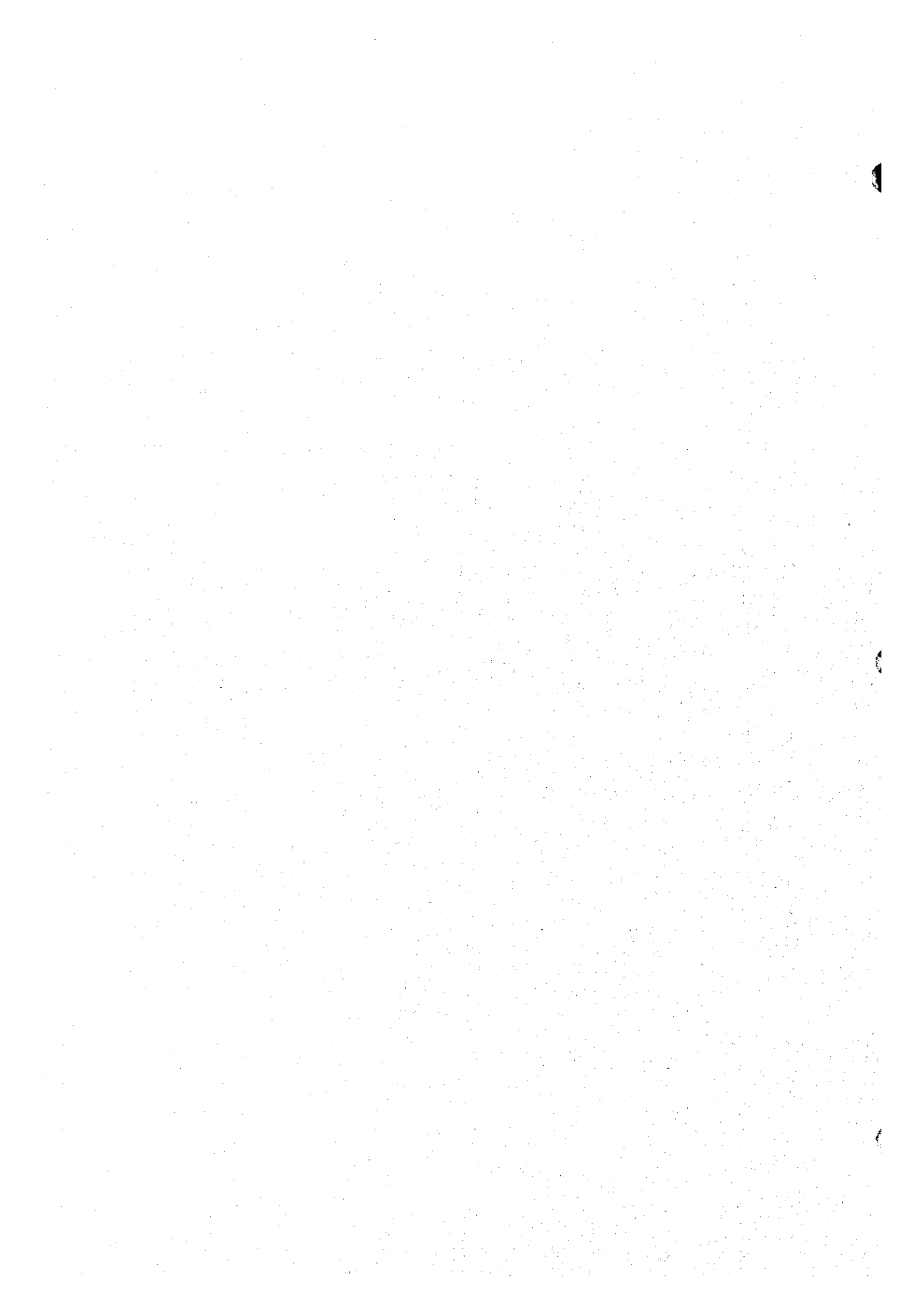


Chapter

6

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**PAST FINANCIAL PERFORMANCE IN  
WATER SUPPLY AND SANITATION**



## **6. PAST FINANCIAL PERFORMANCE IN WATER SUPPLY AND SANITATION**

### **6.1 General**

Based on the Local Government Code of 1991 and NEDA Board Resolution No. 4 (1994), the locally funded programs and projects for the water supply and sanitation sector have been devolved from the central government agencies to the LGUs since 1992. However, the central government still retains its role of providing support to LGUs in the form of technical, institution-building and limited financial assistance.

The financial arrangements conducted, since the sector's devolution to the LGUs, by the province with a special attention to the subject sector are reviewed and discussed in this chapter. The past experience is the basis to seek for appropriate financial arrangements for the medium term development. The essential study components are: (1) LGUs' past financial performance; (2) past public investment and present plans; (3) LGUs' present financing sources and management participation in the sector, (4) existing practices by the LGUs on cost recovery and (5) affordability by users.

### **6.2 LGU's Past Financial Performance**

The provincial government's past financial performance from the year 1994 to 1998 was investigated. Actual financial data were obtained for the years 1994 to 1997, while the financial figures in 1998 are only budgetary estimates. Likewise, the municipalities' past financial performance in the same period (1994 to 1998) is included in the Supporting Report.

#### **6.2.1 Sources and Uses of Funds**

##### **(1) Sources of Funds in the Province**

The sources of income of the LGU are Internal Revenue Allotments (IRA), local tax revenues, non-tax revenues such as grants, aids and subsidies, as shown below. At the present time, IRA is a major financial source of the LGUs.

- (a) IRA – the amount allotted by the National Government to different provinces, municipalities and barangays. A standard formula is used, which considers parameters such as population, land area, number of barangays, cost of devolved national functions, and other factors.

- (b) Tax Revenues -- mainly consist of real property tax, accounting for an average of 18.7% of the total income of the province.
- (c) Grants, Aids and Subsidies -- assisted by JICA, UNDP, UNICEF, etc. and the NDCC (Calamity Fund from the Central Government during floods or whenever the province is declared as calamity area).
- (d) Income from the operation of economic enterprises of the province

Based on the Local Government Code of 1991, 40% of the national internal revenue taxes of the 3<sup>rd</sup> fiscal year preceding the current year (from 1994 onwards) is allocated to the LGUs nationwide, specifically to the administrative units of (1) province (23%); (2) city (23%); (3) municipality (34%), and barangay (20%). Further, respective IRAs in different administrative levels are allotted to all administrative units concerned.

Table 6.2.1 presents the income and expenditures of Agusan del Norte during the period of 1994-1998. Local tax revenues, which were 18.7% of the total income of the province, consist of real property tax, business taxes and licenses, and miscellaneous taxes. IRA's share to total income was 81.3% in annual average, which indicates that the province has historically been dependent on the IRA with its low tax and non-tax revenue collections.

Another source of provincial income is that from the operation of its economic enterprises. By law, the profits from economic enterprises are put in the general fund. In 1997, these economic enterprises were subsidized by the province. The existing economic enterprises of the Agusan del Norte include:

- Provincial Reproduction Center -- business center (dissolved in 1998)
- Equipment Rental Operations -- Motor Pool
- Pagkain ng Bayan -- Agriculture
- Pagkain ng Bayan -- Fishpond
- Provincial Agricultural Demonstration
- Marble Industry
- Citronella Oil Production
- Provincial Economic Assistance Loan Program

In order to mobilize fund sourcing, the 1987 Constitution and the 1991 Local Government code granted the Provincial Government to have its initiative to create new revenue sources.

**Table 6.2.1 Income and Expenditures, 1994-1998**

Province	1994	1995	1996	1997	1998
Receipts	113,864,915.00	131,250,156.61	138,529,229.58	183,610,891.36	225,334,176.50
1. Tax Revenue	113,853,915.00	131,250,156.61	138,529,229.58	183,610,891.36	225,334,176.50
1.1 IRA	94,466,492.00	104,101,297.00	112,029,795.00	150,358,686.00	168,261,860.00
1.2 Local Revenues	19,387,423.00	27,148,859.61	26,499,434.58	33,252,205.36	57,072,316.50
2. Operating and Miscellaneous Revenues	-	-	-	-	-
3. Capital Revenues	-	-	-	-	-
4. Grants and Aids	11,000.00	-	-	-	-
Expenditures:	122,555,351.35	155,839,826.62	151,732,308.48	184,678,307.48	241,942,224.74
1. Current Operating Expenditures	93,316,133.92	120,666,963.89	117,666,000.08	160,769,221.08	203,956,049.55
1.1 Personal Services	72,564,701.93	85,432,055.66	94,435,958.62	123,971,741.18	158,898,890.20
1.2 MOOE	20,751,431.99	35,234,908.23	23,230,041.46	36,797,479.90	45,057,159.35
2. Capital Outlay	2,426,876.72	2,064,525.65	957,418.20	12,703,368.48	15,173,160.20
3. Non-Office	26,812,340.71	33,108,337.08	33,108,890.20	11,205,717.92	22,813,014.99
4. 5% Budgetary Reserve	-	-	-	-	-
Net Income:	(8,690,435.65)	(24,589,670.00)	(13,203,078.90)	(1,067,416.10)	(16,608,048.20)

Source: Provincial Treasurer's Office

## (2) Uses of Funds in the Province

Actual expenditures of the provincial government during the period from 1994 to 1997 show that personnel expenses were major parts with an average of 68% to the total revenue. Maintenance and operating expenses of the province was 17%. In addition, the province has a capital outlay with an average of 1.8% to the total revenue. The funds for the water supply sector were part of the capital outlays of the province.

From 1994 to 1997, the province had a net loss from its operations. The province has likewise projected a net loss of ₱16.6 million in 1998 from operations of ₱21.37 million, after deducting the projected capital outlay and non-office expenditures amounting to ₱15.17 million.

### 6.2.2 Availability of Funds

As previously noted, the IRA comprises 81.3% of the total income of the province, which is tapped to finance most of its expenditures including capital outlays and even non-office expenses (incidental). According to the Provincial Treasurer's Office, the amount of IRA that will be received by the province is known in advance before the end of the preceding year. Thus, for budgeting purposes, the province just uses the actual amount of IRA it received in

the preceding year as its estimate of IRA for the budget year. In the case where the IRA received is larger than that of the preceding year, the province prepares a supplemental budget.

Table 6.2.2 presents the historical IRA of the provincial government and its municipalities between 1994 and budget year 1998. As shown, the IRA of the province was 0.82% of the provincial IRA nationwide in the period 1994-1997 and budget year 1998. While, the total amount of IRA allotted to all its municipalities in the years 1994-1998 was 0.65%. The IRA percentage of each municipality to total municipal IRA nationwide is presented in Table 6.2.2, Supporting Report.

Based on the past financial performance of the province, IRA has been a major source of funds. At first, 20% Development Fund (DF) and 5% Calamity Fund are deducted from the total amount of provincial IRA. Then, the remaining portion of the IRA is combined with other income sources. Contractual and statutory items, which are covered by R.A. 324 (b) are deducted from the pooled income (75% IRA + all other income) before other appropriations are made.

Based on the income statement of the province, available funds of the province are mainly spent to cover personnel salaries, benefits, the MOOE and capital expenditures. The provincial government's combined income from IRA and its tax, and non-tax revenues are just sufficient for its operating, capital and non-office expenses. Thus, there is little surplus income that can be tapped for additional capital expenditures.

For the planned capital expenditures of the province, 20% Development Fund (DF) of the IRA are appropriated. The percentages allotted as the DF are the minimum requirement that should be arranged for capital projects as stated in the memorandum circulars of the DILG.

Table 6.2.3 presents allotted funds for capital expenditures (20% DF) between 1994 and 1998. Referring to the amount of actual expenditures from 1994 to 1997 in use of 20% DF of the province, the allotted DFs were sufficient to cover the actual expenditures. In 1998, it is projected that the DF may be adequate to cover the capital expenditures of the province, since the projected figure is equivalent to the amount of capital outlays. There were no loans incurred, while the province received grants amounting to ₱11,000 in 1994 (refer to Table 6.2.1).

**Table 6.2.2 Internal Revenue Allotment to the Province, 1994-1998**

		1994	1995	1996	1997	1998
National	I National Total of IRA	46,753,000,000.00	55,202,800,000.00	58,022,990,000.00	71,049,000,000.00	80,990,763,000.00
	(a) IRA to all Provinces	11,498,994,193.00	12,696,644,000.00	13,755,011,803.00	17,813,547,246.00	20,054,018,925.00
	(b) IRA to all Municipalities	16,325,288,074.00	18,768,952,000.00	19,607,715,553.00	24,848,688,251.00	28,245,815,434.00
Province	II IRA to Agusan del Norte					
	(1) Total: (2) + (3)	200,102,467.00	220,115,977.00	240,449,153.00	315,730,602.00	355,884,504.00
	(2) Provincial Government	94,466,492.00	104,101,297.00	112,029,795.00	150,358,686.00	168,261,860.00
	Percentage against (a)	0.82%	0.82%	0.81%	0.84%	0.84%
	(3) Municipalities	105,635,975.00	116,014,680.00	128,419,358.00	165,371,916.00	187,621,644.00
	Percentage against (b)	0.65%	0.62%	0.65%	0.67%	0.66%
	Total Income of the Provincial Government	113,864,915.48	131,250,156.61	138,529,229.58	183,610,891.30	225,334,176.50
	Percentage of IRA	83%	79%	81%	82%	75%
Municipality	Total Income of Municipalities	125,034,398.98	143,163,539.61	154,918,792.58	198,624,121.30	244,693,960.50
	Percentage of IRA	84%	81%	83%	83%	77%
V. IRA to Municipalities**						
<b>TOTAL</b>		105,635,895.00	116,014,680.00	128,419,358.00	165,371,916.00	187,621,644.00
Municipality	Buenavista	15,881,037.00	17,945,191.00	19,236,876.00	24,924,856.00	28,741,860.00
	Cabadbaran	13,970,825.00	16,361,099.00	18,004,465.00	22,875,644.00	26,025,429.00
	Carmen	7,155,223.00	7,920,028.00	9,839,398.00	12,245,446.00	13,898,675.00
	Jabonga	9,961,623.00	10,959,820.00	11,750,528.00	14,854,965.00	16,858,594.00
	Kitcharao	7,415,487.00	6,174,032.00	8,785,883.00	11,202,364.00	12,674,595.00
	Las Nieves	13,269,231.00	14,472,394.00	15,398,610.00	20,680,159.00	23,549,531.00
	Magallanes	6,187,992.00	6,892,595.00	7,472,912.00	9,517,426.00	10,768,025.00
	Nasipit	10,690,118.00	11,999,439.00	12,873,420.00	15,746,866.00	17,821,000.00
	R.T. Romualdez	5,603,232.00	6,201,052.00	6,693,538.00	8,865,984.00	10,020,307.00
	Santiago	8,159,911.00	8,975,055.00	9,624,409.00	13,287,142.00	15,121,551.00
	Tubay	7,341,166.00	8,113,975.00	8,739,319.00	11,171,060.00	12,643,822.00

Sources:

Department of Budget and Management, (2) Bureau of Local Government Finance (DOF) and (3) Provincial Annual Report.

Notes

\* IRA to Barangays is not included.

\*\* Figures in bracket are shares (%) in the total of all municipalities in the province.

**Table 6.2.3 Allotted Funds for Capital Expenditures (20% DF), 1994-1998**

Unit: Pesos

Year	IRA of the Province (a)	20% DF (b)	Expenditures on 20% DF (c)	Surplus/(Deficit)
1994	94,466,492.00	18,893,298.40	-	-
1995	104,101,297.00	20,820,259.40	17,882,279.00	2,937,980.40
1996	112,029,795.00	22,405,959.00	18,047,664.50	4,358,294.50
1997	150,358,686.00	30,071,737.20	21,067,565.27	9,004,171.93
1998	168,261,860.00	33,652,372.00	33,652,372.00	-

Note: Data Source: Table 6.2.2, Capital expenditures; Figures in 1998 are projected.

### 6.2.3 Financial Indicators

In order to determine the debt servicing capability of the province, the formula used by the Bureau of Local Government Finance (BLGF) under the Department of Finance (DF) was employed. It takes into account the regular income of the LGU referring to revenues (real property and business taxes), receipts from economic enterprises, and fees and charges that are collected regularly. Receipts from borrowings, grants and inter-fund transfers are not considered as regular income.

Following is the formula adopted by BLGF in computing the debt servicing capacity, where the average annual growth rate to be used should not exceed 15%, according to the MDF Policy Governing Board Resolution 4-95.

$$DSC = [ \{ RINC_1 (1 + AGR) + RINC_1 \} + IRA_2 ] \times 20\% - AMORT$$

Where:

DSC = debt servicing capacity of the LGU

RINC = regular income

AGR = average growth rate

IRA = internal revenue allotment

20% = debt servicing ceiling percentage imposed by the Local Government Code of 1991 under Section 324 (b).

AMORT = amortization of the LGU's outstanding loan

1 = current year

2 = preceding year

Based on the above formula, the amount of the debt servicing capacity of the provincial government was computed to be ₱45.1 million for the year 1998. This amount reflects the maximum loan that can be availed of from MDF. It is reported that there exists a loan amortization at present. The local tax income and IRA of the province are projected at ₱57.07 million and ₱168.26 million, respectively.

## 6.3 Past Public Investment and Present Plans

### 6.3.1 Past and Current Annual Investment Plans

The past and recent development of the water supply and sanitation sector in the province was undertaken by the provincial government and DPWH. The fund from the CDF (Countrywide Development Fund) was also availed of. Water supply sector obtained ₱ 88.1 million in a



total during the period 1995-1998, while sanitation sector only P 201,900. Thus, actual amount of public investments to the WATSAN sector amounted to P88.4 million. (refer to Table 6.3.1). The largest investment registered so far is those for Level III water supply with an aggregate amount of P53.18 million during the said period, followed by Level I and Level II water supply with P 22.33 million and P 11.57 million, respectively.

**Table 6.3.1 Previous Sector Investment to the Province by Concerned Agencies**

Funding Category		1995-1998				
Agency	Funds	Level I	Level II	Level III	Sub-Total	Sanitation
DILG						
DPWH	Foreign Fund 1)					
	Local Fund 2)					
PROVINCE	Provincial Government					
	Municipal Government				1,000.00	
MUNICIPALITY						
OTHERS 3)					88,169,200.00	
<b>TOTAL</b>		<b>22,331,300.00</b>	<b>11,565,900.00</b>	<b>53,180,000.00</b>	<b>88,169,200.00</b>	<b>201,900.00</b>

Source: Provincial Government and Agencies

Note: There is no available breakdown by agency. Figures are combined funds from DPWH (Foreign/Local), Province, Municipalities and CDF.

#### (1) Budgetary Allocation to the Sector

The Budget Office of the province consolidates the budget proposal submitted by all offices of the Provincial Government. While, the DBM issues a Local Budget Memorandum every October of the preceding budget year to guide the provinces in their budget preparation. The sector obtains allotment from the 20% Df allocation by the Provincial Development Council (PDC).

Once, the budgetary arrangement is completed, the local chief executive (Governor) endorses it to the SP for approval and appropriation. The SP usually approves the budget, ideally before January of the budget year. In case the budget is not approved, the province operates on a re-enacted budget, which is based on the last year's budget, until the budget for the current year is approved.

#### (2) Capital Expenditures in the Sector

The projects programmed for implementation in the province by sector, by funding source, and by implementing agency are consolidated and presented by the PPDO in the Provincial Annual Investment Plan (AIP). The AIP is based on the planned investment of the province, as well as on the submission to the PPDO from the municipalities on their

planned investments for the coming year. The AIPs of Agusan del Norte for the Sector from 1995 to 1998 are summarized in Tables 6.3.2 and 6.3.3.

Table 6.3.2 shows the annual planned activities in the water supply sector; the corresponding funding sources and the amount of investment from 1995 to 1998, while Table 6.3.3 summarizes annual sector investments by service level. Levels II & III had the largest fund allocation, particularly in 1998 with the amount of around P44.78 million mainly from DBP/LBP loans. During the period 1995 to 1998, a cumulative amount of P91.6 million was planned to be mainly invested for water supply (P91.48 million), while only P163,200 was planned for sanitation.

In the AIP of the province, a total investment cost of P91.6 million was planned both for water supply and sanitation sector during the period of 1995-1998. But, the actual expenditures for the sector out of the 20% DF of the province were very small with P3.6 million or only 3.9% of the required investments. (refer to Table 6.3.4). There is a further need to clarify which of the planned investments were implemented and funded from any of the available sources such as local funds (provincial and municipal government) and foreign funds.

