NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY

Volume 2: Philippine Water Supply and Sanitation Master Plan

Bicol Region Water Supply and Sanitation Databook and Regional Roadmap

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Acronyms

AIP	Annual Investment Plan
AM	Assistance to Municipalities
BFAR	Bureau of Fisheries and Aquatic Resources
BOD	Biological Oxygen Demand
BRB	Bicol River Basin
BWSA	Barangay Water and Sanitation Association
CBO	Community-Based Organization
CDP	Comprehensive Development Plan
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DJF	December, January and February
DOH	Department of Health
EMB	Environmental Management Bureau
FA	Financial Assistance
FHSIS	Field Health Services Information System
FIES	Family Income and Expenditure Survey
GRDP	Gross Regional Domestic Product
HH	Household
HUC	Highly Urbanized City
IEC	Information, Education and Communication
JJA	June, July and August
JMP	Joint Monitoring Program
LCE	Local Chief Executive
LFPR	Labor Force Participation Rate
LGU	Local Government Unit
LSSP	Local Sustainable Sanitation Plan
LWUA	Local Water Utilities Administration
M&E	Monitoring and Evaluation
MAM	March, April and May
MDG	Millennium Development Goals
NAMRIA	National Mapping and Resource Information Authority
NCR	National Capital Region
NDHS	National Demographic and Health Survey
NEDA	National Economic and Development Authority
NGO	Nongovernment Organization
NRW	Nonrevenue Water
NSSMP	National Sewerage and Septage Management Program
NWRB	National Water Resources Board
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PDP	Philippine Development Plan
PIA	Philippine Information Agency
PNSDW	Philippine National Standards for Drinking Water
PPP	Public-Private Partnership
PSA	Philippine Statistics Authority
PWSSMP	Philippine Water Supply and Sanitation Master Plan

RBCO	River Basin Control Office
RDC	Regional Development Council
RPME	Regional Project Monitoring Evaluation System
RWSA	Rural Waterworks and Sanitation Association
SDG	Sustainable Development Goals
SON	September, October and November
STP	Septage Treatment Plant
TC	Tropical Cyclone
UN	United Nations
UNICEF	United Nations Children's Fund
WD	Water District
WHO	World Health Organization
WQMA	Water Quality Management Area
WRR	Water Resources Region
WSP	Water Service Provider
WSS	Water Supply and Sanitation
ZOD	Zero Open Defecation

Units

%	percent
°C	degree Celsius
ha	hectare
m	meter
m^2	square meter
m^3	cubic meter
mm	millimeter
km^2	square kilometer
lpcd	liters per capita per day
MCM	million cubic meters
PhP	Philippine peso

40°0.000'W

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20°0.000'S

60°0.000'N

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N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

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Region V - Bicol

6

Introduction

Bicol Region

The Bicol Region is located in the southeastern part of Luzon and is bounded by

Lamon Bay on the north, the Philippine Sea on the east and Sibuyan Sea and Ragay Gulf on the west. The northernmost provinces, Camarines Norte and Camarines Sur, are bordered on the west by the province of Quezon.

Designated as Region V, it is composed of six provinces namely, Albay, Camarines Norte, Camarines Sur, Sorsogon (which comprise the Bicol Peninsula), and the offshore islands of Catanduanes and Masbate. It has one independent city: Naga City. Legazpi City, the capital of Albay, is the regional center and largest city.

The Bicol Region is endowed with abundant natural resources, and has large tracts of potential agricultural land. Its major crops include rice, corn, coconuts, bananas, coffee, and jackfruit. It is widely known for its *pili* nuts and abaca.

Aside from agriculture, fishery is a major industry. Its 13 major commercial fishing grounds supply the fish markets of Metro Manila and other parts of the country.

The region takes pride in its most famous tourist attraction, the Mayon Volcano, renowned for its symmetric conical shape. It is also known for its colonial churches and pilgrimage sites, surfing destinations and upscale resorts.

Land Classification

The region has a total land area of 18,155.82 square kilometers (km^2) (4,476,183 acres) or 6% of the country's total land area. About 29% of its land area is classified as public forestland; 71% covers alienable and disposable land.

Economy

The service sector has been the largest contributor to the region's gross regional domestic product (GRDP), followed by the industry sector, and the agriculture, fishery and forestry sector (see Figure 1).

According to the National Economic and Development Authority (NEDA), the region's economy, as measured by GRDP, grew at an average rate of 5.8% from 3.5% in 2010 to 8.4% in 2015.

Its growth was recorded as the fastest among all regions of the country at 8.4% which was almost double its growth in 2014 at 4.3%, and more than the 6.7% planned target.

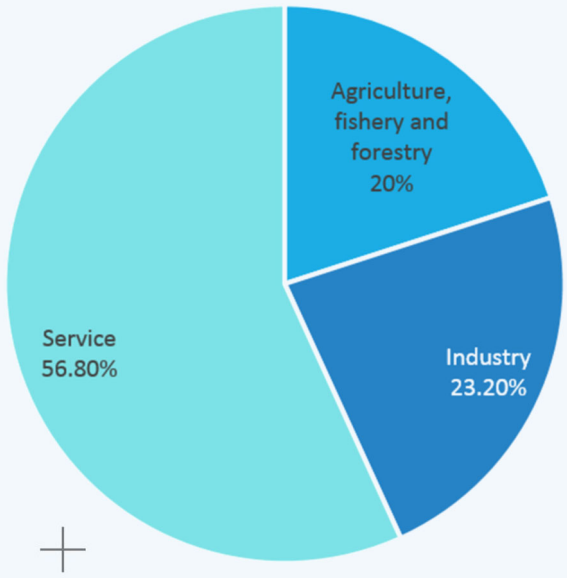

Figure 1: GRDP Contributions per Sector, 2016[1]

Labor and Employment

According to the Philippine Statistics Authority (PSA), as of January 2018, the total labor force participation rate (LFPR) was estimated at 62% of the total population of the region, equivalent to nearly 4.1 million. This shows a decrease of 0.5% from the LFPR in October 2017.

Province-wise, 2016 data show that Masbate had the highest LFPR among the six provinces with 69.4%, though the other provinces did not differ significantly.[2]

The employment rate in the region in January 2018 was considerably high at 96% (from 95.4% in 2017). Consequently the unemployment rate stood at 4% while underemployment was estimated at 33.8%.

Its high underemployment rate has been attributed to the following: closure of several establishments trying to recoup their financial losses, lack of raw materials, and redundancy of jobs. On a provincial scale (2016), Masbate has the highest employment rate at 97.3%.

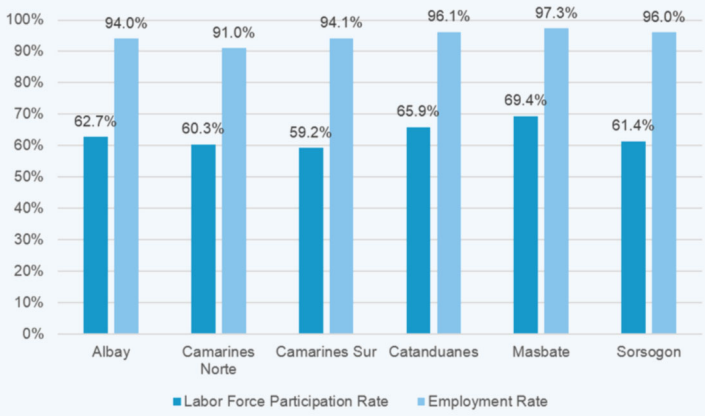

Figure 2: Labor Force Participation and Employment Rates per Province, 2016

[1] *Philippine Statistics Authority, CountryStat Philippines, 2016*
[2] *Philippine Statistics Authority, Labor Force Survey, 2017 and 2018*

Population Density

PSA, 2015 Census

40°0.000'W

120°0.000'W

20°0.000'S

60°0.000'N

40°0.000'S

Legend

Population Density (person/ha)

- 0.00 - 0.91
- 0.91 - 1.45
- 1.45 - 2.09
- 2.09 - 2.86
- 2.86 - 3.94
- 3.94 - 5.35
- 5.35 - 8.31
- 8.31 - 14.31
- 14.31 - 35.13
- 35.13 - 1042.52

N

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WGS 1984 - UTM Zone 51 N

Capalonga
Jose Panganiban
Paracale
Vinzons
Santa Elena
CAMARINES NORTE
Labo
Talisay
Daet
San Vicente
San Lorenzo Ruiz
Basud
Del Gallego
Mercedes
Ragay
Lupi
Sipocot
Cabusao
Siruma
Tinambac
Garchitorena
Lagonoy
Caramoan
Presentacion
Goa
CAMARINES SUR
Bombon
Libmanan
Magarao
Camaligan
Naga City
Gainza
Pamplona
Milaor
Pili
Ocampo
San Jose
Tigaon
Sagnay
Pasacao
San Fernando
Minalabac
Baao
Bula
Iriga City
Buhi Lake
Buhi
Tiwi
Nabua
Malinao
Balatan
Bato Lake
Bato Lake
Polangui
Tabaco City
Malilipot
Bacacay
Rapu-Rapu
Libon
Santo Domingo
ALBAY
Oas
Ligao City
Guinobatan
Camalig
Daraga
Legazpi City
Pio Duran
Jovellar
San Pascual
Sorsogon City
Donsol
Pilar
Castilla
Claveria
SORSOGON
Gubat
Casiguran
Barcelona
Juban
Magallanes
Bulusan
Irosin
Bulan
Santa Magdalena
Matnog
Monreal
San Jacinto
San Fernando
Batuan
Arroroy
Baleno
Masbate City
Mobo
Mandaon
Milagros
MASBATE
Uson
Dimasalang
Palanas
Balud
Cawayan
Catarman
Placer
Pio V. Corpuz
Esperanza
Pandan
Bagamanoc
Panganiban
Caramoran
Viga
CATANDUANES
Gigmoto
San Miguel
Baras
San Andres
Virac
Bato

Figure 3: Distribution of Family Expenditure, 2015[3]

Family Income and Expenditure

There are about 1,262,000 families in Region V, with an estimated total annual average income of PhP187,000 and a total average expenditure of PhP160,000.

In terms of income class, the total average expenditure of households with regard to the PhP40,000-59,999 category is greater than their average income, while the other households have incomes greater than their expenditures.

With family size as an indicator, a family of five has the largest income-expenditure difference, while a single-person household has the least income. This indicates that a five-member family has more savings as compared to other family sizes.

With respect to the disbursement patterns of families in the region and across income levels, the Family Income and Expenditure Survey (FIES) conducted in 2015 revealed that food expenditure registered the highest among the major expenditure groups at 48%. Housing expenses followed at 9.3%, while expenses for water, electricity, gas and other fuels were estimated at 7.4%. Figure 3 shows the expenditure distribution indicating that most families spend more for their basic needs.

Demography

As of 2015, the Bicol Region had a total population of 5,796,989, accounting for 4.4% of the country's population. Camarines Sur had the largest population among the six provinces, while Catanduanes had the smallest population. The region's population growth rate from 2010 to 2015 was registered at 1.29%, lower than the national average of 1.84%.

The population density of the Bicol Region in 2015 averaged 320 persons per square kilometer. A large percentage of its population is concentrated in the cities as well as along the coastal areas (as shown on the map on the left).

Its predominantly rural population is estimated at 84%. Household size in the region averages 4.75 persons (see Table 2).

Table 1: Population per Province, 2015

Region/Province	Population	Land Area (km^2)	Population Density (Persons/ km^2)
Bicol Region	**5,796,989**	**18,155.82**	**320**
Albay	1,314,826	2,575.77	520
Camarines Norte	583,313	2,320.07	250
Camarines Sur	1,952,544	5,497.03	360
Catanduanes	260,964	1,492.16	170
Masbate	892,393	4,151.78	210
Sorsogon	792,949	2,119.01	370

Table 2: Urban and Rural Population per Province, 2015[4]

Region/Province	Urban Population	Rural Population	HH Size
Bicol Region	16%	84%	4.75
Albay	18%	82%	4.74
Camarines Norte	20%	80%	4.48
Camarines Sur	20%	80%	4.86
Catanduanes	3%	97%	4.81
Masbate	9%	91%	4.73
Sorsogon	9%	91%	4.74

[3] *Philippine Statistics Authority, Family Income and Expenditure Survey, 2015*
[4] *Philippine Statistics Authority, Philippine Standard Geographic Code, 2015*

Climate

PAGASA, 2015 Data

40°0.000'W

120°0.000'W

20°0.000'S

60°0.000'N

40°0.000'S

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.

N

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10

WGS 1984 - UTM Zone 51 N

40°0.000'N

40°0.000'W

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Climate

The Bicol Region's climate is tropical with an average temperature of 27°C.

It has three types of climate. Catanduanes, Camarines Norte, and the eastern part of Camarines Sur, Albay, and Sorsogon have a Type II climate, i.e., with no dry season but with a very pronounced maximum rainfall from November to January. Masbate and the western part of Camarines Sur and Albay have a Type III climate which is relatively dry from November to April and wet the rest of the year. The central part of the region has a Type IV climate in which rainfall is evenly distributed throughout the year.

Disaster Risk

The region's geographical location makes it vulnerable to geohazards. This is evident in the number of destructive calamities in the region that have snuffed out lives of untold numbers and damaged property and infrastructure.

The Rapid Geohazards Assessment identifies the most common geohazards in the region (Table 3).

Table 3: Geological and Climatological Hazards

Category	Specific Hazards
Geological	earthquake, liquefaction, earthquake-induced landslide and tsunami, volcanic eruption, coastal erosion, subsidence
Climatological	tropical cyclones (TCs), flooding, drought, rain-induced landslide, sea level rise, storm surge

Climate Change and Hydrological Hazards

The Philippines is at great risk of climate-related hazards, such as TCs, floods, droughts and sea level rise. The effects of observed changes in extreme events and severe climate anomalies include increased occurrence of extreme rains causing: (a) 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. Studies show a general increase in rainfall for 2020, 2050 and beyond. The models, however, 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 highly vulnerable to changes in river flows and the rate of replenishment of 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. Lower 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 higher than 35°C, days when rainfall is more than 300 mm, and rainy days that outnumber dry days) in Region V based on the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) downscaled climate projections are shown in Tables 4 and 5. Four seasons are provided: December, January and February (DJF); March, April and May (MAM); June, July and August (JJA); and September, October and November (SON). The projections were added to the observed values in the past 30-year baseline (1971-2000).

Table 4: Seasonal Projections Under a Medium-Range Emission Scenario

Seasonal Temperature Increase (in °C)	Observed Baseline (1971 - 2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Albay	25.6	27.2	27.8	27.1	0.9	1.2	0.9	0.9	1.8	2.2	1.9	1.8
Camarines Norte	25.7	27.6	28.3	27.3	0.9	1.1	1.0	0.9	1.8	2.2	2.1	1.8
Camarines Sur	25.6	27.5	28.2	27.1	0.9	1.1	1.0	0.9	1.8	2.2	2.0	1.8
Catanduanes	24.7	26.3	27.2	26.4	0.8	1.0	1.0	0.8	1.6	2.0	1.9	1.7
Masbate	26.6	28.4	28.6	28.0	0.9	1.2	1.0	0.9	1.8	2.4	2.1	1.8
Sorsogon	25.9	27.4	27.9	27.3	0.8	1.1	0.9	0.9	1.6	2.1	1.8	1.5
Seasonal Rainfall Change (in %)	Observed Baseline (1971 - 2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Albay	739.8	386.9	705.8	941.3	0.5	-11.1	14.3	6.4	5.7	-18.2	25.3	10.3
Camarines Norte	1029.6	398.5	565.6	1285.7	0.0	-17.8	5.2	7.8	5.6	-31.0	8.9	1.5
Camarines Sur	666.8	347.4	639.6	1029.4	2.0	-14.9	9.5	5.8	4.1	-25.2	16.5	1.9
Catanduanes	1075.4	512.7	646.3	1119.5	13.6	-7.0	16.3	8.7	13.5	-18.7	24.4	8.2
Masbate	510.2	250.7	569.4	739.3	-1.1	-6.5	23.4	12.5	11.1	-7.4	42.9	27.9
Sorsogon	958.1	427.9	660.4	973.6	5.1	-6.8	14.6	10.8	7.4	-11.4	27.3	16.2

Table 5: Frequency of Extreme Events 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
Albay	Legaspi	27	683	1393	6219	3698	3811	1	4	11
Camarines Norte	Daet	118	1141	1981	6675	4288	4412	1	18	16
Catanduanes	Virac Synop	4	206	668	6958	4292	4412	3	4	5
Masbate	Masbate	392	1724	3459	7735	5018	4825	1	2	5

40°0.000'W

120°0.000'W

Contour Map

NAMRIA

20°0.000'S

60°0.000'N

40°0.000'S

CAMARINES NORTE

CAMARINES SUR

CATANDUANES

ALBAY

SORSOGON

MASBATE

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

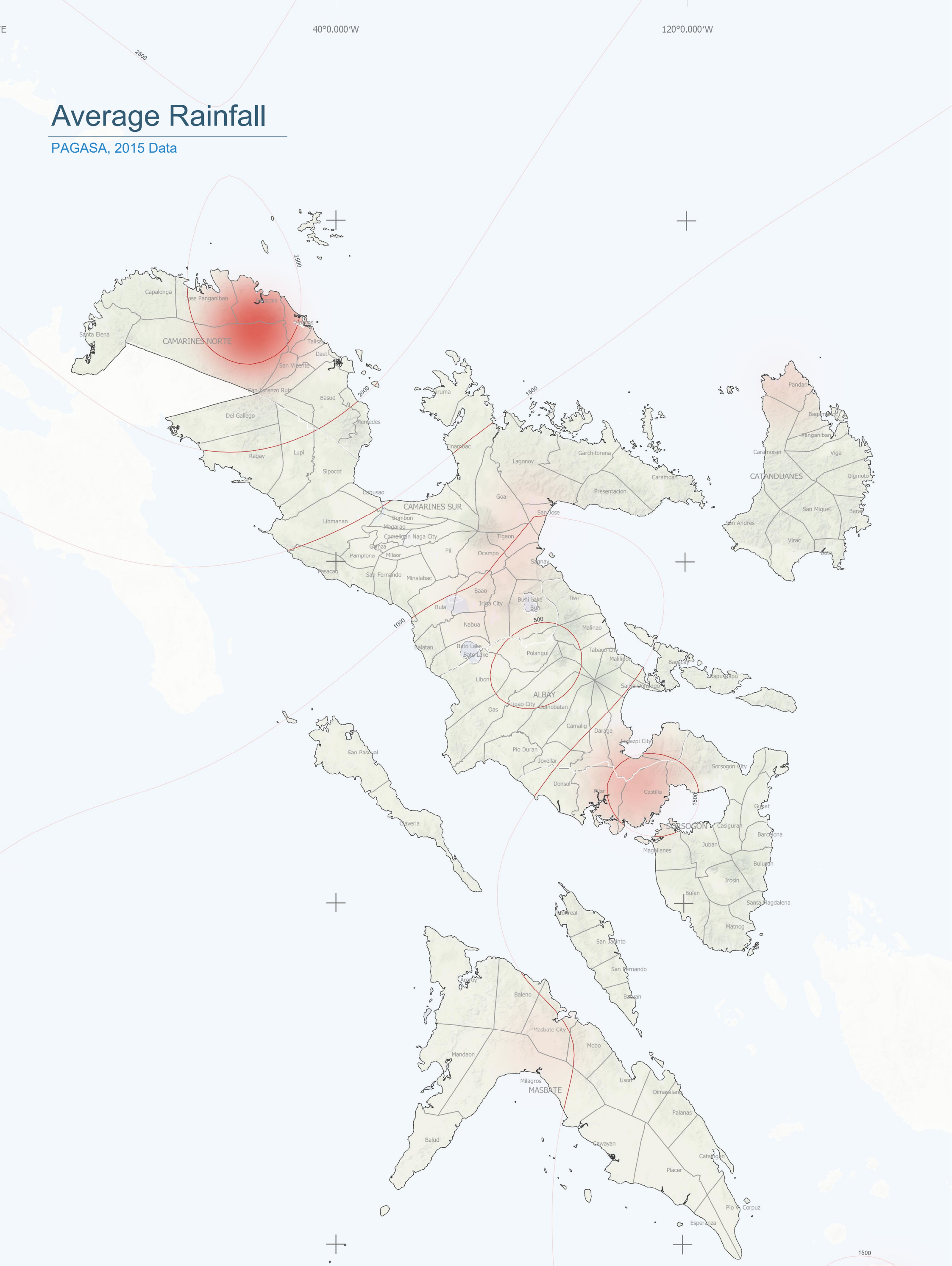
40°0.000'N

40°0.000'W

120°0.000'W

Average Rainfall

PAGASA, 2015 Data



Access to Safe Drinking Water

PSA, 2015 Census

40°0.000'W

120°0.000'W

20°0.000'S

60°0.000'N

40°0.000'S

Capalonga
Jose Panganiban
Paracale
Vinzons
Santa Elena
CAMARINES NORTE
Labo
Talisay
Daet
San Vicente
San Lorenzo Ruiz
Basud
Del Gallego
Mercedes
Ragay
Lupi
Sipocot
Cabusao
Siruma
Tinambac
Lagonoy
Garchitorena
Caramoan
Presentacion
Goa
CAMARINES SUR
Bombon
Libmanan
Magarao
Camaligan
Naga City
Gainza
Pamplona
Milaor
Pili
Ocampo
Tigaon
San Jose
Sagnay
Pasacao
San Fernando
Minalabac
Baao
Bula
Iriga City
Buhi Lake
Buhi
Tiwi
Malinao
Nabua
Balatan
Bato Lake
Bato Lake
Polangui
Tabaco City
Malilipot
Bacacay
Rapu-Rapu
Libon
Santo Domingo
ALBAY
Oas
Ligao City
Guinobatan
Camalig
Daraga
Legazpi City
Pio Duran
Jovellar
San Pascual
Sorsogon City
Donsol
Pilar
Castilla
Gubat
Claveria
SORSOGON
Casiguran
Barcelona
Magallanes
Juban
Bulusan
Irosin
Bulan
Santa Magdalena
Matnog
Monreal
San Jacinto
San Fernando
Aroroy
Baleno
Batuan
Masbate City
Mobo
Mandaon
Uson
Milagros
MASBATE
Dimasalang
Palanas
Balud
Cawayan
Cataingan
Placer
Pio V. Corpuz
Esperanza
Pandan
Bagamanoc
Panganiban
Caramoran
Viga
CATANDUANES
Gigmoto
San Miguel
Baras
San Andres
Virac
Bato

Legend

Safe Drinking Water (%)

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

N

10 0 10 20 30 40 km

14

WGS 1984 - UTM Zone 51 N

WSS Sector Status

Access to Safe Water

Approximately 82% the Bicol Region's population had access to safe water sources in 2015[5].

