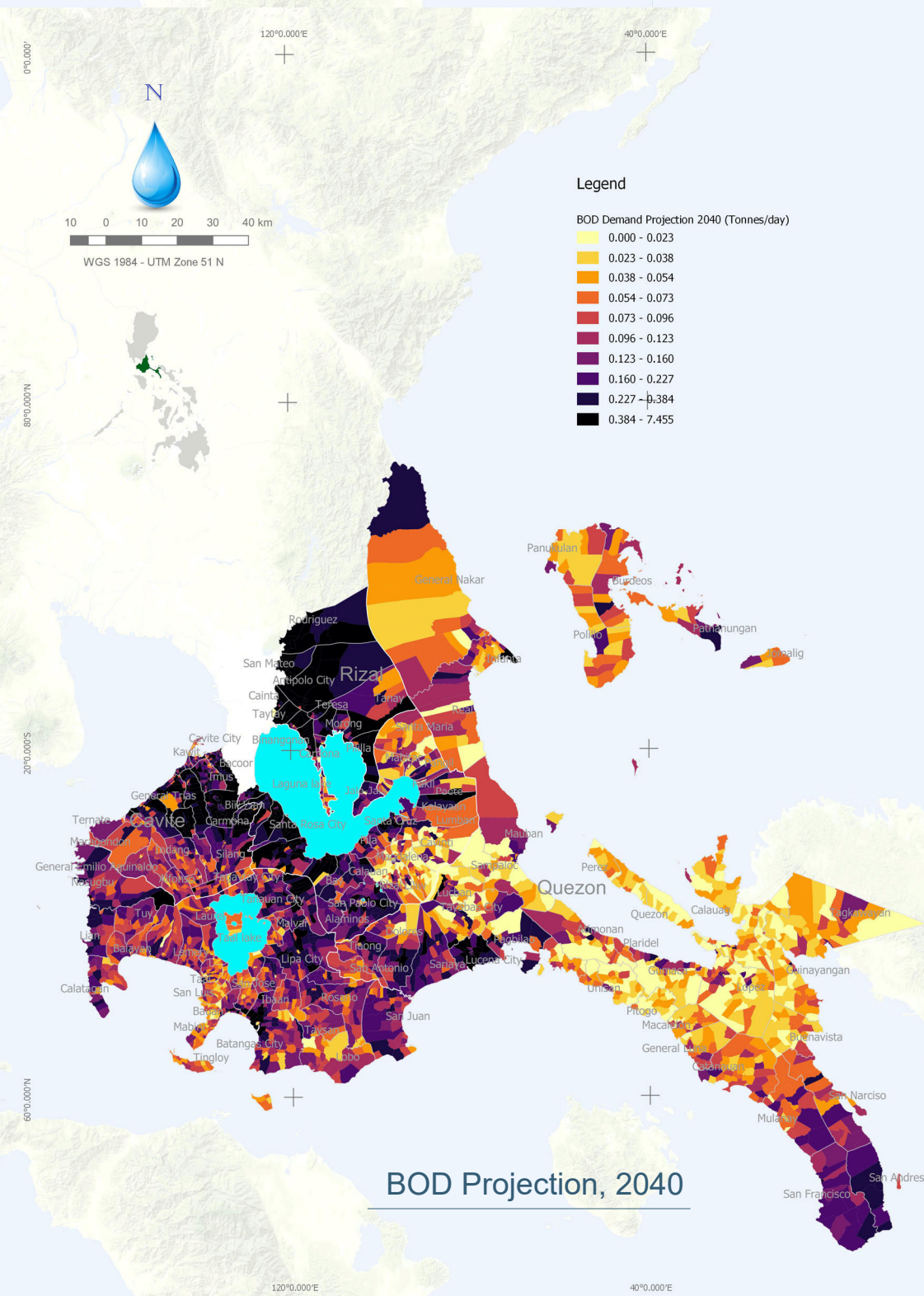
Figure 15: Wastewater Produced, 2015

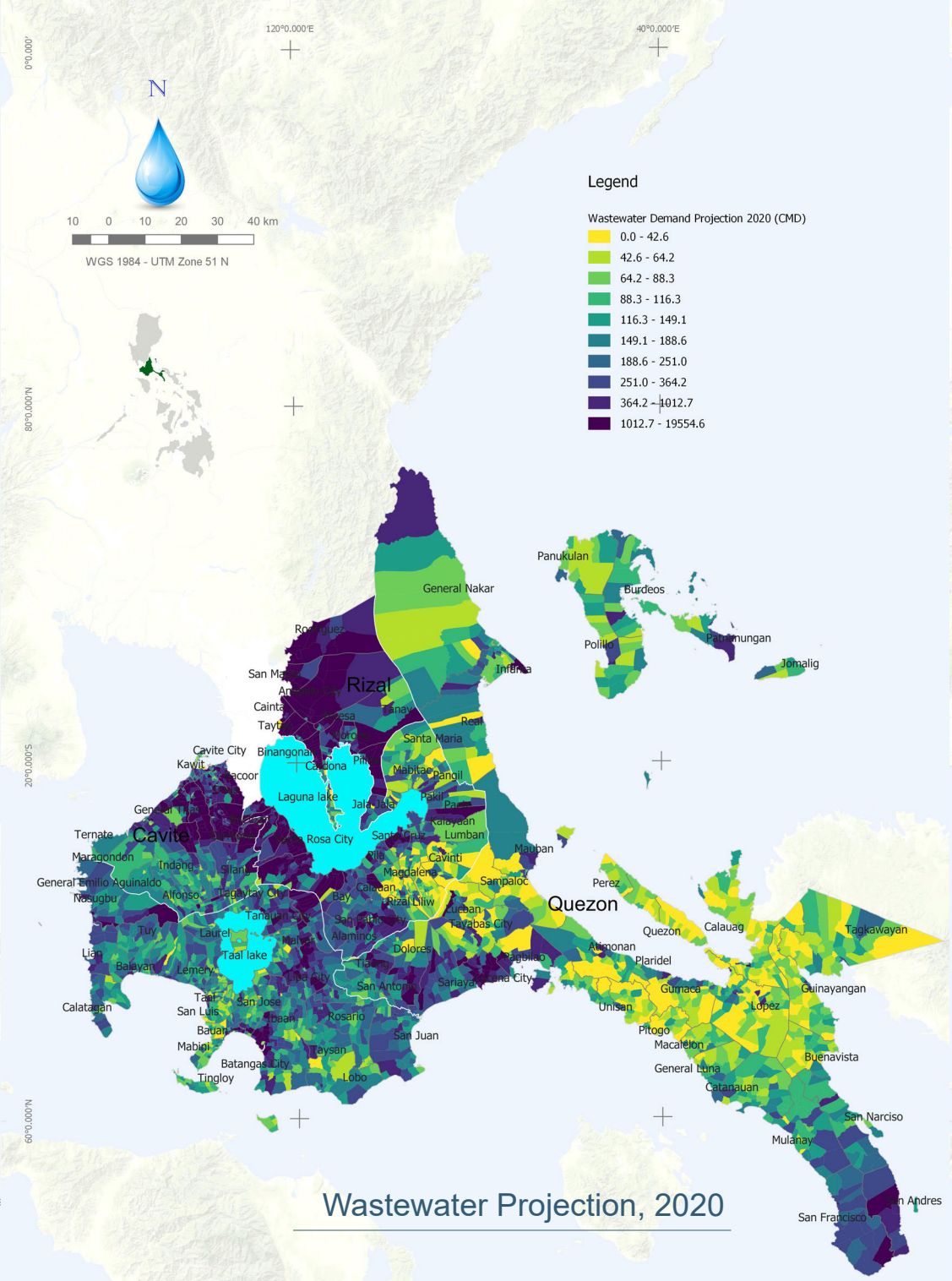
[22] *Philippine Environment Monitor (PEM), 2003*
[23] *Ibid.*

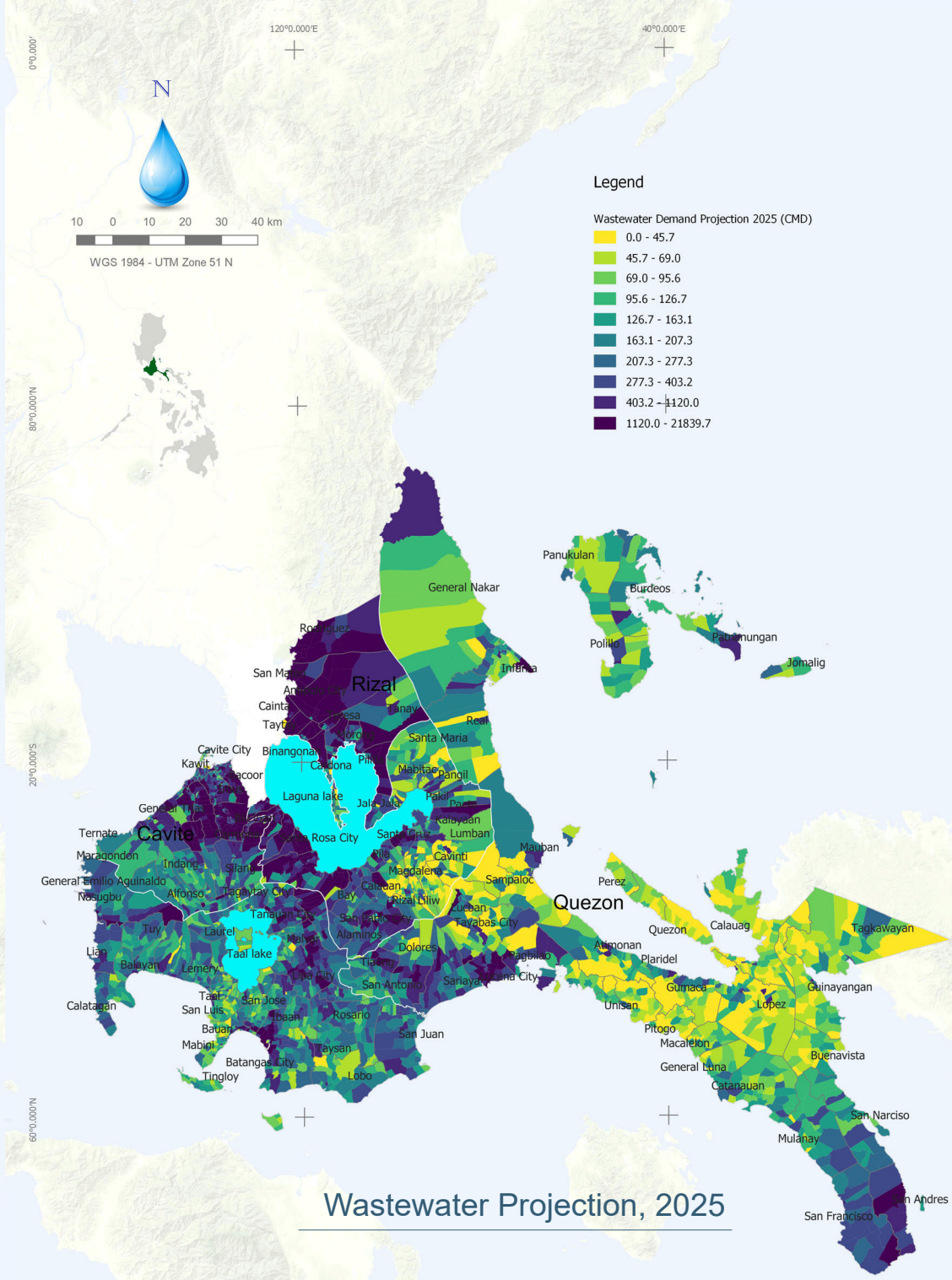

N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2020 (Tonnes/day)
0.000 - 0.019
0.019 - 0.030
0.030 - 0.041
0.041 - 0.056
0.056 - 0.073
0.073 - 0.092
0.092 - 0.120
0.120 - 0.169
0.169 - 0.276
0.276 - 5.254
Rizal
Quezon
Cavite
Laguna
Batangas
BOD Projection, 2020