The AIP of the province for the years between 1996 and 1998 included the repair and maintenance items of water supply facilities. However, no such items were included in 1995. It is important to consider the budget for repair and maintenance of the facilities.

### **6.3.2 Past and Current Breakdown of 20% Development Fund**

The allocation of the 20% DF is guided by DILG Memorandum Circular No.95-215 as amended by Memorandum Circular No. 96-263 issuing 'the Policies and Guidelines on the Utilization of the DF and other related matters'.

As presented in Table 6.3.4, the infrastructure sector obtained 78% of the DF in 1998 (i.e. P26.29 million out of P33.65 million). However, water supply and sanitation sector's share was very minimal with only 3.5% of the DF in the annual average.

**Table 6.3.2 Annual Investment Plan**

Unit: '000 Pesos

Item	1995	1996	1997	1998	Total	% Share
Construction (DW, SW, Spring Box, Reservoir, Tank) Various Local Funding	1,000.00	405.60	2,545.00	15,080.00	19,030.60	20.77
Construction of Rain Collectors/Water Tanks						
Develop Spring Sources National Various Local Funding		100.70		4,200.00	4,300.70	4.60
Spring Development with 1.2 National/Local Funding Various Local Funding		320.90	2,900.00	7,885.00	11,105.90	12.12
Spring Development with 1.3						
Spring Development with Pipes, Water Tank Construction Levels 2/3 National				36,900.00	36,900.00	40.27
Maintenance/Rehab/Improve L1/L2/L3 & SD		281.00	270.00	16,280.00	16,831.00	18.37
Expansion L2/L3		38.70		3,250.00	3,288.70	3.59
Construction of Health Center/Sanitation-Barangay		163.20			163.20	0.19
Water disinfection/Chlorination of water sources - 14 Mun.						
Construction of Water Reservoir-Bunawan Dist. Hosp.						
Water Supply for Provincial Resettlement Project Site						
<b>Total</b>	<b>1,000.00</b>	<b>1,310.10</b>	<b>5,715.00</b>	<b>83,595.00</b>	<b>91,620.10</b>	<b>100.00</b>

Source: Agusan del Norte Annual Investment Programs, 1995 to 1998

**Table 6.3.3 Sector Allocation in the Annual Investment Plan**

Unit: '000 Pesos

Item	1995	1996	1997	1998	Total
Level 1 Foreign Assisted Local	1,000.00	506.30	(National, Local) 2,545.00	(National, Local, CDF) 19,280.00	(National, Local, DCF) 23,331.00
Level 2/3 Local Loan - DBP/IBP	-	320.90	2,900.00	44,785.00	48,005.00
Expansion	-	38.70	-	3,250.00	3,288.70
Repair/Maintenance	-	281.00	270.00	16,280.00	16,831.00
Special Water Supply Projects (Gov't. Centers, Hosp.) - Local	-	24.80	-	-	24.80
Health Centers	-	163.20	-	-	163.20
Water Quality	-	-	-	-	-
Total-Water Supply	1,000.00	1,171.70	5,715.00	83,595.00	91,481.70
Total-Sanitation (Health)	-	163.20	-	-	163.20
<b>Total</b>	<b>1,000.00</b>	<b>1,334.90</b>	<b>5,715.00</b>	<b>83,595.00</b>	<b>91,644.90</b>

Source: Provincial Planning and Development Office

**Table 6.3.4 Allocation of the 20% Development Fund, 1995-1998**

Unit: Pesos

Year	20% Dev't. Fund	Actual Expenditures				Sub-Total	% of Water Supply to 20% DF
		Social Development	Economic Development	Infrastructure	Water Supply		
1995	20,820,259.40	6,002,144.59	3,803,987.79	10,076,146.00	1,000,000.00	20,882,279.00	4.79
1996	22,405,959.00	7,123,810.36	2,533,949.00	10,589,905.00	800,000.00	21,047,664.50	3.57
1997	30,071,737.20	7,248,152.41	1,573,500.20	11,449,710.09	796,202.41	21,067,565.11	2.65
1998	33,652,372.00	5,579,080.00	780,000.00	26,293,292.00	1,000,000.00	33,652,372.00	2.97

### **6.3.3 Existing Plans of the LGUs for the Sector**

The Provincial Government has been undertaking various programs for the water supply and sanitation sector, but there are no specific projects to be implemented at present. The following are the items to be budgetary arranged.

#### **(a) Logistic supports with required funding**

The LGUs through the course of project implementation shall ensure provision of adequate logistic supports with financial arrangements. The LGUs have not given priority to the requirements under the budgetary constraint. The AIP needs to include the plan for the logistic supports entailing manpower and vehicle allocation.

#### **(b) Raising funds and provision of subsidies to support capital development.**

The province provides the subsidies to support capital development at the municipal and barangay levels through its 20% DF. However, barangays and municipalities that request funding must be prompt in submitting the necessary documents to PPDO for processing. Out of the 20% DF, the province may provide logistics for manpower requirement for devolved functions.

## **6.4 LGUs' Present Financing Sources and Management Participation in the Sector**

### **6.4.1 Cost Sharing Arrangements / Counterpart Funding**

The implementation of water supply projects was previously undertaken by DPWH (construction through OECF loan assistance up to 1995) and DILG (BWP - institutional building, UNDP - WATSAN and CIDA - capability building). The DPWH, through its DEOs, still receive requests for assistance from barangay people. This is due to lack of awareness on the part of people regarding the new institutional arrangement and this proved the DEOs' technical ability. The requests, however, are granted on a case-to-case basis, usually if the manpower and budget are available.

The new cost-sharing scheme was authorized in 1998 in accordance with the policy on national government grants. It is stated that "this scheme shall be applied to all new ODA-assisted projects that are currently being packaged in support of LGUs". Programs of central government agencies that involve devolved functions, particularly those that have social

and/or environmental objectives are implemented through a cost-sharing arrangement between the central government agency and LGUs. For any central government grants that are provided for the development of Level I water supply systems and sanitation facilities to the limited classes of municipalities, the LGUs and beneficiaries concerned shall share the capital cost required. No subsidies from the central government will be provided for the construction of Level II and III water supply systems.

#### **6.4.2 ODA Assisted Projects and Grant Aid**

Other external source of funds of the province is foreign assisted projects either directly coursed through the province as in the case of UNICEF or through the central government as in the case of the World Bank funded FW4SP implemented by the DPWH. Water districts in the province likewise avail of funding through loans that are directly obtained from LWUA.

As of now, there was no NGO counterpart funding experienced by the Province. However, the province is currently processing the financing arrangements for one of its projects, the Lake Mainit IAD, through the MDF. The province together with Surigao del Norte is envisaged to undertake this project. The proposed project was submitted and presented to the ICC and waiting approval. Interest rate through this funding scheme is 14% according to the MDF practice.

The province intends to increase its income from other sources and establish a consortium, which may enable them to directly negotiate with the foreign donors.

##### **(I) Arrangement through Conduits**

###### **1) Municipal Development Fund (MDF)**

The MDF is a revolving fund created under Presidential Decree No. 1914 to provide LGUs access to foreign loans, assistance or grants. Operations of the MDF, as well as the evaluation and control of local government transactions of the fund, are guided by the financial policies defined in the Joint Circular No. 6-87 of the DOF, COA and DBM. The policies include, among others, the following:

- On-lending terms for local governments or government corporations to be in accordance with the terms and conditions of the international agreements with foreign financial institutions;

- Loan repayments to conform with the terms and conditions of the corresponding Loan and Project Agreements;
- Annual debt service liabilities to all creditors to be at least 120 per cent of total net annual revenues from all sources after operating costs, unless otherwise provided in a mutual agreement among all parties concerned;
- Repayment to MDF to take precedence over all subsequent borrowings incurred;
- Payment of additional interest, charges and fees on amounts to be relent to local governments may be required by the Secretary of Finance in consultation or agreement with foreign lending institutions and LGUs/Project Cities to cover foreign exchange risks, commitment charges and front-end fees applied on foreign borrowings by lending institutions; and
- Internal revenue/specific tax allotments to be withheld by the DOR in case of default or arrearages for more than three (3) months.

The Policy on accessing loans through the MDF is currently under review by the central government to make the terms and conditions more concessional towards the LGUs.

## 2) Governmental Financing Institutions (GFI)

In the past, the LGUs could not access financing institutions for direct assistance. But with the devolution of the sector to the LGUs, the LGUs could now access direct financing from banks and other financing institutions.

Among the GFIs through which LGUs can access ODA loans are the Land Bank of the Philippines (LBP) and the Development Bank of the Philippines (DBP). For the LGU to enter into a loan, the respective legislative council (PA for the Province, Sangguniang Panlungsod; SP for the City and Sangguniang Bayan; SB for the Municipality) will authorize the Chief Executive Officer (Governor or Mayor, as the case may be). The collateral that the LGU may use in order to avail of loans from the bank could be any of the following: deposit hold out, public land and assignment of IRA.

In a deposit hold out loan, loanable amount is based on the amount in the time deposit account of the LGU in the bank. The LGU is allowed a maximum loanable amount of up to 90 per cent of the total amount of its time deposit account in the bank. One

of the terms for this kind of loan includes deduction of amount due from the LGU's IRA deposited in that bank.

Another condition that the bank usually imposes on the loan is the signing of a MOA between the LGU and the bank, where the LGU guarantees that the loan will be honored despite a change in administration in the next election. Interest rate is not fixed. Loanable amount may be based on the amount of time deposit of the province in the bank. This is called deposit hold out. The province is allowed a maximum loanable amount of up to 90% of its total time deposit in the bank. One of the terms of the loan includes the deduction of loan amortization from the IRA of the Province deposited in that bank.

Other collaterals accepted by the bank are: public land and assignment of IRA. Interest rate is not fixed but fluctuating depending on the current interest rates prevailing during repayment. Penalty charges are imposed whenever the IRA of the province is delayed.

### 3) Foreign Lending Agencies

The external assistance to the Sector in the province comes from foreign assisted projects. Before the devolution of the sector, the province was a beneficiary of UNICEF and JICA health services. After the devolution, the province became the direct recipient of foreign grants. The most recent experience of the province in foreign grants was the UNDP-WATSAN project, where the province is a direct recipient from the donor.

## 6.4.3 LGU-Financed and Managed Waterworks/Water District.

### (1) Past Financial Performance of WDs and RWSAs/BWSAs

Two (2) WDs are currently managed in the province, which are Nasipit WD and Butuan City WD. Table 6.4.1 and Table 6.4.2 show the financial indicators and loan status of WDs in 1998, respectively. The WDs adopted progressive charge method and have achieved 95% efficiency of water charge collection earning surplus income. The average monthly consumption per connection/household is 14-18 cum.

The Butuan WD does not have arrears, while Nasipit WD is in arrears.

**Table 6.4.1 Financial Indicators of Provincial/Municipal Waterworks in the Province (as of June 1998)**

Waterworks	Description						
	No. of Metered Connections	No. of Flat Rate Connections	Average Monthly Rate	Average Consumption per Connection	Average O&M Cost	Average Revenue	Collection Efficiency
	Nos.	Nos.	Pesos/cum.	cum./mo.	Pesos/mo.	Pesos/mo.	Percent (%)
Nasipit WD	2,980	-None-	P= 11.20	14	P 122,051.36	P 528,550.47	95%
Butuan City WD	13,507	-None-	17.50	18		4,543,762.00	95%

**Table 6.4.2 Loan Status of Provincial/Municipal Waterworks (as of June 1998)**

Waterworks	Description			
	Total Loan Aailed	Remaining Payment Period Months	Average Monthly Amortization	Current Arrears
Nasipit WD	16,170.61	242.00	P=40,117.00	14,745.09
Butuan WD	-	-	-	-

## 6.5 Existing Practices by the LGU on Cost Recovery

### 6.5.1 Capital Cost

In the previous arrangements, the capital cost for Level I systems was free to the community, while operation and maintenance was the responsibility of the association. As for Level II systems, the capital cost was shouldered by the RWSA through loan or grants. Water charges collected by each association cover the cost of operation and maintenance and loan amortization. According to the Loan Department of LWUA, the new loan disbursement to RWSAs has been stopped for the last couple of years.

For Level III system, WDs or RWSAs bear the entire capital cost financed by LWUA through loans with concessional terms of 8.5%-12.5% interest rate and repayment period extending up to thirty (30) years. Less capable WDs are granted soft loans that are interest free during the first five (5) years operation. In the occasion of the first assistance by LWUA, the loan for the full investment required could be provided for the WDs. For the expansion/rehabilitation works of the WDs, 90% of required investment may be granted by a loan and the remaining 10% shall be arranged by the equity of WDs. The cost of amortizing the loan and operation and maintenance of the system is recovered through monthly water bills. In case of LGU's operating Level III systems, the capital cost is managed by the LGU using part of DF and other financial sources (borrowings and aids).



Regarding the sanitation sector, the construction of the superstructure and the depository of household toilets is through self-help.

#### **6.5.2 Operation and Maintenance Cost**

The operation and maintenance cost for Level I and II water supply systems is envisioned to be the responsibility of the users. As such, the users shall form an organization (or association) to handle the collection of water charges.

When DPWH had been undertaking the construction of Level I water supply facilities, the DPWH through DEOs assisted to form many BWSAs. However, most of these BWSAs are no longer functioning, due to non-collection of water fees. As a consequence, the users had to go to the LGUs (usually barangay or municipal) to address the problem. In some cases, the users likewise requested the DEOs for assistance.

Although the DPWH had no budget for operation and maintenance, it extended assistance in the form of materials (such as gaskets or joint pipes) from their supplies, if these items are available. Because of this situation, the emphasis was placed on the need of monthly contributions from the users for the O&M. While, some of the active BWSAs for Level I water supply collected monthly fees ranging from ₱10.00 to as much as ₱50.00 per household per month. Of the four BWSAs organized, two BWSAs depended on the barangay council for O&M, while the other two BWSAs had association members who were trained to operate and maintain the facilities.

Cost recovery for Level III systems, particularly those covered by Water Districts is managed through different systems. The households covered by the Water District can be disconnected in case no payment by the users.

The Nasipit and Butuan Water Districts are charging the amounts of ₱11.20 and ₱17.50 per cum., respectively. The water rate structure is based on LWUA's guidelines for water rate setting. Water rates are socialized, based on O&M, operating expenses and capital expenditure requirements of the system for the period, and it should not exceed 5% of the low-income group's household income. Water rates are kept minimal since the Water District should be service-oriented and not profit-oriented.

## **6.6 Affordability of Users**

This sub-section presents the affordability of users by sector service level. However, base information for the analysis is limited to that gathered from field survey at selected barangays and from the water districts in the province.

### **6.6.1 Capital Cost Contribution**

Referring to the group interview results for Level I and II water supply conducted in this study, majorities of respondents are willing to participate in the water supply projects in the future. Of those who are willing to share, majority (41 of 57 respondents or 82%) indicated that they are willing to form BWSA. Only 5% or three (3) respondents wanted to be involved in water rates formulation and 58% wanted to participate in the construction of facilities as well as in O&M of the system. All respondents are willing to contribute free labor during construction. Hence, for Levels I and II water supply, due to insufficient household income, there is a need for LGUs to provide some sort of subsidy.

On the other hand, the construction cost of private toilet seems to be expensive as compared with the family income. The estimated cost of flush type toilet facility is about 5.8 times higher than the median monthly family income in the province and since this is the case, subsidy may be provided by the LGU concerned.

### **6.6.2 Operation and Maintenance Cost**

According to the aforementioned survey for Level I and II water supply, the respondents could not determine who were responsible for maintaining water supply facilities. It was found that the highest amount paid is ₱50.00, equivalent to 1.3% of the median family income. Thus, it can be assumed that the users can well afford to pay the amounts being currently charged by the BWSA, although survey sample size is limited. Majorities of the respondents are willing to participate in the O&M of the water supply facilities in the future. They also pointed out that the water fees being collected at present are not sufficient to operate and maintain the facilities.

It was identified through the barangay survey that there were four barangays which had received provincial government assistance with the amount of ₱70,000-100,000 from 1996 to 1997. The assistance entailed the provision of pipes and formation of the BWSAs. Other

sources of assistance to some barangays included CDF funds, poverty alleviation fund (PAF), and DPWH budget.

In the water districts or Level III waterworks, O&M expenses are basically covered by the user fees depending on the water consumption amount by water user category. The water charge system was established by LWUA to compel water districts to be self-sufficient, financially viable and be able to repay any loans obtained to improve water supply services.

Table 6.6.1 presents the affordability of households by service level. At present, the current water bills in the province seem to be within an affordable range based on experience, although the actual income level varies from municipality to municipality and barangay to barangay (urban barangay population have higher income than those in rural barangays, because of the more diverse economic and commercial activities).

**Table 6.6.1 Affordability in Water Supply and Sanitation Services**

Income/ Level of Service	Amount (Pesos)	% to Monthly Income	Affordable Range (%) 4/
Median of Monthly Income 1/	₱ 3,663.00	100.0	-
Average Level III: Monthly Water Bill 2/	100.00 – 180.00	2.7 – 4.9	5.0 or less
Average Level II: Monthly Water Bill	50	1.36	2.0-3.0
Mo. Level I Expenditures	10.00	0.137 - 0.27	1.0-less
Private Toilet Construction Cost – Flush Type Toilet 3/	21,300.00	581	-

Notes:

1/ 1994 Family Income and Expenditures Survey, NSO. Average salary based on barangay surveys is ₱4,000.00 – ₱5,000.00.

2/ Data from PSPT; It is assumed that 21 cum. will be consumed per family.

3/ Current prices estimated in this study

4/ Based on the experiences mainly from LWUA, DPWH and DILG.

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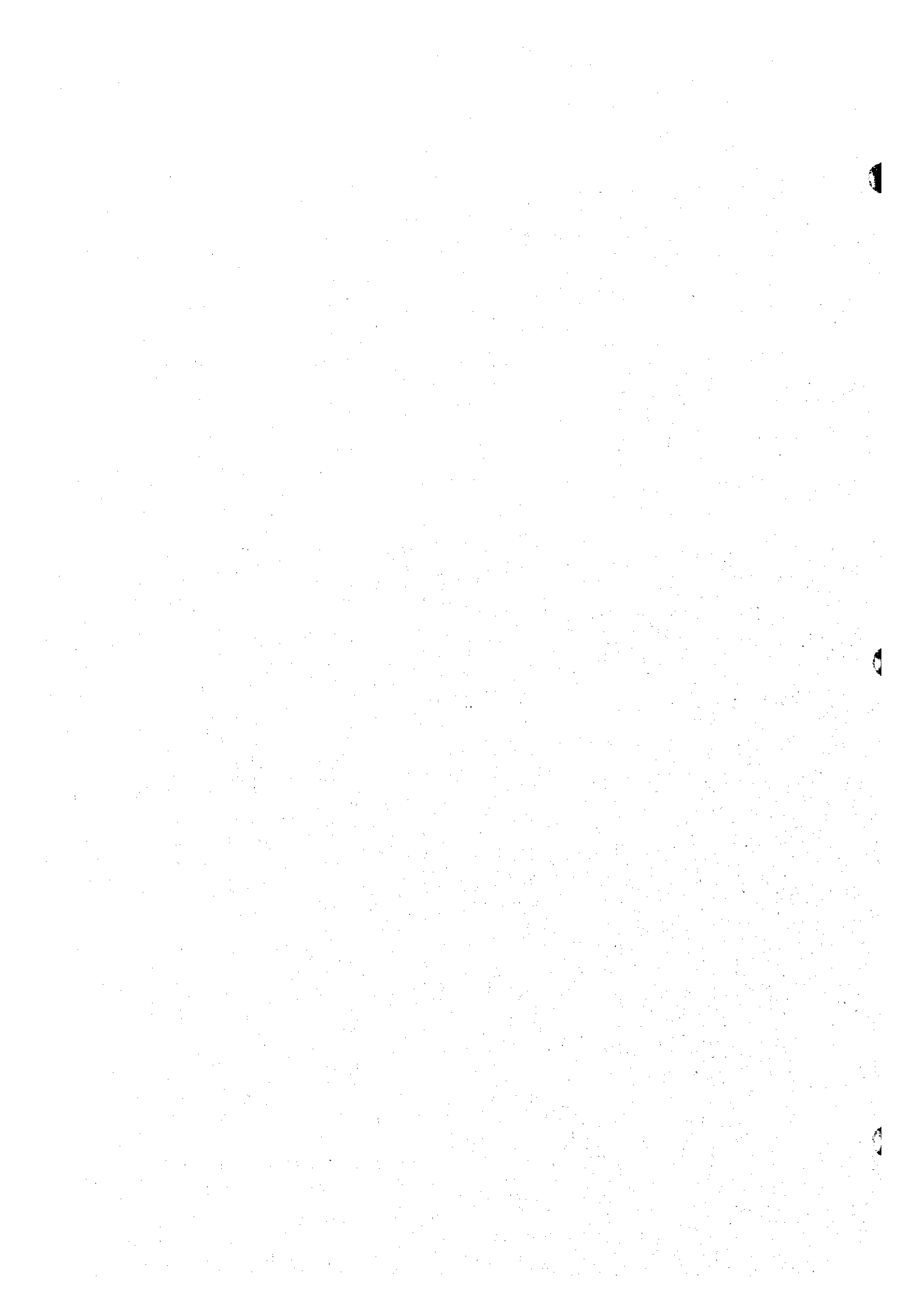
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Chapter

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**WATER SOURCE DEVELOPMENT**

**7**



## 7. WATER SOURCE DEVELOPMENT

### 7.1 General

The study on water source development covers the entire province to come up with water source potential exploitable for mainly domestic water supply. An emphasis is placed on the groundwater availability due to its prevalent use and comparatively conservative development through the future in the jurisdiction of the provincial government. It is also advantageous to utilize groundwater for domestic water supply because of better quality and economical use. Nevertheless, surface water potential of major rivers was studied in terms of quantity (return period flow rate) and quality to provide information for LGU's future use, if necessary.