This figure translates to around 925,000 households. About 31.3% of the region's population has Level III service connection in their own homes while 6.7% has Level II connections shared with the community. Access to Level I (safe sources) comprises 42.5%.

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

The region's access to safe water is on a par with the national average of about 88% — a discrepancy of only about 7%.

Table 6: National and Regional Access to Water Supply[6]

Level of Service	National	Region V
Level III	44.1%	31.3%
Level II	11.2%	6.7%
Level I (Safe Sources)	32.4%	42.5%
Subtotal (Safe Sources)	*87.7%*	*80.5%*
Level I (Unsafe Sources)	12.3%	19.5%
Total	100.0%	100.0%

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

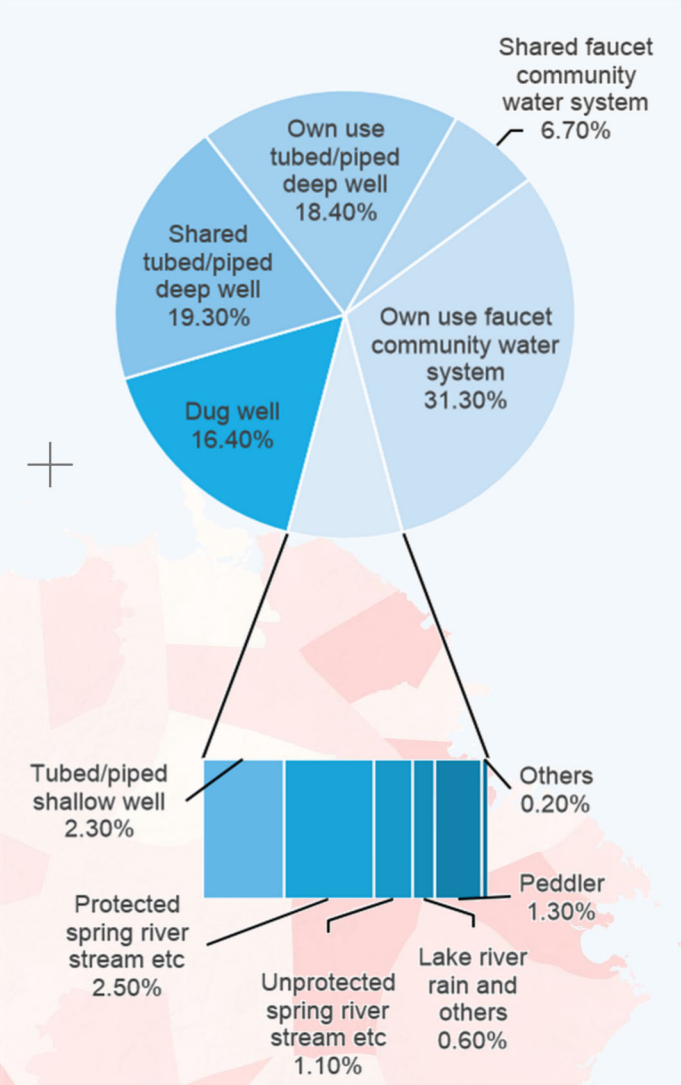


Figure 4: Main Sources of Water Supply, 2015

Table 7 shows safe water access in 2015 at the provincial level.

Table 7: Access to Water Supply per Province[7]

Region/Province	Access to Safe Water Supply
Bicol Region	**75.7%**
Albay	67.4%
Camarines Norte	92.8%
Camarines Sur	72.3%
Catanduanes	87.0%
Masbate	70.5%
Sorsogon	87.7%

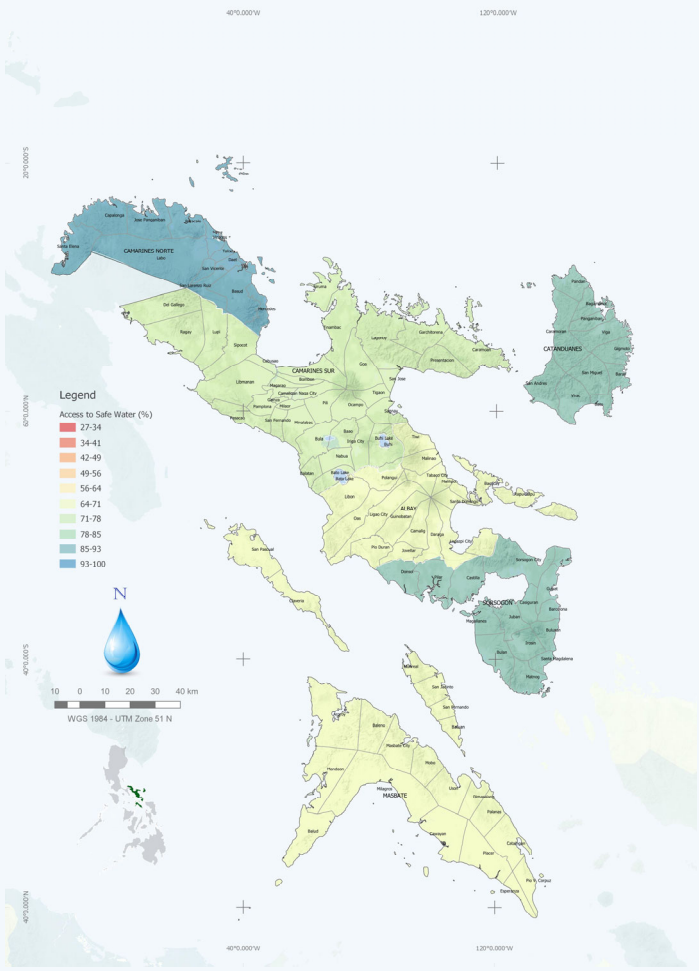


Figure 5: Provincial Access to Safe Water

Drinking Water

The 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.

At the provincial level, Masbate has limited access to safe drinking water — around 60%-62%.

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

[5] Philippine Statistics Authority, Family Income and Expenditure Survey, 2015
[6] Ibid.
[7] Based on Bicol provinces' firsthand data on access to safe water (as gathered during the regional planning workshop)

40°0.000'W

120°0.000'W

Access to Sanitation

Bicol Regional Workshop and Planning Consultation, 2017 Data

20°0.000'S

60°0.000'N

40°0.000'S

40°0.000'N

Access to Sanitation

The Bicol Region's rapid growth has been principally driven by an economic boom in its provincial growth centers (namely, Legazpi City, Daet, Sorsogon City, Bulan, Iriga, and Naga City). Such robust growth, however, comes with an accompanying increase in demand for sanitation services.

Approximately 70% of the region's population has access to improved sanitation.

The 2015 FIES has reported that the regional percentage of access to basic and improved sanitation is almost the same as the national percentage (see Table 8).

The region's open defecation rate, however, is nearly thrice the national percentage. It ranks next to ARMM, which has the highest open defecation rate in the country. (The open defecation rate is a proxy indicator for the lack of access to toilet facilities.)

Table 8: National and Regional Access to Sanitation[8]

Sanitation Coverage	National	Region V
Improved Sanitation	73.77%	69.90%
Basic Sanitation	19.96%	16.33%
Unimproved Sanitation	2.04%	1.88%
Open Defecation	4.23%	11.89%
Total	100.0%	100.0%

Camarines Norte registered the highest access to basic sanitation at 75.54% accounting for only 10.06% of the region's total population. The two provinces with the highest population base in the region — Albay and Camarines Sur — recorded the second highest and second lowest access to sanitation with 74.54% and 58.12%, respectively, according to the 2015 Annual Report of the Field Health Services Information System (FHSIS) of the Department of Health (DOH).

Table 9: Access to Sanitation Facilities per Province/City[9]

Region/Province/ City	HHs with Sanitary Toilets	HHs with Complete Basic Sanitation Facilities
Bicol Region	**68.21%**	**44.96%**
Albay	58.12%	24.50%
Camarines Norte	75.54%	61.80%
Camarines Sur	74.34%	51.02%
Catanduanes	71.99%	39.54%
Masbate	50.26%	33.29%
Sorsogon	71.65%	42.23%
Naga City	*97.76%*	*96.44%*

The minor discrepancy between Tables 8 and 9 regarding totals and averages highlights the difficulty of reconciling the definition of sanitation coverage under the Millenium Development Goals (MDG) with a more stratified and specific definition under the Sustainable Development Goals (SDG). Table 8 reflects the specifics per the SDG's definition. Table 9, on the other hand, reflects the rates of access as defined under the MDG, wherein the percentage of households with complete basic sanitation facilities is a subset of those 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

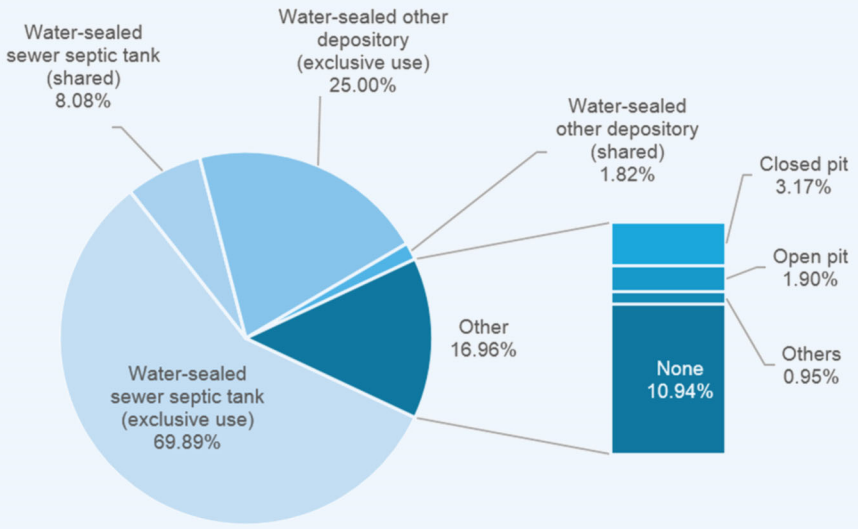


Figure 6: Percentage of Households with Access to Sanitation Facilities

Figure 6 shows the percentage of households per type of sanitation facilities. It represents 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 the Bicol Region 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 two existing septage treatment plants (STPs) in the region. Only Naga City and Legazpi City have put up their own septage treatment plants.

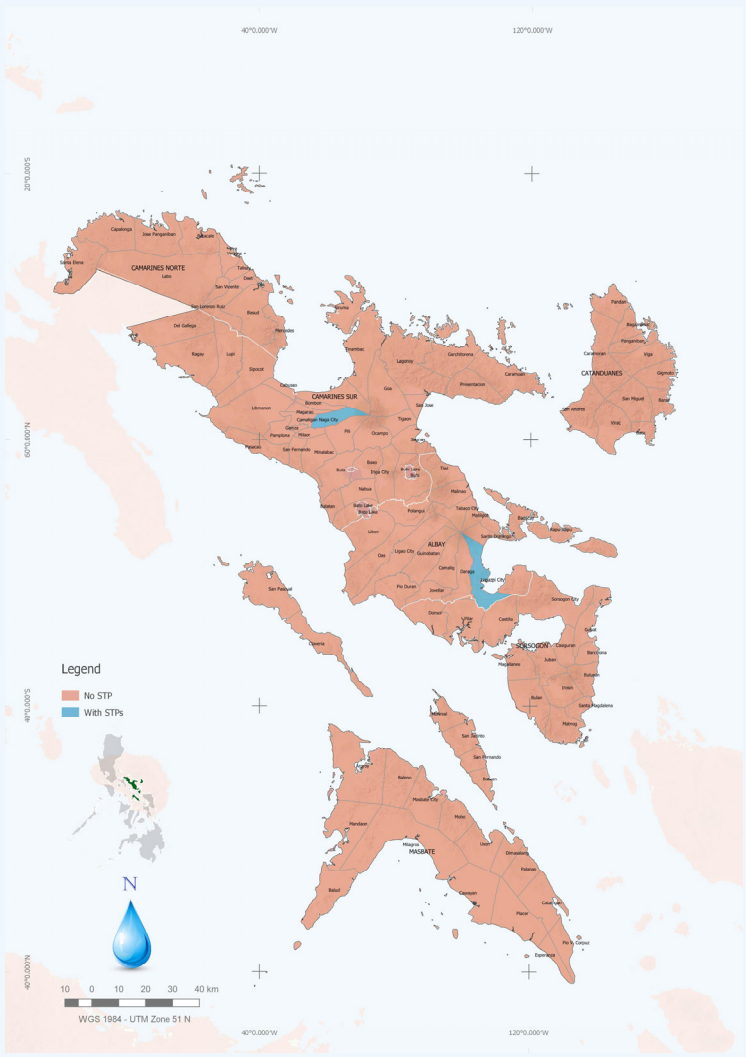


Figure 7: Existing Septage Treatment Plants

[8] *Philippine Statistics Authority, Family Income and Expenditure Survey, 2015*
[9] *Department of Health, FHSIS Annual Report CY 2015 (ro5.doh.gov.ph)*

Bicol Region Rivers and Tributaries

DENR, NWRB, NAMRIA

Water Resources

The Bicol Region is ranked 4th among all administrative regions with the least water resources potential.

The region's water resources potential totals 4,145 million cubic meters (MCM)/year, accounting for only 2.84% of the country's total.

The water resources potential of an area is divided into groundwater and surface water. Groundwater in the region is estimated at 1,085 MCM/year while surface water is estimated at 3,060 MCM/year. Annual rainfall averages 2,460 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.

The region straddles only one WRR, i.e., WRR 5.

Surface Water

Region V is endowed with abundant surface water. The Department of Environment and Natural Resources (DENR) has identified 54 rivers in the region, as well as seven marine water bodies and four lakes. The region is also home to the Bicol River Basin (BRB), one of the major river basins in the country.

Bicol River Basin

The BRB has a catchment area of 317,103 hectares. It traverses Albay, Camarines Sur and Camarines Norte. It is bounded by the high slopes of Mt. Labo, Mt. Isarog, Mt. Malinao, Mt. Masaraga, Mt. Iriga, Mt. Mayon, Ragay Hills and Bicol National Park. According to 2010 Land Cover Map of the National Mapping and Resource Information Authority (NAMRIA), 77% of BRB is planted to annual and perennial crops.

A network of rivers and lakes that drain the BRB travels across 7,309 hectares of land. Headwaters originate from mountain ranges, volcanoes and hills surrounding the catchment area. Lake Buhi, Lake Baao and Lake Bato (the seventh largest lake in the country) are part of the BRB.

The BRB is drained by two major rivers, the Bicol and Libmana Rivers, that converge near Aslong, Libmanan before they empty into the San Miguel Bay. Based on the topographically delineated watershed divide, 43 LGUs are situated wholly or partially within the BRB. Also, eight sub-basins have been identified as within the BRB.

Almost half of the annual rainfall becomes surface runoff based on water balance computations. This is equivalent to at least 1,250 mm of excess water flowing per year.

Protected Areas

About 12,120 hectares or 4% of the total land area of BRB is classified as protected areas.

At least four protected areas are located in the BRB namely, the Bicol National Park, Mt. Isarog Natural Park, Mayon Volcano Natural Park, and Libmanan Caves Natural Park. These are home to hundreds of terrestrial species of wildlife and serve as sanctuary to endangered species.