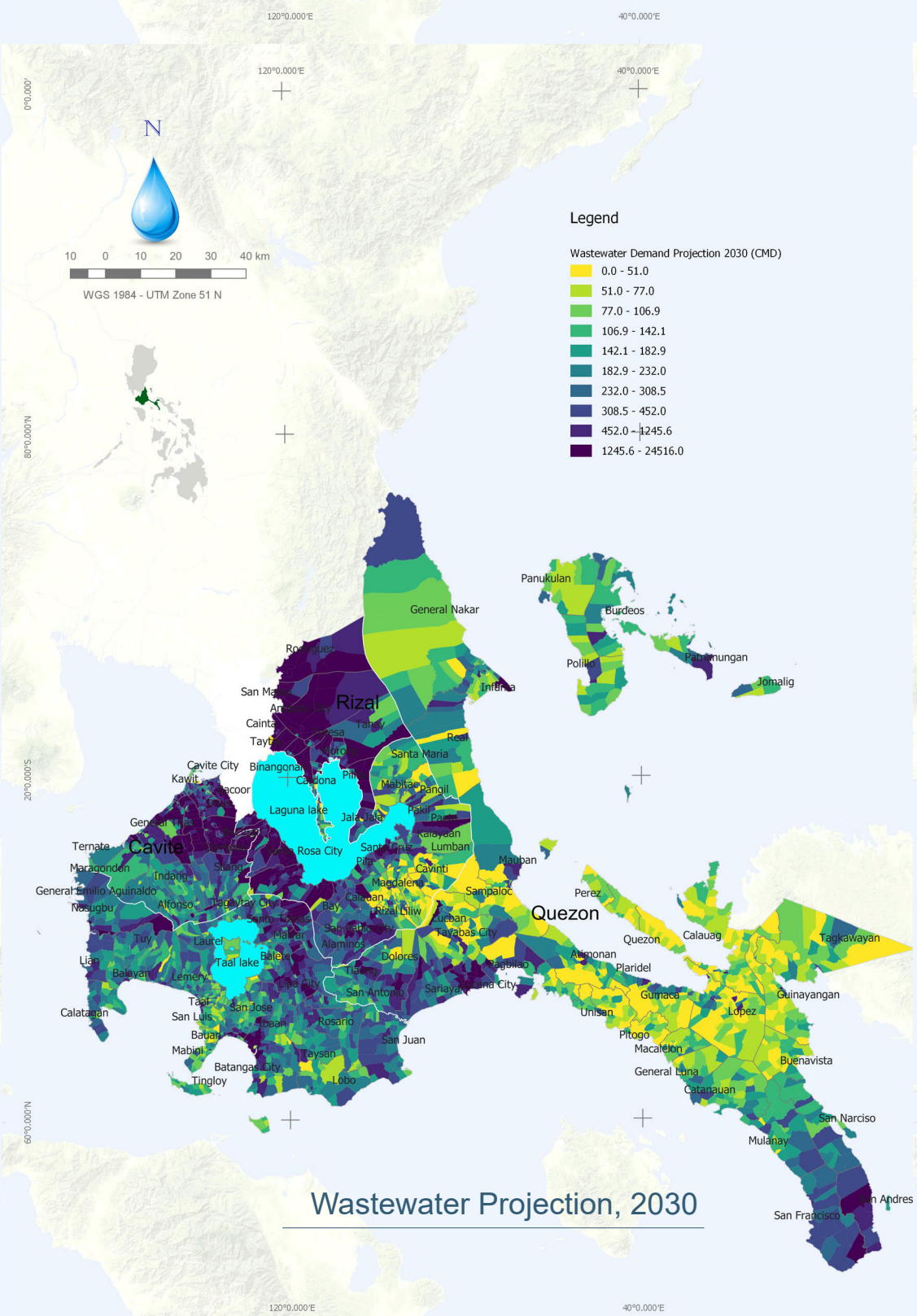

N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2025 (Tonnes/day)
0.000 - 0.020
0.020 - 0.032
0.032 - 0.045
0.045 - 0.061
0.061 - 0.080
0.080 - 0.102
0.102 - 0.133
0.133 - 0.187
0.187 - 0.306
0.306 - 5.868
Rizal
Quezon
Cavite
Laguna
Batangas
BOD Projection, 2025

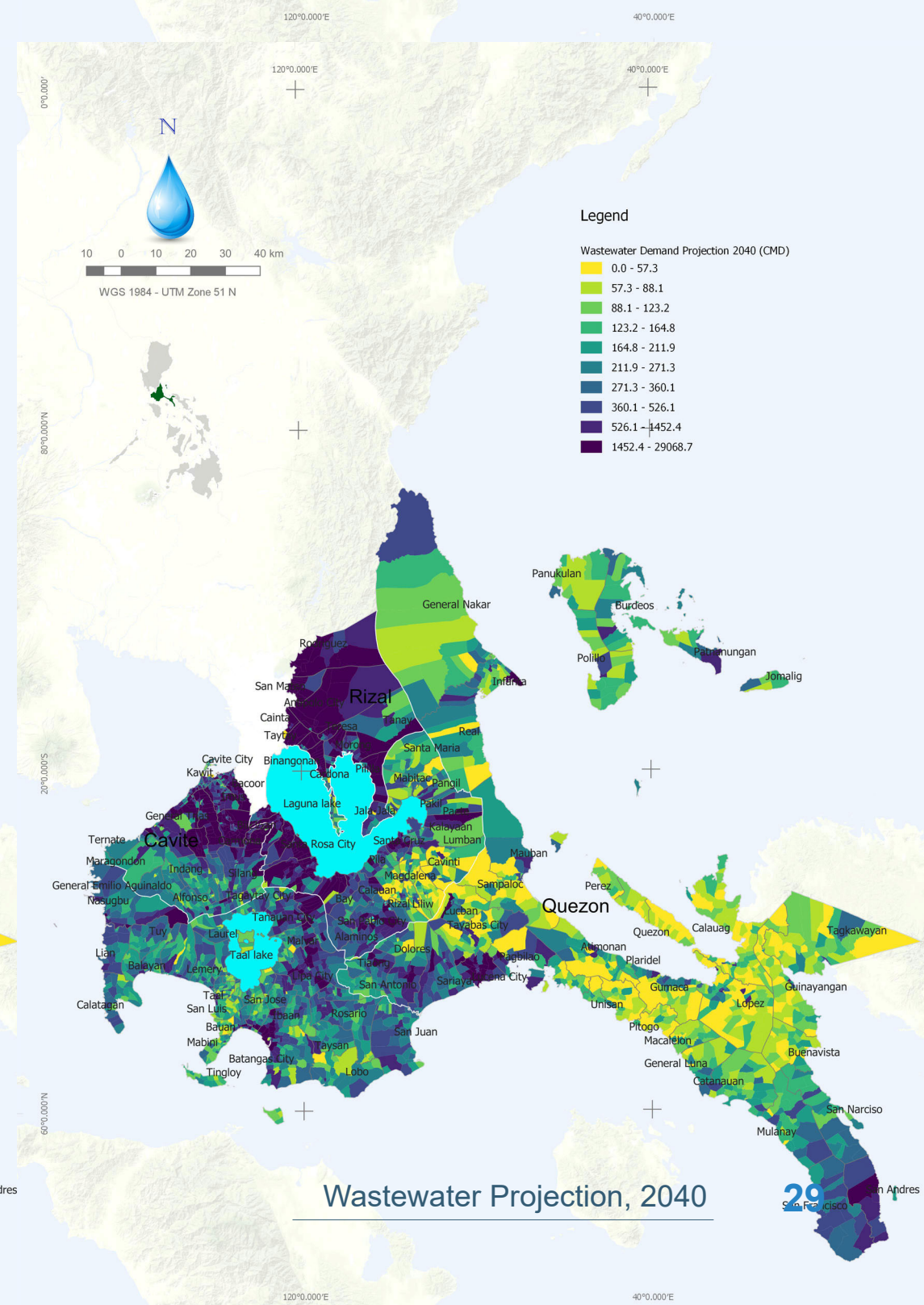

N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2030 (Tonnes/day)
0.000 - 0.021
0.021 - 0.035
0.035 - 0.049
0.049 - 0.066
0.066 - 0.086
0.086 - 0.110
0.110 - 0.144
0.144 - 0.203
0.203 - 0.336
0.336 - 6.442
Rizal
Quezon
Cavite
Laguna
Batangas
BOD Projection, 2030


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2040 (Tonnes/day)
0.000 - 0.023
0.023 - 0.038
0.038 - 0.054
0.054 - 0.073
0.073 - 0.096
0.096 - 0.123
0.123 - 0.160
0.160 - 0.227
0.227 - 0.384
0.384 - 7.455
Rizal
Quezon
Cavite
Laguna
Batangas
BOD Projection, 2040


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2020 (CMD)
0.0 - 42.6
42.6 - 64.2
64.2 - 88.3
88.3 - 116.3
116.3 - 149.1
149.1 - 188.6
188.6 - 251.0
251.0 - 364.2
364.2 - 1012.7
1012.7 - 19554.6
Wastewater Projection, 2020


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2025 (CMD)
0.0 - 45.7
45.7 - 69.0
69.0 - 95.6
95.6 - 126.7
126.7 - 163.1
163.1 - 207.3
207.3 - 277.3
277.3 - 403.2
403.2 - 1120.0
1120.0 - 21839.7
Wastewater Projection, 2025


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2030 (CMD)
0.0 - 51.0
51.0 - 77.0
77.0 - 106.9
106.9 - 142.1
142.1 - 182.9
182.9 - 232.0
232.0 - 308.5
308.5 - 452.0
452.0 - 1245.6
1245.6 - 24516.0
Wastewater Projection, 2030


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2040 (CMD)
0.0 - 57.3
57.3 - 88.1
88.1 - 123.2
123.2 - 164.8
164.8 - 211.9
211.9 - 271.3
271.3 - 360.1
360.1 - 526.1
526.1 - 1452.4
1452.4 - 29068.7
Wastewater Projection, 2040

120°0.000'E
40°0.000'E
0°0.000'
80°0.000'N
20°0.000'S
60°0.000'N

N

Legend

With Water Quality Problem

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Areas with Water Quality Problems

Water Districts' Water Quality Monitoring Data, LWUA, 2015

Water Quality

Water quality measures how good water is in terms of supporting its beneficial uses and fulfilling its environmental values. It is water relative to its use and measured in terms of its physical, chemical, biological and radiological characteristics. It is most frequently used by reference to a set of standards against which compliance can be assessed.

As discussed in the water resources section of this report, CALABARZON has two major river basins. Table 14 shows a list of tributary rivers of the river basins with their corresponding classifications.

Table 14: Classification of Tributary Rivers in Region IV-A

	River	Class
Pampanga River Basin	Pampanga	A/C
	Coronell	-
	Peñaranda	-
	Chico	-
	Sta. Maria	-
	Siniloan	-
	Pagsanjan	-
	Sta. Cruz	-
Pasig-Marikina-Laguna River Basin	San Juan	C
	Cristobal	-
	Biñan	-
	Marikina	A/C
	Morong	-
	Marilao	A/C
	Tuliahan	C
	Imus	-
	Pasig	C

It is a fact that these river basins have been threatened by the indiscriminate or illegal discharge and disposal of industrial, agricultural and domestic waste. Table 15 shows the prevailing causes and effects of such waste on the river basins in Region IV-A.

Open defecation, improper solid waste management and improper farming practices (such as *kaingin*) contribute to the further degradation of water bodies and the quality of the water thereof.

