

Chapter

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

8

8. FUTURE REQUIREMENTS IN WATER SUPPLY AND SANITATION IMPROVEMENT

8.1 General

Phased investments for provincial sector development, Medium-Term Investment (2001-2010) and Long-Term Development (2006-2010), are planned in almost the same manner as adopted in the 1998 Philippine National Development Plan (PNDP), the National Sector Master Plan (NSMP) and Updated Updated Medium-Term Philippine Development Plan.

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 (1998) 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 which 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 (1998) is estimated referring to the NSO population census results (past 3 census periods: 1980 - 1995), the 1995 Census-based Regional and Provincial Population projection prepared by NSO and the Provincial Physical Framework Plan/Comprehensive Provincial Land Use Plan. 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 stu-

dents/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 2005 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 subsection.

(1) Water supply

The base year (1998) service coverage was calculated as a total of 1998 figures and expected by planned/on-going projects scheduled to be completed by 1999. 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-sector	Base Year Service Coverage	Phase I (2001-2005)		Phase II (2006-2011)	
		Population Coverage (%)	Additional Population to be Served	Population Coverage (%)	Additional Population to be Served
Water Supply					
<i>Urban Water Supply</i>	80	80	11,219	95	87,602
<i>Rural Water Supply</i>	68	68	30,240	93	123,238
Sanitation	Household Coverage (%)	Household Coverage (%)	Additional Households to be Served	Household Coverage (%)	Additional Households to be Served
<i>Household Toilet</i>					
<i>Urban Area</i>	80	90	4,863	93	13,387
Flush	8	15	1,924	50	13,387
Pour Flush	83	80	2,708	50	0
VIP/Dry	10	5	231	0	0
<i>Rural Area</i>	71	85	16,574	90	29,269
Flush	3	5	1,741	10	2,242
Pour Flush	73	80	12,707	90	27,027
VIP/Dry	24	15	2,126	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
	54	80	38,985	90	21,637
<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
	71	90	32	100	12
<i>Sewerage</i>	Urban Population Coverage (%)	Not Applicable		Urban Population Coverage (%)	Urban Population to be Served
	0			50	37,078
<i>Solid Waste</i>	Urban Household Coverage (%)	Urban Household Coverage (%)	Additional Urban House- holds to be Served	Not Applicable	
	60	80	9,880		

Table 8.2.2 Estimation of Base Year Service Coverage of Water Supply

Name of Municipality	Area	Population (1998)	Population Served by 1998 Facilities				% Coverage
			Level III	Level II	Level I	Total	
Anini-v	Urban	765			499	499	65
	Rural	19,376		950	10,830	11,780	61
	Total	20,141		950	11,329	12,279	61
Barbaza	Urban	2,924	770		1,087	1,857	64
	Rural	16,251	2,002		8,186	10,188	63
	Total	19,175	2,772		9,273	12,045	63
Belison	Urban	4,809			4,103	4,103	85
	Rural	7,252		650	4,891	5,541	76
	Total	12,061		650	8,994	9,644	80
Bugasong	Urban	7,034	4,866		991	5,857	83
	Rural	21,527	4,078	2,375	8,193	14,646	68
	Total	28,561	8,944	2,375	9,184	20,503	72
Caluya	Urban	5,540			5,107	5,107	92
	Rural	12,372			7,861	7,861	64
	Total	17,912			12,968	12,968	72
Culasi	Urban	5,444	4,455			4,455	82
	Rural	25,903	2,174	1,200	13,903	17,277	67
	Total	31,347	6,629	1,200	13,903	21,732	69
Hamtic	Urban	4,181	1,575	200		1,775	42
	Rural	33,674	617	2,125	17,937	20,679	61
	Total	37,855	2,192	2,325	17,937	22,454	59
Laua-an	Urban	3,775			3,009	3,009	80
	Rural	18,391		3,775	9,038	12,813	70
	Total	22,166		3,775	12,047	15,822	71
Libertad	Urban	2,218			1,693	1,693	76
	Rural	12,831		1,975	6,107	8,082	63
	Total	15,049		1,975	7,800	9,775	65
Pandan	Urban	3,126	2,883			2,883	92
	Rural	22,925	21,160	875		22,035	96
	Total	26,051	24,043	875		24,918	96
Patnongon	Urban	4,739	1,835		1,718	3,553	75
	Rural	26,145	165	4,450	12,069	16,684	64
	Total	30,884	2,000	4,450	13,787	20,237	66
San Jose de Buenavista	Urban	41,483	9,960	150	23,145	33,255	80
	Rural	3,818		150	3,513	3,663	96
	Total	45,301	9,960	300	26,658	36,918	81
San Remigio	Urban	1,236			989	989	80
	Rural	22,744		2,450	15,747	18,197	80
	Total	23,980		2,450	16,736	19,186	80
Sebaste	Urban	10,311	2,885	800	5,231	8,916	86
	Rural	2,251		75	1,472	1,547	69
	Total	12,562	2,885	875	6,703	10,463	83
Sibalom	Urban	8,354	4,614	75	2,375	7,064	85
	Rural	40,776	486	3,000	22,852	26,338	65
	Total	49,130	5,100	3,075	25,227	33,402	68
Tibiao	Urban	4,584	1,228		2,561	3,789	83
	Rural	15,044	1,318	2,650	7,025	10,993	73
	Total	19,628	2,546	2,650	9,586	14,782	75
Tobias Fornier	Urban	4,407	3,683	150		3,833	87
	Rural	22,364	394	3,950	9,651	13,995	63
	Total	26,771	4,077	4,100	9,651	17,828	67
Valderrama	Urban	3,561			2,178	2,178	61
	Rural	12,917			7,214	7,214	56
	Total	16,478			9,392	9,392	57
Provincial Total	Urban	118,491	38,754	1,375	54,686	94,815	80
	Rural	336,561	32,394	30,650	166,489	229,533	68
	Total	455,052	71,148	32,025	221,175	324,348	71

The base year service coverage in urban area (80%) is higher than the updated MTPDP sector target (69%) for the year 1998, while rural area (68%) is behind the sector target of 79%. As identified in Chapter 4, lower service coverage in rural area is considered to arise because of the existence of high percentage of underserved population.