A "Groundwater Availability Map" was prepared, which identifies the areas with available potable water sources. The study has two major components: (1) interpretation of existing geological and groundwater conditions and (2) preparation of Groundwater Availability Map to show groundwater potential areas under three kinds of categorized areas. Furthermore, standard well specifications by municipality were also established to reflect in the medium-term sector development plan. A groundwater quality map was also prepared to supplement the information on the groundwater development for drinking purpose.

The major data used in the study were obtained from concerned agencies (NAMRIA, BMGS, NWRB, LWUA, DPWH and PPDO) and supplemented by the information gathered through questionnaires from relevant local offices in the field (including spring inventories with verifications). The field information directly collected by the Study Team was also effectively used to increase the accuracy of the Map. Among the information, the Geologic Map published by BMGS, the Water Resource Investigation Report and the Well Inventory Database of NWRB are essential for the analysis of geological characteristics, projection of high yielding area and possible area with salt water intrusion, and classification of groundwater potential areas, respectively.

The Groundwater Availability Map may be used for provincial level master plan and feasibility study at present. However, the recommendations on the required investigations were presented for the specific areas with scope of survey, as a reference for LGUs, to conduct them prior to D/D and construction work. Aside from the requirements, updating the map is a requisite to gain more information on current groundwater conditions using the questionnaires prepared for the study. An annual review and updating of the database will enable the LGUs to implement water source development on a project site basis.

The overview on current groundwater use with the conditions is summarized in Table 7.1.1 (Well data collected from each municipality are presented in Table 7.1.1, Water Source Information, Data Report). There are 1,172 shallow wells, 746 deep wells and 83 developed springs, which are currently used in the province (functional sources). Majorities of the wells are shallow wells. About a half of this water sources are public facilities. Of the total existing wells, 79% remains functional at present. In addition to the above sources, 18 untapped springs are accounted.

**Table 7.1.1 Existing Groundwater Sources in the Province**

Category and Classification	Shallow Well	Deep Well	Spring	Total
<b>1. Water source being availed</b>				
a. Public sources	616	380	82	1,078
b. Privately owned sources	556	366	1	923
c. Number of water sources	1,172	746	83	2,001
d. Profile of different sources	59%	37%	4%	100%
<b>2. Water sources with problems and non-functional wells</b>				
a. Water quality problems*	711	0	0	711
b. Non-functional wells	294	227		521
<b>3. Spring source information</b>				
a. Undeveloped			N.A.	N.A.
b. Untapped			18	18

Note: 1: Number of water sources being availed at present including those with water quality problems.

2: Number of existing water sources with problems: being used, but with water quality problem /abandoned wells.

3: Number of springs availed, but not adequately protected; and those as candidate sources to be developed.

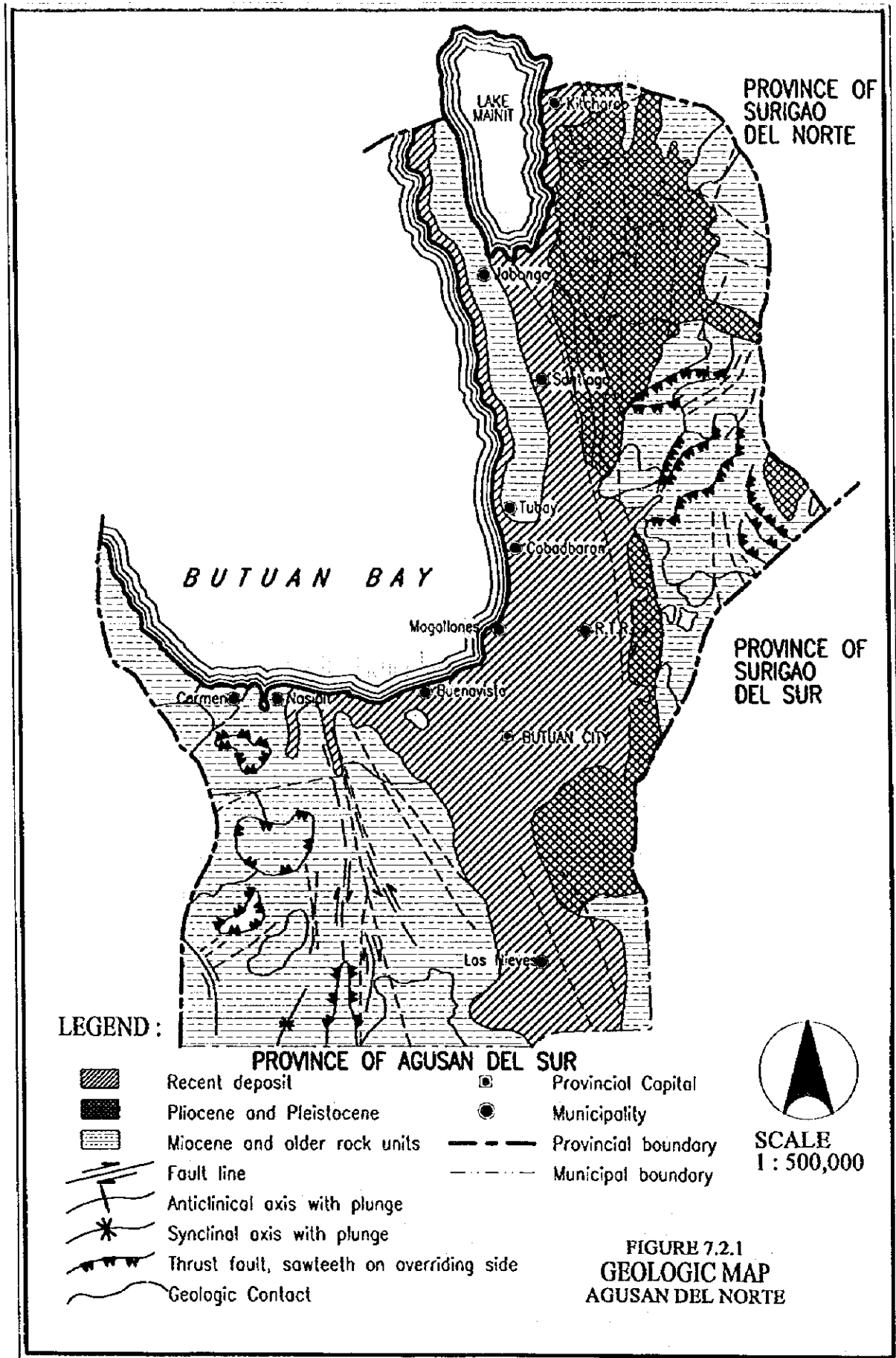
\*: Assumed number of sources (unsafe category) based on the study on existing water supply facilities in Chapter 4.

N.A.: Data not available.

## 7.2 Geology

The rock units in the province are classified into three (3) main groups based on the ages of the rock formation. These are, from the oldest to youngest, the Miocene and Older rocks, the Pliocene to Pleistocene Rocks and the Recent Deposits. The grouping of the rocks is related to their potential as groundwater sources. The younger rocks are considered the most important to groundwater because of their porosity and permeability relative to the older rocks. The





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distribution of these rock groups is shown in Figure 7.2.1, Geological Map and their geological features are described below.

(1) Miocene and Older rocks

The older sedimentary and igneous rock units are distributed in the western, northeastern and northwestern parts of the province. The oldest rocks are sedimentary rocks consisting of graywacke-shale sequence of Cretaceous age and are distributed in southwestern mountains of Mainit Lake. Other older rock units cover the high mountain area in the south-east side of the lake and are made up of undifferentiated graywackes and metamorphosed shale of Cretaceous to Paleogene age.

The mountain ranges, located in the western parts of the province, consist of marine clastic of Upper Miocene age. These rocks are generally very consolidated and groundwater development is difficult.

(2) Pliocene to Pleistocene rocks

The sediments consisting of marine and terrestrial sediments are only distributed in narrow area in the southeastern part of the province. Groundwater development potential is generally high with sufficient thickness of aquifer to allow for groundwater development by means of deep wells.

(3) Recent Deposits

The recent deposits (alluvium) are distributed widely in the central and northwestern areas. They consist mainly of clay, silt, sand and gravel deposits in unconsolidated condition. The alluvial plain is formed by the several formations that have shallow and deep aquifers with high groundwater development potential.

### 7.3 Groundwater Sources

#### 7.3.1 Classification of Groundwater Availability

For planning purpose, the provincial area is divided into the following sub-areas in terms of groundwater availability:

(1) Shallow well area

These are areas having water bearing rock formations of not more than 20 m in depth from the ground surface. Shallow well areas are usually located in alluvial and coastal plains, where Recent unconsolidated materials overlie impervious rocks at shallow depth.

The extent of completely shallow well area is limited, because most of the Recent formations are thick or deposited on the Late Pliocene to Pleistocene rocks, that usually have multiple aquifers located at greater depths.

(2) Deep well area

In deep well areas, the aquifers are located more than 20 m from the ground level. These areas could be found in portions underlain by the Pliocene to Pleistocene and Recent formations. Most of these areas have more than one aquifer occurring at various depths. Areas where shallow and deep wells could be developed are categorized as deep well areas.

(3) Difficult area

These are areas not suitable for well development. The areas under this category largely consist of rock formations older than Miocene in age. The groundwater availability in the aforesaid rocks is very low and usually released in the opened rock fractures. Springs are the common sources of water supply in these areas.

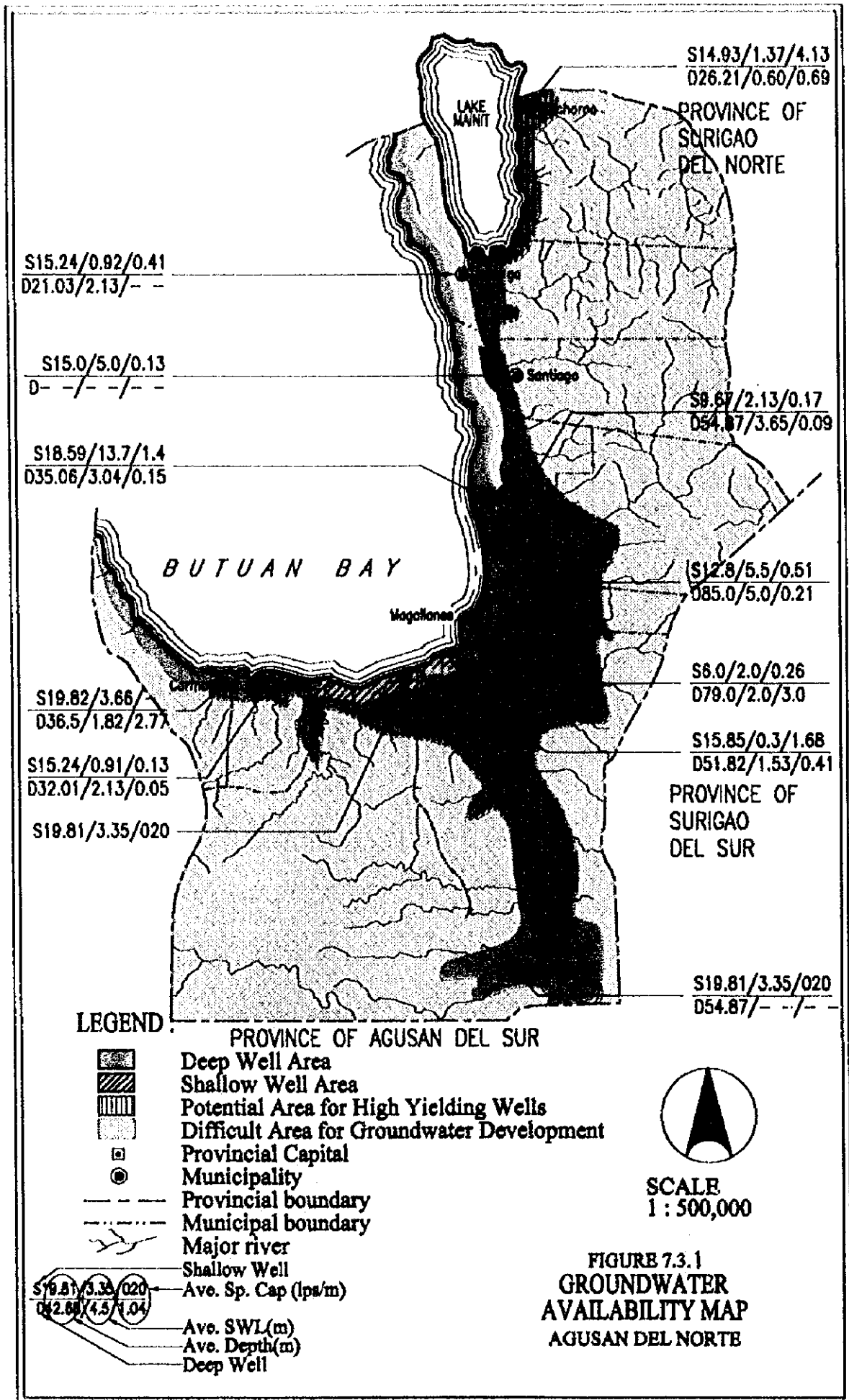
In addition to the above classification, potential areas to have high yielding deep aquifers are also presented based on NWRB's geo-resistivity survey.

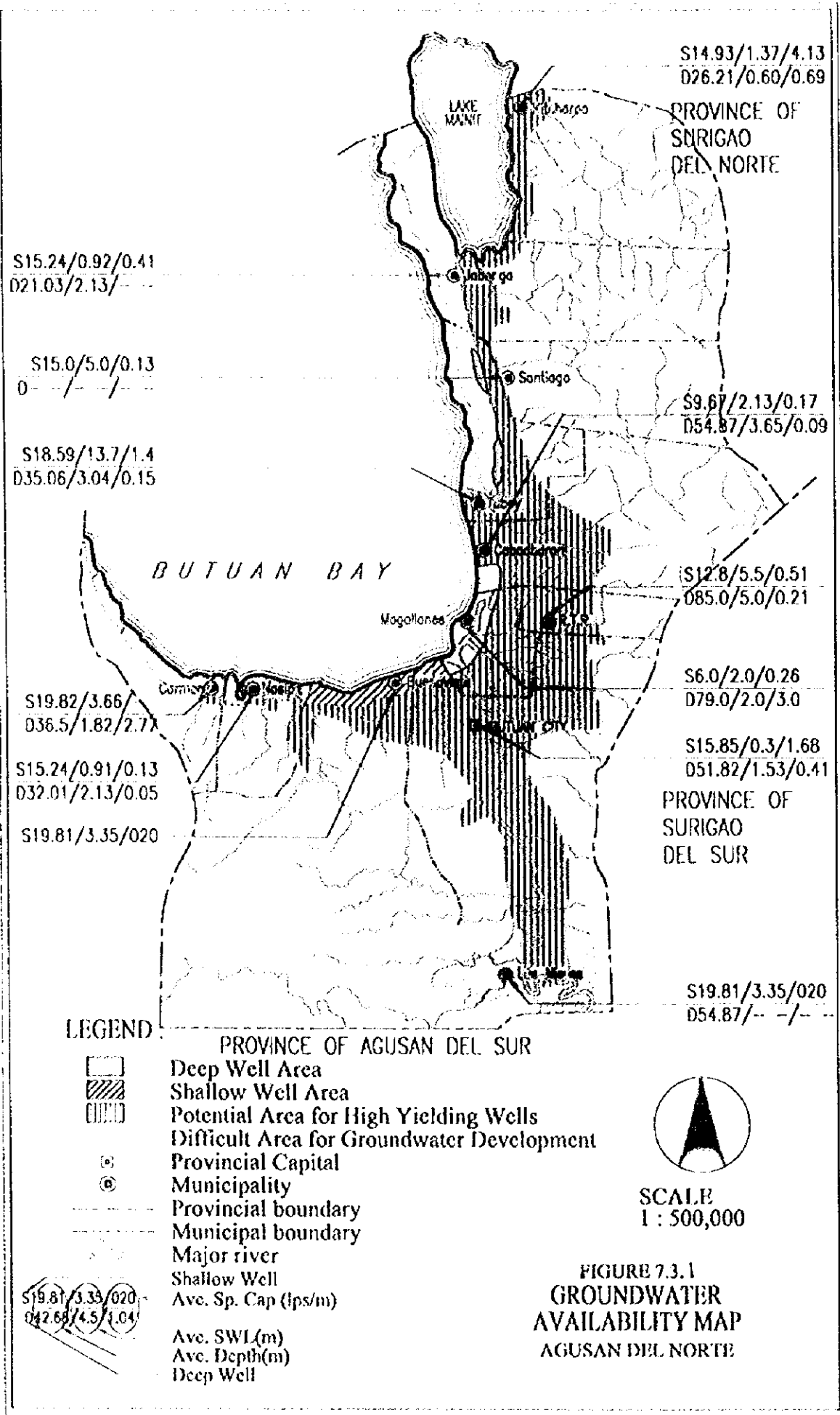
### **7.3.2 Groundwater Availability in the Province**

The Groundwater Availability Map is presented in Figure 7.3.1. The major databases used in the preparation of the map were obtained from BMGS and NWRB. The methodology and study procedure with respective outputs are discussed in 7.3, Supporting Report. Technical information on the wells by municipality is also shown in the same report. The groundwater development potential areas in the province through the future are summarized below.

(1) Shallow well area

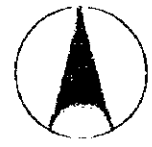
Shallow well areas are present along the seashore on the periphery of Buenavista municipality and along the coastal line on the western side of the mountain range that is located west of Mainit Lake. Wells are generally driven/drilled with an average depth of 6.1 m to 19.8 mbgl. The water table is more than 3.0 mbgl on the periphery of Buenavista municipality, with an average well depth of 13.5 m mbgl; while, the water table is 2.5 mbgl or less in the western side of the mountain range.





**LEGEND**

- Deep Well Area
- Shallow Well Area
- Potential Area for High Yielding Wells
- Difficult Area for Groundwater Development
- Provincial Capital
- Municipality
- Provincial boundary
- Municipal boundary
- Major river
- Shallow Well
- Ave. Sp. Cap (lps/m)
- Ave. SWL (m)
- Ave. Depth (m)
- Deep Well



**SCALE**  
1 : 500,000

**FIGURE 7.3.1**  
**GROUNDWATER**  
**AVAILABILITY MAP**  
**AGUSAN DEL NORTE**

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(2) Deep well area

The deep well area covers approximately 30% of the province, widely distributed in Butuan City, and from the western side of Buenavista municipality up to the south rim of Mainit Lake located in the northern side of the city. The area includes most parts of Butuan City and Magallanes municipality, and a part of Buenavista, Cabadbaran, Remedios.T.Romualdez (R.T.R.), Tubay, Santiago, and Jabonga municipalities.