Based on the wastewater projection maps, most of the region's cities and growing municipalities have higher demand compared to that in other areas. These areas generate more wastewater and wastes that, if left untreated and unmanaged, would pollute existing and future water sources, and increase the incidence of waterborne diseases.

The map on the left shows the areas whose water sources have exhibited signs of poor water quality. The data are based on the water quality reports submitted by WDs to the Local Water Utilities Administration (LWUA). Data on water supply sources that are not covered or owned by WDs are not reflected on this map.

Waterborne Diseases

Waterborne diseases are generally transmitted through water where pathogenic microorganisms live. These diseases can be spread while bathing, washing, or drinking water, or by eating food exposed to contaminated water.[24]

In 2015, 7 cases of cholera, 1 case of schistosomiasis and 97 cases of typhoid and paratyphoid were reported in CALABARZON (although there were no reports of acute watery diarrhea), according to the Field Health Services Information System (FHSIS). This is an indication that many residents in the region still have no safe access to drinking water and sanitation facilities. Comparing the areas with waterborne diseases to those areas without access to water, we can determine a connection between the two.

As of 2017, the Department of the Interior and Local Governance (DILG) reported 18 waterless municipalities[25] in the CALABARZON region (see map below).

These towns were found to have limited access to safe (drinking) water, and that people are forced to resort to other doubtful and unsafe sources of water. Doing so increases their exposure to various waterborne diseases.

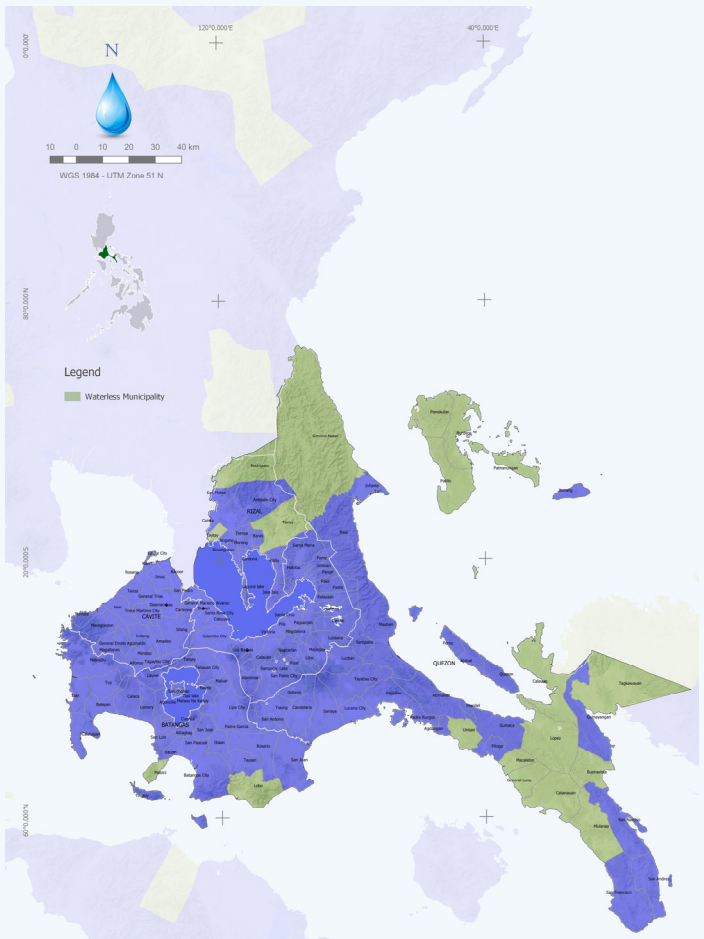


Figure 16: Waterless Municipalities, 2017

Table 15: Main Industries and their Impacts on Water Quality of the River Basins

Source	Impact/Potential Waste Generated
Industrial, Agricultural and Aquaculture	
Effluent and garbage from factories, settlement areas, livestock industry and the various point pollutant sources in the upper reaches of fishponds	Water pollution load
Overpumping of groundwater and inadequate groundwater regulation	Saltwater intrusion
Fertilizer runoff	Increased nitrate and phosphate levels from non-point sources
Pesticide runoff	Increased pesticide levels from non-point sources
Domestic Wastewater	
Absence of a domestic wastewater collection system	Increased BOD
Open defecation	Increased incidence of waterborne diseases
Illegal settlements along easements and leachate from human waste from unsanitary toilets	Higher total and fecal coliform
Absence of a municipal wastewater treatment plant	Increasing pollution load
Solid waste pollution	
Poor solid waste management	Wastes being dumped into the rivers
Sedimentation	
Logging of timber for fuel and slash-and-burn cultivation system	Increased total suspended solids (TSS)
Riverbank erosion/siltation with high velocity rainfall runoff	Increased TSS
Poor flood control and drainage facilities, lack of instruments for rainfall and flood measurements and siltation	Frequent flooding
Mt. Pinatubo eruption	Prolonged and large sediment runoff

[24] *World Health Organization*
[25] *Municipalities with less than 50% service coverage, per the National Anti-Poverty Commission, 2010*

WSS Sector Gaps

In assessing the current state of the water supply and sanitation (WSS) sector in Region IV-A, areas that require upgraded facilities, improved water supply and sanitation systems as well as regular and extensive monitoring protocols were brainstormed and identified at the regional consultation and planning workshop.

Issues, Constraints and Challenges

The planning workshop participated in by concerned provincial officers from Region IV-A and representatives from regional line agencies have produced a working document that identified the “hindering” issues, constraints, and challenges being encountered by the WSS sector in three areas of concern: (a) Planning and Development, (b) Service Provision, and (c) Regulation.

Cross-cutting topics and interlinked thematic issues such as policy and institutional issues, leadership, cultural/ behavioral/attitudinal concerns and capacity were also tackled. Classified as (i) unorganized/undeveloped/ underdeveloped, (ii) developing, and (iii) developed, the WSS sector in each locality was analyzed in terms of interventions needed and “facilitating factors” required to overcome specific constraints in the management of WSS services.

Planning and Development

It is in this context that the workshop participants underscored the sector’s need for a comprehensive WSS development plan based on solid, science-based data. No less than a robust data collection mechanism run and managed by people with technical expertise will suffice. The same is true for people who are involved in planning. Not everyone has the technical expertise, experience, knowledge and related qualifications for the job. The planning process should be entrusted only to trained and experienced professionals. In the immediate term, LGUs must engage the services of people, institutions and organizations with technical expertise and equipment in the gathering of scientific data.

Needless to say, the data collected need a central repository that runs on modern technology to facilitate sharing, access and retrieval. This should provide impetus for the establishment of a national agency that manages WSS data, the lack of which is a major weakness that stifles the development of the sector.

Lack of program and project continuity is another serious problem. A change in leadership, whether elective or appointive positions, usually results in the development agenda being frozen, altered or totally discarded. There is a need for a main development plan (complete with objectives and required courses of action) that the LGUs and the stakeholders themselves put together after a series of consensus-building consultations. For example, LGUs in the upstream should generate a master development plan that municipalities under their jurisdiction may use as a common guide in crafting interventions for the WSS sector.

A task force composed of agencies and technical experts, e.g., from the Community Environment and Natural Resources Office (CENRO) or Provincial Environment and Natural Resources Office (PENRO), and members of the academe, can be organized as local teams.

Service Provision

The “not-in-my-backyard” mentality has been the bane of development projects that require the setting up of “unwanted” infrastructure. A case in point is the developmental freeze happening in Cavite. The construction of the septage treatment plant (STP) for the collection and treatment of fecal waste has been stalled because the identified host barangay/municipality has refused to issue the clearance needed to enable private desludgers to proceed with the project.

There is a need for the creation of an enlightened policy and enabling ordinance for STP. Public consultations and orientations are needed to raise the level of awareness of the community on the importance of STPs.

For financial support, the region considers having Public-Private Partnerships to finance projects that will be monitored by the LGUs.

The creation of a water and wastewater department that is fully autonomous but dedicated to addressing these pressing issues was also recommended at the consultation workshop.

Regulation

The Local Government Code contains no provisions penalizing or sanctioning local governments that have failed to deliver on their promise to improve the state of their water supply and sanitation facilities.

Political will is sorely lacking based on the common perception that local leaders may not be held accountable. Without an accountability mechanism in place, funds or resources will not be allocated.

DILG can step in and include the provision of safe drinking water and sanitation as requirements for the Seal of Good Local Governance (SGLG) granted to LGUs. Failing to comply therewith, LGUs should be imposed restrictions or sanctions.

The lack of financial support for the establishment of treatment facilities as well as the lack of initiative on tariff setting related to the operation and maintenance of such facilities has also been lamented. In a collective view, these issues have stalled concrete measures to give the WSS sector its much needed boost.

Table 16 summarizes the hindering and facilitating impacting the WSS sector in CALABARZON.

Table 16: Hindering and Facilitating Factors

Areas	Hindering Factors	Facilitating Factors
Leadership and Politics	Establishment of STPs not a priority	Availability of funds
	Absence of a government agency fully dedicated to addressing wastewater issues	Interest and support from service providers and LGUs
	LGU officials who lack the drive to implement and enforce the law	
	Lack of initiative to impose tariffs on the operation and maintenance of sanitation facilities	
	Lack of political will among local leaders and arriving at decisions that are not evidence-based.	
	Centralized functions of government agencies	
Capacity Building	Responsible personnel lack of technical know-how	Generation and availability of data, e.g., annual surveys and monthly data sheets submitted by WDs
	Limited knowledge regarding the preparation of financial statements and other types of funding and financing	
	Low level of awareness of the importance of conserving water	
Policy and Institutional Issues	Ignorance of policy among responsible agencies	Generation and proper management of data on water supply
	Lack of specific ordinances coming from LGUs	
	Dependence on the Internal Revenue Allotment (IRA)	
	Conflicting national and local policies	
Funding and Financing	Limited financial resources	Fund grants from DILG (e.g., Performance Challenge Fund, *Salintubig)*
	Lack of financial mechanisms by which to establish sewage treatment plants	Loan grants from financing institutions
Cultural, Behavioral, and Attitudinal Issues	Resistance to the payment of tariffs and lack of receptiveness with regard to new community undertakings	Encouraging and motivating community members to participate in new programs
	Lack of community awareness of WSS regulations/policies/ordinances	
	Lack of interest in research and development	

Regional Vision

"By 2030, the organized WATSAN sector is equipped with technologically advanced and sustained operations in a resilient and healthy community of collaborating and environment-responsible stakeholders for sustainable, equitable, and safe WSS services for all."

The CALABARZON WSS Vision builds on the gains of the previous plans and regional development plan of Region IV-A. The stated vision is challenged by the high poverty incidence in 30 municipalities — a statistic higher than the national average.

In keeping with this vision, key strategies and corresponding success indicators contributing towards the achievement of the overall sector vision were adopted, and key projects and programs were identified, including WSS targets which will adhere to the national WSS targets that are in accord with the PDP and SDGs.

Strategic Framework

The creation of the strategic framework begins with the determination of the issues, constraints and challenges of the water supply and sanitation sector. The diagram on the right shows specific highlights and contrasts, pertaining to areas displaying best practices and those needing improvement.

The WSS challenges will be addressed through the following strategies:

- Promotion of water balance between water supply and demand
- Promotion of proper waste management
- Intensify protection and sustainable management of watershed, coastal, marine and land
- Rehabilitation of degraded forestlands, critical watersheds, and major river basins
- Establish and maintain the required number of water quality monitoring stations
- Regularly monitor ground water extraction
- Establishment of wastewater treatment in cities and municipalities
- Development and adoption of green infrastructure (rainwater harvesting)

Corresponding to the priorities are strategies that were formulated to translate the regional vision into specific approaches to get the best results and achieve the region's WSS targets. These are the region's general approaches applicable to urban and rural contexts of ensuring access to safe water and sanitation.