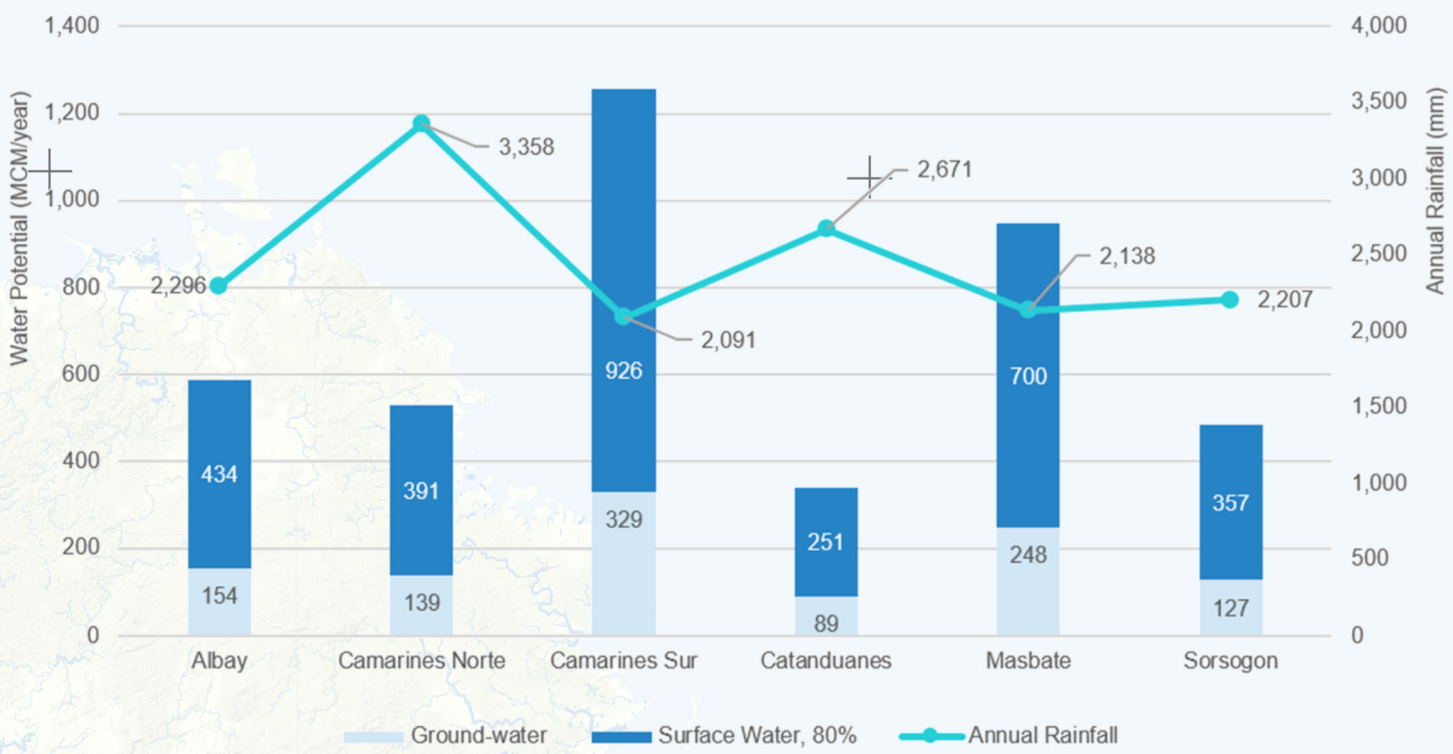


Figure 8: Water Resources Potential and Annual Rainfall[10]

[10] *JICA Master Plan on Water Resources Management in the Philippines, 1998; NWRB; PAGASA Rainfall Data; FAO*

Groundwater Availability

MGB

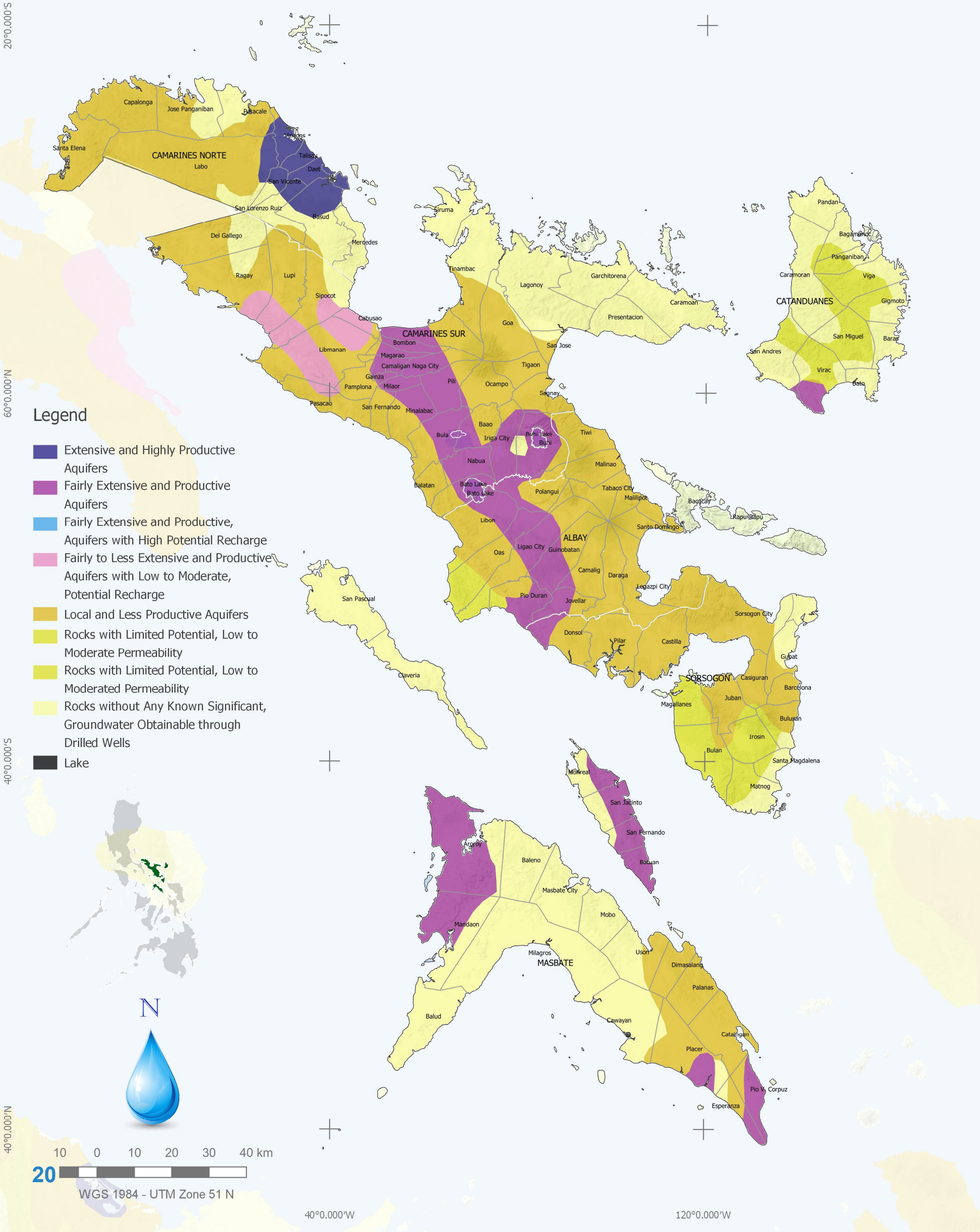


Table 10: Aquifer Classes Based on MGB Aquifer Types

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

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 to be defined in relation to the possible development depth and overall development potential.

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 tied to groundwater storage based on the type and class of aquifer present in a study area (see Table 10).

The Bicol Peninsula is predominantly underlain by the minor aquifer class — specifically the local and less productive kind. A portion of Camarines Norte has extensive and highly productive aquifers. Catanduanes has very low permeability. In Masbate, while there are large areas with no extractable groundwater, major aquifers are found in its northern and southern parts.

Water Use

Water use in the region was estimated at 4,087.75 MCM annually based on awarded water permits as of 2017. Approximately 2,964.67 MCM (72.53%) was allocated for irrigation and categorized as consumptive use. The municipal/domestic sector consumed 161.55 MCM and the industrial sector 41.79 MCM. About 919.74 MCM was reserved for nonconsumptive use such as that of the power sector which consumes 842.52 MCM (see Figure 9).

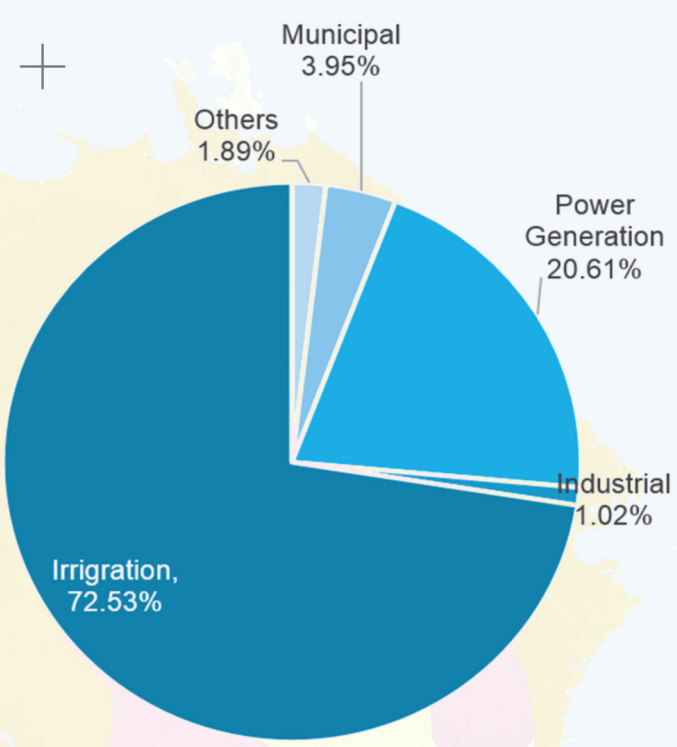


Figure 9: Water Resource Utilization, 2017[11]

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.)[12]

Water availability per capita was computed by comparing the region and provinces' potential against the 2015 population (as shown in Table 11).

The Bicol Region has an estimated per capita water availability of 715 m^3/year, indicating water scarcity.

Table 11: Water Availability per Province

Region/Province	Water Availability (m^3/capita/year) 2015 Population
Albay	447
Camarines Norte	909
Camarines Sur	643
Catanduanes	1,303
Masbate	1,062
Sorsogon	610
Region V	**715**

Figure 10 presents the computed figures to highlight the provinces' level of water availability, stress, and scarcity.

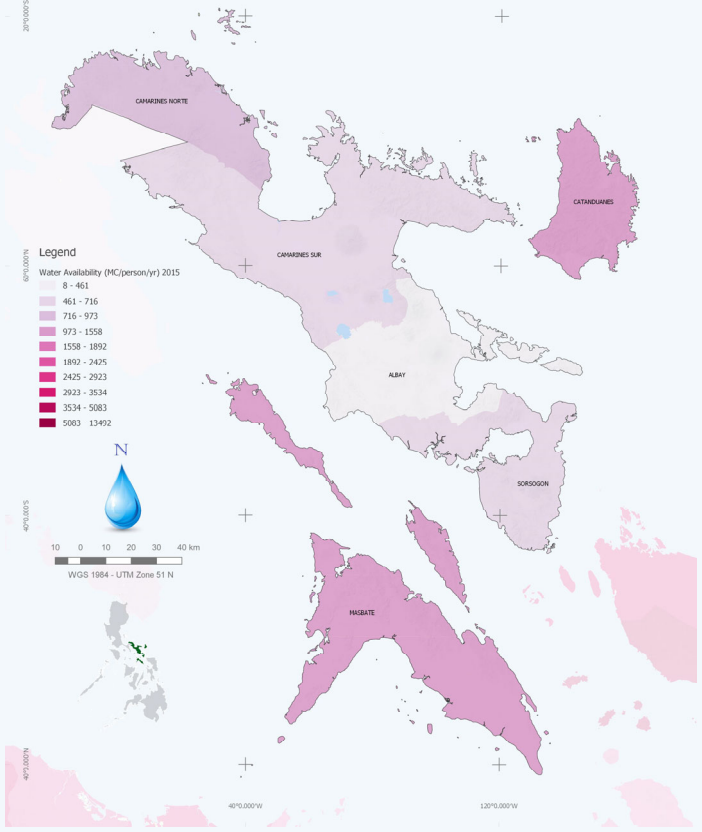


Figure 10: Water Availability Map, 2015

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

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 to establish future trends.

Employing PSA's 2010-based population projections which were adjusted to conform with the actual 2015 population, the region's population is projected to reach 8,139,861 by 2045.

Water Supply and Demand

Water demand projection is fundamental to water supply feasibility studies and preliminary engineering design. It is also an important tool in the preparation of master plans, considering the future needs of a growing population. Water demand projections are developed based on the estimated projected population.

In general, the total water demand is equal to the sum of the domestic, commercial, industrial, institutional, and unaccounted-for water. Computation for water demand at the household level, in particular, is primarily based on the degree of urbanization of a barangay.

In projecting water demand, the units of consumption used are 120 liters per capita per day (lpcd) for urban populations, and 60 lpcd for rural populations. In the NCR and other HUCs, 150 lpcd and 80 lpcd are used for urban and rural populations, respectively.

By 2022, 2030, and 2040, the total water demand of the region would have reached 258 MCM/year, 314 MCM/year, and 382 MCM/year, respectively.

Water Demand vs. Water Resources Potential

The water demand of the industrial, business and domestic sectors in the Bicol 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 (382 MCM/year) to the water resources potential of the region (4,145 MCM/year), the availability of water far exceeds the region's projected water demand up to 2045.

It must be noted, however, that the projected water demand of 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.

The water scarcity in the region may be attributed to the untallied demand not reflected in the statistics cited earlier. Shortages in the water supply in the upcoming years are foreseen if no water management schemes are developed and enforced to control demand shifts.

Approaches to water resources management may include utilization and proper use of existing water resources to ensure sustainable and adequate water supply for domestic use.

Figure 11: Projected Population per Province

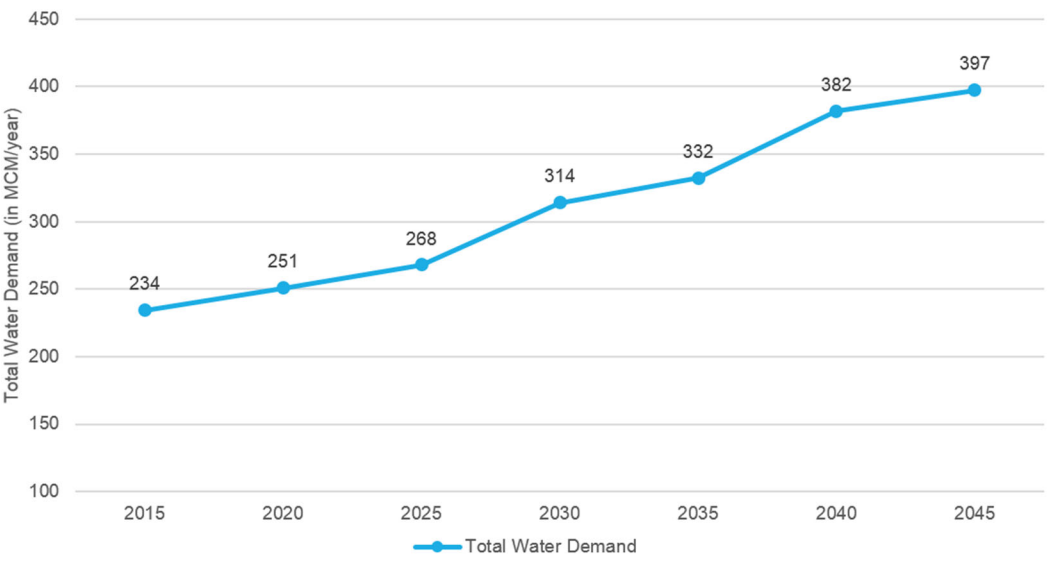
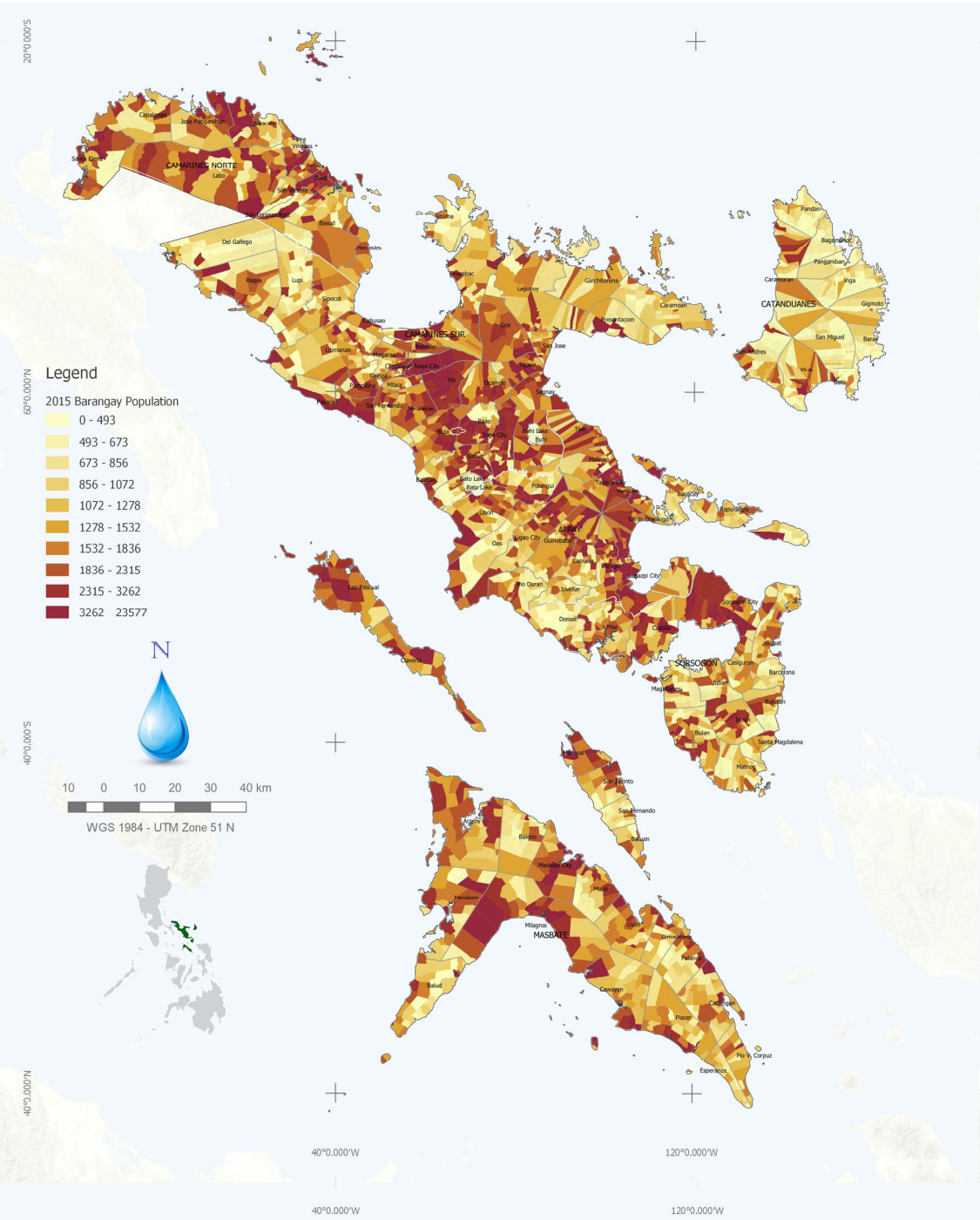
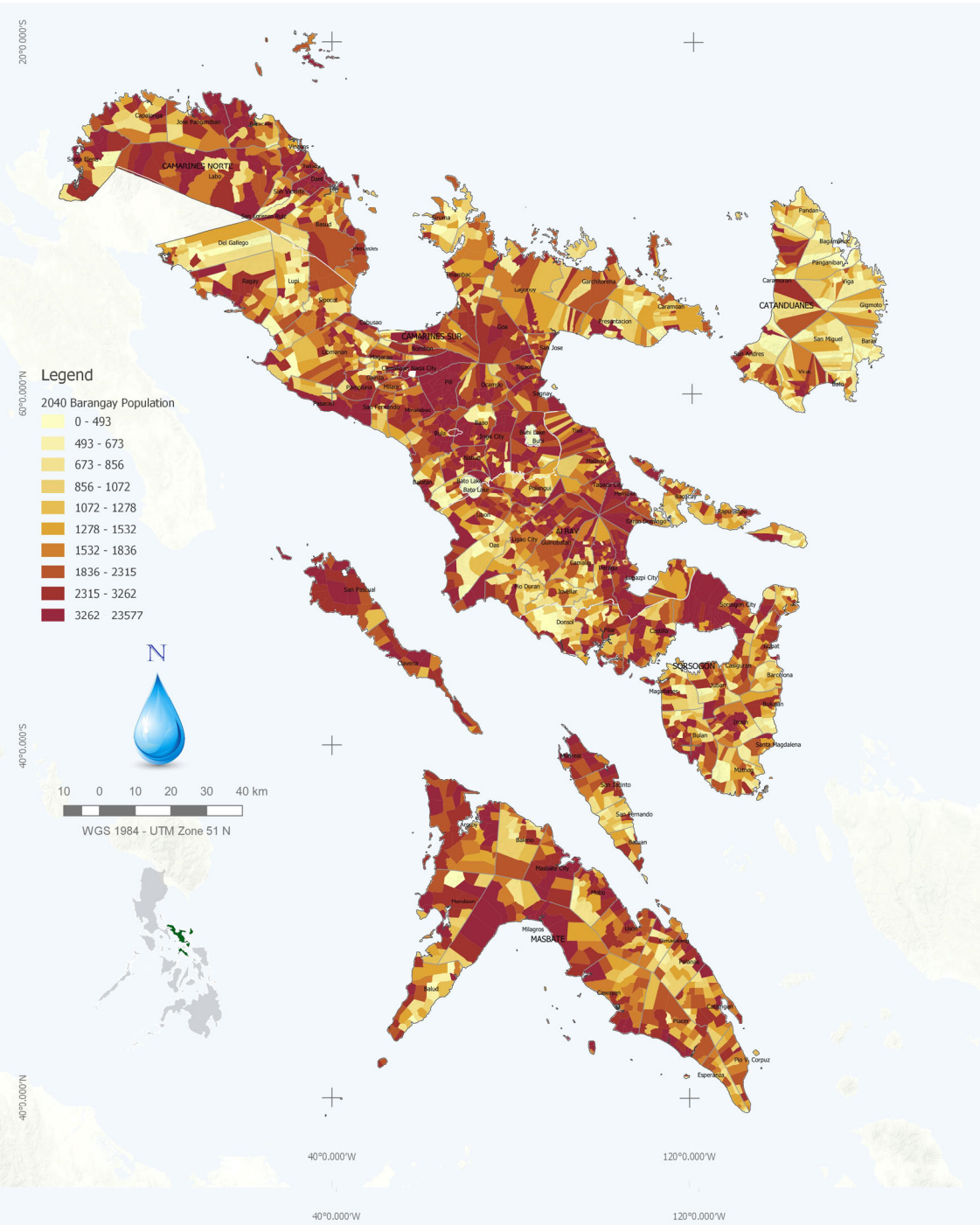