The followings are grouped as high potential areas for deep well development:

- 1) periphery of Butuan City, average depth of existing deep wells is 56.5 mbgl with average water level of 3.5 mbgl, and the average specific capacity is 1.8 cu. m/hr/m.
- 2) the Buenavista municipality area, average depth of existing deep wells is 48.2 mbgl with an average water level of 6.6 mbgl, and the average specific capacity is 2.4 cu. m/hr/m.
- 3) the alluvial plain near Mainit Lake, the average depth of the existing deep wells is 28.9 mbgl with an average water level of 1.6 mbgl, and the average specific capacity is 1.9 cu. m/hr/m.

(3) Difficult area

About 70% of the provincial area is classified as a difficult area for groundwater exploitation. The areas are mountainous, particularly southwest and east of the province, and west of Mainit Lake.

The geology is made up of 1) consolidated sediments: graywacke and shale of Cretaceous age, marine deposits, largely wackes and shale, conglomerate, wackes shales, reef limestone of the Eocene and Miocene age, 2) volcanic rocks: pyroclastics of the Miocene age, 3) igneous intrusive rocks: ultramafic and mafic rocks of the Cretaceous-Paleogene age and quartz, diorite, granodiorite and andesite porphyry of the Neogene age. These rocks and formations are dense, massive, consolidated and impervious. Groundwater occurs only in fissures or fault fracture zones.

### 7.3.3 Groundwater Quality

Groundwater is generally potable except in some areas with high iron content and salt water intrusion. A water resources investigation for the province conducted by NWRB and general information from DPWH-DEO revealed the problem areas, as shown in the Groundwater

Quality Map in Figure 7.3.2. The following are summary of the findings.

(1) High iron content area

Groundwater with high iron content is observed in the following: in shallow wells along the coastal line from the Buenavista to Carmen municipalities; in deep wells with depths of about 60 m in the north area of Tubay municipality and part of Magallanes and R.T.R. municipalities; and, in deep wells with depths of 36 m to 72 m in the area near Las Nieves municipality. In addition, the well water with high iron content in Magallanes also contains methane gas.

(2) Salt water intrusion

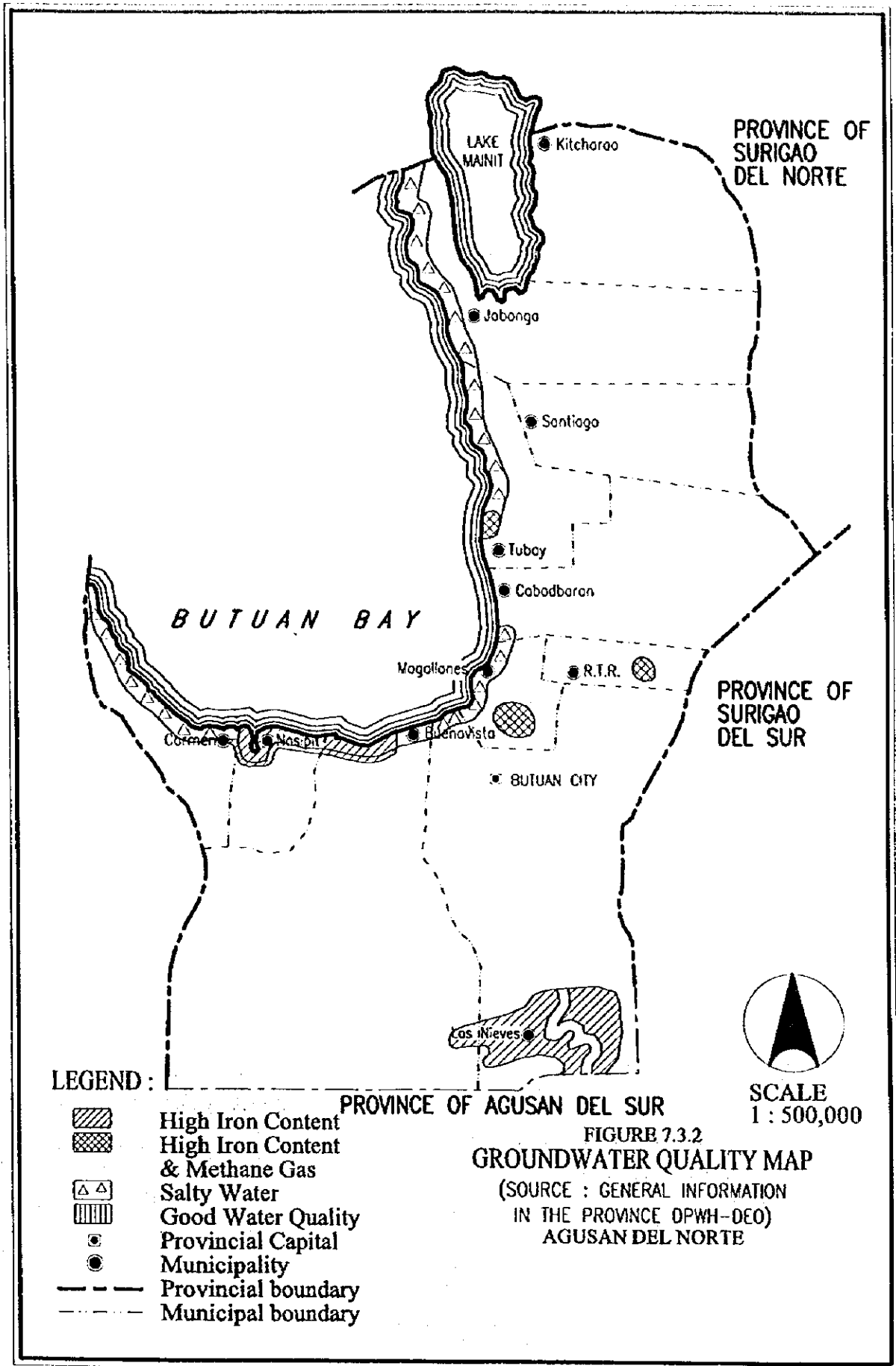
The areas along the seashore in the western side of Butuan City have salt water intrusion only in shallow groundwater with depths of less than 6 m. Furthermore, the coastal area on the northwestern side of the province also has salty water in shallow wells.

#### 7.4 Spring Sources







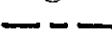
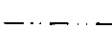
Spring is a natural outlet of groundwater at the ground surface. It occurs when water table intersects the ground surface, usually along the contacts of pervious and impervious rock formation and through rock features. Because of the intense fracturing, particularly older formation, and the presence of large solution openings in limestone, secondary permeability is induced to the rocks that favors spring development.

For the study, springs are categorized into developed, undeveloped and untapped springs. A developed spring is utilized and must have sanitary protection, otherwise it is classified as undeveloped spring, which is considered as unsafe water source. An untapped spring, as the

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**LEGEND :**

-  High Iron Content
-  High Iron Content & Methane Gas
-  Salty Water
-  Good Water Quality
-  Provincial Capital
-  Municipality
-  Provincial boundary
-  Municipal boundary

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SCALE  
1 : 500,000

**FIGURE 7.3.2**  
**GROUNDWATER QUALITY MAP**  
 (SOURCE : GENERAL INFORMATION  
 IN THE PROVINCE DPWH-DEO)  
 AGUSAN DEL NORTE



name implies, is unutilized and flowing in its natural state.

Based on the inventory of water sources prepared through the study, the province has 83 developed springs currently serving the province. These springs issue from high mountain areas in the northwestern, northeastern, and western mountain areas.

Of these springs, 50 have discharges of less than 2.8 l/sec, while 16 have a yield of 2.8 l/sec or more, particularly those located in the northwestern and northeastern areas. In addition, a total of 13 untapped springs are reported in the municipalities of Kitcharao, Tubay, Cabadbaran, R.T.R. Most of these springs do not dry up even during draught period with yields varying from 0.13 to 1.94 l/sec.

On the other hand, the western mountainous areas that are highly dissected with smooth slopes and elevations ranging from 200 m to 600 m have only 16 developed springs. Moreover, a total of 5 untapped springs are reported in the municipalities of Buenavista and Naspit. These springs have an average yield of 0.83 l/sec.

In the mountain areas located southeast of the province, the Las Nieves area has one developed springs with discharge rates of less than 2.8 l/sec. The technical information of the springs in each municipality is presented in Table 7.4.1 Existing Spring Sources, Supporting Report.

## 7.5 Surface Water Sources

The major surface water sources in the province are the Agusan River, the Cabadbaran River, the Kalinawan River, the Linugos River, the Tubay River and Lake Mainit. There are three gauging stations in the province.

Surface water use in the province totaled 31.13 cu.m/sec according to the NWRB's water rights registration database, as of March 1997. Of this usage, 99.5% of the water rights were registered for irrigation. Other surface water uses were for domestic, industrial and fisheries by a few private companies. For domestic water supply, Naspit Inc. has been taking only 750 cu.m/day, together with its industrial surface water use of 10,740 cu.m/day.

Records on river flow, maintenance flow and water use of the major rivers and stream systems, based on available runoff records from the gauging stations are given in Table 7.5.2, Supporting Report. The inflows to and the outflows from the respective municipalities are

estimated as the exploitable potentials of the major rivers in the province.

Water quality analyses were conducted through this study. The results of water quality analysis at selected streams meet the Class A limitation of "DENR Fresh Water Quality Criteria" within the tested parameters. It is noted that the gold mining operations are located in the municipality of Magallanes. These operations have caused environmental pollution of the surface water by heavy metals such as mercury.

## **7.6 Future Development Potential of Water Sources**

### **(1) Groundwater**

Based on the study of existing water sources, groundwater is considered as a safe and more economical source for future water supply requirements of the province.

Shallow wells are the possible source for Level I service. Considering the existing wells in the province, the potential aquifers for shallow wells occur between 6 and 20 mbgl. One disadvantage of shallow wells is the lowering of water level during dry season that reduces the discharge of the wells. Another disadvantage is the usual high susceptibility of shallow aquifers to direct infiltration of surface pollutants.

In general, deep wells have better water quality and invariable yields when developed with appropriate technology. This depends that the wells tap to comparatively deeper aquifer. It reduces the hazards of groundwater pollution. In addition, lowering of groundwater level does not affect the discharge, since usual confinement of deep aquifer rises water level above the aquifers. In Recent deposits and Pliocene to Pleistocene sediments, good aquifers apparently occur from 20 to 190 mbgl.

Additional wells can still be developed to meet the future water supply demand of the province. For future planning purpose, the Groundwater Availability Map includes basic information for municipal groundwater development with the following data: well depth, static water level, and specific capacity, and aquifer formation as shown in Table 7.6.2, Supporting Report. The groundwater development potential in the province is shown in Table 7.6.1.

### **(2) Spring**

A total of 18 untapped spring sources for future development in barangay level are listed in Table 7.6.3 Untapped Spring Source Identification, Supporting Report. The list in

Table 7.6.1 Groundwater Development Potential in the Province

Area	Groundwater Development Potential	Water Quality	Area Feature
1. North-east Area	Shallow well area is distributed along the northwestern coastal line. Well depth: 6.1 to 19.8 mbgl. Water table: 2.5 mbgl or less. Specific capacity: 0.05 to 4.13 l/s/m. Deep well area corresponds to the alluvial areas that cover most part of Butuan City and Magallanes, and a part of cabadbaran, R.T.R., Tubay, Santiago, and Jabonga. Well depth: 21 to 107 mbgl. Water table: 20 to 190 mbgl. Specific capacity: 0.05 to 4.14 l/s/m. Difficult area: eastern mountains.	High iron content: deep wells with depths of about 60 m in the north area of Tubay and a part of Magallanes, and R.T.R.. Methane: deep wells in Magallanes. Salt water intrusion: coastal area in northern side of the province in shallow wells.	High mountainous areas consisting of igneous and sedimentary rocks of older rocks are distributed in the eastern area of the province. In the western side of the mountainous area, alluvial plain is extended with belts of 15 km width from south to north. The plain is extended with 15 km width from north to south. The plain in the central area was formed by the Agusan River, which flows through Butuan City area from southeast to northwest.
2. West-south Area	Shallow well area is present along the periphery of Buenavista. Well depth: 9 to 20 mbgl. Water table: 2.5 mbgl or less. Specific capacity: 0.07 to 2.07 l/s/m. Deep well area is distributed along the small river basins in the Buenavista area and is in undeveloped condition at present. Well depth: 20 to 154 mbgl. Water table: 0.12 to 2.10 mbgl. Specific capacity: 0.13 to 3.15 mbgl.	High iron content: shallow wells along the coastal line from Buenavista to Carmen. Salt water intrusion: shallow wells with depth of less than 6 m along seashore in the western side of Butuan City.	Mountainous areas, formed by sedimentary rocks of early Miocene to Pliocene age, extended to the seashore. Alluvial plain is extended with a belt shape along the seashore and with a width of several kilometers.

cludes detailed data on the barangay name, owner, discharge rate in dry season, transmission line length and elevation differences between spring sources and served areas.

Such springs are mainly located in the western, northeastern and northwestern mountainous areas. Springs are mainly owned by public organizations. Discharge ranges from 0.13/sec to 1.94 l/sec. Most water sources are located within 3.6 km to the service areas while elevation differences between spring sources and served areas range from 5 m to 180 m. The spring development potential in the province is shown in Table 7.6.2.

### (3) Surface Water

The potential surface water volume exploitable from major rivers for domestic water supply was estimated by municipality. The resulting figure is negative only within the Bugabos River basin in Butuan City. This means in this calculation that the maintenance flow could be not maintained within the 10-year return period as a dependable domestic water supply, if the present water rights are fully utilized during a serious drought season. Otherwise, all major rivers and Lake Mainit still have sufficient potential for future development of domestic water supply in terms of river discharge.

The calculation results are shown in Table 7.5.2, Supporting Report. In particular, municipalities situated in the Agusan River basin, such as Butuan City, Las Nieves and Magallanes, are privileged to use a large amount of river water. Only the municipality of Carmen has no major and sustainable surface water source in the province.

## 7.7 Water Source Development for Medium-Term Development Plan

For preparation of the medium-term development plan in terms of water source development, standard specifications of wells by municipality were prepared. The parameters such as well depth, static water level and specific capacity are shown in Table 7.7.1, which were established using well information from NWRB and the province (detail data base is included in Table 7.1.1, Data Report) and the hydrogeological assessment presented in Table 7.6.2, Supporting Report.

Shallow wells are currently used in some municipalities. The municipal areas are categorized into deep well and shallow well areas considering the practices. The proportions (%) of shallow and deep wells are determined with reference to groundwater development potential in the Groundwater Availability Map. Furthermore, the well locations are assumed in terms

Table 7.6.2 Spring Development Potential in the Province

Area	Spring Water Development Potential	Water Quality	Aerial Feature
1. Northeast area	In the periphery of northeast high mountains, there are 64 developed and 13 untapped springs. Discharge of untapped springs: 0.13 to 1.94 l/sec.	Potable	Eastern mountains consist of igneous and sedimentary rocks of old age. The mountains have steep slopes and many streams originating from springs.
2. Southwest area	Number of spring water sources in mountainous areas is only five. Discharge of untapped springs: 0.83 l/sec.	Potable	Mountains with smooth slope are highly dissected.

Table 7.7.1 Standard Specification of Wells by Municipality

Municipality	Type	Type	Proportion (%)	Standard Specification			Remarks
				Depth Range (m)	SWI. (m)	Specific Capacity (l/sec/m)	
Bucnavista	Rural	SW	0	10<D<20	2	0.5	
		DW	15	25<D<85	4	0.5	
	Urban	SW	90	10<D<20	2	1.0	
		DW	10	25<D<85	4	1.0	
Cabadbaran	Rural	SW	5	10<D<15	3	0.5	
		DW	30	25<D<95	5	0.5	
	Urban	SW	0	10<D<15	3	1.0	
		DW	100	25<D<95	5	1.0	
Carmen	Rural	SW	0	10<D<20	3	0.5	
		DW	10	25<D<155	7	1.5	
	Urban	SW	0	10<D<20	3	0.5	
		DW	100	25<D<155	7	1.5	
Jabonga	Rural	SW	0	10<D<20	2	1.0	
		DW	15	20<D<30	2	1.0	
	Urban	SW	0	10<D<20	2	1.0	
		DW	40	20<D<30	2	1.0	
Kicharao	Rural	SW	0	5<D<20	2	0.5	
		DW	15	20<D<50	2	0.5	
	Urban	SW	0	5<D<20	2	1.0	
		DW	10	20<D<50	2	1.0	
Las Nieves	Rural	SW	0	10<D<20	5	0.5	
		DW	10	20<D<70	5	0.5	
	Urban	SW	0	10<D<20	5	0.5	
		DW	100	20<D<70	5	0.5	
Magallanes	Rural	SW	0	5<D<20	2	0.5	
		DW	80	25<D<90	4	2.5	
	Urban	SW	0	5<D<20	2	0.5	
		DW	100	25<D<90	4	2.5	
Naspit	Rural	SW	0	10<D<20	3	1.0	
		DW	30	20<D<90	10	1.0	
	Urban	SW	0	10<D<20	3	1.0	
		DW	100	20<D<90	10	1.0	
Tubay	Rural	SW	0	10<D<20	7	0.5	
		DW	30	25<D<80	4	0.5	
	Urban	SW	0	10<D<20	7	0.5	
		DW	100	25<D<80	4	0.5	
R.T.Romualdez	Rural	SW	0	10<D<20	3	1.0	
		DW	30	30<D<110	2	1.0	
	Urban	SW	0	10<D<20	3	1.5	
		DW	100	30<D<110	2	1.5	
Santiago	Rural	SW	0	10<D<20	5	0.5	
		DW	10	30<D<45	10	0.5	
	Urban	SW	0	10<D<20	5	0.5	
		DW	10	30<D<45	10	0.5	
	Rural	SW					
		DW					
	Urban	SW					
		DW					

of rural and urban areas by municipality referring to the classification of rural and urban barangays. For the municipalities without any well data, the well parameters are appropriated using those in adjoining towns, provided they have similar hydrogeologic features.

For the furtherance in collecting accurate information to design the concrete specifications of the planned wells, the following recommendations are made. Prior to the detailed design or pre-construction stages, additional detailed groundwater investigation entailing electric resistivity survey and the construction of test wells in the municipalities of Santiago, R.T.R., Magallanes and Las Nieves shall be conducted. Of these municipalities, Santiago and Magallanes areas have very few existing well information in the entire areas. Therefore, electric resistivity survey shall be carried out both in the urban and rural areas, and a test boring is proposed to be constructed in the urban area. While, other areas have information enough to design new water source facilities in the rural area, the survey and test borings shall be carried out only in the urban area.

The groundwater development for water supply in urban areas (Level II and III systems) will require the construction of deep wells with larger casing diameters of 6" or more, which expect larger production rates. In these cases, short spacing intervals between the adjacent wells often cause the well interference due to the large lowering of pumping water level when the adjacent wells simultaneously pump up during long period. This results in the intermittent pump operation with excess electric consumption. Thus, appropriate spacing interval and number of wells to be constructed per sq. Km were estimated as shown in Table 7.7.1 Spacing Arrangements for Planned Wells, Supporting Report.

Spring sources, proposed by barangay level, for future development are shown in Table 7.6.3, Supporting Report. They shall also be investigated to confirm the development possibility in the following items: (1) locations and type of spring sources. (2) fluctuation of discharge rates through the year, (3) distances between spring sources and proposed served areas and (4) elevation differences between the two points.