A more detailed discussion with respect to achieving increased access to potable water considering the various segments comprising the water utilities, such as undeveloped/underdeveloped, developing and developed, is shown in Table 17.

Table 17: Strategies in Achieving Increased Access to Potable Water

Segment	Target	Strategic Statement
Undeveloped/Underdeveloped		
Level 1	▪ Zero waterless barangays ▪ Reduction to 5% of unsafe sources of water supply (2022) and universal access to safe water (2030)	▪ Government investment in the development of water supply systems (WSS) to upgrade unsafe sources to safe sources ▪ Promoting water harvesting in far-flung areas
Level 2	▪ Upgrade of Level II systems to Level III	▪ Establishing WDs or LGU-led water utilities that can operate commercially ▪ Upgrading Level II systems to Level III ▪ Creation of a body that provides technical and financial assistance to barangay water associations and rural waterworks to upgrade their level of service
Developing		
Water Districts (Categories C and D)	▪ Zero nonoperational WDs	▪ Prioritizing conversion of nonoperational to operational WDs ▪ Assisting low performing WDs in rehabilitation and expansion works ▪ Providing a window for low cost funds that can be accessed by low performing WDs to expand coverage
Non-WDs (financially struggling water utilities)	▪ Organizing water utilities and allowing them to operate commercially ▪ 100% recovery of O&M cost	▪ Allowing the commercialization of water utility operations; encouraging LGUs to establish WDs or similar local government corporations or economic enterprises
Developed		
Level 3	▪ 100% coverage of franchise area ▪ Ensuring the sustainability of operations of Level III systems ▪ Continuing expansion programs to ensure 100% coverage	▪ Increasing private sector participation ▪ Ensuring a robust regulatory framework to balance the interest of consumers and operators/WSPs ▪ Encouraging business establishments and residential communities to embark on rainwater harvesting programs

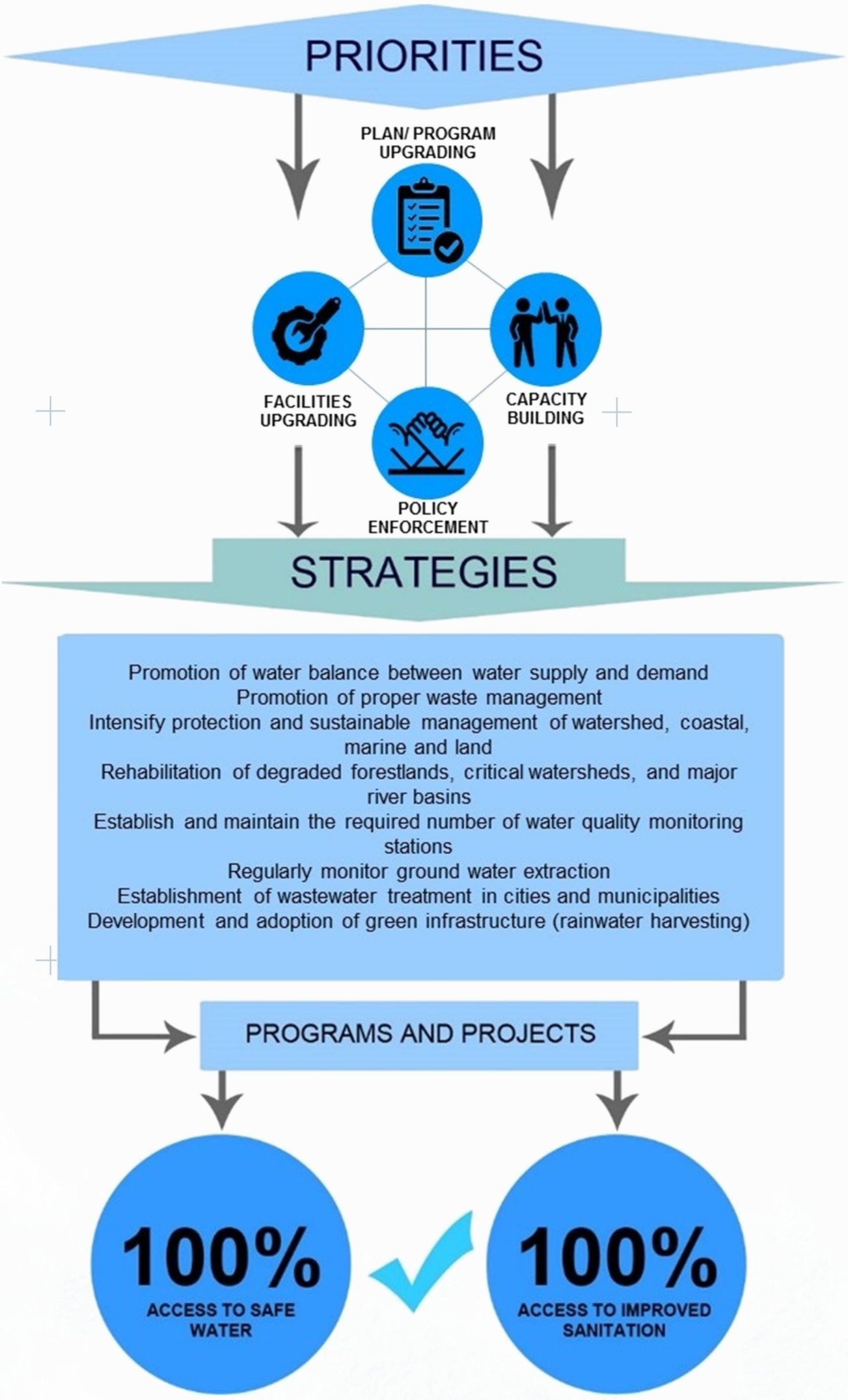


Figure 17: CALABARZON WSS Strategic Framework

Access Targets for Water Supply and Sanitation

As experts knowledgeable in and thoroughly familiar with the social and environmental conditions in their respective provinces, the workshop participants were given free rein in setting targets concerning water supply and sanitation access (but were guided by the prescribed goals).

Their targets were based on current and baseline data (i.e., population growth rates, water resources availability, topographical and geographical setting, etc.), the status quo (funding constraints, political and cultural challenges, etc.), and the realistic attainability of set targets.

For 2022, CALABARZON strives to achieve 96.3% access to safe water and for 2030, 100% access. Universal access by 2040 is equivalent to more than 1 million HHs. Improved access to sanitation is set at 100% for 2022 and 2030.

Figures 18 and 19 graph the targets for WSS for 2022 and 2030, respectively, in regard to the number of households.