Figure 12: Projected Water Demand

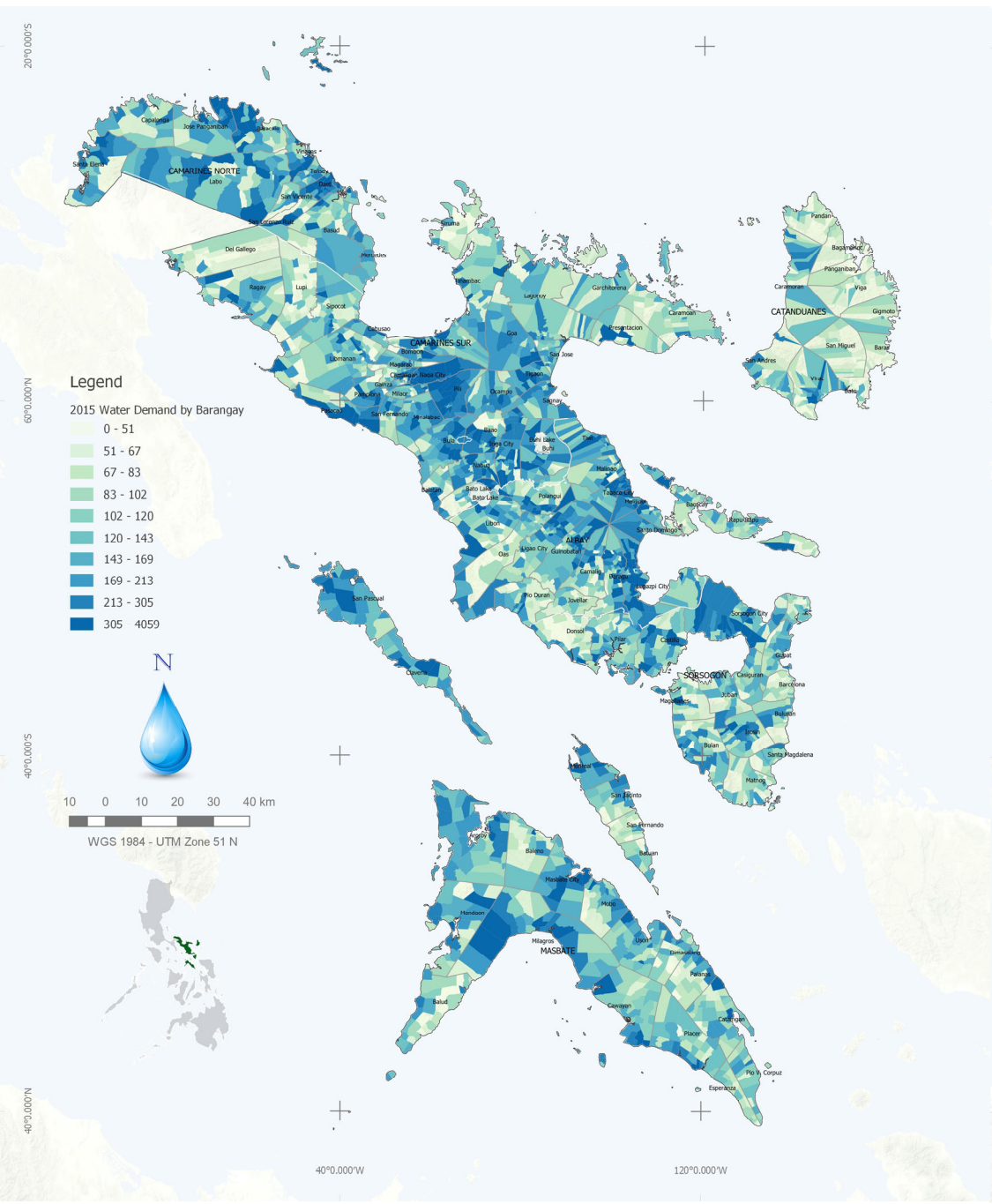
2015 Population



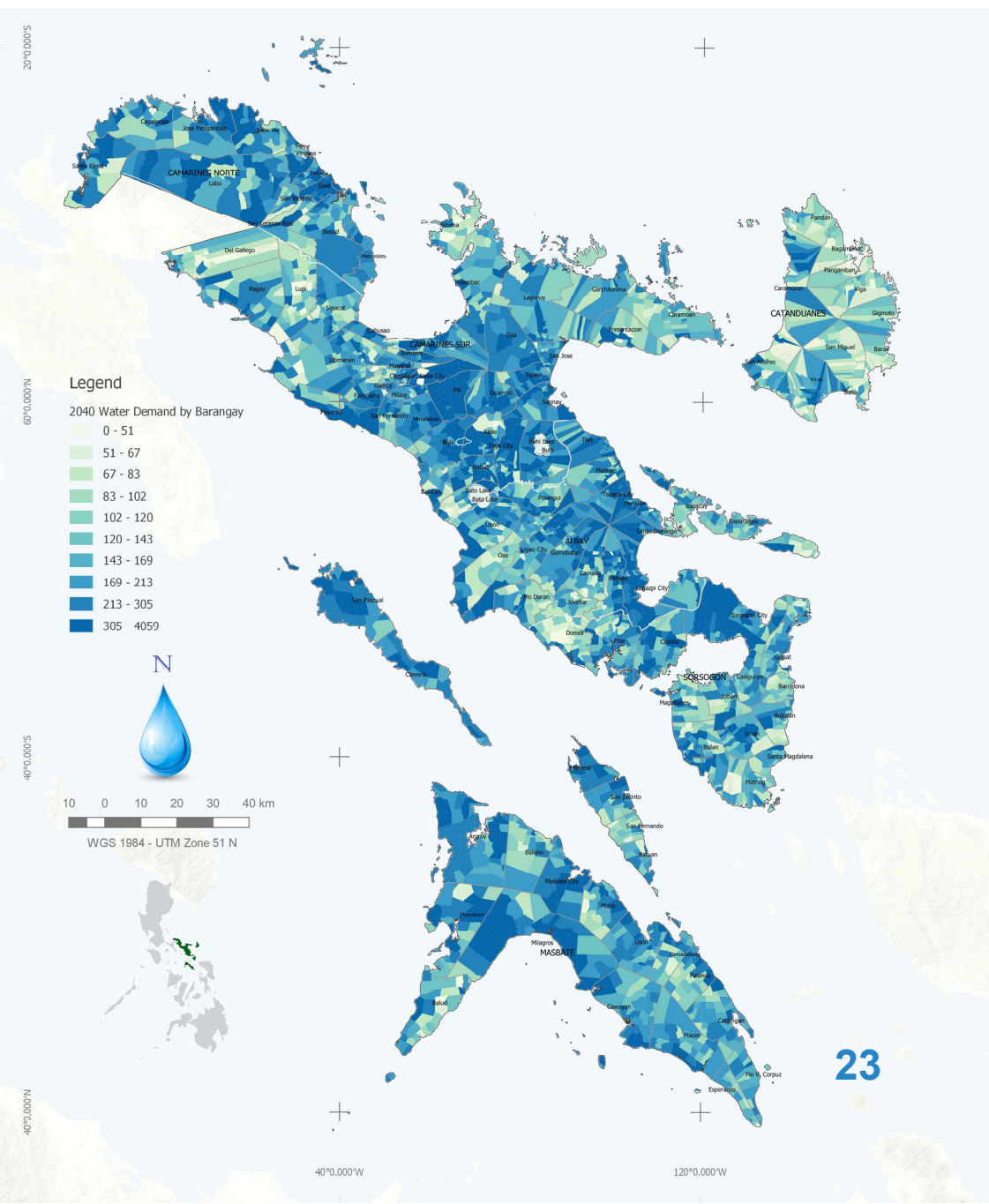
2040 Population Projection



2015 Water Demand

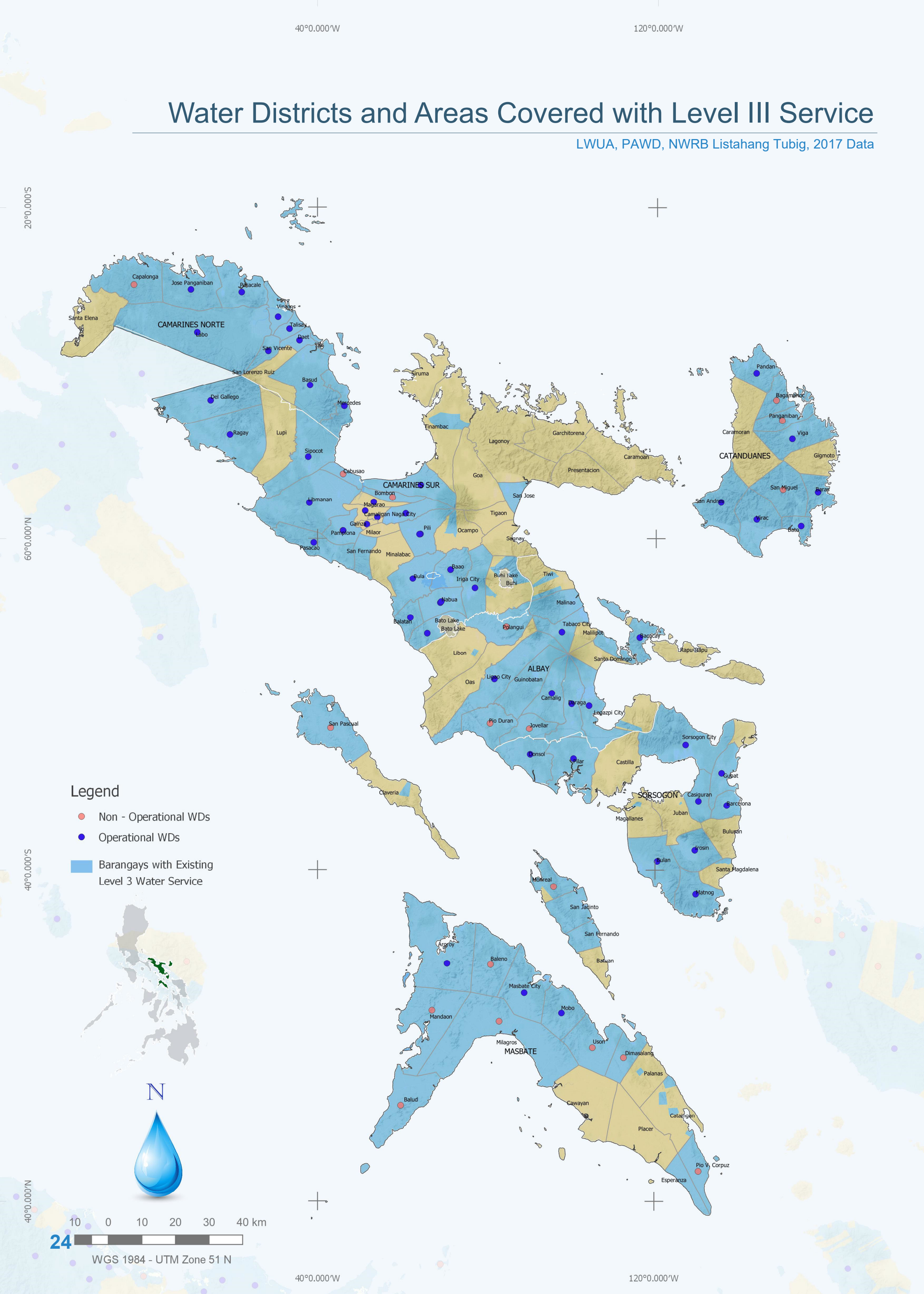


2040 Water Demand Projection



Water Districts and Areas Covered with Level III Service

LWUA, PAWD, NWRB Listahang Tubig, 2017 Data



WSS Infrastructure

Water service providers (WSPs) of various management types serve around 42% of the Bicol Region[13].

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 is not in accord with the figures in PSA's 2015 FIES mainly because the former came from various sources[14], with the bulk of the data coming from the National Water Resources Board's (NWRB) Listahang Tubig.

Furthermore, it cannot be ascertained that all WSPs in the region have already registered under Listahang Tubig or are continually updating their operations data.

Nevertheless, these data help economic experts and engineers gain insights into the region's situation in relation to its existing water utilities.

Water Districts

As of 2015, there were 55 WDs in the Bicol Region, 37 of which were operational and 18 nonfunctional. These WDs cover about 2.75 million users or roughly 47% of the total population. Of this figure, 46% (roughly 1.3 million users) receives water service.

Camarines Sur has the widest coverage while Masbate has the most limited coverage with only 2 operational WDs out of its 11. Camarines Norte's WD service is covered by a joint venture agreement with Prime Water.

LGU-Led Water Utilities

There are 435 LGU-led water utilities in 114 cities and municipalities in Region V.

Camarines Sur has the most number of water utilities of this type with 183, while Camarines Norte has the least with 13. Albay has the largest population percentage served while Camarines Norte has the least number of users served.

BWSA

A total of 223 BWSA utilities in Region V have been providing water service to 218,200 users in 41 LGUs.

RWSA

There are 65 RWSA utilities serving 15 LGUs in Region V as of 2015.

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).

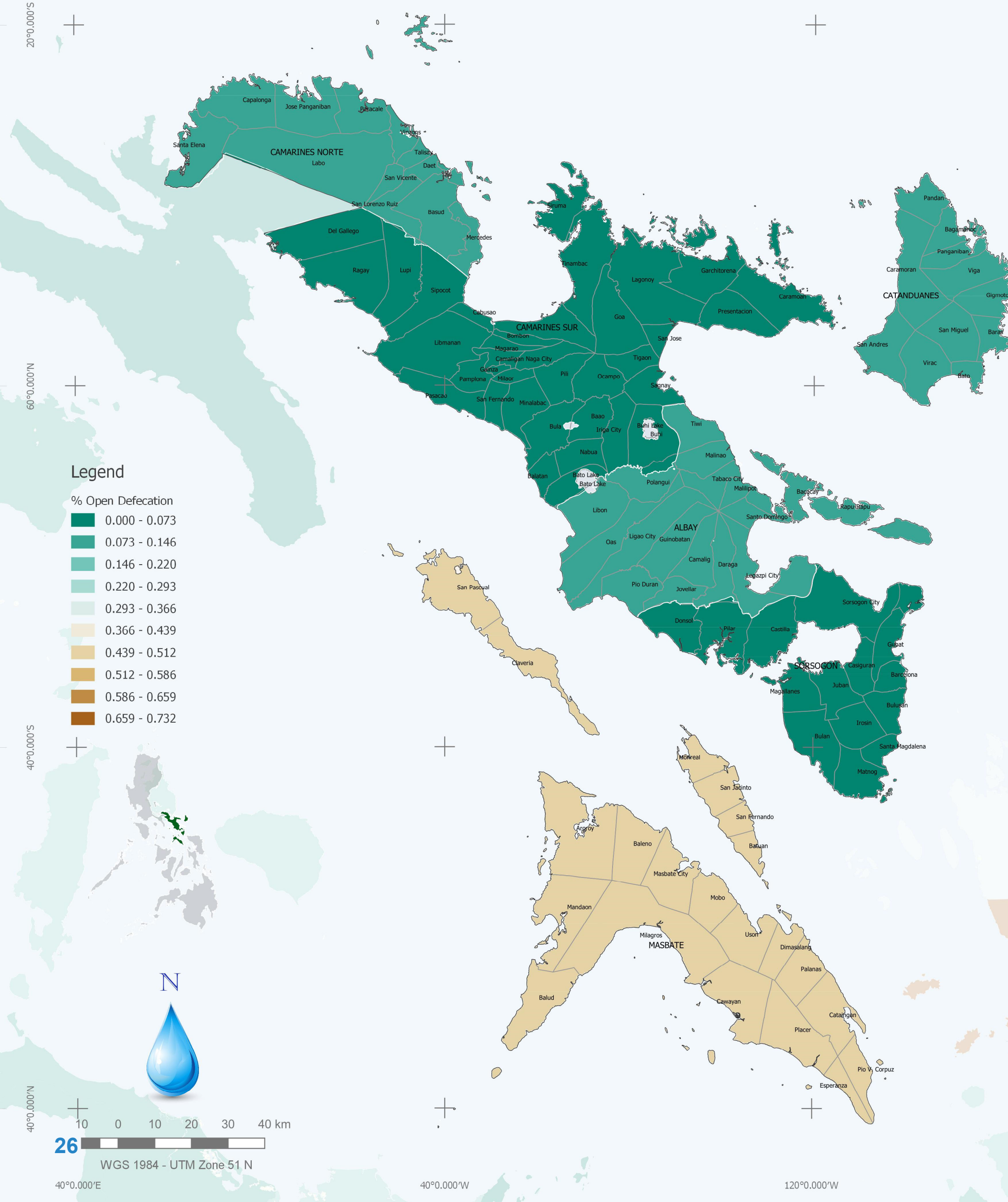
Table 12: Water Service Providers per Province

Region/Province	No. of LGUs	Type & No. of WSPs		Service Area	Population Served	
					Total	%
Albay	18	WD	8	704,311	334,107	47.44%
		LGU-led	111		267,776	20.37%
		BWSA	44		57,160	4.35%
		RWSA	1		430	0.03%
		Private/Others	93		43,895	3.34%
		Subtotal	**257**	**1,314,826**	**703,368**	**53.50%**
Camarines Norte	12	WD	4	223,587	169,466	75.79%
		LGU-led	13		20,560	3.52%
		BWSA	4		1,845	0.32%
		RWSA	1		1,180	0.20%
		Private/Others	11		1,985	0.34%
		Subtotal	**33**	**583,313**	**195,036**	**33.44%**
Camarines Sur	37	WD	15	922,792	463,456	50.22%
		LGU-led	183		83,600	4.28%
		BWSA	27		20,305	1.04%
		RWSA	18		23,035	1.18%
		Private/Others	478		223,445	11.44%
		Subtotal	**721**	**1,952,544**	**813,841**	**41.68%**
Catanduanes	11	WDs	8	166,180	67,474	40.60%
		LGU-led	22		24,040	9.21%
		BWSA	33		20,060	7.69%
		RWSA	25		18,586	7.12%
		Private/Others	35		24,460	9.37%
		Subtotal	**123**	**260,964**	**154,620**	**59.25%**
Masbate	21	WD	11	124,981	43,685	34.95%
		LGU-led	74		100,525	11.26%
		BWSA	97		88,370	9.90%
		RWSA	6		6,385	0.72%
		Private/Others	155		81,565	9.14%
		Subtotal	**343**	**892,393**	**320,530**	**35.92%**
Sorsogon	15	WD	9	603,590	173,162	28.69%
		LGU-led	32		33,085	4.17%
		BWSA	18		30,460	3.84%
		RWSA	14		20,285	2.56%
		Private/Others	68		11,435	1.44%
		Subtotal	**141**	**792,949**	**268,428**	**33.85%**
Bicol Region	114	WD	55	2,745,441	1,251,351	45.58%
		LGU-led	435		529,586	9.14%
		BWSA	223		218,200	3.76%
		RWSA	65		69,901	1.21%
		Private/Others	840		386,785	6.67%
		Grand Total	**1,618**	**5,795,989**	**2,455,823**	**42.37%**

[13] Based on LWUA and PAWD's water district data. Other WSP data were based on Listahang Tubig (data as of 2017)
[14] Local Water Utilities Administration (LWUA), PAWD, NWRB Listahang Tubig

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 whereby 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 various health-related problems.