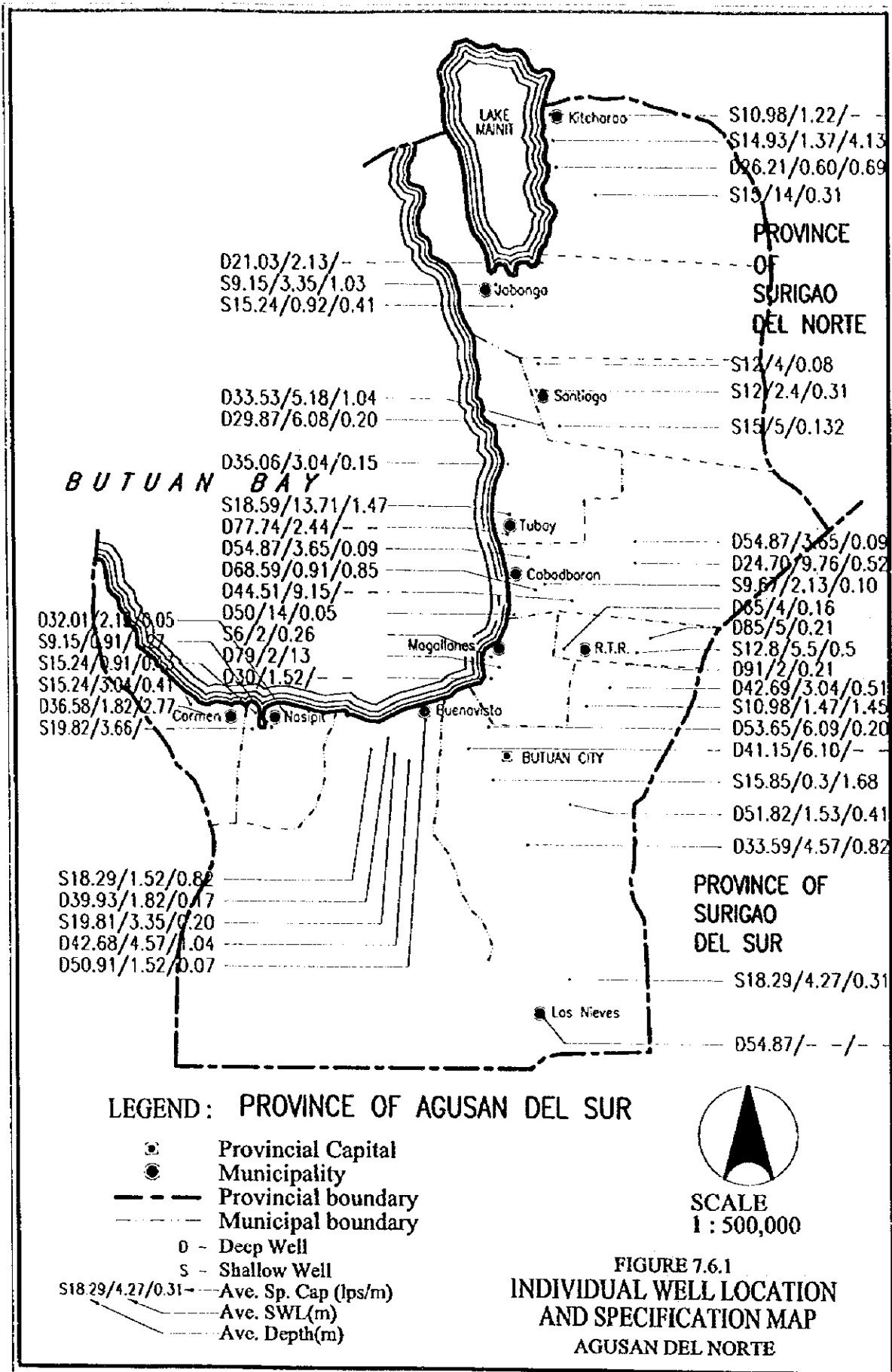
**Table 7.7.2 Additional Detailed Groundwater Investigation**

Municipality	Survey Area	Survey Activities and Specification	
		Electric Resistivity Survey	Test Well
Santiago & Magallanes	Urban	Survey area: one site Measuring line: 4 Measuring interval: 200 m Length of a measuring line: 1 km Prospecting depth: 100 m	Number of test wells: one Casing diameter: 200 mm Well depth: 100 m Including pumping test, electric logging, and water quality analysis
	Rural area	Survey area: two sites Measuring lines: 2/each site, 4 in Total Measuring interval: 200 m Length of a measuring line: 1 km Prospecting depth: 100 m	N.A.
R.T.R & Las Nieves	Urban area	Measuring lines: 4 Measuring interval: 200 m Length of a measuring line: 1 km Prospecting depth: 150 m	Number of test wells: one Casing diameter: 200 mm Well depth: 100 m Including pumping test, electric logging, and water quality analysis

Note: Not applicable



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 FILENAME : ACUSAN-DELNORTE(WLSM)

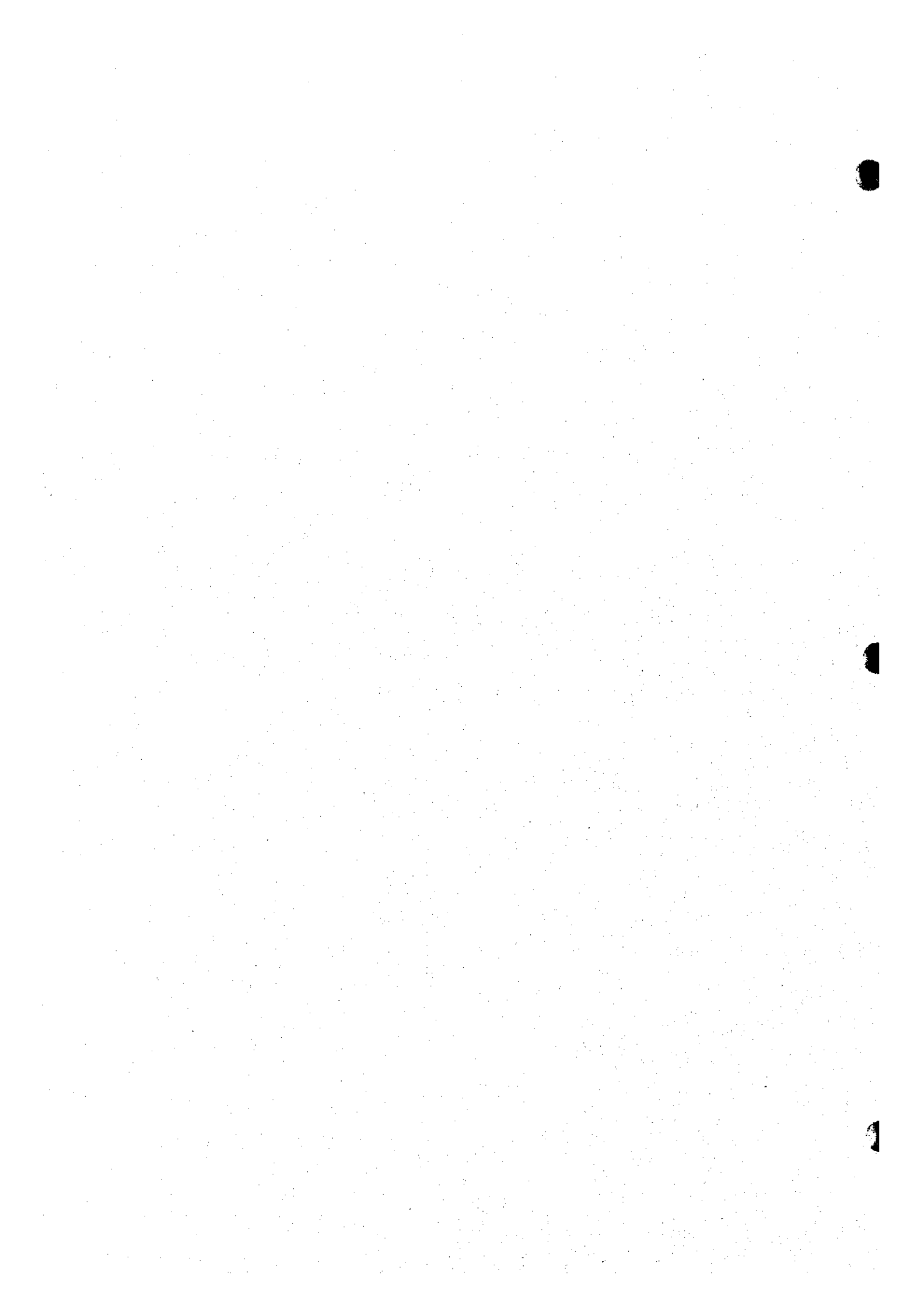


Chapter

8

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**FUTURE REQUIREMENTS IN WATER  
SUPPLY AND SANITATION IMPROVEMENT**



## **8. FUTURE REQUIREMENTS IN WATER SUPPLY AND SANITATION IMPROVEMENT**

### **8.1 General**

Phased investments for provincial sector development are planned in almost the same manner as adopted in the 1998 Philippine National Development Plan (PNDP) and the National Sector Master Plan (NSMP), Medium-Term Investment covering the years 1999 to 2003 and Long-Term Development covering the period 2004 to 2010.

Targets of provincial service coverage for the two phases are established as percentages of beneficiaries or utilities to be served by sub-sector. Service coverage in the base year (1997) and national sector targets indicated in the National Sector Master Plan (NSMP) and the updated Medium-Term Philippine Development Plan, 1996 - 1998 (MTPDP) are the bases of the study. Sector targets that are not prescribed in the national plan; school and public toilets as well as sewerage are assumed based on the current conditions. In addition, preliminary discussions on solid waste management are included as a vital component of sanitation sector.

Projection of frame values by municipality is undertaken for respective sub-sectors; future population by urban and rural area, the number of student enrollment to public schools and the number of public utilities. Reference base figures for the study of framework are the 1995 Census of Population and Housing, the statistical data of the province and the information from relevant agencies. Provincial population by target year and the base year (1997) is estimated by adopting the projection method being used by NSO. While, the population distribution to urban and rural areas prepared by NSO in 1995 is modified to meet actual conditions in the classification of the areas.

Types of required facilities and their implementation criteria according to service level standards are referred to the NSMP and the NEDA Board Resolution No. 12 (s. 1995). Some planning conditions and assumptions not prescribed in the national plan are conferred to the relevant standards of sector agencies and provincial government. For sewerage requirements, the deficit in sanitation must first be addressed. Partial upgrading of on-site disposal to a sewerage system (off-site disposal) is envisaged in the final target year.

In estimating future requirements by municipality, additional population (or number of students/public utilities) to be served by sub-sector is first calculated as a shortfall at target years in comparison between each target and its base year service coverage. In this regard,

planned/on-going projects to be completed by respective base years are considered as part of existing services for each target year. Required number of facilities by sector component is then estimated corresponding to the said additional population (or number of students/public utilities) to be served. Rehabilitation work for Level I facilities limited to new deep wells to be constructed under PW4SP is taken into account. Generally, rehabilitation of deep wells and shallow wells constructed by means of conventional method is difficult.

Logistic support is considered as a minimum requirement of LGUs for community development and training, and other relevant activities along with the implementation of PW4SP. The types and number of well drilling/rehabilitation equipment and supporting vehicle for Level I facilities are also suggested as reference information. Also, minimum requirements for setting up a provincial laboratory to support drinking water quality surveillance and monitoring are described. This will include building, instrument/equipment and reagent/chemical requirements. The 1993 Philippine National Standards for Drinking Water (PNSDW) requires that initial examinations of water from newly constructed sources should first be undertaken before operation for public use and henceforth periodic examinations of these water supply sources/facilities.

Project priority for medium-term development is discussed entailing general criteria to identify specific projects. However, at the provincial level master plan, it is suggested that municipal priority ranking be used for allocation of provincial fund.

## **8.2 Targets of Provincial Sector Plan**

Provincial sector targets for the years 2003 and 2010 are determined as the provincial average of the desirable minimum level for each sub-sector. Table 8.2.1 summarizes the target percentages to be served by sub-sector. Details by sub-sector are discussed in this sub-section.

### **(1) Water supply**

The base year (1997) service coverage was calculated as a total of 1997 figures and expected by planned/on-going projects scheduled to be completed by 1998. Table 8.2.2 shows service coverage for the planning purpose (details are referred to Supporting Report).

Table 8.2.1 Provincial Sector Targets

Sub-sectors	Existing Service Coverage	Phase I (1999-2003)		Phase II (2004-2010)	
		Population Coverage (%)	Additional Population to be Served	Population Coverage (%)	Additional Population to be Served
<b>Water Supply</b>	Population Coverage (%)	Population Coverage (%)	Additional Population to be Served	Population Coverage (%)	Additional Population to be Served
<i>Urban Water Supply</i>	74	85	20,134	95	80,210
<i>Rural Water Supply</i>	55	65	39,469	93	83,387
<b>Sanitation</b>	Households Coverage (%)	Households Coverage (%)	Additional Households to be Served	Households Coverage (%)	Additional Households to be Served
<i>Household Toilet</i>					
<i>Urban Household</i>	70	90	6,485	95	11,160
Flush	5	20	2,518	50	10,660
Pour Flush	85	75	3,192	50	500
VIP	10	5	775	0	0
<i>Rural Household</i>	79	85	10,139	95	24,345
Flush	0	0	0	0	0
Pour Flush	86	90	7,257	100	24,345
VIP	14	10	2,882	0	0
<i>School Toilet</i>	Public School Student Coverage (%)	Public School Student Coverage (%)	Additional Public School Students to be Served	Public School Student Coverage (%)	Additional Public School Students to be Served
	48	80	25,697	90	26,347
<i>Public Toilet</i>	Public Utilities Coverage (%)	Public Utilities Coverage (%)	Additional Public Utilities with Sanitary Toilets	Public Utilities Coverage (%)	Additional Public Utilities With Sanitary Toilets
	100	100	33	100	40
<i>Sewerage</i>	Urban Population Coverage (%)	Not Applicable		Urban Population Coverage (%)	Urban Population to be Served
	0			50	44,393
<i>Solid Waste</i>	Urban Household Coverage (%)	Urban Household Coverage (%)	Additional Households to be Served	Not Applicable	
	78	90	7,723		

Table 8.2.2 Estimation of Base Year Service Coverage of Water Supply

Name of Municipality	Area	Population (1997)	Population Served by 1997 Facilities				Percentage Coverage
			Level III	Level II	Level I	Total	
Buenvista	Urban	14,470		1,040	3,324	4,364	30
	Rural	32,641		4,868	5,084	9,952	30
	Total	47,111		5,908	8,408	14,316	30
Cabadbaran	Urban	17,005			14,879	14,879	87
	Rural	37,104		10,292	19,065	29,357	79
	Total	54,109		10,292	33,944	44,236	82
Carmen	Urban	4,323		3,445	158	3,603	83
	Rural	11,860		524	6,871	7,395	62
	Total	16,183		3,969	7,029	10,998	68
Jabonga	Urban	3,028		2,718		2,718	90
	Rural	17,838		11,111	1,057	12,168	68
	Total	20,866		13,829	1,057	14,886	71
Kitcharao	Urban	6,573		6,370		6,370	97
	Rural	8,563		3,501	1,506	5,007	58
	Total	15,136		9,871	1,506	11,377	75
Las Nieves	Urban	1,109		528	581	1,109	100
	Rural	23,325		2,984	2,752	5,736	25
	Total	24,434		3,512	3,333	6,845	28
Magallanes	Urban	13,265		9,260		9,260	70
	Rural	4,813		2,692	27	2,719	56
	Total	18,078		11,952	27	11,979	66
Nasipit	Urban	16,131	9,804		3,613	13,417	83
	Rural	19,332	8,076	1,928	4,235	14,239	74
	Total	35,463	17,880	1,928	7,848	27,656	78
Remedios T. Romualdez	Urban	3,758			2,429	2,429	65
	Rural	9,572		3,977	2,377	6,354	66
	Total	13,330		3,977	4,806	8,783	66
Santiago	Urban	8,058		7,523	535	8,058	100
	Rural	8,669		6,396		6,396	74
	Total	16,727		13,919	535	14,454	86
Tubay	Urban	3,226		1,108		1,108	34
	Rural	14,046		168	4,106	4,274	30
	Total	17,272		1,276	4,106	5,382	31
PW4SP Study Area	Urban	90,946	9,804	31,992	25,519	67,315	74
	Rural	187,763	8,076	48,441	47,080	103,597	55
	Total	278,709	17,880	80,433	72,599	170,912	61

The base year service coverage in urban area (74%) is exceeding the updated MTPDP sector target (68.8%) for the year 1998, while rural area (55%) is far behind the sector target of 79%. As identified in Chapter 4, the lower service coverage in rural area is caused by the presence of a large number of unsafe sources/facilities or no provision of water supply facilities.

For Phase I development, targets of service coverage for water supply by urban and rural area are established in consideration of about 10% increase from the base year. 85% and 65% is adopted for urban and rural area, respectively. Phase II targets are planned to increase in urban and rural water supply coverage to 95% and 93%, respectively, as envisaged in the NSMP.

## (2) Sanitation

### 1) Household toilets

As with water supply, the base year service coverage is calculated as shown in Table 8.2.3 reflecting any planned or on-going projects scheduled to be completed by 1998 (details are referred to Supporting Report).

The province has base year service coverage of 76%, which is above the current national average coverage of 60%. Urban area registers a level of 70% that is well above the national average coverage. Rural area is further high at 79%. By type of sanitary toilet facility, the existing percentage composition to total served households is as follows:

<u>Type</u>	<u>Urban (%)</u>	<u>Rural (%)</u>
Flush	5	0
Pour-flush	85	86
VIP latrine	10	14

To attain sufficiency and equitable access to basic services, provincial target of Phase I for urban household toilets is planned at 90%, while, for rural household toilets, 85% is projected. This is pursued to lessen the gap of the coverage between the urban and rural areas and to achieve a balanced distribution of this basic facility as embodied in the PNDP. For Phase II, 95%, 2 percent higher than the target set by the NSMP is adopted for both urban and rural household toilets.



Table 8.2.3 Base Year Service Coverage of Household Toilets

Name of Municipality	Area	1997										Households and Population Using Sanitary Toilets			Service Coverage (%)			
		Population		HHs		Number of Households			Population		Flush	Pour Flush	VIP/Dry	Total	Flush	Pour Flush	VIP/Dry	Total
		Urban	Rural	Total	Urban	Rural	Total	Flush	Pour Flush	VIP/Dry								
Buena Vista	Urban	14,470	2,788	2,103	2,103	2,103	10,853	75										75
	Rural	32,641	5,989	4,113	4,113	4,113	22,523	69										69
	Total	47,111	8,777	6,216	6,216	6,216	33,376	71										71
Cababaran	Urban	17,005	3,103	595	2,249	2,844	15,645	19										92
	Rural	37,104	6,961	31	5,923	5,954	31,910	85										86
	Total	54,109	10,064	626	8,172	8,798	47,555	6										87
Carmen	Urban	4,323	820	753	753	753	3,978											92
	Rural	11,860	2,281	60	1,811	1,871	9,726	3										79
	Total	16,183	3,101	60	2,564	2,624	13,704	2										83
Jabonga	Urban	3,028	536	520	520	2,938	97											97
	Rural	17,838	3,135	3,135	3,135	17,838	100											100
	Total	20,866	3,671	3,655	3,655	20,776	100											100
Kitcharao	Urban	6,573	1,199	947	947	5,193	79											79
	Rural	8,563	1,565	1,070	1,070	5,823	68											68
	Total	15,136	2,764	2,017	2,017	11,016	73											73
Las Nieves	Urban	1,109	188	127	127	755	68											68
	Rural	23,325	4,114	2,457	2,457	13,995	60											60
	Total	24,434	4,302	2,584	2,584	14,750	60											60
Magallanes	Urban	13,265	2,356	412	412	2,256	17											17
	Rural	4,813	846	452	452	2,551	53											53
	Total	18,078	3,202	864	864	4,807	27											27
Nasipit	Urban	16,131	3,108	1,935	1,935	10,002	62											62
	Rural	19,332	3,593	3,535	3,535	18,946	98											98
	Total	35,463	6,701	5,470	5,470	28,948	82											82
Remedios T. Romualdez	Urban	3,758	665	547	547	3,082	82											82
	Rural	9,572	1,827	1,209	1,209	6,318	66											66
	Total	13,330	2,492	1,756	1,756	9,400	70											70
Santiago	Urban	8,058	1,283	997	997	6,286	78											78
	Rural	8,669	1,300	1,230	1,230	8,236	95											95
	Total	16,727	2,583	2,227	2,227	14,522	86											86
Tubay	Urban	3,226	556	366	366	2,130	66											66
	Rural	14,046	2,486	88	1,826	1,914	10,816	4										73
	Total	17,272	3,042	88	2,192	2,280	12,946	3										75
PW4SP Study Area	Urban	90,946	16,602	595	9,837	11,551	63,118	4										7
	Rural	187,763	34,097	31	23,272	26,940	148,682	68										11
	Total	278,709	50,699	626	33,109	38,491	211,800	65										9

The existing composition of the 3 facility types serves as an indicator in the distribution for Phase I, while for Phase II, VIP and sanitary pit privy/latrine (dry-type) is phased-out.