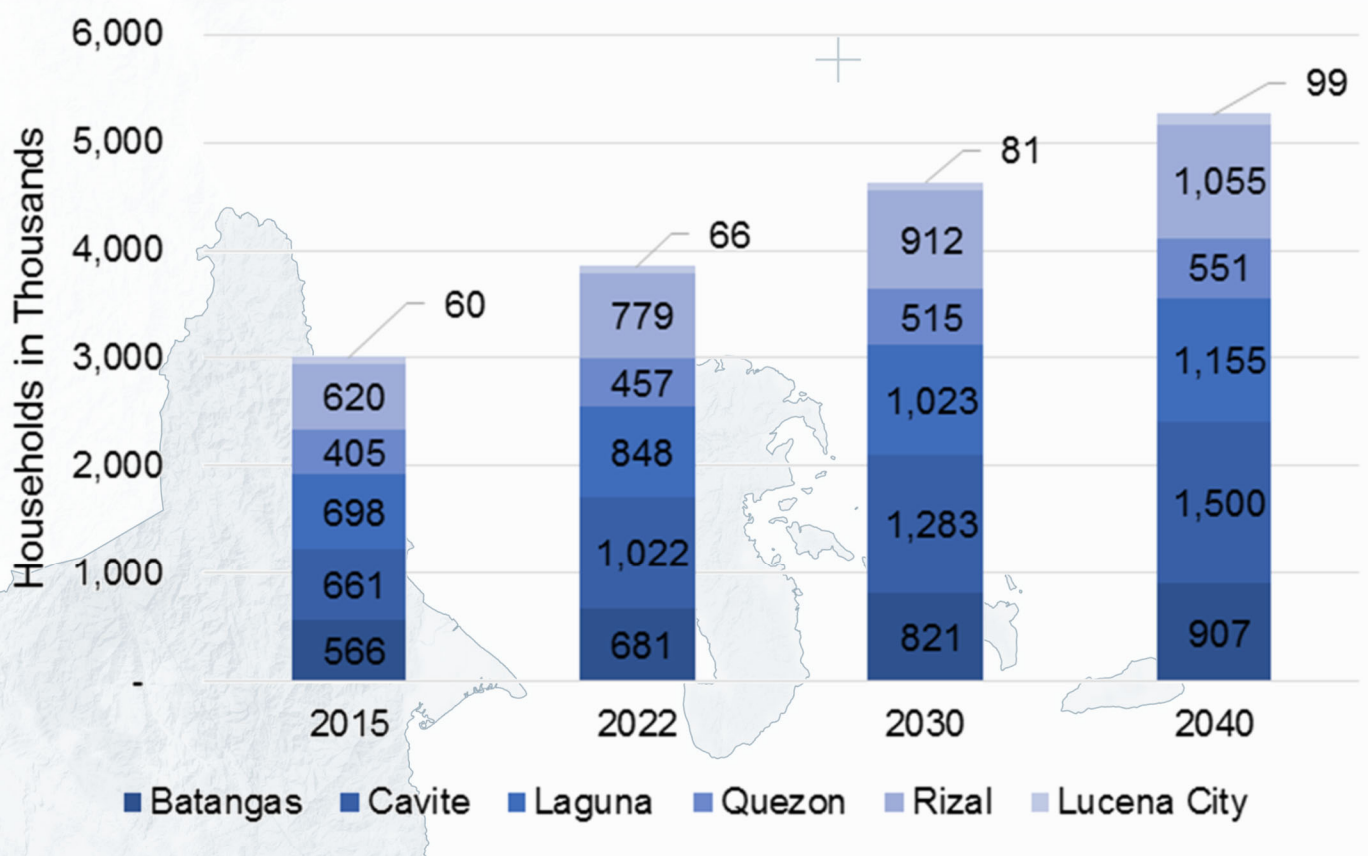


Figure 18: Targeted Households with Access to Safe Water

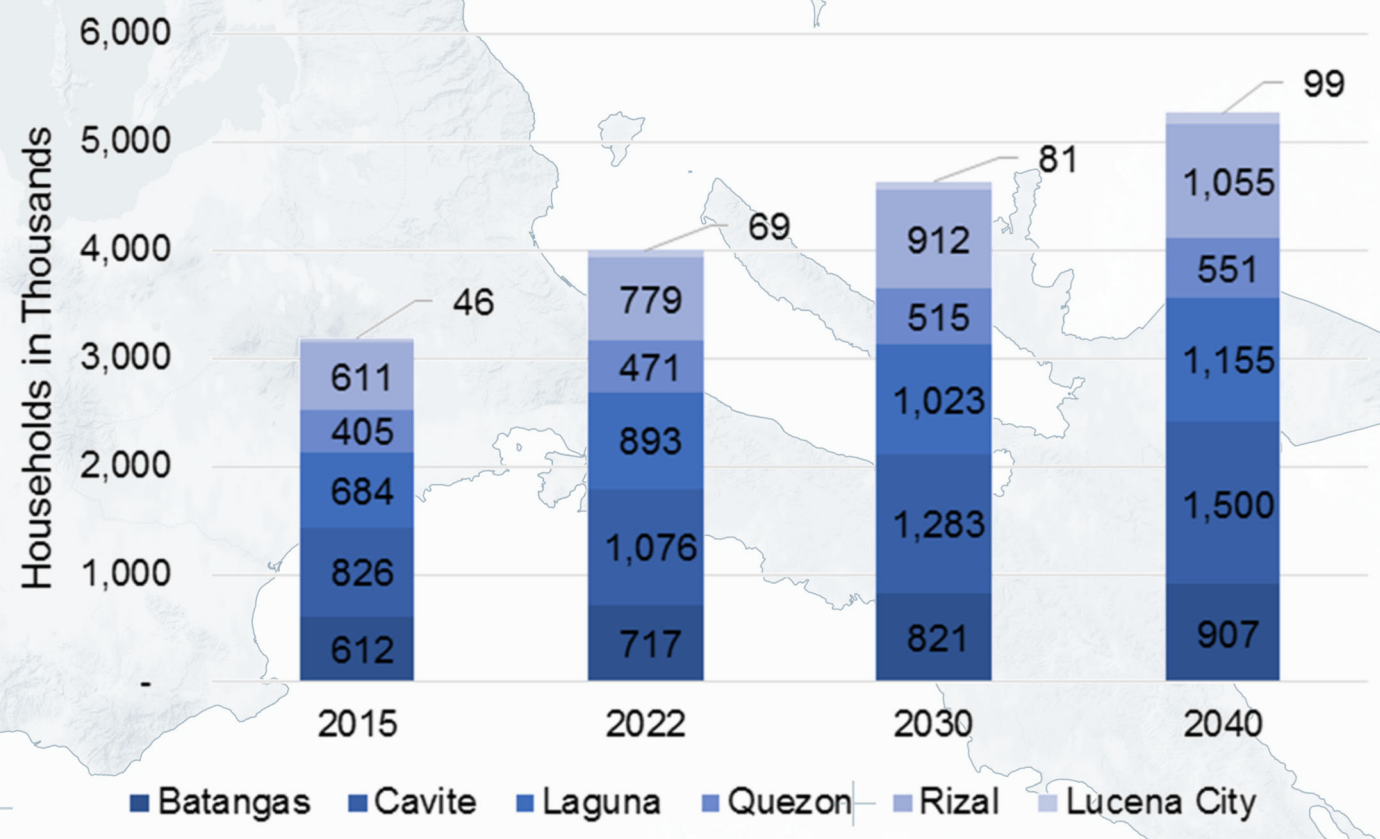


Figure 19: Targeted Households with Access to Sanitation

Water Supply Targets

BATANGAS			
Category	2022	2030	2040
Level III	83.8%	88.8%	100.0%
Level II	2.0%	2.0%	0.0%
Level I	9.3%	9.3%	0.0%
With Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CAVITE			
Category	2022	2030	2040
Level III	95.0%	100.0%	100.0%
Level II	0.0%	0.0%	0.0%
Level I	0.0%	0.0%	0.0%
With Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

LAGUNA			
Category	2022	2030	2040
Level III	61.5%	81.5%	100.0%
Level II	6.5%	0.0%	0.0%
Level I	27.0%	18.5%	0.0%
With Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

QUEZON			
Category	2022	2030	2040
Level III	60.0%	80.0%	100.0%
Level II	27.0%	10.0%	0.0%
Level I	10.0%	10.0%	0.0%
With Access	97.0%	100.0%	100.0%
No Access	3.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

RIZAL			
Category	2022	2030	2040
Level III	91.2%	96.9%	100.0%
Level II	6.4%	3.2%	0.0%
Level I	2.5%	0.0%	0.0%
With Access	100.0%	100.0%	100.0%
No Access	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

LUCENA CITY			
Category	2022	2030	2040
Level III	85.8%	95.0%	100.0%
Level II	7.2%	5.0%	0.0%
Level I	2.0%	0.0%	0.0%
With Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CALABARZON			
Category	2022	2030	2040
Level III	80.8%	91.1%	100.0%
Level II	6.4%	2.2%	0.0%
Level I	9.1%	6.7%	0.0%
With Access	96.3%	100.0%	100.0%
No Access	3.7%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

Sanitation Targets

BATANGAS			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared / Communal / Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
With Access	100.0%	100.0%	100.0%
Total	100.0%	100.0%	100.0%

CAVITE			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared / Communal / Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
With Access	100.0%	100.0%	100.0%
Total	100.0%	100.0%	100.0%

LAGUNA			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared / Communal / Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
With Access	100.0%	100.0%	100.0%
Total	100.0%	100.0%	100.0%

QUEZON			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	2.0%	0.0%	0.0%
Shared / Communal / Limited	0.0%	0.0%	0.0%
Open Defecation	1.0%	0.0%	0.0%
With Access	99.0%	100.0%	100.0%
Total	100.0%	100.0%	100.0%

RIZAL			
Category	2022	2030	2040
Improved	100.0%	100.0%	100.0%
Basic	0.0%	0.0%	0.0%
Shared / Communal / Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
With Access	100.0%	100.0%	100.0%
Total	100.0%	100.0%	100.0%

LUCENA CITY			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared / Communal / Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
With Access	100.0%	100.0%	100.0%
Total	100.0%	100.0%	100.0%

CALABARZON			
Category	2022	2030	2040
Improved	90.5%	100.0%	100.0%
Basic	4.0%	0.0%	0.0%
Shared / Communal / Limited	5.5%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
With Access	100.0%	100.0%	100.0%
Total	100.0%	100.0%	100.0%

Strategic Interventions

After the planning and consultation workshops, a working document detailing specific strategic interventions to improve water supply and sanitation access in CALABARZON was formulated. Based on their consensus during the workshops, these proposed interventions were deliberated on to make them adaptable to actual local conditions. (These are discussed more thoroughly in the National Master Plan and may be adopted accordingly at the local level.)

Tables 18 and 19 show the specific strategic interventions for water supply and sanitation, respectively.

Table 18: Proposed Strategic Interventions for Water Supply

Access to Safe Water	Planning and Development	Service Provision	Regulation	Promotion
95% Access to Safe Water in 2022 Universal Access in 2030	▪ Planning, program or project design ▪ Establishing labs and water quality testing centers ▪ Lobbying for the Regional WSS Masterplan	▪ M&E expansion ▪ Rehabilitation/Non-revenue water (NRW) reduction maintained at 20% of total production ▪ Integration/ Amalgamation ▪ Automation ▪ Residuals management ▪ Mitigation ▪ Water potability maintained at all times ▪ Providing 24/7 water supply service ▪ Achieving 100% coverage ▪ Residuals management	▪ Water resources protection ▪ Arbitration ▪ Environmental and social safeguards ▪ Compliance with PNSDW 2017 ▪ Close monitoring of Joint Agreement ▪ Compliance training from DOH ▪ Resource studies	▪ Willingness to connect and pay ▪ Demand creation

Table 19: Proposed Strategic Interventions for Sanitation

Access to Improved Sanitation	Planning & Development *Planning* *Program or Project Design* *Institution Building* *Training* *Financing* *Climate/Disaster Resiliency* *Policy*	Service Provision *Operations* *M&E* *Expansion* *Amalgamation* *Automation*	Regulation *Tariff/Pricing* *Resource* *Arbitration* *Registration, Permits, Rights*	Promotions *Social Preparation* *Advocacy* *Demand Creation* *Behavior Change*
High Access Areas with 60% to 100% Improved Sanitation Coverage	▪ Local Sustainable Sanitation Plan (LSSP) should be incorporated into the WSS Sector Plan, local development plan (LDP), annual investment program (AIP), and local health plan. ▪ A sewerage system program should be developed to provide service in the urban core coordinating with those in charge of the septage management program; project urban sprawl ▪ A National Sewerage and Septage Management Program (NSSMP) subsidy grant for sewerage and septage management programs (SMP) should be in place. ▪ Capacity development in regard to sewerage systems should be planned and integrated with other infrastructure. ▪ A sanitation ordinance covering sewerage system and septage management services should be passed, possibly integrating it into the environment code and Water Quality Management	▪ Sanitation programs should focus on implementing sewerage systems and completing septage management programs. ▪ Expansion of urbanized and urbanizing barangays should be pursued. ▪ M&E system should conform to PSA/ Census (covered by sewerage system, households desludged, and on-site systems).	▪ Tariff should be computed using full cost recovery with infusion of capex subsidy for sewerage projects. ▪ LGU implementers have undergone compliance training given by DOH and DENR (particularly in sewerage systems), and the Dept. of Agriculture (DA) with respect to regulations/guidelines governing disposal of by-products. ▪ Penalties should be strictly imposed on those not complying with certain requirements, including LGUs/WDs by filing cases with the environmental ombudsman.	▪ Promotions should focus on enjoining the public to connect to the sewerage system when made available stressing the importance of compliance and the benefits therefrom. ▪ Promotional efforts regarding water demand management should be supported to minimize wastage and unnecessary use of water. ▪ Building buy-in for paying for sanitation services should be promoted.

Physical Interventions

To meet the targets for access and coverage as well as the normative content of water (service standards), capital investments are necessary. The details of these investments in 2022 and 2030 are listed in Table 20.

Table 20: Capital Investments Required to Meet Water Supply Targets

Service Level	2022	2030
Level III	▪ Water source assessment and development ▪ Construction of water treatment facilities ▪ Distribution network expansion ▪ Provision of service connections ▪ NRW reduction program ▪ Watershed and water resources protection, management and development ▪ Development of a Water Safety Program ▪ Adoption of a rainwater harvesting program ▪ Establishment of adequately equipped laboratory testing centers in strategic areas to serve all service levels clientele	▪ Water source assessment and development ▪ Construction of water treatment facilities ▪ Distribution network expansion ▪ Provision of service connections ▪ NRW reduction program ▪ Watershed and water resources protection, management and development ▪ Development of a Water Safety Program ▪ Adoption of a rain water harvesting program ▪ Automation of operations and major services
Level II	▪ Rehabilitation of existing water supply system to upgrade it to Level III	▪ Rehabilitation of water supply system to upgrade it to Level III
Level I	▪ Upgrading to “safe level” those water sources found “unsafe”	▪ Adoption of a rain water harvesting program in areas not reached by Levels II and III services

Capital investments for the sanitation targets will include basic sanitation programs, septage management programs, and sewerage management programs.