Among the regions, Region V has the second highest open defecation rate of 11.89%. As of 2015, more than 689,000 people were reported practicing open defecation in waterless areas along the coastlines where settlers 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 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 current BOD in the Bicol Region.

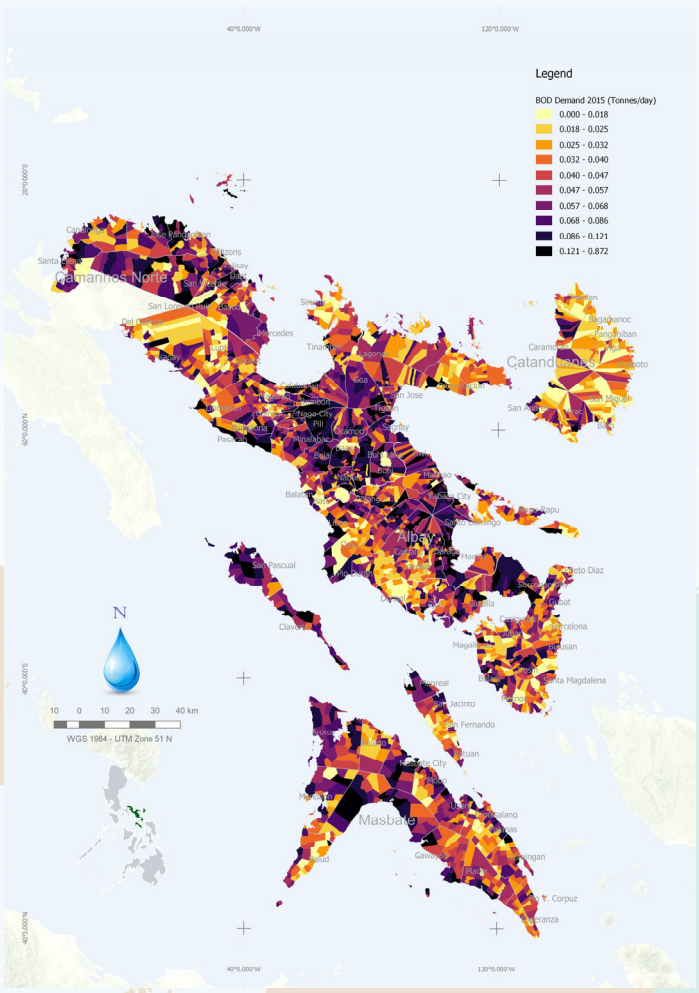


Figure 13: Biological Oxygen Demand, 2015

Industrial and agricultural wastewater generation may be estimated using 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.

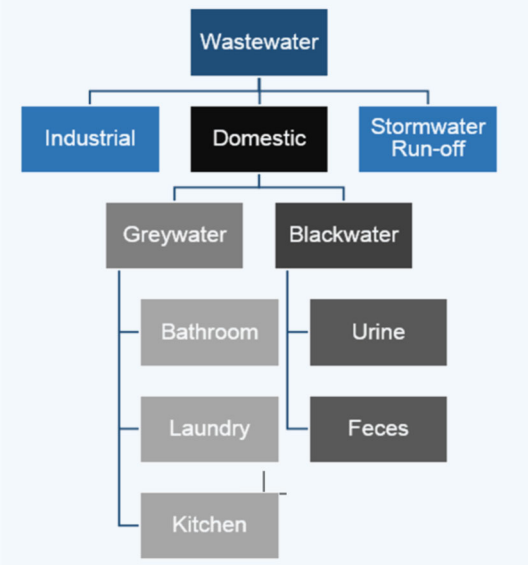


Figure 14: Categories of Wastewater

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[15] per person per day is used.

The wastewater[16] 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 current wastewater in the region is shown in Figure 15.

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

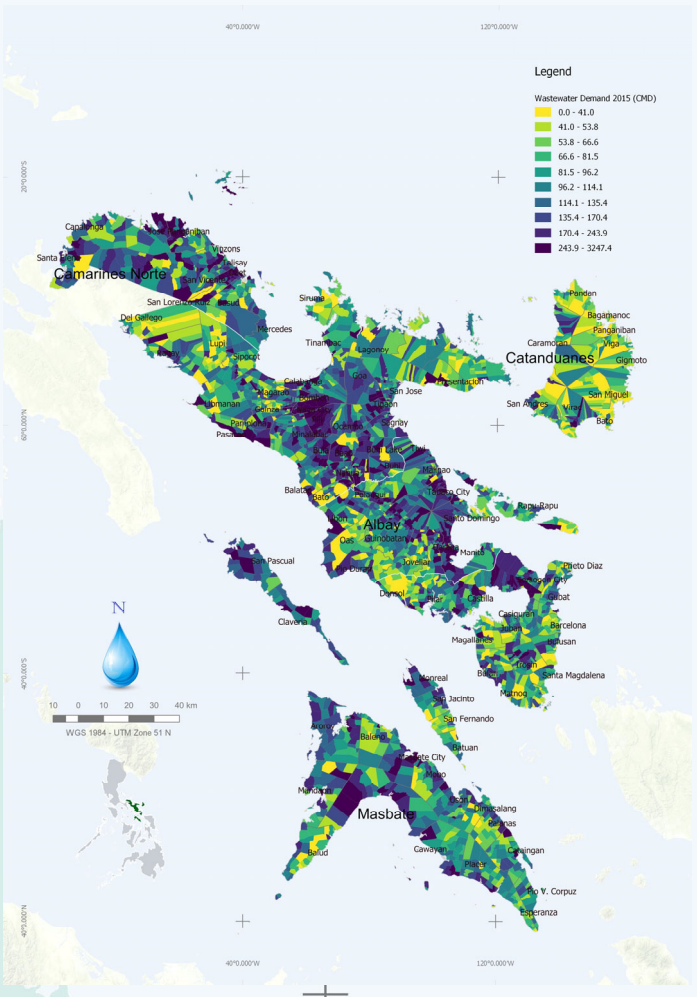
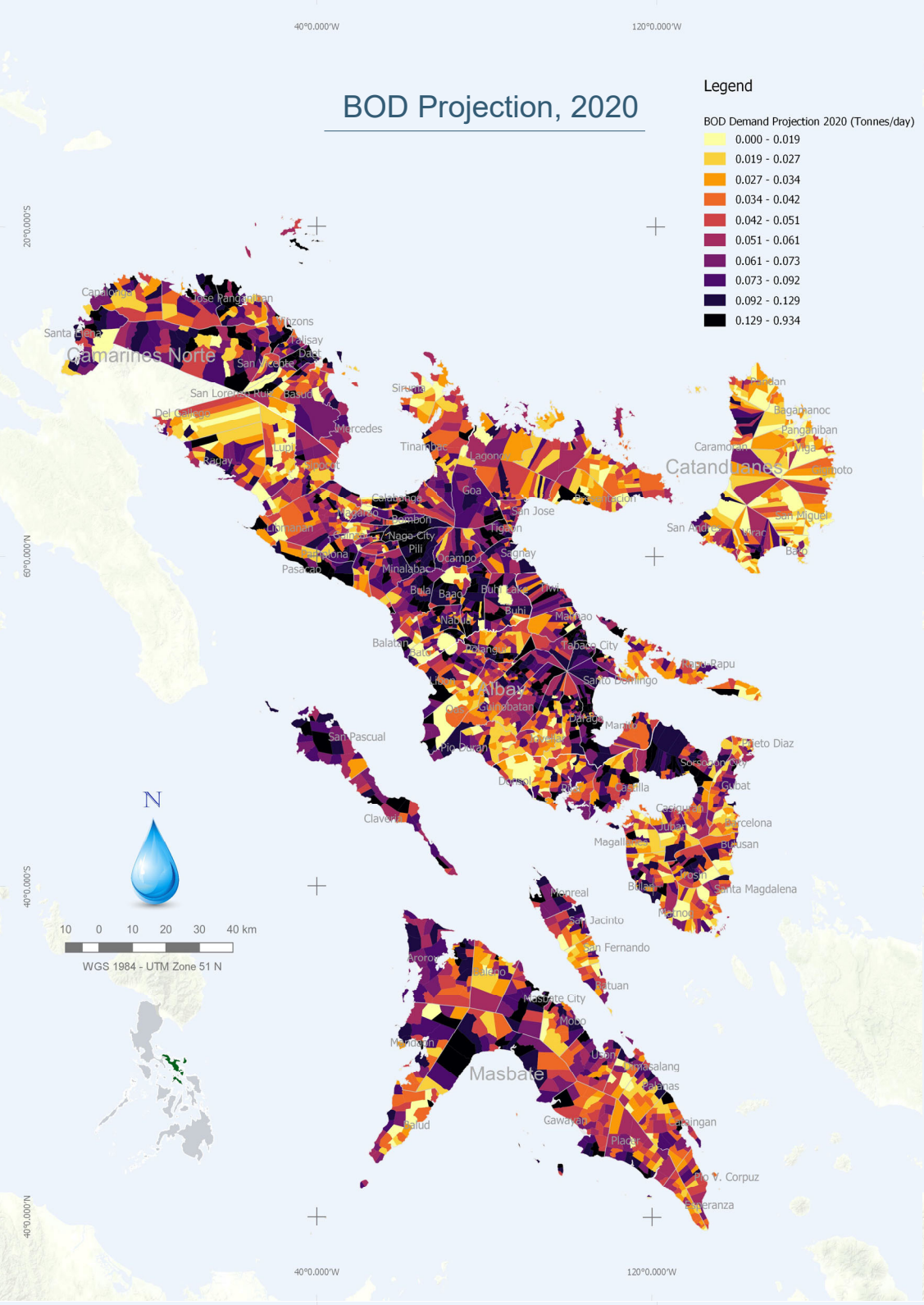


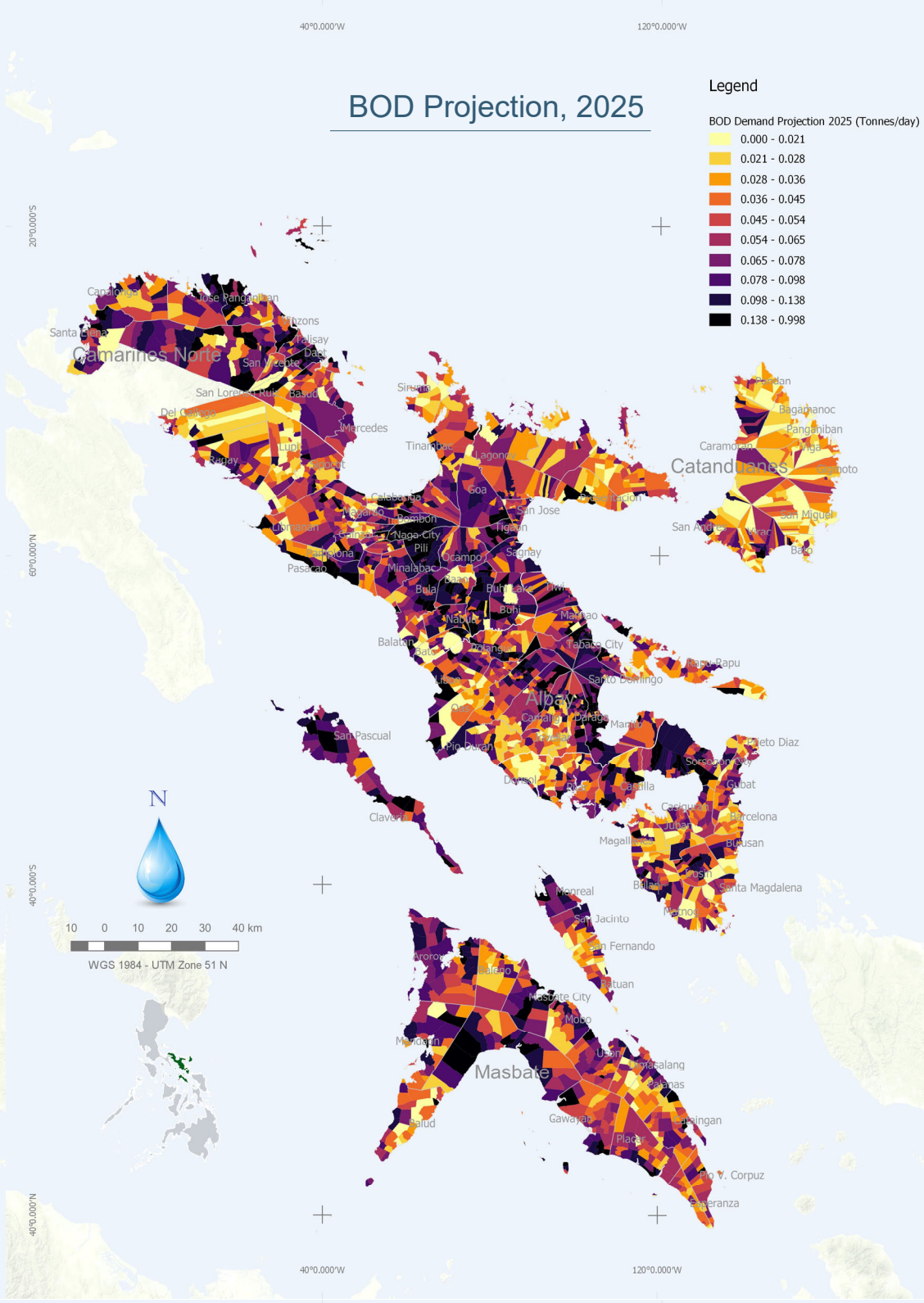
Figure 15: Wastewater Produced, 2015

[15] Philippine Environment Monitor (PEM), 2003
[16] Ibid.

BOD Projection, 2020



BOD Projection, 2025



BOD Projection, 2030

BOD Projection, 2040

Wastewater Projection, 2020

Legend

Wastewater Demand Projection 2020 (CMD)

- 0.0 - 43.6
- 43.6 - 57.0
- 57.0 - 70.7
- 70.7 - 86.7
- 86.7 - 102.6
- 102.6 - 121.8
- 121.8 - 144.7
- 144.7 - 182.4
- 182.4 - 260.7
- 260.7 - 3477.8

Wastewater Projection, 2025

Legend

Wastewater Demand Projection 2025 (CMD)

- 0.0 - 46.1
- 46.1 - 60.4
- 60.4 - 75.1
- 75.1 - 92.2
- 92.2 - 109.2
- 109.2 - 129.7
- 129.7 - 154.2
- 154.2 - 194.8
- 194.8 - 277.8
- 277.8 - 3712.3

Wastewater Projection, 2040

Legend

Wastewater Demand Projection 2030 (CMD)

- 0.0 - 51.5
- 51.5 - 67.4
- 67.4 - 83.3
- 83.3 - 102.3
- 102.3 - 121.1
- 121.1 - 143.2
- 143.2 - 170.3
- 170.3 - 213.7
- 213.7 - 305.3
- 305.3 - 4032.5

Wastewater Projection, 2045

Legend

Wastewater Demand Projection 2040 (CMD)

- 0.0 - 59.6
- 59.6 - 77.9
- 77.9 - 96.4
- 96.4 - 118.5
- 118.5 - 140.4
- 140.4 - 166.2
- 166.2 - 197.0
- 197.0 - 247.5
- 247.5 - 354.9
- 354.9 - 4566.0

Camarines Norte
Catanduanes
Albay
Masbate
Capalonga
Jose Panganiban
Vinzons
Santa Elena
Talisay
Daet
San Vicente
San Lorenzo Ruiz
Basud
Del Gallego
Mercedes
Lupi
Sipocot
Siruma
Tinambac
Lagonoy
Goa
Calabanga
Magarao
Bombon
Libmanan
Gainza
Pamplona
Pasacao
Ocampo
Minalabac
Baao
Buhi
Buhi Lake
Tiwi
Nabua
Bula
Pili
Naga City
Tigaon
San Jose
Presentacion
Sagnay
Pandan
Bagamanoc
Panganiban
Caramoran
Viga
Gigmoto
San Andres
Virac
San Miguel
Bato
Balatan
Polangui
Malinao
Tabaco City
Rapu-Rapu
Libon
Santo Domingo
Oas
Guinobatan
Camalig
Daraga
Manito
Jovellar
Pio Duran
San Pascual
Prieto Diaz
Sorsogon City
Donsol
Pilar
Castilla
Gubat
Casiguran
Juban
Barcelona
Magallanes
Bulusan
Irosin
Bulan
Santa Magdalena
Matnog
Monreal
San Jacinto
San Fernando
Batuan
Claveria
Aroroy
Baleno
Mandaon
Masbate City
Mobo
Uson
Dimasalang
Palanas
Balud
Cawayan
Cataingan
Placer
Pio V. Corpuz
Esperanza

N

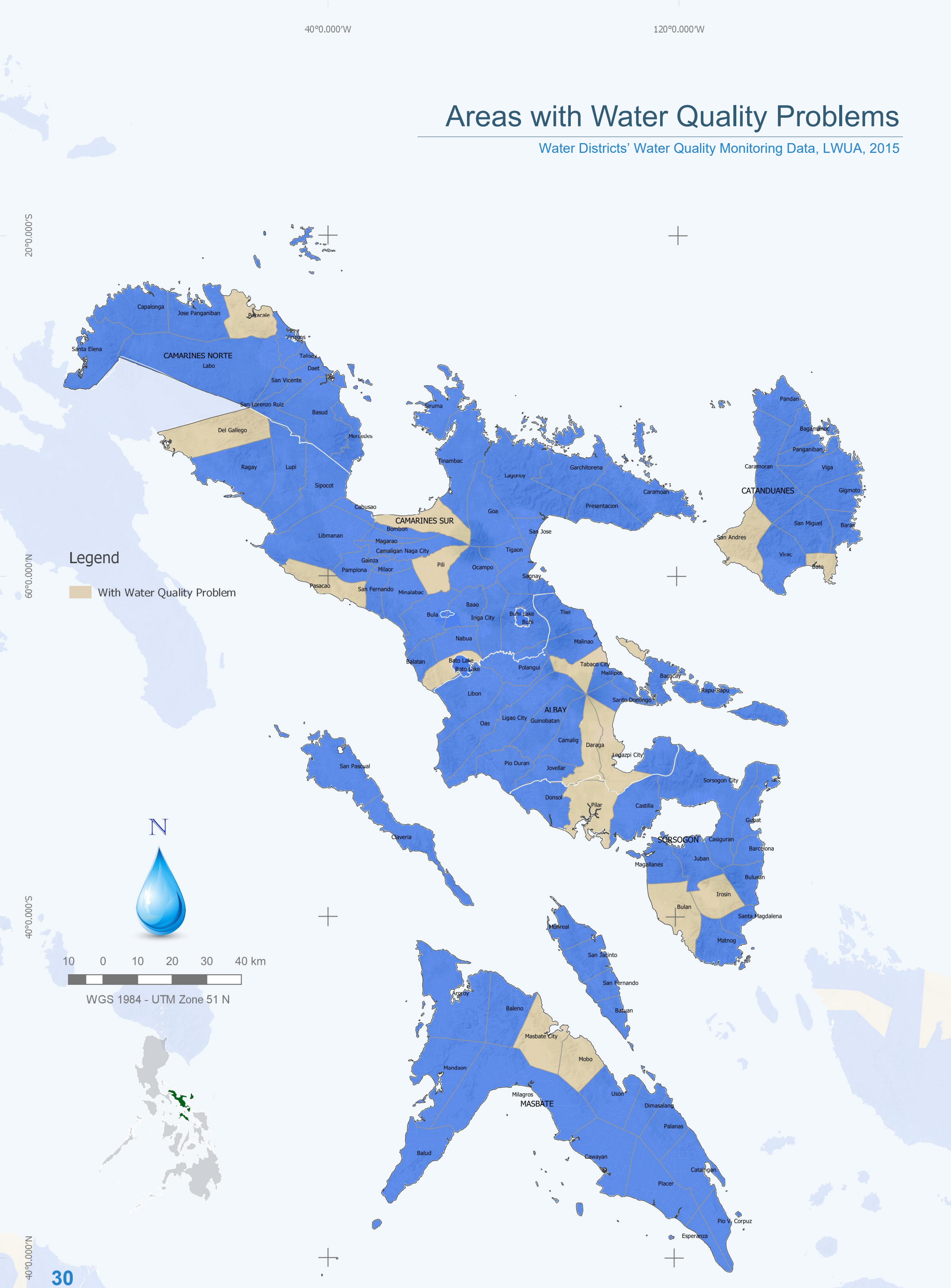
10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

20°0.000'S
40°0.000'N
60°0.000'N
40°0.000'S
40°0.000'W
120°0.000'W

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 its beneficial use and environmental value. It is water relative to its use and measured in terms of its physical, chemical, biological and radiological characteristics. It is most frequently used in reference to a set of standards against which compliance can be assessed.