2) School toilets

The base year service coverage of public school students is shown in Table 8.2.4 counting expected coverage of any planned or on-going projects scheduled to be completed by 1998 (details are referred to Supporting Report).

**Table 8.2.4 Base Year Service Coverage of Public Toilets and Public Toilets**

Name of Municipality	Public School Toilets			Public Toilets		
	Total Number of Public School Students (1997)	Std. No. of Public School Students that can be Served by Sanitary Toilets in Base Year (1997)	Service Coverage (%)	Number of Public Utility with Toilets in 1997	Number of Public Utility with Sanitary Toilets in Base Year (1997)	Service Coverage (%)
Buenvista	7,963	6,960	87	4	4	100
Cabadbaran	10,935	2,000	18	4	4	100
Carmen	3,783	240	6	4	4	100
Jabonga	3,819	1,440	38			
Kitcharao	2,874	1,920	67	2	2	100
Las Nieves	4,100	1,040	25	1	1	100
Magallanes	2,780	320	12	2	2	100
Nasipit	5,444	5,444	100	2	2	100
R. T. Romualdez	789	640	81	1	1	100
Santiago	3,332	2,600	78	1	1	100
Tubay	3,451	880	25	1	1	100
<b>PW4SP Study Area</b>	<b>49,270</b>	<b>23,484</b>	<b>48</b>	<b>22</b>	<b>22</b>	<b>100</b>

Base year service coverage is 48% applying the standard number of public school students to be served by one (1) unit of toilet facility. The low level is due to a large number of unsanitary or absence of facilities.

In the absence of national targets for school toilets, the existing level of service coverage is the base in setting up the targets. It is expected that all new construction of school-buildings will entail sanitary toilets enabling the coverage to increase on a high level. For Phases I and II, 80% and 90% are set, respectively.

3) Public toilets

The base year service coverage considering expected additional coverage by 1998 is shown in Table 8.2.4 (details are referred to Supporting Report).

All existing public utilities are served with at least one sanitary toilet giving 100% coverage. This can be attributed by the fact that all public utilities (mostly public markets) are provided with sanitary toilet facilities.

Without national targets as of now, the indicator in setting up provincial targets would be the existing level of coverage. Accordingly, 100% coverage for both Phase I and Phase II are assumed.

### (3) Sewerage

Given the non-existence of sewerage systems in any municipality at the present time, this plan does not consider the service during Phase I. For Phase II, a target of 50% coverage was applied to urban population of municipalities with more than 10,000 urban population provided by Level III water supply systems.

### (4) Solid waste

The municipal level data in 1997 on the number of households served by the municipal refuse collection revealed that the current practice is concentrated to urban areas. The base year service coverage for urban area by municipality is reflected in Table 8.2.5.

About 26% of the total households in the province relied on municipal refuse collection using trucks or a 78% urban household coverage. These municipalities have a total of 8 units of collection truck.

No national targets have yet been set. However, considering the present level of coverage, a 90% urban household coverage is applied for the medium-term period (1999-2003).

**Table 8.2.5 Base Year Service Coverage of Municipal Solid Waste System in 1997**

Name of Municipality	Total No. of Households	No. of Urban Households	No. of Households Served	Coverage of Households (%)	Coverage of Urban Households (%)
Buenavista	8,777	2,788	963	11	35
Cabadbaran	10,064	3,103	6,628	66	100
Carmen	3,101	820	50	2	6
Jabonga	3,671	536			
Kitcharao	2,764	1,199			
Las Nieves	4,302	188			
Magallanes	3,202	2,356	2,719	85	100
Nasipit	6,701	3,108	2,526	38	81
Remedios T. Romualdez	2,492	665	87	3	13
Santiago	2,583	1,283			
Tubay	3,042	556			
<b>PW4SP Study Area</b>	<b>50,699</b>	<b>16,602</b>	<b>12,973</b>	<b>26</b>	<b>78</b>

### 8.3 Projection of Frame Values

#### 8.3.1 Population Projection

Future population for all municipalities by urban and rural area was projected for the target years of 2003 and 2010 together with the present population in 1997 as a planning base year.

Regional population in the future is published by the NSO, while projection at provincial and municipal levels was not available during the time of study. The future population of LGUs was therefore projected in the following manner (details are included in the Supporting Report). Reference information/data used for the study are:

- Population census data of 1980, 1990 and 1995 on different administrative levels,
- National and Regional population projection by the NSO based on 1995 census results
- "Ratio method" generally used by the NSO for population projection (details are shown in 8.3.1, Supporting Report)
- Revised classification of urban and rural barangays by the PPDO comparing with NSO statistical information, and
- The 1995 Philippine Yearbook.

The past population development at different administrative levels was first reviewed to come up with the demographic characteristics of the region and province. Then, through review of NSO regional population projection and the 1995 Philippine Yearbook, the behavior of population development through the future was analyzed. Referring to these demographic studies, population projection of the region by target year was confirmed to be reasonable.

Population projection of the province was carried out applying the "ratio method". The projected figures were studied by means of declining annual growth rates employing a simple compounded formula  $(1+r)^n$ . Present population of the province in 1997 was also estimated in the same manner. Likewise, municipal population was projected. Major study procedures and their results are presented below.

(1) Review of past population development in the province and population distribution in 1995 to urban and rural areas.

The past population development during census periods from 1980 to 1990 and from 1990 to 1995 revealed that:

- The province recorded an average annual growth rate of 2.45% (1980-1990) which was almost the same as that of the region, but, the average annual growth rate of 2.02% (1990-1995) decreased slightly compared with that of the region at 2.33%.

- Percentage of provincial population to the regional population slightly decreased from 13.2% in 1980 to 13.1% in 1995 caused by the lower growth rate of the province from 1990 to 1995 than that of the region.

The classification of urban and rural areas compiled in 1995 population census was reviewed and updated by the PPDO. As a result of some revisions in the barangay classification, the population by municipality was adjusted as shown in Table 8.3.2, Section 8.3.1, Supporting Report.

(2) Manner of population projection

The regional population projected by the NSO based on 1995 census results was employed. However, a review of the population has to be made in the near future upon endorsement of the Regional Development Plan (1998-2008) for the Caraga Region that is currently under presentation. The following are the projection procedures.

- 1) Adoption of regional population projected by the NSO for the years 1995 to 2020  
Annual growth rates of regional population projected by NSO were analyzed using simplified formula. The conservative growth rates were calculated reflecting demographic characteristics of moderate decline of fertility and mortality rates described in the 1995 Philippine Yearbook.
- 2) Application of ratio method for population projection of the province and municipalities

Adopted formula is: 
$$R(k) = R(0) \prod_1^k (1 + r - kr/50)$$

where: R(k) = ratio in "k"th year from 1995 of the population to that of the region or of the population of the municipality to that of the province

R(0) = ratio in 1995 of the population of the province to that of the region or of the population of the municipality to that of the province

r = initial rate of change of the ratio

k = "k"th year from 1995

The initial rate of change is derived based on the levels and trends of the ratio observed in the 1970, 1980, 1990 and 1995 censuses.

3) Categorization of the province and municipalities to set initial rate (r)

Four standard types are prepared based on the trends of the rate (r) as observed in the censuses of 1970, 1980, 1990 and 1995. Initial rate to be used for each type of province or municipality is determined using a set criteria (refer to Section 8.3.1, Supporting Report).

The province was classified as Type I and an initial rate of change (r) was estimated at 0.0036.

(3) Present provincial population (1995) including its municipalities was estimated, applying the initial rates of change as mentioned above (further broken down to urban and rural areas), assuming that the behaviors of past population development prevailed up to the present.

(4) Household size in 1997 was also assumed to be the same as that in 1995.

Population by target year and the year 1997 is presented in Table 8.3.1 covering all municipalities broken down to urban and rural areas. Number of households by target year was also studied and included in Table 8.3.5, Supporting Report.

Table 8.3.1 Future Population by Urban and Rural Area by Municipality

Name of Municipality	1997			2003			2010		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Buenavista	14,470	32,641	47,111	16,569	37,376	53,945	18,977	42,809	61,786
Cabadbaran	17,005	37,104	54,109	19,257	42,020	61,277	21,815	47,600	69,415
Carmen	4,323	11,860	16,183	4,531	12,431	16,962	4,752	13,037	17,789
Jabonga	3,028	17,838	20,866	3,346	19,707	23,053	3,698	21,782	25,480
Kitcharao	6,573	8,563	15,136	7,224	9,411	16,635	7,943	10,346	18,289
Las Nieves	1,109	23,325	24,434	1,328	27,938	29,266	1,591	33,468	35,059
Magallanes	13,265	4,813	18,078	14,598	5,296	19,894	16,070	5,831	21,901
Nasipit	16,131	19,332	35,463	17,923	21,478	39,401	19,920	23,872	43,792
Remedios T. Romualdez	3,758	9,572	13,330	4,412	11,237	15,649	5,180	13,194	18,374
Santiago	8,058	8,669	16,727	9,833	10,579	20,412	12,001	12,910	24,911
Tubay	3,226	14,046	17,272	3,591	15,636	19,227	3,999	17,411	21,410
<b>PW4SP Study Area</b>	<b>90,946</b>	<b>187,763</b>	<b>278,709</b>	<b>102,612</b>	<b>213,109</b>	<b>315,721</b>	<b>115,946</b>	<b>242,260</b>	<b>358,206</b>

### 8.3.2 School Enrollment Projection

From the 1995 total population of the province, the number of children who would be enrolling in elementary and high school levels for all municipalities is derived.

School age population is extrapolated from the NSO age group classification of 5-9, 10-14 and 15-19 years old bracket by municipality. The age group for the elementary level is from 6 to 13 years, while that for the high school level is from 14 to 17 years. The percentages of school age population for the target years are based on the existing composition or structure of the 1995 population.

From the school age population, the number of children who would attend either private or public school, by target year is computed using the projected participation rate. The participation rate by target year varies depending on the socio-economic condition of the province. Generally, an improved economy will result to a higher participation rate. For the province, an increase in the participation rate in both private and public schools is foreseen.

The number of public school students by target year is then derived from the projected number of children who will attend school. A participation rate for public school enrollment is established based on the existing participation rate of public school students to the total school age population. An increase of 6% from the 1997 rate is foreseen in 2003 and another increase of 14% from the 2003 rate in 2010 (details are referred to Table 8.3.6, Supporting Report).

Table 8.3.2 shows the projected number of public school students by municipality, by target year. About 62,000 and 84,000 public school students are estimated to enroll for years 2003 and 2010, respectively.

**Table 8.3.2 Projected Public School Enrollment and Number of Public Utilities by Municipality**

Name of Municipality	Number of Public School Student			Number of Public Utilities		
	1997	2003	2010	1997	2003	2010
Buenvista	7,963	9,955	14,033	4	8	13
Cabadbaran	10,935	13,485	18,713	4	8	14
Carmen	3,783	4,122	4,983	4	7	10
Jabonga	3,819	4,562	5,402		2	5
Kitcharao	2,874	3,380	4,513	2	5	9
Las Nieves	4,100	5,585	7,206	1	3	5
Magallanes	2,780	3,314	4,865	2	5	8
Nasipit	5,444	6,875	11,521	2	5	10
Remedios T. Romualdez	789	1,934	2,648	1	4	7
Santiago	3,332	4,295	5,616	1	4	7
Tubay	3,451	3,969	4,419	1	4	7
<b>PW4SP Study Area</b>	<b>49,270</b>	<b>61,476</b>	<b>83,919</b>	<b>22</b>	<b>55</b>	<b>95</b>

### **8.3.3 Projection of the Number of Public Utilities**

The number of public utilities (limited to public markets and bus/jeepney terminals) by target year is projected in urban areas for all municipalities. The provincial physical framework plan and the provincial comprehensive development plan serve as references in the projection. Bus or jeepney terminals are considered in major transport routes of the province.

A total of 33 public markets, bus/jeepney terminals and parks/playgrounds are planned for construction by year 2003 and another 40 by the year 2010. Table 8.3.2 presents the total number of public utilities by municipality by target year (details are referred to Supporting Report).

### **8.3.4 Planning Area and its Projected Population for Sewerage**

Urban areas with more than 10,000 population provided by Level III water supply systems in 2010 serve as the planning area. Population in the area is considered as the potential population to be served.

Five (5) municipalities with a combined urban population of 44,400 are considered (refer to Table 8.5.5).

### **8.3.5 Number of Households to be Served by Municipal Solid Waste Collection System**

The number of urban households in 2003 is the potential households for the planning (refer to Table 8.3.5, Supporting Report).

## **8.4 Types of Facilities and Implementation Criteria**

### **8.4.1 Water Supply**

The following are major conditions and assumptions applied to urban and rural water supply, which are intended as a guide for the implementation of sector projects.

#### **(1) Urban water supply**

Prevailing situation of urban water supply in each municipality was first reviewed mainly focusing on existing water sources and magnitude of service coverage. Planned/on-going projects for concerned municipalities were also studied and reflected on PW4SP planning, with due attention to merging of municipalities into an integrated water supply sys-



system. Potential water source for future development was then evaluated based on the study results in Chapter 7, taking into account the possibility to utilize untapped spring sources. Recommendations arising from these studies were also incorporated for furtherance of water supply development.

Aforementioned studies were carried out by the following sequence:

- Review of existing water supply systems and water sources;
- Review of planned/on-going projects;
- Establishment of planning conditions pertaining to service level, utilization of existing facilities, water sources, and number of systems; and
- Recommendations for furtherance of water supply development.

1) Review of existing water supply systems and water sources

Majority of the existing Level III and II systems in the municipalities is utilizing spring sources. The municipality of Nasipit is served by WD with spring and deep well sources, while the rest of the municipalities are mostly served by Level II systems owned/operated by municipalities/communities and by public/private Level I facilities. The magnitude of water supply coverage varies from about 1,000 persons to 15,000 persons by municipality. It shall be noted that only Nasipit has Level III water supply system in urban area of the PW4SP study area.

Preference is made to utilize spring sources owing to less O&M activities and cost compared to deep well with electric motor pump.

2) Review of planned/on-going projects

A project proposal was submitted to NEDA for Lake Mainit Integrated Area Development (LMIAD) expecting OECF loan from Japan. The project entails water supply component for the municipalities of Jabonga, Kitcharao, Santiago and Tubay. These areas are proposed to avail spring sources, but details are not available at this moment. Water supply systems in these municipalities will be developed as an independent municipal water supply system.

3) Establishment of planning conditions

a. Service level

It shall be noted that, a national policy for urban water supply is a Level III system, in general, as the most suitable measure. Therefore, for the investment needs of the sector development, it is assumed in this PW4SP that underserved or

unserved urban population at present and in the future will be provided with individual house connections. However, it does not intend to exclude from being implemented Level I and II facilities in urban areas as individual cases in the future.

b. Utilization of existing facilities

The existing Level I and II facilities are considered to be utilized during the Phase I period. However, the population served by these facilities is assumed to be absorbed by Level III service in Phase II.

c. Water sources

Possibility/availability to utilize surface water and groundwater (spring and deep well) is evaluated as potential water sources for water supply development.

From the viewpoints of cost effectiveness and easy O&M of water supply system, utilization of spring sources is given due priority in the course of urban water supply planning. Application of deep wells for water source is regarded as the second priority in principle. Surface water is, on the other hand, not adopted at this moment, because of large capital investment requirements and complexity of surface water treatment.

Water source development study revealed that most of the municipalities in the PW4SP planning area have high potential for spring development. However, no untapped spring suitable for urban water supply has yet been identified (details are referred to in Supporting Report).

Table 8.4.1 presents a summary of potential water source together with water supply conditions of the existing systems.

The municipality of Magallanes does not have a preferable groundwater development potential owing to its locality that is situated on a peninsula surrounded by mangroves, while the rest of the municipalities have both spring and deep well development potential.

**Table 8.4.1 Potential Water Source for Urban Water Supply**

Name of Municipality	Served Population in Base Year			Existing Source in Municipality		Potential Water Source		Remarks
	Level III	Others	Total	Spring	Deep Well	Spring	Deep Well	
Buenvista	0	4,364	4,364	□	□	□	□	
Cabadbaran	0	14,872	14,872	□		□	□	
Carmen	0	3,497	3,497	□	□	□	□	
Jabonga	0	2,718	2,718	□		□	□	Component of proposed LMAIAD
Kitcharao	0	6,370	6,370	□	□	□	□	Component of proposed LMAIAD
Las Nieves	0	1,109	1,109	□	□	□	□	
Magallanes	0	9,260	9,260		□	x	□	
Nasipit	9,804	4,381	14,185	□	□	□	□	Existing WD
R. T. Romualdez	0	2,680	2,680	□	□	□	□	
Santiago	0	8,058	8,058	□		□	□	Component of proposed LMAIAD
Tubay	0	1,108	1,108	□		□	□	Component of proposed LMAIAD

Note: □ - Available; x - Not available.

With regard to deep well development, the groundwater productivity was assumed based on the study results of water sources in Chapter 7 and presented in Table 8.4.2. This planning parameter is applied where deep well source is applied for urban water supply.

**Table 8.4.2 Groundwater Productivity**

Name of Municipality	Specific Capacity (liter/sec/m)	Well Depth (meter)	Groundwater Productivity per Deep Well (cum/16Hr)
Buenvista	0.44	80	253
Cabadbaran	0.75	80	432
Carmen	0.50	120	288
Jabonga	0.67	40	386
Kitcharao	1.32	40	760
Las Nieves	0.16	80	92
Magallanes	0.33	80	190
Nasipit	0.83	80	478
R. T. Romualdez	0.37	80	213
Santiago	0.27	40	156
Tubay	0.62	80	357

d. Number of systems

In principle, one (1) Level III system is considered for urban area of every municipality. In the municipalities with existing Level III system/s, the expansion of the system was first considered. In case of no existence of Level III system/s, a new system was recommended. Existing plan/s on the development of Level III/WD are also taken into account to determine respective systems of the municipalities.

The possibility and necessity to merge service area of some neighboring municipalities to an urban water supply system were also studied from the viewpoints of:

- water source constraints, and
- economical development/scale merit of water supply system by cost reduction of water source development and other common facilities as well as O&M cost/minimized number of technical staff.

Municipalities taken up in this PW4SP are scattered throughout the province and therefore have less possibility of merging with neighboring municipalities in urban water supply development.

However, some municipalities situated at coastal area, such as Magallanes, are expected to the risk of salt water intrusion in future groundwater development. Further study on system merging shall be made for these municipalities with reference to water source arrangements.

In addition to the above, any rural barangay/s being served by the existing urban Level III system are considered to continue throughout the future.

e. Rehabilitation

Rehabilitation of existing and future facilities is assumed to be undertaken by the operating bodies.

4) Recommendations for future water supply development

Although various untapped spring sources were identified during the course of PW4SP preparation, no untapped spring suitable for urban water supply was yet found. Since the province has high potential for spring development, further survey to identify suitable spring sources is prerequisite in the course of feasibility study and detailed design. Among others, confirmation of possible/dependable yield throughout the year, elevation and distance from the potential service area as well as topographic conditions to allow gravity flow of supply is indispensable.

System merging in some coastal municipalities shall be further studied from the aspect of water source arrangements as mentioned above.

(2) Rural water supply

1) Service level

Level I systems are generally planned for rural areas where houses are scattered (deep and/or shallow wells). Spring development is excluded from Level I planning in view of cost effectiveness. Level II systems are considered where houses are clustered and suitable untapped spring is available.

Service level standards are set forth as 15 households per source for Level I and 5 households per communal faucet for Level II, as defined in the national plan.

Application of Level III systems in rural areas may be considered in a case to case basis during actual implementation.

2) Utilization of existing facilities

The existing facilities/systems in all service levels were considered to be utilized throughout the future.

3) Water source

For Level I facilities, deep well construction is given priority wherever applicable considering safety against possible contamination and stable water supply. Standard specifications of shallow and deep wells are summarized in Table 8.4.3 based on the water source evaluation results presented in Chapter 7. Conventional construction method (driven well) may be employed under the favorable substrata or hydro-geological conditions. The standard structure of wells in application of "open-hole drilling and gravel pack" is presented in Figure 8.4.1, Supporting Report.