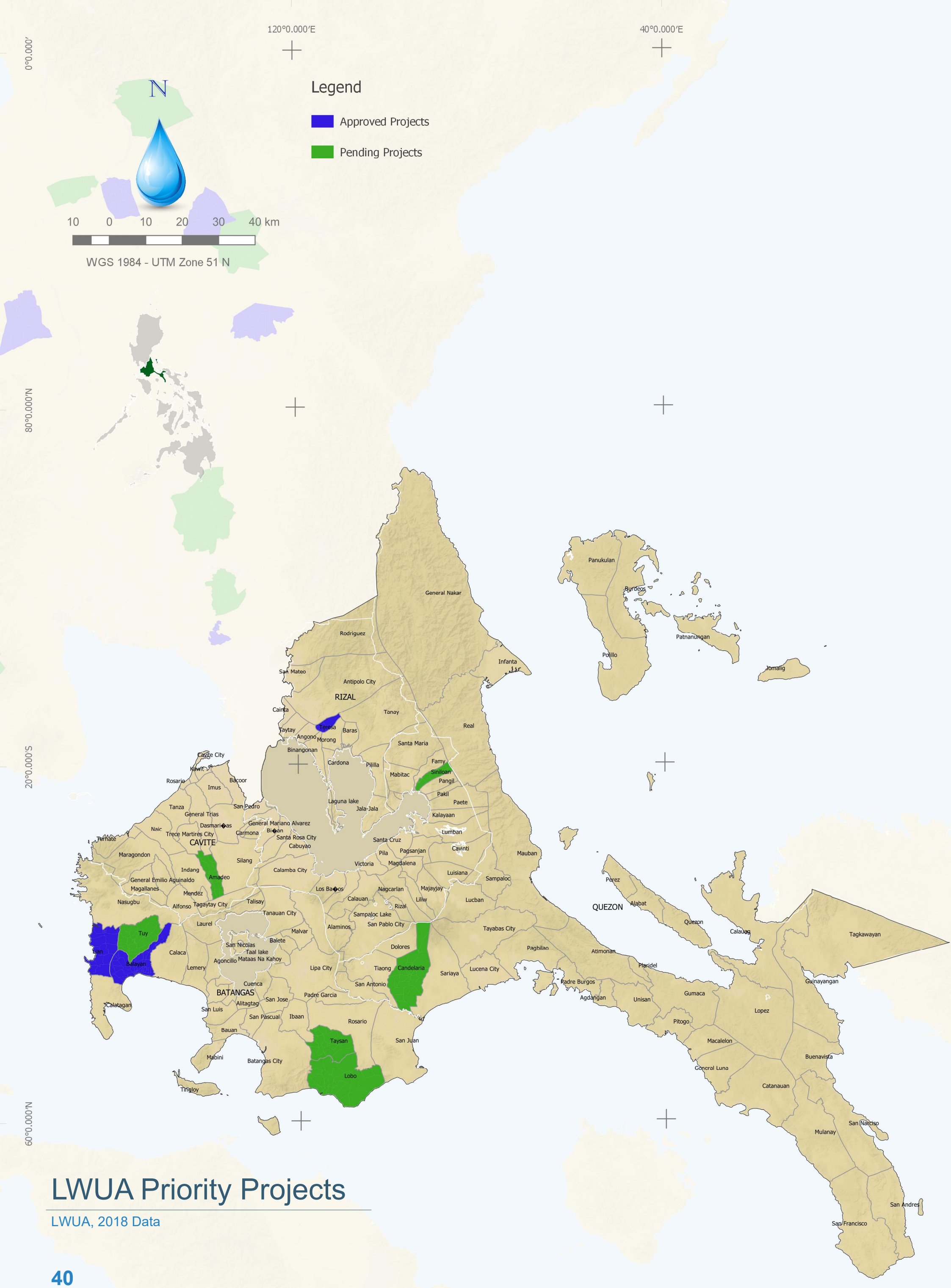
Targets for 2022 will mainly focus on basic sanitation. The septage and sewerage management programs are to be undertaken to achieve 2030 targets, although these programs may be implemented as early as 2022.

Nonphysical Interventions

To support the CapEx programs and ensure the efficient operation of the newly constructed facilities, institutional and regulatory reforms are to be undertaken (as shown in Table 21).

Table 21: Institutional and Regulatory Reforms Required to Achieve Water Supply and Sanitation Goals

Items	Undeveloped/Underdeveloped	Developing	Developed
Water Service Provision	▪ LGUs will organize/establish water utilities as commercial enterprises in their jurisdictions or form a WD. ▪ LGUs will create offices to handle Level II and Level I services.	▪ WDs and LGU-run utilities will be motivated to improve their performance by offering them incentives/rewards.	▪ A system for independent evaluation and due diligence regarding public-private partnership projects will be set up.
Planning and Development	▪ An agency will be created to spearhead efforts to improve the WSS sector at the provincial level. The provincial office shall coordinate development plans for water and sanitation of all municipalities in the province, pursue efforts (in coordination with the DENR) in watershed rehabilitation, and provide training programs to LGUs in water supply development and management.		
Regulation	▪ Service standards for water supply and sanitation will be defined. ▪ An independent group will be formed to monitor the performance of water and sanitation service providers, other than the WDs, within the province. WDs will continue to be regulated by the LWUA. The monitoring group could later be made part of a regulatory body.		



LWUA Priority Projects

LWUA, 2018 Data

Addressing the Gaps

Water Supply Investment Requirements

Physical Investments

To address WSS infrastructure gaps and fulfill specific targets and commitments for 2022 and 2030, the cost of infrastructure investments was derived based on anticipated demand. Such demand was based on projected population, economic growth, as well as factored-in investments to ensure the continuous delivery of WSS services provided by existing systems. The computation included the anticipated need to upgrade existing service levels (i.e., from Level II to Level III, Level I to Level II or Level III).

For infrastructure development, CALABARZON requires capital investments of about PhP63.25 billion and PhP44.15 billion for 2022 and 2030, respectively. Unit development costs employed to arrive at these sums are estimated at PhP34,600 per HH for Level III, PhP20,300 for Level II, and PhP9,100 for Level I.

These rates are direct costs and cover items such as water source development, water treatment facilities, storage requirements, transmission and distribution lines, and pumping requirements, and provision of service connections.

Furthermore, these unit costs (determined to suit local conditions in CALABARZON) were derived by applying regional cost factors (with respect to labor, material, and equipment costs) to the computed development base costs for NCR. NCR values are pegged at PhP31,800/HH, PhP18,700/HH, and PhP8,400/HH for Levels III, II, and I, respectively.

The cost deviations (from the NCR base rates) were taken into account considering the region's distinct geographical, economical, and accessibility characteristics, and labor, material, and equipment costs, which are bound to affect the implementation costs of any project. The regionalization of costs ensures that computed regional investment requirements for the Master Plan and the Regional Roadmaps are as realistic as possible befitting each locale.

Aside from the direct costs, indirect costs were also considered in estimating the total investment requirements. These items include project preparation activities (which may affect budget considerations) before actual construction work begins. Items considered and percentage values used in relation to the total direct costs computed are shown in Table 22.

Total expenses for establishing water quality testing laboratories have also been taken into account. It is assumed that one laboratory per province will be constructed.

Table 23 shows a summary of the total investment requirements of the region. The detailed methodology on how the regional costs at CALABARZON were derived is referenced in Annex D of the main volume of the Philippine WSS Master Plan.

Nonphysical Investments

Institutional and regulatory reforms have to be pursued to complement infrastructure development and ensure that water supply systems constructed will operate efficiently. Costs of reform implementation have not been estimated at the regional level and are projected to be not substantial compared to the infrastructure investments.

LGUs, WDs, and other stakeholders are obligated to influence decision makers to pursue relevant reforms in the water sector. These reforms serve as non-infrastructure investments and typically include organization/institutional development, regulatory strengthening, capacity building, and project management.

Proposed interventions include the following:

- The model of existing water utilities should be identified in areas where there are no water districts. The establishment of WDs should be proposed in municipalities with a population of at least 20,000, subject to an agreement with the local chief executives. If LGUs are not amenable to forming a WD, water utilities that can operate commercially (e.g., a similar local government water corporation or economic enterprise) should be set up.
- Priority should be given to operationalizing nonfunctional WDs, particularly those in municipalities categorized as 3rd class and higher.
- The target expansion of service coverage shall be conducted at the municipal level. Municipalities with lower than 50% coverage will be given priority in the investment program.

The map on the left shows the nine municipalities with WDs included in LWUA's list of projects. Balayan, Lian and Teresa WD have secured LWUA's financial assistance (FA) for their projects. The remaining seven (7), i.e., Lobo, Tayusan, Tuy, Amadeo, Siniloan and Candelaria WDs, have filed requests for FA that are still pending approval.

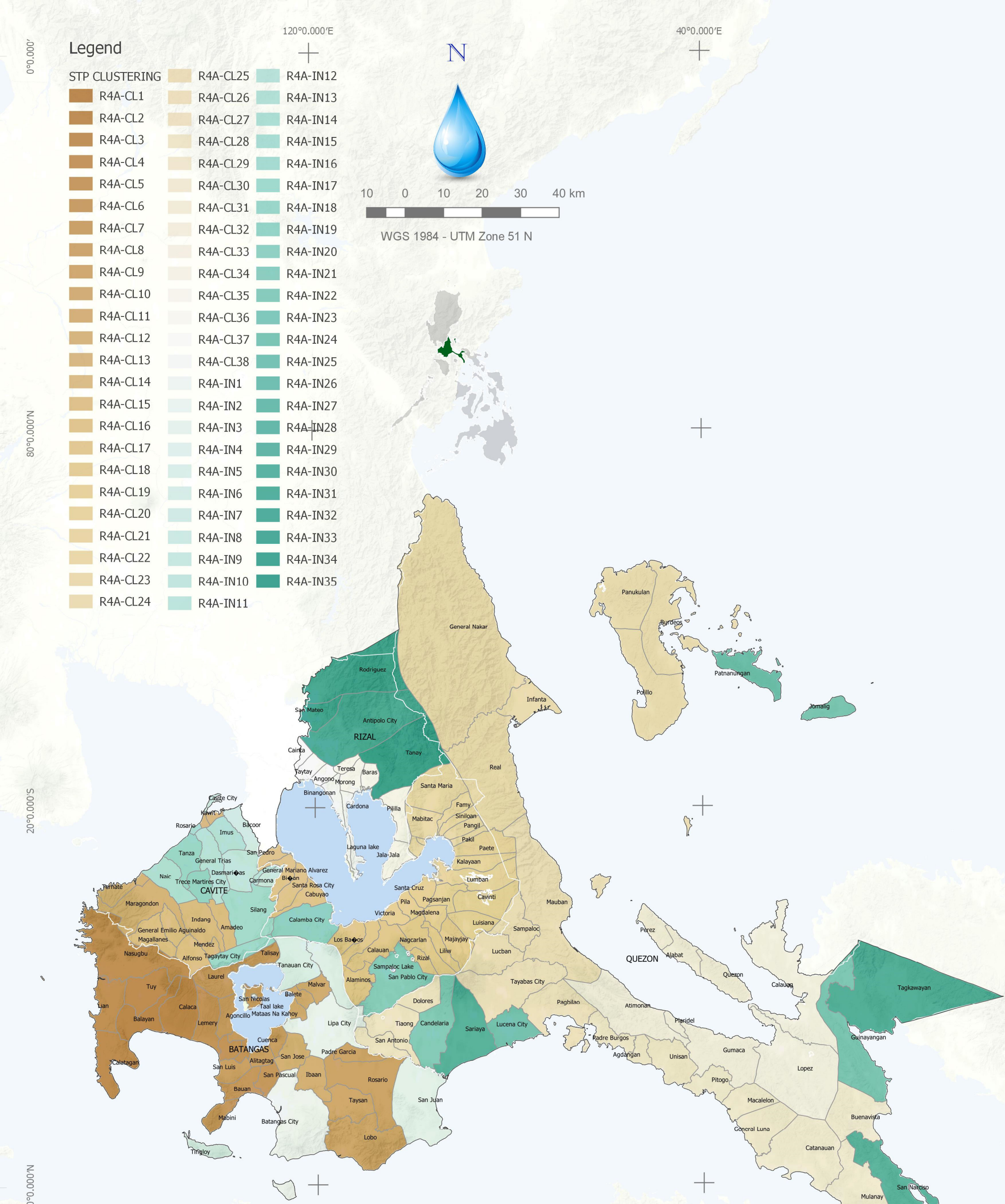
Table 22: Indirect Costs Employed[26]

Water Supply		
Contingency	10.0%	Percentage of Total Direct Cost
Feasibility Study	3.0%	Percentage of Total Direct Cost
Detailed Engineering Design	6.0%	Percentage of Total Direct Cost
Construction Supervision	5.0%	Percentage of Total Direct Cost
ROW/Land Acquisition	3.0%	Percentage of Total Direct Cost
Organizational Cost/Permits	2.0%	Percentage of Total Direct Cost
Capacity Development	33,350	1 Staff Employee per 100 HH (LWUA)

Table 23: Total Investment Costs for Water Supply Sector

Province	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Batangas	20,061	5,962
Cavite	18,446	11,709
Laguna	5,401	12,784
Quezon	11,662	5,889
Rizal	7,677	7,804
Total	**63,247**	**44,148**

[26] *Based on industry standards*



Septage Treatment Plants Clustering

Sanitation Investment Requirements

Physical Investments

Basic Sanitation Program. The Department of Health (DOH) plans to prescribe a national basic sanitation program for the entire country – looking into a combination of microfinance and behavior change communication. A Department Administrative Order on standard septic tank use and design will also be released by the DOH soon after planned consultation activities have been rolled out in the country's three major island groups (Luzon, Visayas, and Mindanao).