A water quality study commissioned by the DENR Environmental Management Bureau (EMB) in 2010 classified bodies of surface water in the region according to water quality (Table 13).

Table 13: Classification of Surface Water Bodies in Region V

Surface Water	Classification
Libmana River	Class A
Pulantuna River	Class A
Bicol River	Class A
Naga River	WQMA and Class C
Pawili River	Class C
Quinale River	Class C
Waras River	Unclassified
Lake Buhi	WQMA and Class B

Lake Buhi (in Camarines Sur) with an area of 18 km^2 and an average depth of 8 m has been experiencing fish kills in recent years. According to a water quality monitoring report of the Bureau of Fisheries and Aquatic Resources (BFAR) Regional Office V, the fish kill that took place in October 2010 was mainly caused by highly polluted waters.

After several tests were conducted, Lake Buhi was found to have very high ammonia nitrogen concentration. Moreover, very high traces of hydrogen sulfide, a poisonous gas, were detected.

In 2013, the DENR declared Lake Buhi Watershed the first Water Quality Management Area (WQMA) in the Bicol Region. This move sought to protect and improve the water quality of the watershed to make it a sustaining water resource.[17]

There are five drinking water quality testing laboratories in Region V recognized and accredited by the DOH — two in Albay and one each in Camarines Norte, Camarines Sur and Masbate. Only Regional Health Laboratory No. 5 in Legaspi City and the Metropolitan Naga Water District Laboratory in Naga City, however, have complete testing capabilities, i.e., based on physical, chemical and bacteriological parameters.

In the same breath, open defecation, the improper disposal of domestic wastewater and the lack of treatment facilities contribute to the further degradation of water bodies.

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 in which pathogenic microorganisms live. These diseases can be spread while bathing, washing, or drinking water, or by eating food exposed to contaminated water[18].

At least 66 residents (34 children and 32 adults) have fallen ill of suspected typhoid fever in 18 villages in the town of Oas in Albay, per municipal health records. It was found that the patients had drunk contaminated water sourced from the town's water reservoir from which most households in the vicinity drew their drinking water.[19]

Open defecation, one of the primary causes of waterborne diseases, is likewise practiced in many parts of Region V.

As of 2017, the Department of the Interior and Local Government (DILG) reported 25 waterless[20] municipalities in the Bicol Region (see Figure 16).

Residents in these areas have limited access to safe (drinking) water, and thus, are forced to resort to unsafe sources of water. Doing so increases their exposure to a host of waterborne diseases.

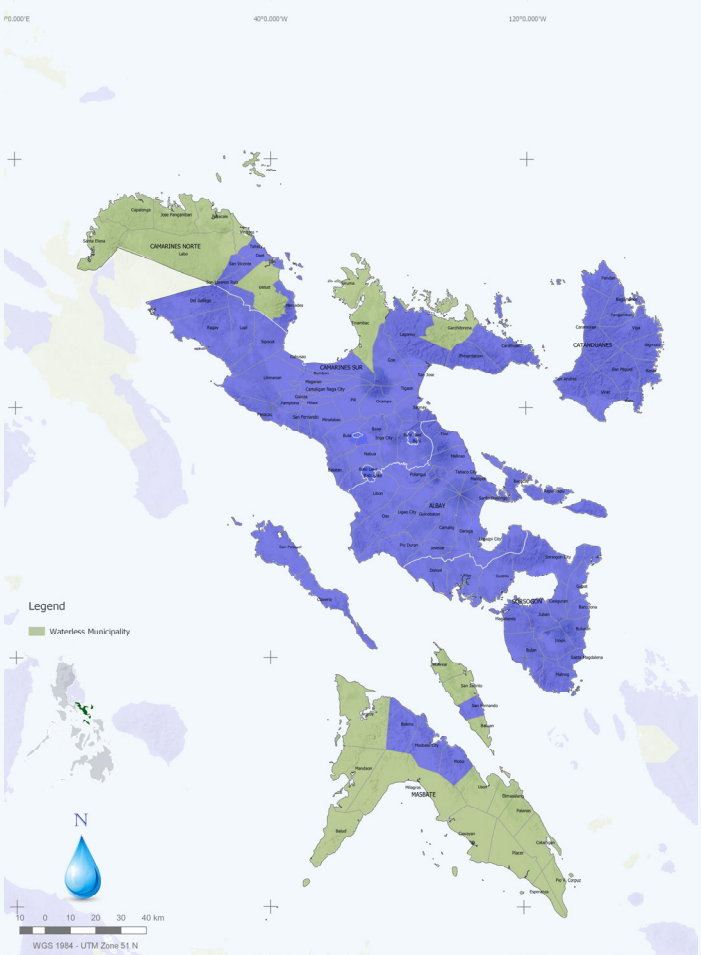


Figure 16: Waterless Municipalities

[17] Environmental Management Bureau (Region V)
[18] World Health Organization
[19] Inquirer.net, 2013
[20] Municipalities with less than 50% service coverage, National Anti-Poverty Commission, 2010

WSS Sector Gaps

In assessing the current state of the WSS sector in the Bicol Region, 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 workshop on water supply and sanitation in Region V produced a clear picture of realities on the ground, based on personal experiences, local knowledge and insights shared by key stakeholders and resource persons from the academe, nongovernment organizations (NGOs) and other concerned institutions.

The focused discussions resulted in the identification of weaknesses, inadequacies and other complications that have hindered the growth and development of the WSS sector in Region V. More importantly, the exchange of ideas also led to the adoption of specific recommendations on how to put an end to the sector's stagnation and facilitate the creation of momentum toward its accelerated development.

Planning and Development

Planning is commonly defined as "a strategic process to achieve developmental objectives." In a broad sense, it is a fundamental management undertaking that requires "logical thinking, rational decision-making and total dependence on reliable data and factual information."

Three current issues were identified under the planning and development pillar: funding, WSS sector not seen as a priority, and the lack of local experts.

Funding has been an inhibiting issue in the WSS sector. This may be attributed to the sector not being a priority of the government. There are a number of reasons behind this.

One is the prevailing ignorance of the role water supply and sanitation services plays in attracting investments and creating jobs. There is lack of awareness that (just like power, roads and bridges) the water supply and sanitation situation in a given locality is regarded by business people as a certified growth driver that greatly influences their investment decisions.

Another reason for fund insufficiency is the leadership's tendency to shy away from high impact but challenging, expensive and long-term projects of which water supply and sanitation management is a prime example.

Worse, financial and economics literacy is wanting in various levels of governance, thus preventing relevant information badly needed by the sector to correct the leadership's misconceptions, misgivings, and apprehensions.

A major mitigating factor is an effort to turn local chief executives (LCEs) and policy makers into WSS sector development advocates through focused discussions and seminars with the objective of enlightening them about the compelling reasons the WSS sector should be on the front burner of the government's development agenda.

Should the desired change in the mindset and disposition of LCEs and policy makers finally happen, there is reason to believe that the other factors hindering the development of the WSS sector such as unhealthy political dynamics and inefficient local bureaucracy will become a thing of the past.

Service Provision

In regard to service provision, the main hindering factors are the inefficiency of water provision, lack of sanitation providers and the unaffordability of services. At the root of these hindering factors is the lack of available financing aggravated by limited water supply sources. Enhancing the service area's attractiveness to investors is a proven solution and this could be done through the creation of a business-friendly environment where investors are allowed to recover the costs of doing business and make reasonable profit from their enterprise.

Another area of concern is the absence of a lead agency to regulate and monitor the WSS sector. Equally troubling is the revelation of pervasive personnel inefficiency. Sensitive and crucial positions in concerned government agencies are being filled with personnel who do not possess the required qualifications. Worse, staff skills enhancement initiatives in the form of training and seminars are not conducted, thus perpetuating a situation where hardly anything is accomplished by personnel not fit for the job. Institutionalization of a fully functioning regulatory regime is a priority mitigating factor. But capacity building alone through training and seminars will not suffice to fill the capacity gaps. A sensible and straightforward personnel and systems overhaul is long overdue.

The negative impacts of insufficient political will exacerbated by conflicts and disagreements between those in charge of governance cannot be overemphasized. The discord not only results in poor coordination and lack of synergy — it also kills private sector initiatives and discourages the formation of partnerships. For financiers and investors to come in, they will need an attractive environment where rules and regulations are honored and implemented by stakeholders pulling in the same direction.

Regulation

The lack of expertise on the part of hired personnel in the WSS sector is one of the major factors affecting the regulation area. As technical fitness and competence required are not readily available, there is a shallow pool of talents to choose from, enabling those with insufficient qualifications to occupy critical positions.

Other inhibiting factors identified include the absence of concrete policies on how to jumpstart the development of the WSS sector, the lack of integrated institutional mechanisms on water and sanitation as well as institutional weaknesses on enforcement and implementation capabilities.

The crafting of relevant ordinances, their harmonization with local national policies and activation of a credible and well-motivated enforcement arm will go a long way in generating sufficient momentum to push the development of the WSS sector to a higher level.

Table 14 summarizes the hindering and facilitating factors impacting the WSS sector in the Bicol Region.

Table 14: Hindering and Facilitating Factors

	Hindering Factors	Facilitating Factors
Planning and Development	Low-level of participation/involvement of technical experts in planning activities and lack of awareness among stakeholders of the current state of the WSS sector Low priority given to WSS by local and political leaders Absence of permanent/regular rural sanitary inspectors in municipalities Lack of institutionalized programs Absence of a single regulatory body Overlapping mandates given to line agencies Lack of funds Dependence of communities on government dole-outs High poverty incidence Difference in political affiliation Lack of awareness among government leaders that an improved WSS sector is a driver of growth	Financial assistance from international NGOs or donor agencies Third-party laboratories Resiliency studies/mechanisms Provision of technical assistance Institutionalization of projects and programs Creation of a regulatory body to oversee the WSS sector Turning local chief executives and policy makers into WSS sector development advocates through focused seminars and discussions
Service Provision	Inefficient water supply and limited water sources Unaffordability of water and sanitation services/ high cost of water supply Lack of septage facilities and sanitation providers Lack of zeal among agencies to initiate water projects Lack of ordinances related to sanitation Collaboration gap, i.e., absence of a lead agency handling the WSS sector Insufficient political will among local leaders, decision and policy makers, and water users in general Capacity gaps Lack of available financing Political discord among local leaders No staff development programs Inability to implement programs and projects that will improve delivery of services Lack of IEC programs Mismatch between job requirements and qualifications/skills of hired staff employees	Strict enforcement of and adherence to rules and regulations Proper and close coordination of WD/LGU in implementing WSS projects Strengthening of political will Seminars that generate awareness among local constituents/rural residents about the importance of WSS Upgrading the technical capacity of water providers Revisiting and updating of existing development plans Improvement of plans and programs regarding service delivery Implementation of strategies for sourcing funds Strict policy enforcement Utilization of bulk water supply sources Partnerships with other entities
Regulation	Lack of access to financing Absence of responsible agencies to implement existing laws Absence of concrete policies on WSS Lack of integrated institutional mechanisms for water and sanitation Lack of policy enforcement Lack of skilled technical personnel Improper attitudes and cultural perspective WSS sector not seen as a priority Lack of economic significance placed on WSS	Crafting of policies for WSS sector Information dissemination campaigns Orientation and training programs Adoption of best sanitation practices to foster improved public health standards Assignment of committed personnel

Regional Vision

"By 2030, we envision Happy and Healthy Bicolanos with access to safe, adequate, and sustainable water supply and sanitation services supported by responsible and collaborative stakeholders".

The Bicol Region's WSS vision was developed by the visioning group with the objective of enabling the entire region to achieve universal access to safe and sustainable water by 2030.

In essence, safe water encompasses sanitation, rationalizing the necessity of improved water and sanitation projects that will sustain adequate water supply, ensure its good quality and affordability, and upgrade sanitation infrastructure.

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 figure shows strategic priorities for the Bicol Region highlighting the provinces' individual plans. Priority areas include capacity building, information dissemination, project development and politics. These priorities have been observed to be the major areas of concern in relation to the provincial plans (as discussed in "Issues, Constraints and Challenges").

Corresponding strategies 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 (categorized as undeveloped/underdeveloped, developing and developed) is shown in Table 15.

Table 15: Strategies in Achieving Increased Access to Potable Water

Segment	Target	Strategic Statement
Undeveloped/Underdeveloped		
Level I	▪ 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 II	▪ 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 III	▪ 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

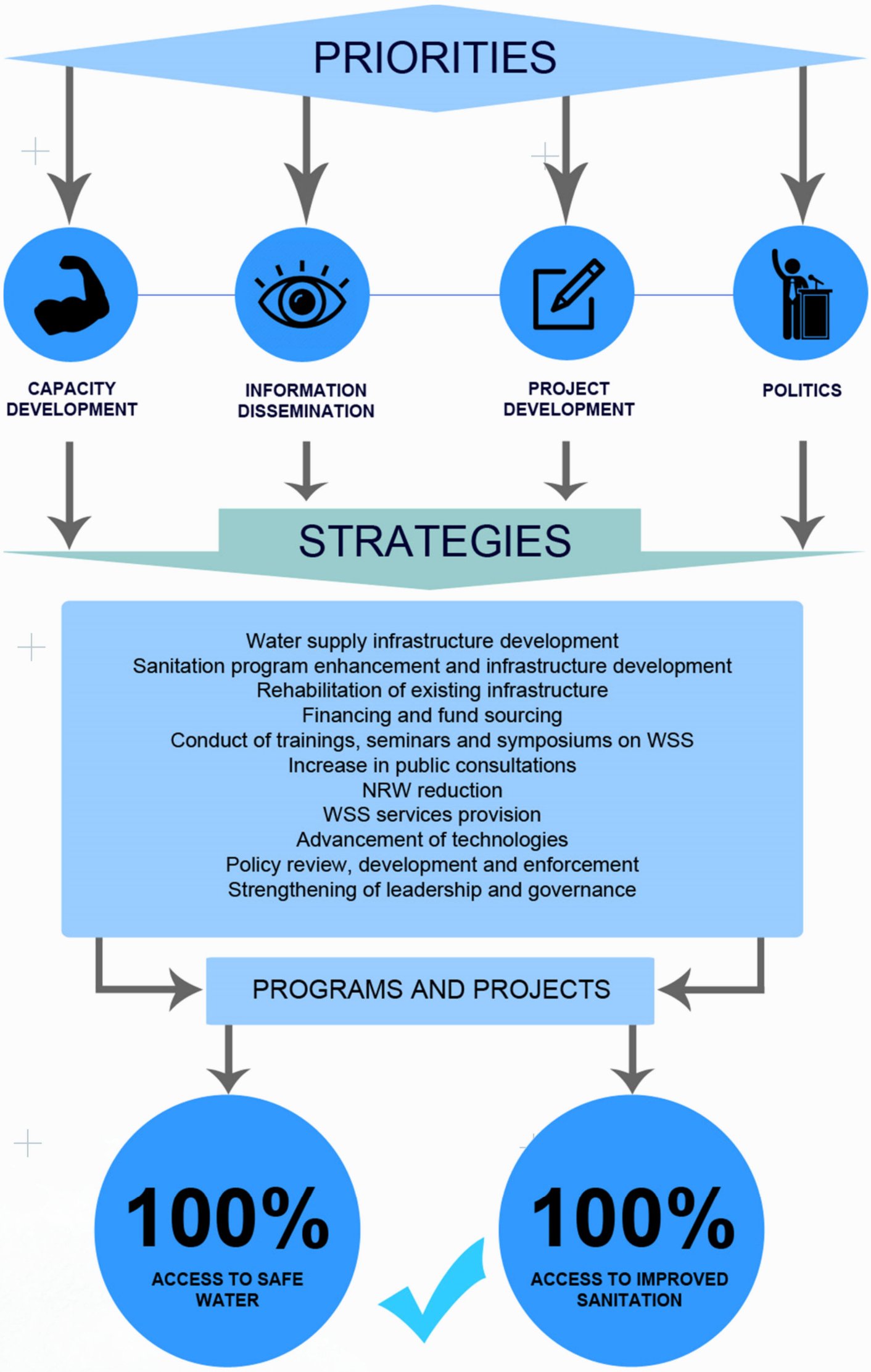


Figure 17: Bicol WSS Strategic Framework

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 (even as they 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.

The Bicol Region strives to achieve 96.6% access to safe water by 2022 and 100% access by 2030. Universal access by 2030 means more than 1,644,223 HHs will benefit. Improved access to sanitation is set at 87.1% by 2022 and universal access by 2030.

Figures 18 and 19 graph the WSS targets for 2022 and 2030 in terms of additional households.