**Table 8.4.3 Standard Specifications of Level I Wells**

Specification	Shallow Well	Deep Well
Construction Method	Open-hole drilling and gravel pack	
Casing Diameter	50mm	100mm
Borehole Diameter	150mm	200mm
Ranges of Well Depth	Standard Depth	
0 - 20m	20m	Not Applicable
21 - 50m	Not Applicable	40m
51 - 100m	Not Applicable	80m
101 - 150m	Not Applicable	120m

Spring development is also included in Level I planning adopting its share of 10%. This takes into account the existing percentage of developed spring (6%) among public Level I facilities as safe water sources.

For Level II systems, only untapped springs suitable for water supply purpose are considered. Identified untapped springs are presented in Table 7.4.1, Supporting Report.

Profile between gravel packed well and natural gravel packed well for Level I water supply

The open-hole drilling method is employed for well construction to ensure ground water yield from adequate aquifer in provision of proper screen location and specifications. The conventional "cased-hole driven well" shall be used only in cases where well specifications are established in the specified area with sufficient information on the hydro-geological condition including existence of natural gravel at the expected aquifer.

It is important to study on the potential area to adopt natural gravel method, which can perform the same level of function as gravel-packed wells. Such areas are usually limited to the upper stream of larger rivers in alluvial fans and alluvial plains. The arial proportion between those in application of gravel-packed and natural gravel pack wells will be worked out referring to the condition of the province.

Modification needs of riser pipe diameter according to the water level of deep wells

The standard specification of deep well hand pump is set with a diameter of 2-1/2 inch in the plan. However, water level of the deep wells may range between 20m and around 40m, depending on the aquifer conditions.

Although, Maruei type deep well pump with a cylinder, currently used in the Philippines, has operation experience of up to 40m in pumping water level, the diameter of riser pipe shall be adjusted between 1" to 2-1/2" to mitigate required power at the pump handle (calculating required power under the specific pumping water level).

4) Number of systems/facilities

Number of Level I wells is estimated based on the service level standard; while, the number of springs coincides with the number of Level II systems.

### 5) Rehabilitation

Rehabilitation of existing Level I wells is not considered, since most of the existing wells constructed by driving method is not suitable for rehabilitation to recover their functions. However, minor repair work for handpump and concrete apron is a requisite.

## 8.4.2 Sanitation

The conditions and assumptions are established for the different sanitation components to serve as guides in the implementation of projects.

### (1) Household toilets

Three types of sanitary toilet facilities for individual houses are considered for Phase I; flush, pour-flush and VIP/sanitary pit privy (dry-type). While for Phase II, flush and pour-flush are planned considering the improvement of living standard.

The type of toilet facilities is dependent on the existing or planned service level of water supply in the community. In urban and rural areas with Level I or II water supply facilities, only pour-flush or VIP/dry type are considered, while in urban areas with Level III water supply systems, flush type toilets requiring a piped water connection are included. Isolated rural areas where there is dearth of water supply, sanitary pit privy (dry type) is considered.

### (2) School toilets

Standard service level currently used by DECS (40 students per unit facility) is employed for both phases.

The standard toilet facility (1 building) with 5 units of toilet bowl to serve for 200 students is adopted for the planning purpose, which is modified from FW4SP design to provide a shallow well as a water source.

### (3) Public toilets

As a minimum requirement, at least 1 sanitary toilet facility is assumed to be provided for respective utilities: public market and bus/jeepney terminal.

The standard FW4SP design with 6-units of toilet bowl for the market is adopted. In this design, it is assumed that water supply will be tapped from the existing system, hence an elevated water tank is provided.

#### **8.4.3 Urban Sewerage**

The commencement of staged implementation of the sewerage program is planned in Phase II for the limited urban area (50% of urban population served by Level III system for the municipalities with urban population of more than 10,000). It is practical to start the program fully using the existing facilities to allow for lower initial investment cost than starting at once a conventional sewerage system (refer to Figure 8.4.2 Staged Improvement in Sewage Collection Method, Supporting Report).

Low cost off-site technologies such as small bore sewer for collection of effluent from septic tank are to be adopted. Improvement of sewage collection method may be gradually achieved from combined sewer to separate sewerage system.

Sewage treatment facilities may range from community scale septic tank or imhoff tank to aerated lagoon systems and to a more advanced treatment process such as oxidation ditch. For this PW4SP, aerated lagoons are assumed as a representative treatment facility for planning purpose. Daily average wastewater quantity is assumed to be 100 liters per capita per day.

#### **8.4.4 Solid Waste**

In terms of facility requirements, this PW4SP only studied the number of refuse collection trucks required for the year 2003. A rated capacity of 5 cu.m truck/vehicle is considered for calculation of required units of truck. Disposal of solid waste shall be studied in detail through investigations, F/S and D/D. Unit solid waste generation for urban area is assumed to be 0.418 kg. per capita per day.

### **8.5 Service Coverage by Target Year**

#### **8.5.1 Water Supply**

The service coverage in terms of population to be served by target year was estimated by urban and rural area by municipality. The service coverage in rural area was further



subdivided by service level (Level I & Level II) to finally come up with physical requirements.

Base figures applied to estimate the future service coverage and the additional population to be served are:

- provincial sector targets,
- population projection by target year, and
- base year service coverage (served population) by existing facilities.

Future requirements in terms of additional population to be served were then estimated by urban (Level III) and rural (Level I & II) area by municipality as a shortfall to meet the population to be served in each target year. The population served in base year is adopted as the population served in target year, when the former population exceeds the population to be served in the target year/s. Manner of calculation is specifically presented by phase.

#### (1) Phase I requirements

Additional service coverage was estimated as a shortfall of the population to be served in Phase I comparing with the population served in base year. In this connection, existing facilities both in urban and rural areas are assumed to be utilized during the Phase I period.

The utilization of untapped springs for Level II systems was given priority during Phase I period for rural water supply. At the time of this plan preparation, forty nine (49) untapped springs in six(6) municipalities were identified.

#### (2) Phase II requirements

Additional service coverage was estimated as a shortfall of the population to be served in Phase II comparing with the population served in Phase I. In this regard, existing facilities in rural area were assumed to be utilized through the two Phases, while urban population served by Level I and II facilities in base year was assumed to be absorbed by Level III service during Phase II period.

Table 8.5.1 shows the population to be served by target year, (details are referred to Supporting Report).

Through Phase I development, approximately 59,600 persons in the province will be served by additional water supply services, of which 20,100 persons or 34% of the total will be urban population and 39,500 persons or 66% will be rural population.

In the Phase II period, a total of 163,600 persons, of which 80,200 persons or 49% in urban area and 83,400 persons or 51% in rural area, will be further benefited by water supply

Table 8.5.1 Population to be Served by Target Year (Water Supply)

Name of Municipality	Area	Phase I Coverage (2003)										Phase II Coverage (2010)											
		Total Population			Service Coverage			Additional Population to be Served				Total Population			Service Coverage			Additional Population to be Served					
		Level III	Level II	Level I	Level III	Level II	Level I	Level III	Level II	Level I	Level III	Level II	Level I	Level III	Level II	Level I	Level III	Level II	Level I	Level III	Level II	Level I	Total
Buena Vista	Urban	16,569	1,040	3,324	14,084	9,720	9,720	18,977	18,028	8,408	8,408	18,028	8,408	8,408	8,408	18,028	8,408	8,408	8,408	18,028	8,408	8,408	34,844
	Rural	37,376	7,048	17,246	24,294	14,342	14,342	42,809	39,812	7,048	7,048	32,764	32,764	32,764	32,764	39,812	7,048	7,048	7,048	39,812	7,048	7,048	46,857
	Total	53,945	8,088	20,570	38,378	9,720	24,062	61,786	58,832	15,456	15,456	71,576	58,832	58,832	58,832	79,624	15,456	15,456	15,456	79,624	15,456	15,456	81,701
Cabadbaran	Urban	19,257	1,489	14,879	16,368	1,489	1,489	21,815	20,724	1,091	1,091	20,724	1,091	1,091	20,724	1,091	1,091	1,091	20,724	1,091	1,091	21,815	
	Rural	42,020	10,825	19,065	20,890	533	533	47,600	44,268	3,332	3,332	44,268	3,332	3,332	44,268	3,332	3,332	3,332	44,268	3,332	3,332	47,600	
	Total	61,277	11,314	33,944	46,258	1,489	1,489	69,415	64,992	4,421	4,421	64,992	4,421	4,421	64,992	4,421	4,421	4,421	64,992	4,421	4,421	71,515	
Carmen	Urban	4,531	248	3,445	3,851	248	248	4,531	4,531	0	0	4,531	4,531	4,531	4,531	4,531	4,531	4,531	4,531	4,531	4,531	4,531	
	Rural	12,431	524	7,556	8,080	685	685	17,789	16,638	1,151	1,151	16,638	1,151	1,151	16,638	1,151	1,151	1,151	16,638	1,151	1,151	17,789	
	Total	16,962	772	11,001	11,931	933	933	24,328	23,276	2,632	2,632	23,276	2,632	2,632	23,276	2,632	2,632	2,632	23,276	2,632	2,632	24,328	
Jabonga	Urban	3,346	126	2,718	2,844	126	126	3,346	3,346	0	0	3,346	3,346	3,346	3,346	3,346	3,346	3,346	3,346	3,346	3,346	3,346	
	Rural	19,707	11,111	1,699	12,810	642	642	21,782	20,257	1,525	1,525	20,257	1,525	1,525	20,257	1,525	1,525	1,525	20,257	1,525	1,525	21,782	
	Total	23,053	12,237	4,417	15,654	1,268	1,268	23,564	22,514	3,171	3,171	22,514	3,171	3,171	22,514	3,171	3,171	3,171	22,514	3,171	3,171	23,564	
Kitcharao	Urban	7,224	6,370	0	6,370	0	0	7,224	7,224	0	0	7,224	7,224	7,224	7,224	7,224	7,224	7,224	7,224	7,224	7,224	7,224	
	Rural	9,411	5,142	975	6,117	1,641	1,641	10,346	9,622	724	724	9,622	724	724	9,622	724	724	724	9,622	724	724	10,346	
	Total	16,635	11,512	1,948	12,487	3,282	3,282	18,289	17,168	2,366	2,366	17,168	2,366	2,366	17,168	2,366	2,366	2,366	17,168	2,366	2,366	18,289	
Las Nieves	Urban	1,328	528	581	1,129	20	20	1,591	1,511	80	80	1,511	80	80	1,511	80	80	80	1,511	80	80	1,591	
	Rural	27,938	2,984	15,176	18,160	12,424	12,424	33,468	32,636	832	832	32,636	832	832	32,636	832	832	832	32,636	832	832	33,468	
	Total	29,266	3,512	15,757	19,289	12,444	12,444	35,059	33,272	912	912	33,272	912	912	33,272	912	912	912	33,272	912	912	34,460	
Magallanes	Urban	14,598	3,148	9,260	12,408	3,148	3,148	16,070	15,267	803	803	15,267	803	803	15,267	803	803	803	15,267	803	803	16,070	
	Rural	5,296	2,692	780	3,442	723	723	5,831	5,423	408	408	5,423	408	408	5,423	408	408	408	5,423	408	408	5,831	
	Total	19,894	5,834	13,040	15,850	3,871	3,871	21,901	20,690	1,211	1,211	20,690	1,211	1,211	20,690	1,211	1,211	1,211	20,690	1,211	1,211	21,901	
Nasipit	Urban	12,923	11,622	3,613	15,235	1,818	1,818	18,924	18,924	0	0	18,924	18,924	18,924	18,924	18,924	18,924	18,924	18,924	18,924	18,924	18,924	
	Rural	21,478	2,466	7,848	30,012	1,818	1,818	32,556	31,659	897	897	31,659	897	897	31,659	897	897	897	31,659	897	897	32,556	
	Total	34,401	14,134	23,483	45,247	3,636	3,636	51,480	50,583	1,715	1,715	50,583	1,715	1,715	50,583	1,715	1,715	1,715	50,583	1,715	1,715	52,281	
Remedios T. Romualdez	Urban	4,412	1,321	2,429	3,750	1,321	1,321	5,180	4,921	259	259	4,921	259	259	4,921	259	259	259	4,921	259	259	5,180	
	Rural	11,237	5,549	1,755	7,304	1,572	1,572	13,194	12,270	924	924	12,270	924	924	12,270	924	924	924	12,270	924	924	13,194	
	Total	15,649	6,874	4,184	11,054	2,893	2,893	18,374	17,191	1,173	1,173	17,191	1,173	1,173	17,191	1,173	1,173	1,173	17,191	1,173	1,173	18,374	
Santiago	Urban	9,833	300	7,523	8,358	300	300	12,001	11,401	600	600	11,401	600	600	11,401	600	600	600	11,401	600	600	12,001	
	Rural	10,579	6,396	480	6,876	480	480	12,910	12,006	904	904	12,006	904	904	12,006	904	904	904	12,006	904	904	12,910	
	Total	20,412	13,919	1,015	15,234	780	780	24,911	23,407	1,504	1,504	23,407	1,504	1,504	23,407	1,504	1,504	1,504	23,407	1,504	1,504	24,911	
Tubay	Urban	3,591	1,944	1,108	3,652	1,944	1,944	5,599	5,199	400	400	5,199	400	400	5,199	400	400	400	5,199	400	400	5,599	
	Rural	15,636	3,558	6,605	10,163	3,390	3,390	17,411	16,192	1,219	1,219	16,192	1,219	1,219	16,192	1,219	1,219	1,219	16,192	1,219	1,219	17,411	
	Total	19,227	5,502	7,713	13,815	5,384	5,384	22,010	21,391	2,619	2,619	21,391	2,619	2,619	21,391	2,619	2,619	2,619	21,391	2,619	2,619	22,010	
PWASP Study Area	Urban	102,612	29,958	31,992	25,519	97,449	20,134	115,946	110,148	5,798	5,798	110,148	5,798	5,798	110,148	5,798	5,798	5,798	110,148	5,798	5,798	115,946	
	Rural	213,109	58,295	75,542	141,913	9,854	29,615	39,469	242,260	8,076	8,076	242,260	8,076	8,076	242,260	8,076	8,076	8,076	242,260	8,076	8,076	250,336	
	Total	315,721	88,253	107,534	167,432	107,303	127,064	155,415	152,408	13,874	13,874	152,408	13,874	13,874	152,408	13,874	13,874	13,874	152,408	13,874	13,874	165,882	

services. This additional service coverage in urban area includes upgrade of service level for 57,500 persons served by Level I and II facilities in 1997

## 8.5.2 Sanitation

### (1) Household toilets

The service coverage (number of households to be served) by different types of sanitary facility is estimated by urban and rural area by municipality for the years 2003 and 2010.

The future service coverage and additional households to be served are estimated to meet the provincial targets using the number of household served in the base year and the number of households in target years.

Additional number of households to be served by different type of facility by urban and rural area by municipality is the shortfall of the number of households to be served in target years comparing with either that in base year or in Phase I (details are referred to Supporting Report). However, when the number of households to be served in target year/s is less than or equal to that in base year, no additional number of households to be served is counted.

In the determination of the number of households to be served by flush type toilet, when the number of households to be served in the target year is higher than in base year, the target coverage is applied with conditions. When the target coverage is higher than Level III water supply coverage, the latter coverage is adopted, while in the other case, the target coverage is applied. In cases where the target coverage is less than that in base year, the base year coverage is adopted.

For Phase I, any type of existing sanitary facilities both in urban and rural areas is to be utilized during Phase I period. For Phase II, water-sealed toilet facilities in Phase I both in urban and rural areas are to be utilized.

The projected number of served households at the end of the Phase I period is 50,000. Additional households to be served totaled to 17,000, of which 39% is urban households and 61% is rural households. While at the end of Phase II period, the number of served households are 85,000 with an additional households to be served at 36,000. Table 8.5.2 provides the number of households to be served by target year for urban and rural areas by municipality.

Table 8.5.2 Additional Number of Households to be Served by Target Year (Household Toilets)

Name of Municipality	Area	Phase I Coverage (2003)										Phase II Coverage (2010)																							
		Total Households					No. of Served Households					Addit. No. of Households to be Served					Total Households					No. of Served Households					Addit. No. of Households to be Served								
		Flush	Pour	Flush	Flush	Total	Flush	Pour	Flush	Flush	Total	Flush	Pour	Flush	Flush	Total	Flush	Pour	Flush	Flush	Total	Flush	Pour	Flush	Flush	Total	Flush	Pour	Flush	Flush	Total				
Buenavista	Urban	3,192	575	2,154	144	2,873	575	51	144	770	4,744	2,254	2,109	144	4,507	1,679	4,338	1,679	4,338	1,679	4,338	1,679	4,338	1,679	4,338	1,679	4,338	1,679	4,338	1,679	4,338	1,679	4,338		
	Rural	6,858	575	5,246	583	5,829	1,133	1,184	583	1,716	10,702	2,254	9,584	583	10,167	1,679	8,488	1,679	6,809	1,679	8,488	1,679	6,809	1,679	8,488	1,679	6,809	1,679	8,488	1,679	6,809	1,679	8,488		
	Total	10,050	1,150	7,400	727	8,127	1,716	2,300	727	2,486	15,446	4,508	11,693	727	14,674	3,358	11,297	3,358	11,297	3,358	11,297	3,358	11,297	3,358	11,297	3,358	11,297	3,358	11,297	3,358	11,297	3,358	11,297		
Cahaburan	Urban	3,514	633	2,372	158	3,163	38	123	158	319	5,454	2,591	2,432	158	5,181	1,958	60	1,958	60	2,018	60	2,018	60	2,018	60	2,018	60	2,018	60	2,018	60	2,018	60	2,018	
	Rural	7,884	31	6,000	670	6,701	77	670	747	11,904	31	10,604	670	11,274	1,230	4,604	1,230	4,604	1,230	5,834	1,230	5,834	1,230	5,834	1,230	5,834	1,230	5,834	1,230	5,834	1,230	5,834	1,230	5,834	
	Total	11,398	664	8,372	828	9,864	115	1,340	828	1,066	17,358	2,622	13,036	828	16,466	2,988	2,190	2,190	2,190	4,148	2,190	4,148	2,190	4,148	2,190	4,148	2,190	4,148	2,190	4,148	2,190	4,148	2,190	4,148	
Carmen	Urban	860	155	580	39	774	155	580	735	1,188	565	525	39	1,129	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	410	
	Rural	2,391	155	1,829	203	2,032	1,760	2,349	1,769	3,259	3,259	2,893	203	3,096	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	1,064	
	Total	3,251	310	2,409	242	2,806	2,520	3,109	2,529	6,518	6,518	5,788	242	6,036	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124	2,124
Jabonga	Urban	592	107	399	27	533	107	399	506	965	440	412	27	879	333	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346
	Rural	3,463	107	2,821	314	3,135	314	3,135	314	5,446	3,135	4,860	314	5,174	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039	2,039
	Total	4,055	214	3,220	341	3,668	421	3,668	421	6,371	4,447	5,652	341	6,053	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333	3,333
Xitichamo	Urban	1,318	107	1,127	59	1,186	107	1,186	239	1,986	944	884	59	1,887	944	944	944	944	944	944	944	944	944	944	944	944	944	944	944	944	944	944	944	944	944
	Rural	1,720	107	1,316	146	1,462	246	1,462	392	2,587	2,587	2,312	146	2,458	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996	996
	Total	3,038	214	2,443	205	2,648	426	2,648	631	4,574	4,574	4,694	205	4,345	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940	1,940
Las Nieves	Urban	225	20	173	10	203	20	173	76	398	189	179	10	378	169	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	
	Rural	4,927	20	3,769	419	4,188	1,312	4,191	1,731	8,567	4,191	7,500	419	7,949	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761	3,761
	Total	5,152	40	3,942	429	4,391	1,624	4,391	1,907	10,134	4,692	8,269	429	8,721	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	7,522	
Magallanes	Urban	2,593	467	1,750	117	2,334	467	1,338	117	1,922	4,018	1,999	1,791	117	3,817	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	
	Rural	931	712	712	79	791	260	79	339	1,438	1,438	1,306	79	1,385	594	594	594	594	594	594	594	594	594	594	594	594	594	594	594	594	594	594	594	594	594
	Total	3,524	1,179	2,462	196	3,125	727	1,598	196	2,261	5,476	3,305	1,999	1,966	5,202	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	
Nasipit	Urban	3,453	622	2,331	155	3,108	622	396	155	1,173	4,980	2,366	2,210	155	4,731	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	1,744	
	Rural	3,992	622	3,181	354	3,535	622	396	354	5,988	5,988	5,316	354	5,670	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	2,135	
	Total	7,445	1,244	5,512	509	6,643	1,244	792	509	1,527	10,968	7,682	7,526	509	10,401	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	3,879	
Remedios T. Romualdez	Urban	781	141	527	35	703	141	527	613	1,295	613	580	35	1,230	474	474	474	474	474	474	474	474	474	474	474	474	474	474	474	474	474	474	474	474	
	Rural	2,144	141	1,640	182	1,822	431	1,822	613	3,299	3,299	2,952	182	3,134	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	1,312	
	Total	2,925	282	2,167	217	2,525	574	2,167	1,226	4,512	4,512	3,904	217	4,295	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	2,786	
Santiago	Urban	1,566	282	1,057	70	1,099	282	60	70	1,419	1,419	1,425	70	1,349	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	298	
	Rural	1,586	282	1,213	135	1,348	135	135	135	3,228	3,228	2,932	135	3,093	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	1,719	
	Total	3,152	564	2,270	205	2,575	417	205	205	5,447	6,228	4,225	205	5,917	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	3,160	
Tubay	Urban	619	111	418	28	557	111	418	529	1,000	475	447	28	950	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	393	
	Rural	2,767	111	2,117	235	2,352	2,029	2,447	2,529	4,353	4,353	3,900	235	4,118	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	1,783	
	Total	3,386	222	2,535	263	2,909	1,111	2,447	2,529	5,353	5,353	4,755	263	5,092	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	3,176	
PNV&SP Study Area	Urban	18,713</																																	

(2) School toilets

The service coverage or the number of public school students to be served is estimated by municipality for the years 2003 and 2010.