CALABARZON will need about PhP5.94 billion for basic sanitation from 2016 to 2022 to reach its target of 100%.

This was derived by multiplying the unserved population by the unit development costs with regard to establishing specific on-site sanitation facilities. (An annex to this report and the National Master Plan explains the unit costs and derived costs for specific sanitation interventions.)

Septage Management Program. A clustering approach will be recommended to reduce capital costs and attain economies of scale. The proposed clustering per province is shown on the map on the left.

The region needs about PhP8.94 billion and PhP1.41 million for 2022 and 2030, respectively for its septage management program.

Sewerage System Program. Only Lucena City will be required at this time to plan and implement a sewerage system for its urban core. However, rapidly urbanizing cities (i.e., candidate HUCs) should also consider planning for sewerage services in the interim.

The indicative cost for sewerage was computed based on the 50% coverage of the HUCs' urban population only. The unit cost was derived per the procedure applied to septage management, wherein the unit cost was based on the National Septage and Sewerage Master Plan (NSSMP) estimations and later adjusted considering other factors.

The region needs about PhP103 million and PhP293 million for 2022 and 2030, respectively, for its sewerage system program.

Nonphysical Investments

CALABARZON, like other regions in the country, will require substantial assistance from the national government, or where technical and financial assistance can be funneled. This will include an inventory or survey and assessment of existing sanitation facilities, capacity development for implementing local agencies (local health office, environment and natural resources office, office of the building official, and general services office), institutional, policy and regulatory environment development (which would require the involvement of capacitance support offices like the budget and treasurer's office, bids and awards committee, commission on audit office, engineering office, office of legal services/affairs, barangay affairs office, office of the local chief executive, and the local legislative council).

Other nonstructural interventions that may require a budget include developing a monitoring and evaluation (M&E) system to monitor progress, support planning, and guide development training programs, promotional campaigns and other legislative advocacies, and initiate hygiene promotion programs.

Table 24: Total Investment Costs for Sanitation Sector

Province/City	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Batangas	21,067	3,553
Cavite	30,353	6,711
Laguna	17,712	4,009
Quezon (excluding Lucena City)	5,625	1,506
Rizal	6,956	4,567
Lucena City	3,760	704
Total	**85,473**	**21,050**

Proposed Projects and Programs

A list of projects and investment programs has been developed during the regional planning workshop to assess the current state of the WSS sector and propose projects to increase access to and upgrade water supply and sanitation facilities at the provincial or regional level.

The DILG, Department of Environment and Natural Resources (DENR) River Basin Control Office (RBCO) and LWUA have proposed projects in the WSS sector in addition to those discussed and agreed on at the regional workshop.

This list of projects does not cover only infrastructure projects, but also nonphysical investment requirements, such as capacity development programs, information dissemination campaigns, and watershed management plans. These projects run the gamut from conception, proposal, pre-feasibility and feasibility study stages, detailed engineering design, to pre-procurement and procurement. Figure 20 shows the distribution of the investment requirement per province. Based on the proposed projects and programs, the region needs PhP29.7 billion to boost its WSS sector.

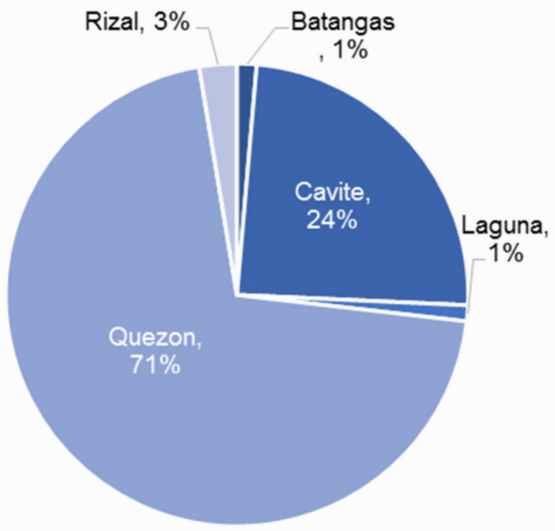
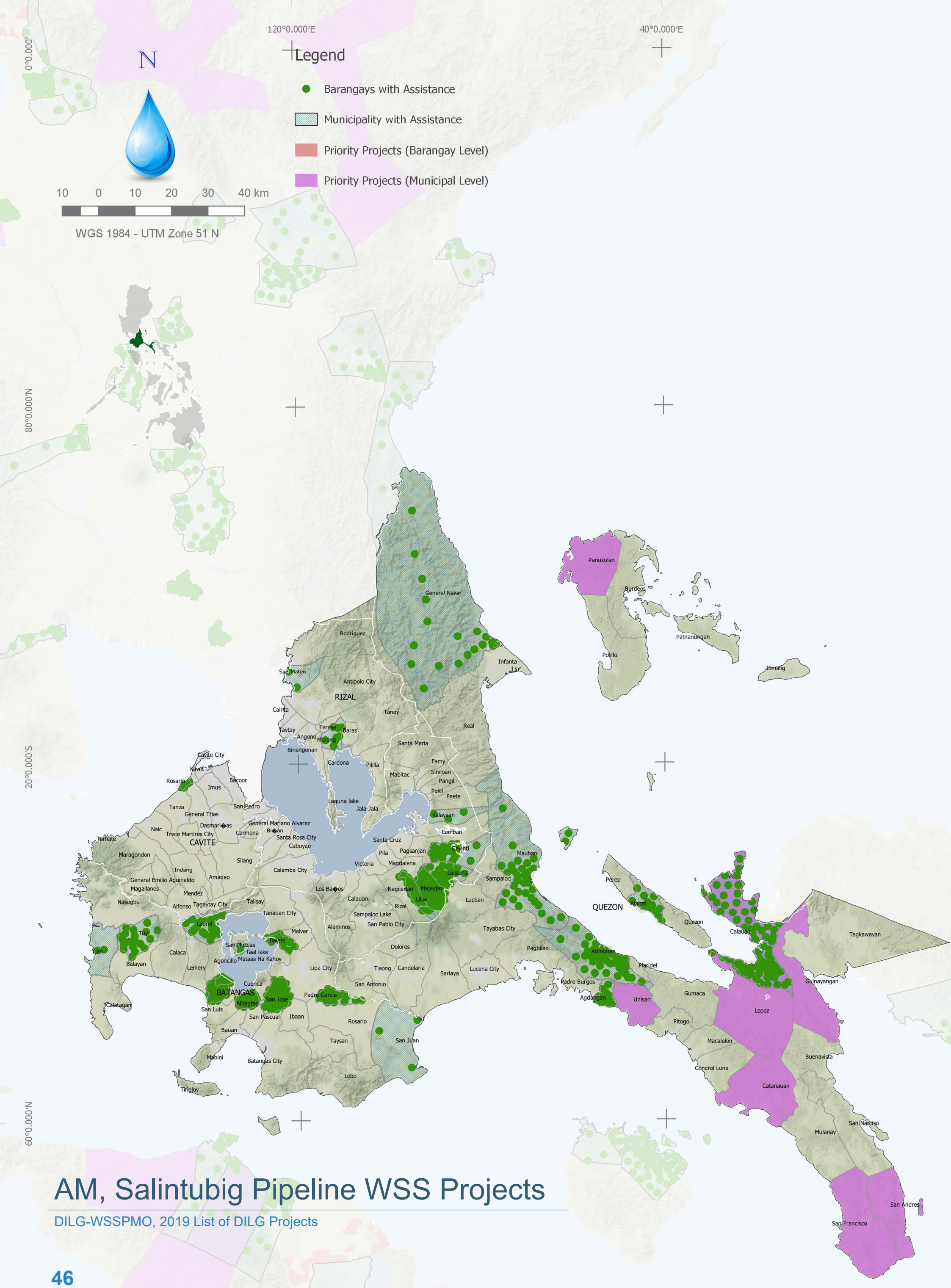


Figure 20: Distribution of Investment Requirement per Province

Batangas								
Water Supply	Period	Budget Requirement (PhP Million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1 Phase 1: Construction of nine (9) water supply systems, drilling of production wells, installation of submersible pumps and construction of elevated water tanks	Short Term	18.67	1 STP For 12 provincial government-operated hospitals	Long Term	54.00		
2 Phase 2: Nine (9) proposed water supply systems, drilling of production wells, installation of submersible pumps and construction of elevated water tanks	Short Term	21.91	2 PGENRO Batangas Environment Laboratory Accredited By DENR-EMB and PNS ISO 177025.2005	Short Term	3.00		
			3 Distribution of toilet bowls	Short Term	0.45	**406.5**	**54,396**
			4 Provision of sanitary toilet facility package	Short Term	0.50		
			5 Strengthening of waste management projects	Medium Term	8.00		
			6 Proposed domestic wastewater and septage treatment plants in 15 cluster locations province-wide	Long Term	300.00		
	Total	**40.58**		**Total**	**365.95**		
Cavite							
Water Supply	Period	Budget Requirement (PhP Million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1 Level III WS expansion in the municipalities of Mainit, Malamig, and Maligamgam covering 20,000 households	Short Term	3,000.00	1 Preparation of septage treatment plant in northern cluster municipalities	Short Term	500.00		
2 Revival of the 10 nonoperational WDs in the municipalities of Mainit, Malamig, and Maligamgam	Short Term	1,500.00					
3 Preparation of IWRM Plan for Matubig River	Short Term	500.00				**7,238.0**	**1,076,276**
4 Maragondon Bulk Water Supply Project covering 4 municipalities	Short Term	1,051.00					
5 Trece Martires City Water Supply Project	Short Term	687.00					
	Total	**6,738.00**		**Total**	**500.00**		
Laguna							
Water Supply	Period	Budget Requirement (PhP Million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1 Construction of Level I water supply facilities in selected areas	Short Term	11.30	1 Construction of sanitary toilet facilities in target areas	Short Term	1.60		
2 Construction/rehabilitation of Level II water supply facilities in Los Baños, Bay and Victoria	Short Term	153.00				**330.9**	**848,214**
3 Construction/rehabilitation of Level III water supply facilities in San Pedro City	Short Term	165.00					
	Total	**329.30**		**Total**	**1.60**		

Quezon								
Water Supply	Period	Budget Requirement (PhP Million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)	
1 Dumacaa River Irrigation Project	Short Term	265.00	1 Lucena STP	Short Term	-			
2 Quipot River Irrigation Project	Short Term	1,000.00	2 Centralized ST: Tiaong	Short Term	-			
3 Macalelon Irrigation Project	Short Term	700.00						
4 Kaliwa Dam Project	Short Term	18,700.00						
5 Upgrading Unsafe Level I to Safe Level I Service	Short Term	-				**20,979.0**	**470,789**	
6 Updgrading of Level II to Level III system (urban)	Short Term	-						
7 Metro Quezon WD Water Supply Project	Short Term	314.01						
	Total	**20,979.01**		**Total**	**-**			

Rizal							
Water Supply	Period	Budget Requirement (PhP million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1 Upgrading of Level I systems to Level II (upland)	Long Term	300.00	1 Maintenance of STPs in provincial hospitals in Antipolo and Jalajala	Long Term	60.00		
			2 Maintenance of existing STP of hospitals	Long Term	15.00		
			3 Septage treatment plants for water districts	Long Term	400.00	**780.2**	**778,539**
			4 Provision of complete sets of toilet facilities	Short Term	5.20		
	Total	**300.00**		**Total**	**480.20**		



AM, Salintubig Pipeline WSS Projects

DILG-WSSPMO, 2019 List of DILG Projects

Identified Priority Projects (2019-2020)

The tables below show the priority projects identified by LWUA and DILG for 2019-2020. The map on the left shows the various barangays and municipalities to be covered by DILG's Assistance to Municipalities (AM) and Salintubig Projects in 2019.