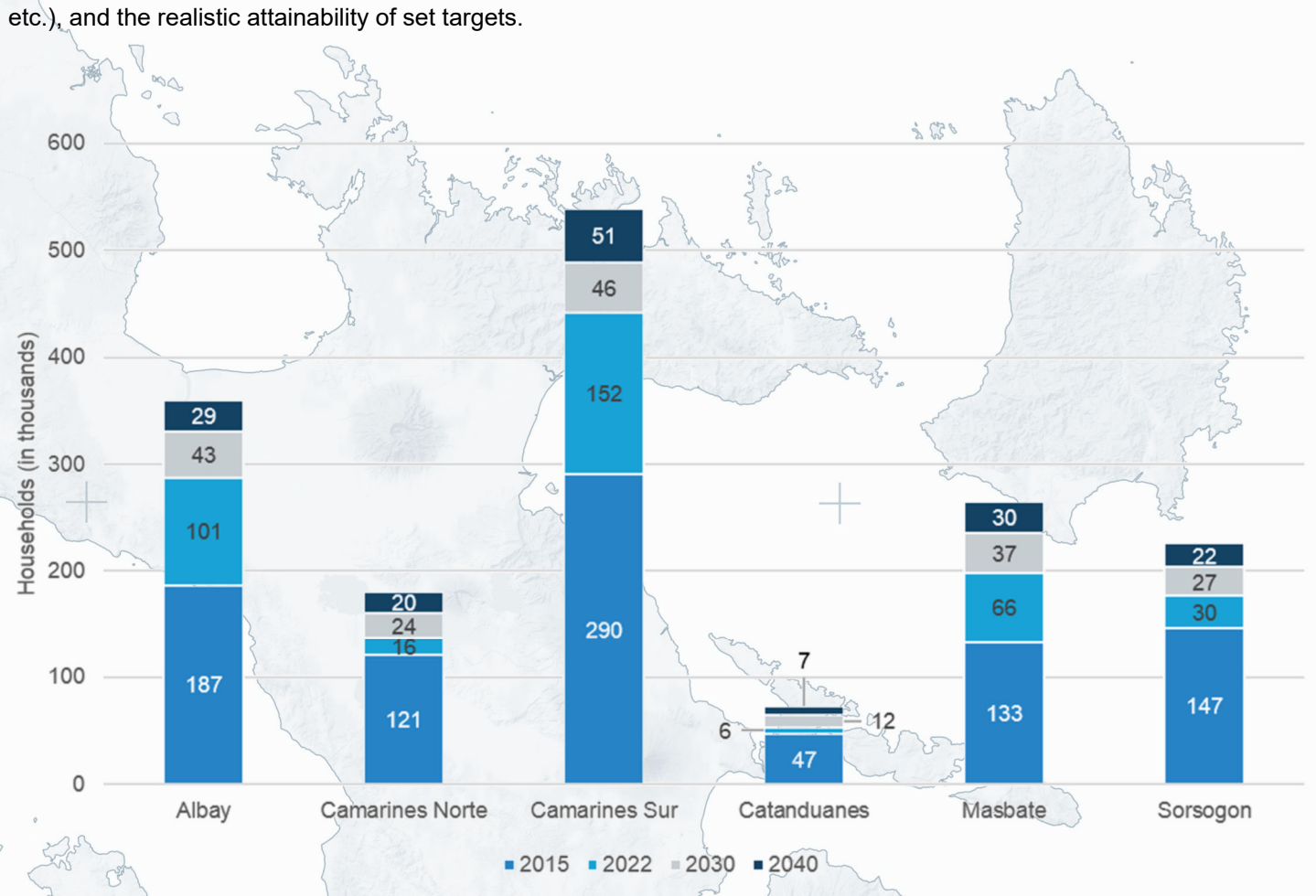


Figure 18: Targeted Households with Access to Safe Water

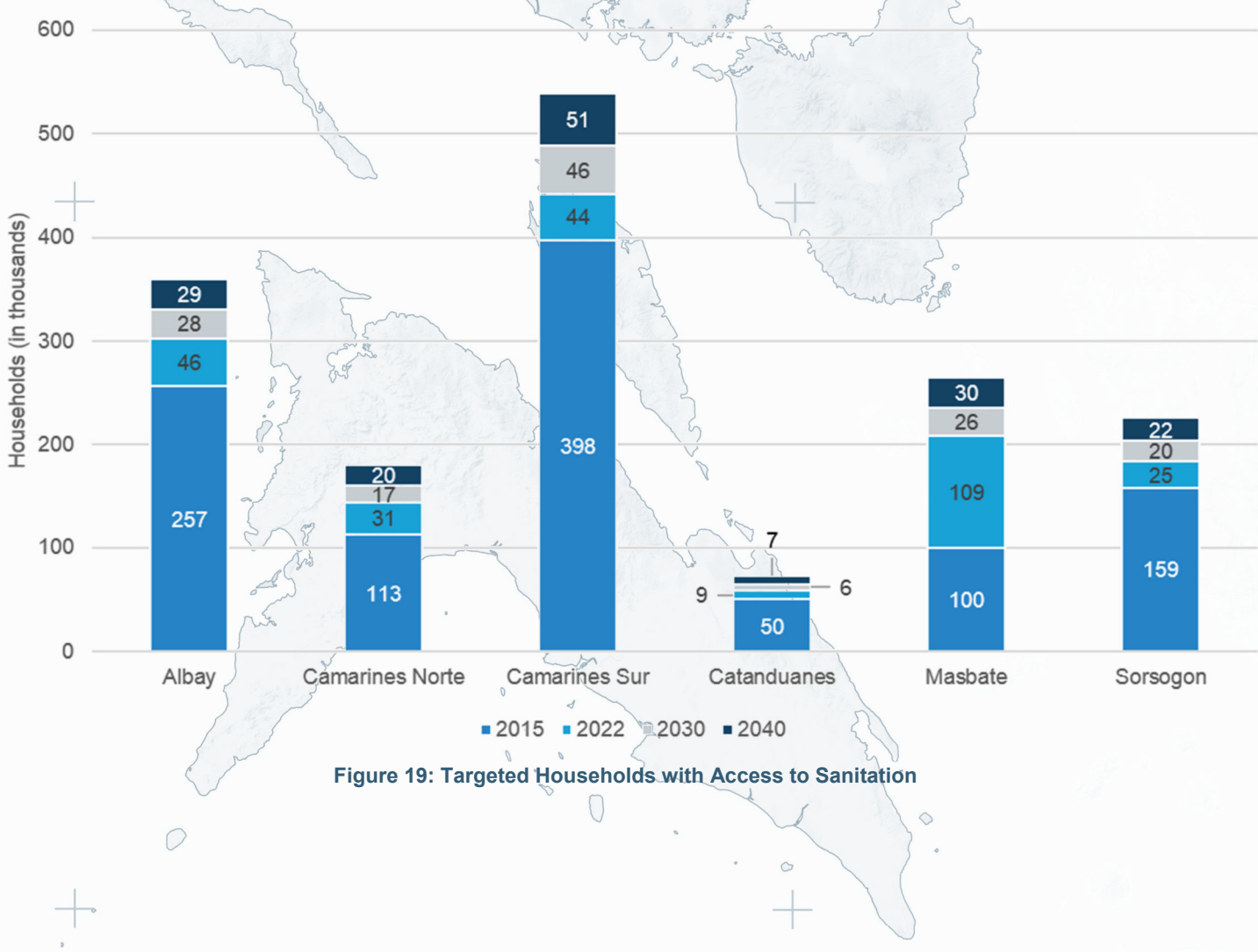


Figure 19: Targeted Households with Access to Sanitation

Water Supply Targets

ALBAY			
Category	2022	2030	2040
Level III	50.0%	74.0%	100.0%
Level II	30.0%	16.0%	0.0%
Level I	15.0%	10.0%	0.0%
Safe Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CAMARINES NORTE			
Category	2022	2030	2040
Level III	55.0%	68.0%	100.0%
Level II	31.0%	26.4%	0.0%
Level I	9.0%	5.6%	0.0%
Safe Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CAMARINES SUR			
Category	2022	2030	2040
Level III	56.0%	67.0%	100.0%
Level II	29.4%	21.0%	0.0%
Level I	14.6%	12.0%	0.0%
Safe Access	100.0%	100.0%	100.0%
No Access	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CATANDUANES			
Category	2022	2030	2040
Level III	40.0%	85.0%	100.0%
Level II	30.0%	10.0%	0.0%
Level I	20.0%	5.0%	0.0%
Safe Access	90.0%	100.0%	100.0%
No Access	10.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

MASBATE			
Category	2022	2030	2040
Level III	37.3%	47.7%	100.0%
Level II	37.0%	38.7%	0.0%
Level I	20.7%	13.7%	0.0%
Safe Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

SORSOGON			
Category	2022	2030	2040
Level III	40.9%	51.8%	100.0%
Level II	30.5%	34.6%	0.0%
Level I	24.6%	13.6%	0.0%
Safe Access	96.0%	100.0%	100.0%
No Access	4.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

BICOL REGION			
Category	2022	2030	2040
Level III	48.9%	64.3%	100.0%
Level II	31.1%	24.6%	0.0%
Level I	16.6%	11.1%	0.0%
Safe Access	96.6%	100.0%	100.0%
No Access	3.4%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

Sanitation Targets

ALBAY			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.0%	0.0%	0.0%
Shared/Communal/ Limited	2.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CAMARINES NORTE			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.0%	0.0%	0.0%
Shared/Communal/ Limited	1.0%	0.0%	0.0%
Open Defecation	1.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CAMARINES SUR			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.0%	0.0%	0.0%
Shared/Communal/ Limited	1.0%	0.0%	0.0%
Open Defecation	1.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CATANDUANES			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.0%	0.0%	0.0%
Shared/Communal/ Limited	2.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

MASBATE			
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%
Total	100.0%	100.0%	100.0%

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

BICOL REGION			
Category	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.5%	0.0%	0.0%
Shared/Communal/ Limited	1.0%	0.0%	0.0%
Open Defecation	0.5%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

Strategic Interventions

After the regional planning and consultation workshop, a working document detailing specific strategic interventions to improve water supply and sanitation access in Region V was formulated. The participants deliberated on these proposed interventions 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 16 and 17 show the specific strategic interventions for water supply and sanitation, respectively.

Table 16: 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 17: 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 Areas (WQMA) action plan.	▪ 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 18.

Table 18: 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 19).

Table 19: 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 each 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 each 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).

The Bicol Region requires capital investments for infrastructure development of about PhP16.16 billion and PhP13.7 billion to achieve 2022 and 2030 targets, respectively. Unit development costs employed to arrive at these sums are estimated at PhP33,300 per HH for Level III, PhP19,600 for Level II, and PhP8,800 for Level I.

These rates are direct costs and cover 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 the Bicol Region) 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 per household for Level III, PhP18,700 for Level II, and PhP8,400 for Level I.

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 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 20.

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 21 shows a summary of the total investment requirements of the region. (The detailed methodology of how the regional costs for the Bicol Region 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 three Bicol municipalities where priority WD projects have been approved and those pending approval for LWUA's financial assistance (FA). The WDs in Casiguran and Bulan have secured LWUA's financial assistance (FA) for their respective projects. The request for FA from Viga's WD is pending approval.

Table 20: Indirect Costs Employed[21]

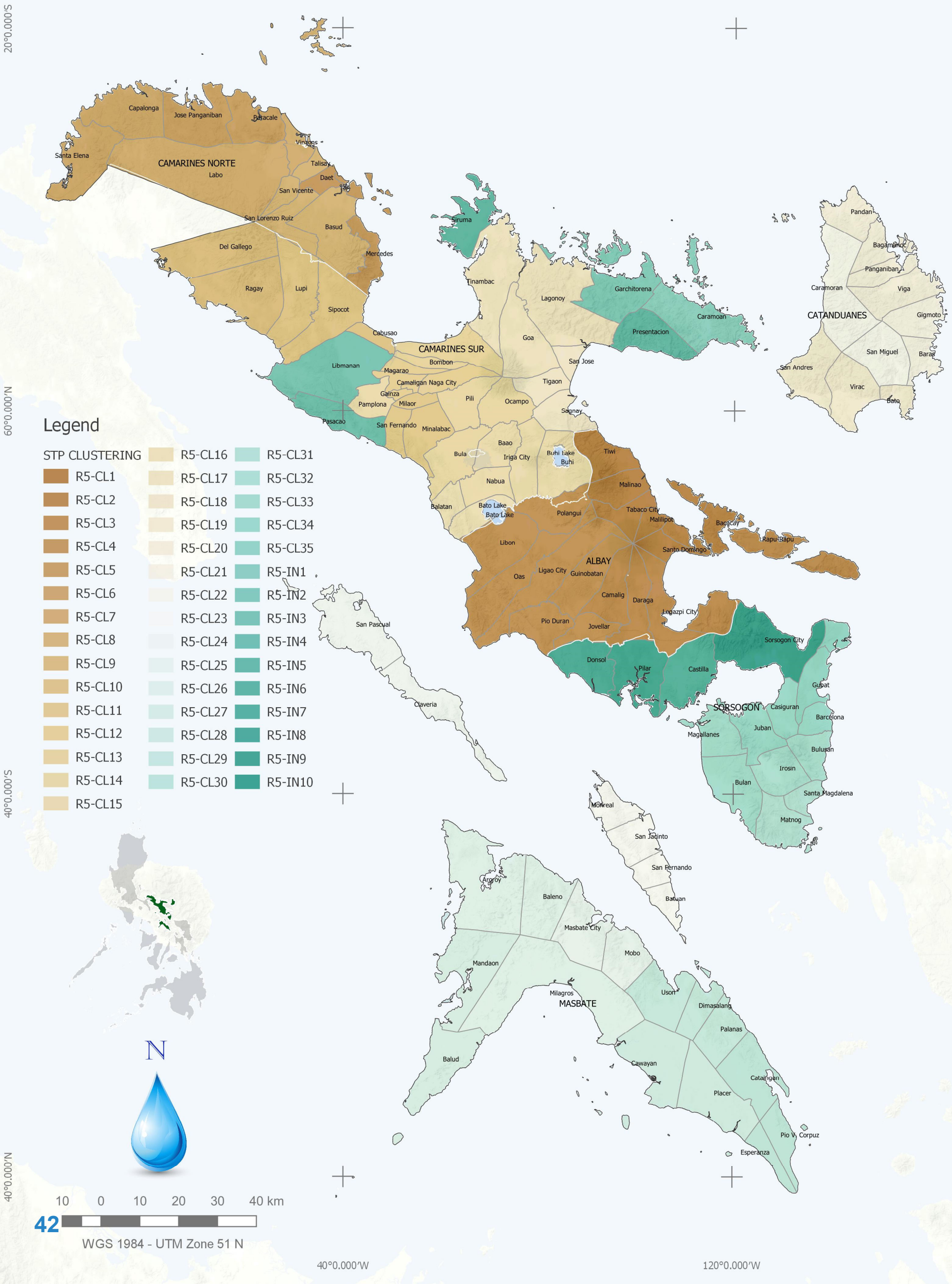
Water Supply		
Contingency	10.0%	Percentage of Total Direct Cost
Feasibility Study	3.0%	Percentage of Total Direct Cost
Detailed Engineering Design	6.0%	Percentage of Total Direct Cost
Construction Supervision	5.0%	Percentage of Total Direct Cost
ROW/Land Acquisition	3.0%	Percentage of Total Direct Cost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

Table 21: Total Investment Costs for Water Supply Sector

Province	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Albay	4,374	3,996
Camarines Norte	1,046	1,306
Camarines Sur	7,591	3,444
Catanduanes	409	1,374
Masbate	1,792	1,822
Sorsogon	945	1,674
Total	**16,157**	**13,616**

[21] *Based on Industry Standards*

Septage Treatment Plant Clustering



Sanitation Investment Requirements

Physical Investments

Basic Sanitation Program. The 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).

The Bicol Region will need about PhP11.3 billion for basic sanitation from 2016 to 2022 to reach a target of 97%.

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 will need about PhP2.9 billion and PhP307 million for 2022 and 2030, respectively, for its septage management program.

Sewerage System Program. There are no sewerage systems required at this time in the Bicol Region. However, rapidly urbanizing cities (i.e., candidate HUCs) should also consider planning for sewerage services in the interim. Candidate HUCs may be closely examined initially in Camarines Sur (in Iriga City and Naga City, for example) and Albay (i.e., in Legazpi City, Tabaco, Ligao, and Daraga) as urbanization may set in more rapidly in these places than in other capital towns of the other provinces, like Daet and Labo in Camarines Norte, Bulan and Sorsogon City in Sorsogon and Masbate City in Masbate.

Nonphysical Investments

The Bicol Region, 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 22: Total Investment Costs for Sanitation Sector

Province	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Albay	5,159	973
Camarines Norte	1,415	550
Camarines Sur	4,309	1,630
Catanduanes	618	208
Masbate	3,576	895
Sorsogon	1,792	677
Total	**16,869**	**4,933**

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, 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 PhP51.63 billion to boost its WSS sector.

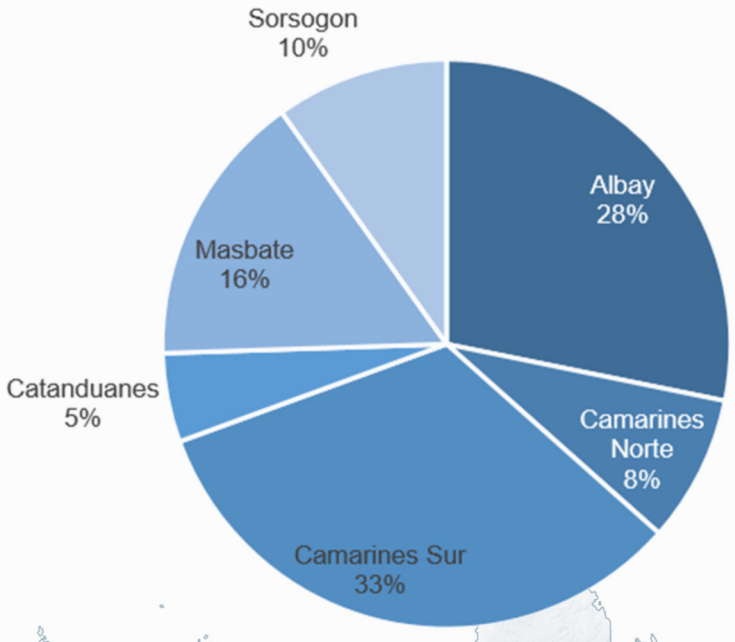


Figure 20: Distribution of Investment Requirement per Province

Albay							
	Water Supply	Period	Budget Requirement (PhP Million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)
1	Construction of Bariw water system (Burok-Burokan Spring)	Short Term	5.00				
2	Construction of Mayong water system	Short Term	10.00				
3	Construction/Rehabilitation of water systems and facilities		371.00				
4	Development of water system facilities at resettlement sites (Alobo, Gapo and Del Rosario)	Short Term	2,796.87				**4,762**
5	LCWD Performance Improvement Program	Short Term	0.540				
6	Tagaytay deep well water system	Short Term	1.00				
	Total		**3,184.41**				

Camarines Norte							
	Water Supply	Period	Budget Requirement (PhP Million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)
1	Level III WS for 63,769 households	Short Term	75.00	1 Construction of septage treatment plants in 5 cluster municipalities	Medium Term	4,471.155	
2	Revival of 2 nonoperational WDs in the municipalities of Sta. Elena and Capalonga	Short Term	33.712,5				
3	Preparation of a feasibility study for Itok River and Minasag River	Long Term	14.6085				
4	Construction of Modular filtration plant, Phase III	Short Term	52.00				
5	Construction of potable water system, Brgy. Mataque	Short Term	4.00				**4,739.13**
6	Construction of water supply system in Brgy. Talobatib	Short Term	2.32				
7	Nonrevenue water reduction	Medium Term	68.00				
8	Rehab/improvement of water system Level II, Brgy. Tacad	Short Term	6.33				
9	Talobatib water supply system	Short Term	12.00				
	Total		**267.97**	**Total**		**4,471.16**	

Camarines Sur							
	Water Supply	Period	Budget Requirement (PhP Million)	Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)
1	Development of water source and pipe lines (Iriga City)	Long Term	0.10	1 Septage management plant (Iriga City)	Long Term	0.20	
2	Reviving of Level I & II systems	Medium Term		2 Septage management plant (Metro Naga)			
3	Lake Bato WQMA	Long Term					
4	Installation of parallel main lines (Iriga City)	Short Term	0.015				
5	Installation of reverse osmosis filter (Milaor)	Short Term	0.01				
6	Adaptation & Mitigation Initiative in Agriculture (AMIA) Project	Long Term					
7	El Verde Project (environmental management projects)	Long Term	0.80				**326.125**
8	Expansion of main line pipes & water source development (Metro Naga)	Long Term	300.00				
9	Expansion of main line pipes (Iriga City)	Short Term	25.00				
10	Tree nurturing (ADNU)	Long Term					
11	Water Quality Management (Naga River and Lake Buhi)	Long Term					
	Total		**325.925**	**Total**		**0.20**	