The future service coverage and additional number of students to be served are estimated using the number of students served in the base year, the number of students in target years and the provincial sector targets.

Additional number of students to be served by municipality is the shortfall of the number of students to be served in targets comparing with either that in base year or in Phase I (details are referred to Supporting Report). However, when the number of students to be served in target/s is less than or equal to the base year, no additional number of households to be served is considered.

The existing facilities are to be utilized during Phase I period, while the facilities in Phase I are to be utilized during Phase II period.

The projected number of served students at the end of Phase I period is 49,000. The additional students to be served are 26,000. While at the end of Phase II period, the projected number of served students are 76,000 with an additional students to be served at 26,000.

Table 8.5.3 summarizes the number of public school students to be served by target year.

**Table 8.5.3 Additional Number of Public School Students to be Served by Target Year (School Toilets)**

Name of Municipality	Phase I Coverage (2003)			Phase II Coverage (2010)		
	Total No. of Public School Student	Std. No. of Public School Students to be Served	Add'l. No. of Public School Student to be Served	Total No. of Public School Student	Std. No. of Public School Students to be Served	Add'l. No. of Public School Student to be Served
Buenavista	9,955	7,964	1,004	14,033	12,630	4,666
Cabadbaran	13,485	10,788	8,788	18,713	16,842	6,054
Carmen	4,122	3,298	3,058	4,983	4,485	1,187
Jabonga	4,562	3,650	2,210	5,402	4,862	1,212
Kitcharao	3,380	2,704	784	4,513	4,062	1,358
Las Nieves	5,585	4,468	3,428	7,206	6,485	2,017
Magallanes	3,314	2,651	2,331	4,865	4,379	1,728
Nasipit	6,875	5,500	56	11,521	10,369	4,869
Remedios T. Romualdez	1,934	1,547	907	2,648	2,383	836
Santiago	4,295	3,436	836	5,616	5,054	1,618
Tubay	3,969	3,175	2,295	4,419	3,977	802
<b>PW4SP Study Area</b>	<b>61,476</b>	<b>49,181</b>	<b>25,697</b>	<b>83,919</b>	<b>75,528</b>	<b>26,347</b>

### (3) Public toilets

The service coverage of public utilities with sanitary toilet facility by municipality is estimated for the years 2003 and 2010.

The future service coverage and additional coverage are estimated using the existing number of public utilities with sanitary toilets in the base year, the number of public utilities in target years, and provincial sector targets.

The additional number of public utilities with sanitary toilets needed by municipality is the shortfall of the number of public utilities in target year comparing with either the existing coverage or Phase I coverage (details are referred to Supporting Report).

The existing sanitary facilities are to be utilized during Phase I period. The facilities in Phase I are to be utilized during Phase II period.

The number of served public utilities at the end of Phase I period is 55. The additional public utilities to be served are 33. While at the end of Phase II period, the number of served public utilities are 95 with an additional public utilities to be served at 40. Table 8.5.4 summarizes the additional number of public utilities to be served by municipality by target year.

#### 8.5.3 Urban Sewerage

The service coverage in 2010 (Phase II) is estimated for the municipalities with population of more than 10,000 in urban area provided by Level III water supply. It is assumed that half of the population in the area/s is to be served by the sewerage systems. Table 8.5.5 shows the population to be served in Phase II.

#### 8.5.4 Solid Waste

Future requirements in the sub-sector are studied giving priority to urban area for the Phase I. Staged improvement for the rural area shall be studied in the future.

Service coverage in Phase I was assumed at 90% with reference to the present service coverage of 78% in urban area.. Additional service coverage in Phase I is calculated as a shortfall of target coverage in Phase I comparing with current service coverage. Table 8.5.6 presents additional service coverage for Phase I in the urban area.

Table 8.5.4 Additional Number of Public Utilities with Sanitary Toilets by Target Year

Name of Municipality	Type	Phase I Coverage (2003)		Phase II Coverage (2010)	
		Add'l. No. of Public Utility with Sanitary Toilets	No. of Public Utility with Sanitary Toilets	Add'l. No. of Public Utility with Sanitary Toilets	No. of Public Utilities with Sanitary Toilets
Buena Vista	Public Market	1	2	1	3
	Bus/Jeepney Term	1	2	2	4
	Parks/Playground	2	4	2	6
	Total	4	8	5	13
Cabadbaran	Public Market	1	2	1	3
	Bus/Jeepney Term	1	2	1	3
	Parks/Playground	1	3	1	4
	Total	3	7	3	10
Carmen	Public Market	1	2	1	3
	Bus/Jeepney Term	1	1	1	2
	Parks/Playground	3	3	1	4
	Total	2	6	3	9
Jabonga	Public Market	1	1	1	2
	Bus/Jeepney Term	1	1	1	2
	Parks/Playground	1	1	2	3
	Total	3	3	4	7
Kitcharao	Public Market	1	1	1	2
	Bus/Jeepney Term				
	Parks/Playground	1	3	1	4
	Total	2	4	2	6
Las Nieves	Public Market	1	2	1	3
	Bus/Jeepney Term	1	1	1	2
	Parks/Playground	1	1	1	2
	Total	3	4	3	7
Magallanes	Public Market	1	2	2	4
	Bus/Jeepney Term	1	2	2	4
	Parks/Playground	1	1	1	2
	Total	3	5	5	10
Nasipit	Public Market	1	2	1	3
	Bus/Jeepney Term	1	2	1	3
	Parks/Playground	1	1	1	2
	Total	3	5	3	8
Remedios T. Romualdez	Public Market	1	2	1	3
	Bus/Jeepney Term	1	1	1	2
	Parks/Playground	1	1	1	2
	Total	3	4	3	7
Santiago	Public Market	1	2	1	3
	Bus/Jeepney Term	1	1	1	2
	Parks/Playground	1	1	1	2
	Total	3	4	3	7
Tubay	Public Market	1	2	1	3
	Bus/Jeepney Term	1	1	1	2
	Parks/Playground	1	1	1	2
	Total	3	4	3	7
PW4SP Study Area	Public Market	12	21	13	34
	Bus/Jeepney Term	10	14	13	27
	Parks/Playground	11	20	14	34
	Total	33	55	40	95

**Table 8.5.5 Population to be Served by Urban Sewerage in Phase II**

Name of Municipality	Urban Population in 2010	Level III Water Supply Coverage	Population to be Served
Buenavista	18,977	18,028	9,489
Cabadbaran	21,815	20,724	10,908
Magallanes	16,070	15,267	8,035
Nasipit	19,920	18,924	9,960
Santiago	12,001	11,401	6,001
<b>PW4SP Study Area</b>	<b>115,946</b>	<b>110,148</b>	<b>44,393</b>

**Table 8.5.6 Additional Number of Urban Households to be Served by Municipal Solid Waste System in Phase I**

Name of Municipality	No. of Urban Households Served in the Base Year	Phase I Coverage (2003)		
		No. of Urban Households	Urban Households Coverage	Add'l. No. of Urban Households to be Served
Buenavista	963	3,192	2,873	1,910
Cabadbaran	6,628	3,514	6,628	
Carmen	50	860	774	724
Jabonga		592	533	533
Kitcharao		1,318	1,187	1,187
Las Nieves		225	203	203
Magallanes	2,719	2,593	2,719	
Nasipit	2,526	3,453	3,108	582
Remedios T. Romualdez	87	781	703	616
Santiago		1,566	1,410	1,410
Tubay		619	558	558
<b>PW4SP Study Area</b>	<b>12,973</b>	<b>18,713</b>	<b>20,696</b>	<b>7,723</b>

## 8.6 Facilities, Equipment and Rehabilitation to Meet the Target Services

### 8.6.1 Water Supply

#### (1) Required facilities

Water supply facilities required by service level were estimated by urban and rural area by municipality based on the additional service coverage by target year and summarized in Table 8.6.1 (details are referred to Supporting Report).

#### Urban water supply:

Physical requirements of Level III systems were estimated as the number of required house connections. Mode of project indicates whether future urban water supply will be



Table 8.6.1 Water Supply Facilities Required by Target Year

Name of Municipality	Phase I (2003) Requirements										Phase I (2010) Requirements									
	Urban Water Supply (Level III)					Rural Water Supply					Urban WS (Level III)					Rural Water Supply				
	Mode of Project	No. of Add'l. Deep Wells	No. of HHS Connection	Level II		Level I			No. of Add'l. Deep Wells	Total No. of Wells	No. of HHS Connection	Level I			No. of Shallow Wells	Total No. of Wells				
				No. of System	No. of Communal Faucets	Number of Deep Wells	No. of Shallow Wells	40 m				80 m	120 m	Sub-total			40 m	80 m	120 m	Sub-total
BuenaVista	New	2	1,873	4	80	23	23	126	149	2	2,077	39	39	220	259					
Cabadbaran	New	1	272	1	20					3	4,809	72	72	168	240					
Carmen	New	1	47			1	1	8	9	1	1,067	7	7	61	68					
Jabonga	New	1	22			2	2	6	8	1	847	19	19	106	125					
Kitcharao	N/A			3	60					1	1,887	11	11	48	59					
Las Nieves	New	1	3			15	15	131	146	1	373	22	22	195	217					
Magallanes	New	1	559			7	7	1	8	2	3,030	28	28	6	34					
Nasipit	Expansion	1	350	1	20					1	1,826	38	38	86	124					
R. T. Romualdez	New	1	234	3	60					1	900	25	25	58	83					
Santiago	New	1	48			1	1	4	5	2	2,775	9	9	77	86					
Tubay	New	1	335	6	120	9	9	20	29	1	464	31	31	70	101					
PWASP Study Area	Exp.-1	11	3,743	18	360	3	54	1	58	16	20,055	39	255	7	1,095					
	New-9							296	354						1,396					

implemented as expansion of existing system or construction of a new system. Number of water sources was also estimated based on water source evaluation results in Chapter 7.

Rural water supply:

Physical requirements of Level II systems were estimated as the number of systems and number of communal faucets, while that of Level I wells was estimated as the number of wells with classification of deep and shallow wells. Deep wells were further subdivided in terms of three different standard depths based on the water source evaluation results. Furthermore, as for Level I facilities, in this PW4SP, 85% of the total required facilities will be implemented by public (LGUs) and 10% of these public Level I facilities will be allocated to spring development.

(2) Rehabilitation

Rehabilitation requirements were estimated as 10% of the total number of deep wells to be constructed under PW4SP. Rehabilitation work will be mainly redevelopment of wells by means of air surging, while minor repair of concrete apron and handpump will be undertaken by respective beneficiary organizations.

(3) Equipment

Logistic support:

For rural water supply development, 1 unit each or set of the following equipment was considered necessary for the provincial government to conduct various activities of PW4SP implementation;

Transportation- service vehicle

Office equipment- computer with printer, typewriter, mimeo machine, scanning machine and copier

Field equipment- water testing kit, sound system, tape recorder and tools for maintenance

For urban water supply, no hardware was considered

Well drilling and rehabilitation equipment:

As a reference information, necessary types and number of well drilling and rehabilitation equipment were studied considering the existing equipment of sector agencies in the province. During Phase I, a total of 45 Level I deep wells shall be newly constructed and 10% of these deep wells shall be rehabilitated annually. Although there are considerable requirements, only 1 unit of truck-mounted percussion drilling rig is available at DPWH-DEO in the province, while no air compressor for well rehabilitation equipment is available neither at provincial government or sector agencies.

Therefore, 1 set of drilling rigs (1 set of medium size percussion type) together with 1 set of well rehabilitation equipment, 1 unit of support vehicles for well rehabilitation and 1 unit of service trucks for deep well construction shall be mobilized/procured either by private sector or LGUs (details are referred to Supporting Report).

Selection of well drilling machine:

An appropriate type of well drilling machine with its specifications shall be selected after comprehensive study on the technical requirements, local capability in O&M of the machine and cost effectiveness.

From the technical viewpoint, geological conditions in the province allow for the use of either rotary or percussion type drilling machine (no rock drilling is expected). While, in view of economical and O&M experience on the machine in the local area, a percussion type is recommendable. Although, the rotary type machine is quite effective to reduce construction period under soft soil condition, special training on mud-circulation, handling manner, etc. are required together with additional equipment and materials as compared with percussion type. The drilling speed of the percussion type is rather slow, but has advantages in drilling boulder and cobble formations.

One unit of truck mounted percussion drilling machine is considered to be procured in the long-term development period.

(4) Laboratory

Upgrading of Existing Provincial Laboratory in Provision of Instrument/Equipment:

One (1) set of instrument/equipment will be necessary to upgrade the existing provincial laboratory in order for the LGU to undertake regular water quality monitoring and surveillance activities. The following are the requirements:

	<u>Item</u>	<u>Unit</u>	<u>Number</u>
1.	Instrument/Equipment		
	Turbidity meter	set	1
	Color meter	set	1
	pH/Residual chlorine checker	set	1
	Refrigerator	set	1
	Portable water quality testing kit	set	1
	Electric stove	set	1
	Range hood	set	1
2.	Glassware/Chemical	set	1

## 8.6.2 Sanitation

This sub-section refers to physical requirements by target year covering household, school and public toilet facilities. Table 8.6.2 presents the required sanitation facilities by target year. Rehabilitation for the sanitation facilities is considered as part of recurrent cost.

### (1) Household toilets

Future requirements in the number of household toilets by different type for urban and rural areas were estimated based on the additional households to be served by type of facility both for urban and rural areas by target year (details are referred to Supporting Report).

### (2) School toilets

The future requirements in the number of toilet facilities were estimated based on the standard number of students to be served by a 5-unit standard facility and the additional students to be served by target year (details are referred to Supporting Report).

Total required facilities were further broken down into urban and rural areas by applying the percentage share of urban and rural population.

### (3) Public toilets

Future requirements in the number of toilet facilities were estimated based on the additional number of toilets for public markets and bus/jeepony terminals located in urban areas (details are referred to Supporting Report).

## 8.6.3 Urban Sewerage and Solid Waste

Physical requirements for the sewerage facilities are not discussed in this sub-section. Further study shall be conducted in the future.

As reference information, the number of refuse collection trucks was estimated for the urban area in Phase I. Nine (9) additional units of truck are required to meet assumed service coverage as reflected in Table 8.6.3.

Table 8.6.2 Sanitation Facilities Required by Target Year

Name of Municipality	Phase I (2003) Requirements										Phase II (2010) Requirements									
	Urban Sanitation					Rural Sanitation					Urban Sanitation					Rural Sanitation				
	No. of Households		No. of Public Toilets		No. of Public Sch. Toilets	No. of Households		No. of Public Toilets		No. of Public Sch. Toilets	No. of Households		No. of Public Toilets		No. of Public Sch. Toilets	No. of Households		No. of Public Toilets		No. of Public Sch. Toilets
	Flush	VIP/ Dry	Public Market	Bus/ Jeppney Terminal	Park/ Playground	Flush	Poor Flush	VIP/ Dry	Total	No. of Public Sch. Toilets	Flush	Poor Flush	VIP/ Dry	Total	No. of Public Sch. Toilets	Flush	Poor Flush	VIP/ Dry	Total	No. of Public Sch. Toilets
Buena Vista	575	144	770	12	1	2	1,133	333	1,716	28	1,679			1,679	19	1	2	2	4,338	44
Cabacbaran	38	123	158	17	2	1	77	670	747	37	1,958	60		2,018	26	2	2	2	4,604	58
Carmen	155	580	735	4	1	1	1,769		1,769	12	410			410	6	1	1	1	1,964	16
Jabonga	107	27	134	3	1	1		314	314	16	233	13		346	4	1	1	1	2,039	21
Kitcharamo		180	59	239	6	1	1	246	392	8	944			944	9	1	1	2	996	11
Las Nieves	20	46	10	76	1	1	1,312	419	1,731	21	169	6		175	1	1	1	1	3,761	31
Magallanes	467	1,338	1,117	1,922	10	1	260	79	339	4	1,442	41		1,483	16	1	1	1	594	6
Nasipit	622	396	1,555	1,173	13	1		354	354	15	1,744			1,744	28	2	2	2	2,135	28
Remedios T. Romualdez	141		35	176	2	1	1	431	613	6	474	33		527	3	1	1	1	1,312	9
Santiago	282	60	70	412	8	1		135	135	9	1,140	298		1,441	12	1	1	1	1,719	13
Tubay	111	418		529	3	1	1	2,029	2,029	13	364	29		393	4	1	1	1	1,783	16
PWASP Study Area	2,516	3,192	775	6,483	79	12	10	11	10,139	169	10,660	500		11,160	124	13	13	14	24,345	253

**Table 8.6.3 Number of Refuse Collection Trucks Required in Phase I**

Name of Municipality	Add'l. Urban Households to be Served	Estimated Daily Amount of Refuse to be Generated (Kg)	Number of Collection Truck Required
Buenavista	1,910	799	1
Cabadbaran			
Carmen	724	303	1
Jabonga	533	223	1
Kitcharao	1,187	497	1
Las Nieves	203	85	1
Magallanes			
Nasipit	582	244	1
Remedios T. Romualdez	616	258	1
Santiago	1,410	590	1
Tubay	558	234	1
<b>PW4SP Study Area</b>	<b>7,723</b>	<b>3,233</b>	<b>9</b>

### 8.7 Identification of Priority Projects for Medium-Term Development Plan

In general, the present service coverage by municipality with reference to the target coverage indicates the direction of development effort for implementing PW4SP with municipal priorities.

Specific projects shall be selected subject to detailed studies and rather not discussed in provincial master plan. In addition, pertinent information to identify priority projects is not available both at provincial and municipal level during this PW4SP preparation, except some WDs for future expansion work.

The general criteria for identifying priority projects as guide for implementing the PW4SP are summarized below.

The first level of priority should be given to projects with positive feasibility studies and identified funding. Next level of priority would be given to projects with positive feasibility studies, although no funding source has been identified. The third level should be those for which feasibility study has been conducted. Within each level, if funds were insufficient, a ranking could be carried out in application of some factors such as willingness-to-pay, water-related disease status and per capita cost. Under the above-mentioned conditions, the implementors shall prepare a list of projects.

Due attention shall be paid on the importance of integrated development of relevant sub-sectors to maximize the effects and benefits through simultaneous implementation of water supply and sanitation projects. On a municipal level priority, synthetic evaluation of sector components for concerned municipalities (which is studied in the financial arrangements, Chapter 11) may be used for implementation arrangements.