Assistance To Municipalities (2019)			
Province	Municipality	Project Name	Amount
Batangas	Kalayaan	Rehabilitation/Improvement Of Level III Water System In Longos	1,248,000
Batangas	Liliw	Rehabilitation/Improvement Of Level III Water System	6,524,000
Batangas	Luisiana	New Construction Of Level II Potable Water Supply System	10,864,000
Batangas	Majayjay	Rehabilitation/Improvement Of Level III Water System	9,864,000
Batangas	Agdangan	Rehabilitation/Improvement Of Level II Water System	1,722,000
Batangas	Alabat	Rehabilitation/Improvement Of Level II/Level III Water System In Alabat, Quezon	1,780,000
Batangas	Alabat	Rehabilitation/Improvement Of Level II/Level III Water System In Camaya, Barangay Villa Norte	4,000,000
Batangas	Atimonan	New Construction Of Level II Potable Water Supply System	2,000,000
Batangas	Calauag	Construction Of Potable Water Supply System	2,457,000
Batangas	General Nakar	Rehabilitation/Improvement Of Level II/Level III Water System	10,321,000
Batangas	Mauban	Rehabilitation/Improvement Of Level II Water System	7,588,000
Batangas	Morong	Improvement Of Level II Water System	1,000,000
Cavite	Cavinti	Rehabilitation/Improvement Of Level III Water System	6,716,000
Cavite	Kalayaan	Rehabilitation/Improvement Of Level III Water System In San Juan	2,000,000
Cavite	Kalayaan	Rehabilitation/Improvement Of Level III Water System In San Antonio	3,000,000
Laguna	San Juan	New Construction Of Level II Potable Water Supply System In Brgy. Sapangan	3,000,000
Laguna	San Nicolas	Improvement Of Water System	2,000,000
Laguna	Taal	New Construction Of Level II Potable Water System	2,000,000
Laguna	Tuy	Construction Of Potable Water Supply System	3,200,000
Laguna	Rosario	Improvement Of Water System	4,756,000
Laguna	Rosario	Expansion Of Water System In Bagbag I	1,558,000
Laguna	Rosario	Expansion Of Water System In Ligtong I	1,706,178
Quezon	Balete	New Construction Of Level II Potable Water Supply System	9,757,000
Quezon	Lian	New Construction Of Level II Potable Water Supply System In So. Centro, Brgy. Lumaniag	5,773,500
Quezon	Lian	New Construction Of Level II Potable Water Supply System In Brgy. Putingkahoy	5,773,500
Quezon	Padre Garcia	Construction Of Potable Water Supply System	3,000,000
Quezon	San Jose	Rehabilitation/Improvement Of Level III Water System	9,704,000
Quezon	San Juan	New Construction Of Level II Potable Water Supply System In Brgy. Poctol	3,000,000
Quezon	San Juan	New Construction Of Level II Potable Water Supply System In Brgy. Bataan	3,000,000
Rizal	Alitagtag	Rehabilitation/Improvement Of Level III Water System	2,000,000
		Total	**131,312,178**

SALINTUBIG (2019)			
Province	Municipality	Project Name	Amount
Quezon	Calauag	Level III Water System (Salintubig)	20,000,000
Quezon	Catanauan	Construction/Upgrading Of Potable Water System	15,000,000
Quezon	Guinayangan	Development Of Potable Water System In All Barangays	12,000,000
Quezon	Lopez	Construction Of Level II Water Supply, Brgys. Paagan, Ramot, And Tubaday	11,000,000
Quezon	Panukulan	Potable Water Supply	10,000,000
Quezon	San Adres	Spring Development Projects: Bocacliw Spring	15,000,000
Quezon	San Francisco	Provision Of Water System To All Barangays Unserved By BWD	15,000,000
Quezon	Unisan	Potable Water Supply	11,000,000
		Total	**109,000,000**

LWUA (2017-2018)				
Province	Municipality	Project Type	Status	Amount
Batangas	Balayan	Expansion	Approved	9,000,000
Batangas	Lian	Expansion	Approved	5,000,000
Rizal	Teresa	Expansion	Approved	7,000,000
Batangas	Balayan	Expansion	Pending approval	12,000,000
Batangas	Lian	Expansion	Pending approval	65,000,000
Batangas	Lobo	Expansion	Pending approval	15,000,000
Batangas	Taysan	Expansion	Pending approval	10,300,000
Batangas	Tuy	Expansion/Admin Bldg.	Pending approval	18,000,000
Cavite	Amadeo	Expansion	Pending approval	100,000,000
Laguna	Siniloan	Expansion/Admin Bldg.	Pending approval	25,000,000
Quezon	Candelaria	Expansion	Pending approval	24,000,000
			Total	**290,300,000**

Appendix A: Provincial and HUC Profiles

BATANGAS	31 municipalities	Agoncillo, Alitagtag, Balayan, Balete, Bauan, Calaca, Calatagan, Cuenca, Ibaan, Laurel, Lemery, Lian, Lobo, Mabini, Malvar, Mataasnakahoy, Nasugbu, Padre Garcia, Rosario, San Jose, San Juan, San Luis, San Nicolas, San Pascual, Santa Teresita, Santo Tomas, Taal, Talisay, Tingloy, Tuy
	Three (3) component cities	Batangas City, Lipa, Tanauan
	1,078 barangays	182 urban, 896 rural
Land Area	3,119.75 sq. km.	
Demographics (2015)	Population (2015) – 2,694,335 Population Growth Rate (2000 to 2015) – 2.30 Population Density – 860 per sq. km.	
Economy	• Major Industries - agriculture, livestock raising, fishery, tourism, cottage industries, trading • Major Crops - coffee, sugar, bamboo, pineapples • Major Products - *jusi*, fan knives, *lambanog*, *tuba* • Batangas City is the second most important international seaport in Luzon and a major entry point for goods coming from the country's southern part and from international ports.	
Poverty Incidence (2015)	On Families – 6.8% On Population – 9.3%	
CAVITE	16 municipalities	Alfonso, Amadeo, Carmona, General Emilio Aguinaldo, General Mariano Alvarez, Indang, Kawit, Magallanes, Maragondon, Mendez, Naic, Noveleta, Rosario, Silang, Tanza, Ternate
	seven (7) component cities	Bacoor, Cavite City, Dasmarinas, General Trias, Imus, Tagaytay, Trece Martires
	829 barangays	258 urban, 571 rural
Land Area	1,426.06 sq. km.	
Demographics (2015)	Population (2015) – 3,678,301 Population Growth Rate (2000 to 2015) – 3.86 Population Density – 2,300 per sq. km.	
Economy	• Major Industries - agriculture, forestry, fishing, tourism, cut flower production • Major Crops - rice, coffee, pineapples • Cavite has 12 economic zones – the largest, covering 177 hectares, is located in Gen. Trias. The province hosts the region's manufacturing companies engaged in garments, textiles, semiconductors, and pharmaceuticals, and food processing.	
Poverty Incidence (2015)	On Families – 4.5% On Population – 6.8%	

LAGUNA	24 municipalities	Alaminos, Bay, Calauan, Cavinti, Famy, Kalayaan, Liliw, Los Baños, Luisiana, Lumban, Mabitac, Magdalena, Majayjay, Nagcarlan, Paete, Pagsanjan, Pakil, Pangil, Pila, Rizal, Santa Cruz, Santa Maria, Siniloan, Victoria
	six (6) component cities	Biñan, Cabuyao, Calamba, San Pablo, San Pedro, Santa Rosa
	674 barangays	207 urban, 467 rural
Land Area	1,917.85 sq. km.	
Demographics (2015)	Population (2015) – 3,035,081 Population Growth Rate (2000 to 2015) – 2.89 Population Density – 1,600 per sq. km.	
Economy	• Major Industries - agriculture, fishery, mining, manufacturing, tourism, outsourcing • Major Crops - rice, corn, coconuts, mangoes, bananas • Laguna is known as the country's "automotive capital" because it is where most automotive assemblers are found. • It is also known as the "Silicon Valley of the Philippines" where its electronics and semiconductor industry has flourished with big companies such as Samsung, Toshiba and Panasonic setting up business. • Its most famous tourist and travel destinations are the Pagsanjan Falls, Calamba and Los Baños hot springs, Mt. Makiling and Caliraya Lake.	
Poverty Incidence (2015)	On Families – 4.1% On Population – 5.4%	

QUEZON	39 municipalities	Agdangan, Alabat, Atimonan, Buenavista, Burdeos, Calauag, Candelaria, Catanauan, Dolores, General Luna, General Nakar, Guinayangan, Gumaca, Infanta, Jomalig, Lopez, Lucban, Macalelon, Mauban, Mulanay, Padre Burgos, Pagbilao, Panukulan, Patnanungan, Perez, Pitogo, Plaridel, Polilo, Quezon, Real, Sampaloc, San Andres, San Antonio, San Francisco, San Narciso, Sariaya, Tagkawayan, Tiaong, Unisan
	one (1) independent city	Lucena
	one (1) component cities	Tayabas
	1,242 barangays	100 urban, 1,142 rural
Land Area	8,989.39 sq. km.	
Demographics (2015)	Population (2015) – 1,856,582 Population Growth Rate (2000 to 2015) – 1.48 Population Density – 210 per sq. km.	
Economy	• Major Industries - agriculture, fishery • Major Crops - rice, corn, bananas, coffee • Quezon is the country's top producer of coconut products (desiccated coconut, virgin coconut oil, coconut juice, and copra). • The province accounts for 33% (or around 132,239 MT) of fish production in the region. • Commercial, industrial and banking activities are mostly concentrated in its southern and central parts.	
Poverty Incidence (2015)	On Families – 17.1% On Population – 22.7%	

Appendix A: Provincial and HUC Profiles

RIZAL	13 municipalities	Angono, Baras, Binangonan, Cainta, Cardona, Jalajala, Morong, Pilila, Rodriguez, San Mateo, Tanay, Taytay, Teresa
	one (1) component city	Antipolo
	188 barangays	108 urban, 80 rural
Land Area	1,191.94 sq. km.	
Demographics (2015)	Population (2015) – 2,884,227 Population Growth Rate (2000 to 2015) – 3.50 Population Density – 2,400 per sq. km.	
Economy	• Major Industries - agriculture, manufacturing, aquaculture/fishery, tourism, garments • Major Crops - rice, coffee, cacao, high-value fruits such rambutan, cashew, mangoes, citrus, avocado • Rizal is famous for the Hinulugang Taktak in Antipolo City and Antipolo Cathedral (for which it is known as the “pilgrimage capital of the Philippines”). Other tourist destinations include the Daranak Falls and Tinipak River in Tanay.	
Poverty Incidence (2015)	On Families – 3.6% On Population – 5.4%	
LUCENA CITY	Lucena City is the "Cocopalm City of the South".	
	33 barangays	33 urban, 0 rural
Land Area	80.21 sq. km.	
Demographics (2015)	Population (2015) – 266,248 Population Growth Rate (2000 to 2015) – 2.02 Population Density – 3,300 per sq. km.	
Economy	• Agricultural, commercial and industrial activities contribute significantly to the city’s economy. • It is famous for its dried and smoked fish, distilled liquors, bamboo and rattan furniture, ornamental flowers and plants, and vegetable and meat products (one of them, the popular Lucban longganisa). • Several coconut oil mills as well as car assembly and manufacturing plants are found in Lucena City. • It hosts the factories and warehouses of big companies such as San Miguel Brewery, Coca-Cola Bottlers Philippines and Ginebra San Miguel.	
Poverty Incidence (2015)	On Families – 3.6% On Population – 5.4%	

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