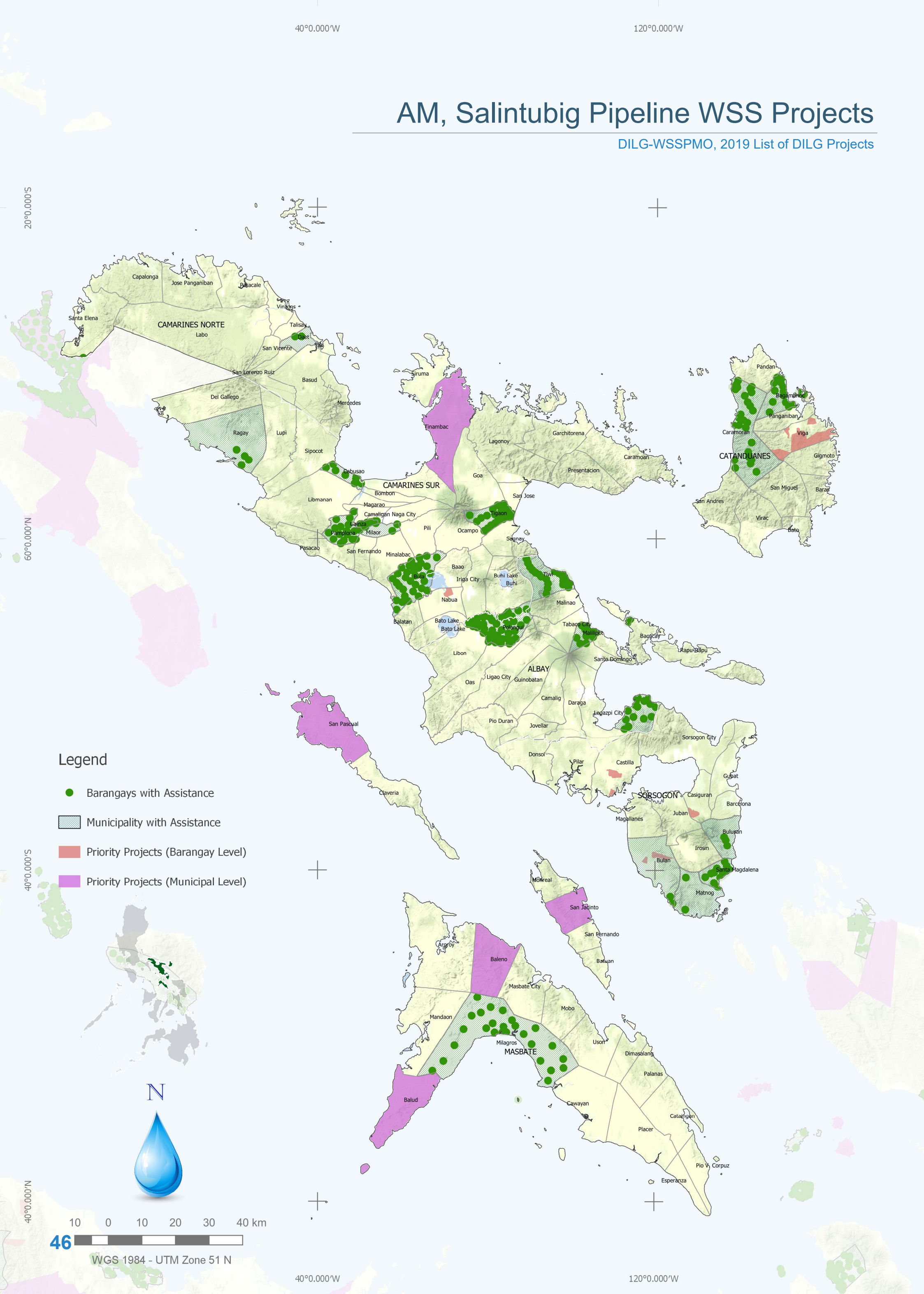
Catanduanes								
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)
1	Improvement of Cawayan transmission line	Short Term	0.01	1	Acquisition of STP site	Long Term		
2	Improvement of Bigaa transmission lines	Short Term	0.005	2	Construction of STP	Long Term	82.351	
3	Expansion of service areas	long term	0.30					
4	Construction of Sibanhan rapid sand filter	Short Term	3.00					
5	Franchise-wide re-piping and upgrading	Medium Term	8.80					
6	Repair of water supply intake structure (Cawayan & Bigaa)	Short Term	5.00					
7	Upgrade of Cawayan transmission pipeline	Short Term	5.00					
8	Rehabilitation of Cawayan transmission pipeline	Medium Term	31.00					
9	Cawayan to Sto. Domingo transmission line	Medium Term	12.00					
10	Sibanjan treatment facilities	Medium Term	11.00					**204.47**
11	Rehabilitation of Padurog transmission line	Medium Term	6.00					
12	Construction of Padurog access road and treatment facilities	Medium Term	13.00					
13	Construction of pump station in Brgy. Siv, Virac	Medium Term	7.50					
14	Construction of pump station and Palnab-Igan transmission line	Medium Term	13.00					
15	Construction of pump station in Provincial Capitol Compound	Medium Term	4.50					
16	Valencia distribution pipeline	Medium Term	2.00					
	Total		**122.12**		**Total**		**82.35**	

Masbate								
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)
1	Level III Expansion Program (2 barangays)	Short Term	3.50	1	Construction of septage treatment plant	Short Term	50.00	
2	Proposed Level III water supply system in 4 barangays including water source development (Bagacay River)	Long Term	95.50	2	Construction of sanitary toilets with septic tanks	Long Term	588.832	
3	Level III Expansion Program in Brgy. Maingaran, Masbate City	Medium	10.50	3	Proposed CLTS training	Short Term	0.80	
4	Reduction of NRW from 27% to 15%	Long Term	10.00	4	Organization of MWASHC	Short Term	0.15	
5	Construction of Level II water system	Long Term	486.64	5	Organization of LDWQMC	Short Term	0.15	
6	Construction of Level III water system including water source development		750.00	6	Reproduction of C4D materials	Medium Term		
7	Upgrading of Level I water system to Level II	Long Term	4.30205	7	Implementation of solid waste segregation project	Long Term	10.00	
8	Upgrading Level II water facilities to Level III	Long Term	156.21					
9	Cleanup of rivers & streams	Medium	1.50					**2,555.21**
10	Dispersal of seedlings & tree planting	Short Term	5.00					
11	IEC project on soil & water conservation	Short Term	15.00					
12	Watershed management protection (river source)	Long- term	100.00					
13	MMWD construction of additional water source	Short Term	10.00					
14	MMWD water treatment facilities	Short Term	25.00					
15	Mobo WD - POW 1 and 2	Short Term	129.626					
16	Reduction of NRW	Medium Term	2.50					
17	Watershed management protection (river source)	Long Term	100.00					
	Total		**1,905.28**		**Total**		**649.93**	

Sorsogon								
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)
1	Orientation and training of employees of water cooperatives in 540 barangays re: systems operation and maintenance	Long Term	30.00	1	Construction of 2 units STP for Sorsogon City	Long Term	64.04	
2	Rehab of transmission lines and expansion of distribution lines in various municipalities	Long Term	357.10	2	Construction of 1 unit STP for Matnog & Sta. Magdalena	Long Term	22.08	
3	Construction of additional water supply systems (Level II & III) for various municipalities	Long Term	743.00	3	Construction of 1 unit STP for Irosin & Bulusan	Long Term	30.31	
4	Development of new water sources (springs) in Brgy. Hidhid and Calintaan Island including Subic Beach - Matnog Water District	Long Term	85.00	4	Construction of 1 unit STP for Bulan	Long Term	38.10	
5	Establishment of a bamboo nursery	Short Term	2.00	5	Construction of 1 unit STP for Magallanes, Juban & Casiguran	Long Term	38.93	
6	Construction and rehabilitation of water system, water reservoir and pipeline	Long Term	24.50	6	Construction of 1 unit STP for Barcelona, Gubat & Prieto Diaz	Long Term	39.22	**2,778.90**
7	Drilling of new well in Brgy. Basud, Sorsogon City	Short Term	12.00	7	Construction of 1 unit STP for Donsol	Long Term	18.94	
8	Establishment of an agroforestry nursery in Brgy. Pangpang, Sorsogon City	Short Term	5.00	8	Construction of 1 unit STP for Pilar	Long Term	28.15	
9	Formulation of policies and regulations for WSPs	Short Term		9	Construction of 1 unit STP for Castilla	Long Term	22.03	
10	1.4km pipe laying expansion in Brgy. San Isidro, Sorsogon City	Short Term	3.00	10	Construction of 9 units STP for LGU hospitals	Long Term	180.00	
11	Purchase of agroforestry seedlings (for distribution)	Short Term	0.75	11	Construction of 34,483 improved sanitary toilets (1 toilet per household)	Long Term	1,034.00	
12	Purchase of bamboo seedlings (for distribution)	Short Term	0.75					
	Total		**1,263.10**		**Total**		**1,515.80**	

AM, Salintubig Pipeline WSS Projects

DILG-WSSPMO, 2019 List of DILG Projects



Identified Priority Projects

The table 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				
Province	Municipality	Project Type	Project Title	Amount (PhP)
Albay	Malilipot	Potable water system	Expansion of Level II Water Supply System	11,239,000
Albay	Manito	Potable water system	Rehabilitation/Improvement of Level II Water System	7,452,000
Albay	Polangi	Potable water system	Expansion of Level III Water Supply System	7,593,000
Albay	Tiwi	Potable water system	Rehabilitation/Improvement of Level II Water System	1,466,000
Camarines Norte	Daet	Health and sanitation	Construction of Sanitary Toilets and Hygiene Facilities for Public Places in Barangay VI	3,000,000
Camarines Norte	Daet	Health and sanitation	Construction of Sanitary Toilets and Hygiene Facilities for Public Places in Barangay Lagon	3,000,000
Camarines Sur	Bula	Potable water system	New Construction of Level II Water Supply System in Inoyonan	6,000,000
Camarines Sur	Bula	Potable water system	Expansion of Level II Water Supply System	4,726,000
Camarines Sur	Cabusao	Health and sanitation	Rehabilitation/Improvement/Upgrading of Existing Sanitary Toilets and Hygiene Facilities for Public Places	353,000
Camarines Sur	Gainza	Health and sanitation	Construction of Sanitary Toilets and Hygiene Facilities for Public Places	1,505,000
Camarines Sur	Milaor	Potable water system	Expansion of Level III Water Supply System in Capucnasan	1,100,000
Camarines Sur	Milaor	Potable water system	Expansion of Level III Water Supply System in Dalipay	1,000,000
Camarines Sur	Pamplona	Potable water system	Expansion of Level II Water Supply System	5,352,000
Camarines Sur	Ragay	Potable water system	New Construction of Level II Potable Water Supply System in Barangay Agrupacion	1,744,500
Camarines Sur	Ragay	Potable water system	New Construction of Level II Potable Water Supply System in Barangay Cale	1,744,500
Camarines Sur	Ragay	Potable water system	New Construction of Level II Potable Water Supply System in Barangay Cabinitan	1,744,500
Camarines Sur	Ragay	Potable water system	New Construction of Level II Potable Water Supply System in Barangay Cabugao	1,744,500
Camarines Sur	Tigaon	Health and sanitation	Rehabilitation/Improvement/Upgrading of Existing Sanitary Toilets and Hygiene Facilities for Public Places	200,000
Catanduanes	Bagamanoc	Potable water system	Rehabilitation/Improvement of Level II Potable Water System	1,700,000
Catanduanes	Caramoran	Potable water system	Rehabilitation/Improvement of Level II Potable Water System	2,000,000
Masbate	Milagros	Potable water system	Rehabilitation/Improvement of Level II Potable Water System	10,479,000
Sorsogon	Bulan	Potable water system	New Construction of Level II Potable Water Supply System in Barangay Osmeña	3,361,000
Sorsogon	Bulan	Potable water system	New Construction of Level II Potable Water Supply System in Barangay Sagrada	4,000,000
Sorsogon	Bulusan	Potable water system	New Construction of Level II Potable Water Supply System in San Rafael, San Bernardo	3,800,000
Sorsogon	Bulusan	Potable water system	New Construction of Level II Potable Water Supply System in Tinampo	2,500,000
Sorsogon	Bulusan	Potable water system	Rehabilitation/Improvement of Level II Water System in San Rafael	1,462,000
Sorsogon	Bulusan	Potable water system	New Construction of Level II Potable Water Supply System in San Francisco	2,000,000
Sorsogon	Matnog	Potable water system	Upgrading of Water System in Barangay Sisigon	1,000,000
Sorsogon	Matnog	Potable water system	Upgrading of Water System in Barangay Sua	1,617,000
Sorsogon	Sta. Magdalena	Potable water system	Rehabilitation/Improvement of Level III Water System	4,947,000
			Total	**99,830,000**

SALINTUBIG (2019)				
Province	Municipality	Project Title	Barangay	Amount (PhP)
Camarines Sur	Nabua	Level III Water System	Santa Barbara (Maliban)	2,000,000
Catanduanes	Viga	Rehabilitation/Improvement of Water System	Mabini	1,000,000
Catanduanes	Viga	Construction of Tinago Potable Water Supply System	Tinago	6,000,000
Catanduanes	Viga	Rehabilitation of Begonia Water System	Begonia	1,000,000
Catanduanes	Viga	Construction/Rehabilitation of San Jose (Oco) Potable Water System	San Jose (Oco)	1,000,000
Catanduanes	Viga	Improvement of Rizal Water System	Rizal	3,000,000
Catanduanes	Viga	Rehabilitation of Peñafrancia Potable Water System	Dela Peñafrancia	2,500,000
Catanduanes	Viga	Improvement of Barangay Osmeña Water System	Osmeña	3,000,000
Catanduanes	Viga	Improvement of San Vicente Water System	San Vicente	1,000,000
Catanduanes	Viga	Rehabilitation of Quezon Water System	Quezon	1,500,000
Sorsogon	Bulan	Construction of Potable Water System	Osmeña, A. Bonifacio, Daganas and Jamorawon	2,000,000
Sorsogon	Casiguran	Potable Water System	Mabini	1,000,000
Sorsogon	Castilla	Construction of Miluya Water System	Miluya and Tomalaytay	2,000,000
			Total	**27,000.000**

Appendix A: Provincial Profiles

Albay	15 municipalities	Bacacay, Camalig, Daraga (*Locsin),* Guinobatan, Jovellar, Libon, Malilipot, Malinao, Manito, Oas, Pio Duran, Polangui, Rapu- Rapu, Santo Domingo, Tiwi
	three (3) component cities	Legazpi City, Ligao City and Tabaco City
	720 barangays	60 urban, 660 rural
Land Area	2,575.77 square kilometers	
Demographics (2015)	Population (2015) – 1,314,826 Population Growth Rate (2000 to 2015) – 1.40 Population Density – 510 per sq. km	
Economy	• Major industries - agriculture, manufacturing • Major products - handicrafts • Major crops - coconut, rice, abaca, corn • Albay, which boasts the Tiwi Geothermal Plant, is a major supplier of geothermal energy to the Luzon power grid.	
Poverty Incidence (2015)	On Families – 17.6% On Population – 25.2%	

Camarines Norte	12 municipalities	Basud, Capalonga, Daet, Jose Panganiban, Labo, Mercedes, Paracale, San Lorenzo Ruiz, San Vicente, Santa Elena, Talisay, Vinzons
	282 barangays	22 urban, 260 rural
Land Area	2,320.07 square kilometers	
Demographics (2015)	Population (2015) – 583,313 Population Growth Rate (2000 to 2015) – 1.23 Population Density – 250 per sq. km	
Economy	• Major industries – agriculture, mining, raising of poultry and livestock, fishery • Major products - metallic minerals (gold, silver, iron, lead), non-metallic minerals (silica sand, kaolin, diatomite, limestone) • Major crops - coconut, palay, rootcrops, pineapple, vegetables. • Camarines Sur has an international seaport located at Jose Panganiban.	
Poverty Incidence (2015)	On Families – 29.3% On Population – 36.4%	

Camarines Sur	35 municipalities	Baao, Balatan, Bato, Bombon, Buhi, Bula, Cabusao, Calabanga, Camaligan, Canaman, Caramoan, Del Gallego, Gainza, Garchitorena, Goa, Lagonoy, Libmanan, Lupi, Magarao, Milaor, Minalabac, Nabua, Ocampo, Pamplona, Pasacao, Pili, Presentacion, Ragay, Sagñay, San Fernando, San Jose, Sipocot, Siruma, Tigaon, Tinambac
	one (1) component city	Iriga City
	one (1) independent city	Naga City
	1,063 barangays	61 urban, 1002 rural
Land Area	4,499.46 square kilometers	
Demographics (2015)	Population (2015) – 1,952,544 Population Growth Rate (2000 to 2015) – 1.52 Population Density – 360 per sq. km	
Economy	• Major industries – agriculture, mining, fishery • Major crops - rice, coconut, abaca, banana • An agro-industrial center in the Bicol Region, Camarines Sur is home to the world's smallest fish, the *sinarapan*.	
Poverty Incidence (2015)	On Families – 27.1% On Population – 35.2%	

Catanduanes	11 municipalities	Bagamanoc, Baras, Bato, Caramoan, Gigmoto, Pandan, Panganiban, San Andres, San Miguel, Viga, Virac
	315 barangays	7 urban, 308 rural
Land Area	1,492.16 square kilometers	
Demographics (2015)	Population (2015) – 260,964 Population Growth Rate (2000 to 2015) – 1.27 Population Density – 170 per sq. km	
Economy	• Major industries - agriculture, weaving, handicraft making • Major products – abaca, souvenir items such as bags, lamps, utility boxes, handmade paper • Major crops - palay, banana • Clothing made of abaca fiber has found its niche in the local and international fashion industry.	
Poverty Incidence (2015)	On Families – 33.6% On Population – 43.4%	

Appendix A: Provincial Profiles

Masbate	20 municipalities	Aroroy, Baleno, Balud, Batuan, Cataingan, Cawayan, Claveria, Dimasalang, Esperanza, Mandaon, Milagros, Mobo, Monreal, Palanas, Pio V. Corpuz, Placer, San Fernando, San Jacinto, San Pascual, Uson
	one (1) component city	Masbate City
	550 barangays	15 urban, 535 rural
Land Area	4,151.78 square kilometers	
Demographics (2015)	Population (2015) – 892,393 Population Growth Rate (2000 to 2015) – 1.53 Population Density – 210 per sq. km	
Economy	• Major industries - agriculture, fishery, raising of poultry, cattle, horses, goats and swine, furniture making, metalcraft, ceramics • Major products - handicrafts, garments, minerals such as gold, manganese, copper, silver, iron, chromite, limestone, guano, and carbon • Major crops - rice, corn, root crops, coconuts • Masbate is the country's second major producer of cattle (next to Bukidnon).	
Poverty Incidence (2015)	On Families – 35.5% On Population – 45.4%	

Sorsogon	14 municipalities	Barcelona, Bulan, Bulusan, Casiguran, Castilla, Donsol, Gubat, Irosin, Juban, Magallanes, Matnog, Pilar, Prieto Diaz, Santa Magdalena
	one (1) component city	Sorsogon City
	541 barangays	15 urban, 526 rural
Land Area	2,119.01 square kilometers	
Demographics (2015)*	Population (2015) – 792,949 Population Growth Rate (2000 to 2015) – 1.31 Population Density – 370 per sq. km	
Economy	• Major industries - agriculture, fishery, cottage industries • Major crops – banana, *pili*, coconut • Freshwater and offshore fishing resources have yet to be fully developed. • It has abundant (though untouched) deposits of sulfur, kaolin, limestone, and coal.	
Poverty Incidence (2015)	On Families – 31.7% On Population – 41.3%	


40°0'0"N
60°0'0"N
20°0'0"S
40°0'0"S
0°0'0"
80°0'0"E
160°0'0"E

National Economic and Development Authority

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