For Phase I development, targets of service coverage for water supply by urban and rural were set up considering the following conditions:

- i) at least the existing service coverage shall be secured to meet population increase;
- ii) physical targets of Level I facility for rural water supply under the on-going ADB-assisted project shall be incorporated into medium-term development plan; and
- iii) viable investment using available IRA to be allocated to water supply sector shall be considered.

With regard to rural water supply, population to be served under on-going ADB-assisted project was assumed as additional population to be served to meet increase of the population in rural area.

Thus, the existing service coverage of 80% for urban and 68% for rural area are assumed in the medium-term period.

Phase II targets are planned to increase 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 1999 (details are referred to Supporting Report).

The province has base year service coverage of 73%, which is well above the current national average coverage of 60%. Urban area registers a level of 80%, while rural area has 71%, both above the national average coverage. By type of sanitary toilet facility, the existing percentage composition to total households is as follows:

Type	Urban (%)	Rural (%)
Flush	8	3
Pour-flush	83	73
VIP latrine	10	24

Table 8.2.3 Base Year Service Coverage of Household Toilets

Name of Municipality	Area	1998		Households and Population Using Sanitary Toilets								
		Popula- tion	HHs	Number of Households				Popula- tion	Service Coverage (%)			
				Flush	Pour Flush	VIP/Dry	Total		Flush	Pour Flush	VIP/Dry	Total
Anini-v	Urban	765	135	10	102		112	635	7	76		83
	Rural	19,376	3,497	14	2,343	225	2,582	14,339		67	6	74
	Total	20,141	3,632	24	2,445	225	2,694	14,974	1	67	6	74
Barbaza	Urban	2,924	549	39	401	42	482	2,574	7	73	8	88
	Rural	16,251	3,156	65	1,811	236	2,112	10,889	2	57	7	67
	Total	19,175	3,705	104	2,212	278	2,594	13,463	3	60	8	70
Belison	Urban	4,809	907	10	677	115	802	4,232	1	75	13	88
	Rural	7,252	1,448	11	914	305	1,230	6,165	1	63	21	85
	Total	12,061	2,355	21	1,591	420	2,032	10,397	1	68	18	86
Bugasong	Urban	7,034	1,374	28	474	408	910	4,643	2	34	30	66
	Rural	21,527	4,229	110	1,632	586	2,328	11,840	3	39	14	55
	Total	28,561	5,603	138	2,106	994	3,238	16,483	2	38	18	58
Caluya	Urban	5,540	1,045	104	618	3	725	3,823	10	59		69
	Rural	12,372	2,330		1,332	23	1,355	7,176		57	1	58
	Total	17,912	3,375	104	1,950	26	2,080	10,999	3	58	1	62
Culasi	Urban	5,444	1,076		812	60	872	4,410		75	6	81
	Rural	25,903	5,150	314	1,715	548	2,577	12,952	6	33	11	50
	Total	31,347	6,226	314	2,527	608	3,449	17,362	5	41	10	55
Hamtic	Urban	4,181	821	73	586	23	682	3,471	9	71	3	83
	Rural	33,674	6,463	49	3,720	688	4,457	23,236	1	58	11	69
	Total	37,855	7,284	122	4,306	711	5,139	26,707	2	59	10	71
Laua-an	Urban	3,775	749	5	371		376	1,888	1	50		50
	Rural	18,391	3,808	2	1,896	918	2,816	13,610		50	24	74
	Total	22,166	4,557	7	2,267	918	3,192	15,498		50	20	70
Libertad	Urban	2,218	421	9	336		345	1,819	2	80		82
	Rural	12,831	2,329	4	849	748	1,601	8,854		36	32	69
	Total	15,049	2,750	13	1,185	748	1,946	10,673		43	27	71
Pandan	Urban	3,126	643	112	364	32	508	2,470	17	57	5	79
	Rural	22,925	4,603	256	3,206	214	3,676	18,340	6	70	5	80
	Total	26,051	5,246	368	3,570	246	4,184	20,810	7	68	5	80
Patnongon	Urban	4,739	938	25	792		817	4,123	3	84		87
	Rural	26,145	5,303	94	3,311	821	4,226	20,916	2	62	15	80
	Total	30,884	6,241	119	4,103	821	5,043	25,039	2	66	13	81
San Jose de Buenvista	Urban	41,483	8,039	819	5,233	553	6,605	34,017	10	65	7	82
	Rural	3,818	779	220	418	85	723	3,551	28	54	11	93
	Total	45,301	8,818	1,039	5,651	638	7,328	37,568	12	64	7	83
San Remigio	Urban	1,236	257		145	20	165	792		56	8	64
	Rural	22,744	4,267	243	1,635	456	2,334	12,510	6	38	11	55
	Total	23,980	4,524	243	1,780	476	2,499	13,302	5	39	11	55
Sebaste	Urban	10,311	2,054	25	1,700	20	1,745	8,765	1	83	1	85
	Rural	2,251	441		194	138	332	1,689		44	31	75
	Total	12,562	2,495	25	1,894	158	2,077	10,454	1	76	6	83
Sibalom	Urban	8,354	1,579	16	1,213	168	1,397	7,352	1	77	11	88
	Rural	40,776	7,872	13	4,799	1,570	6,382	33,029		61	20	81
	Total	49,130	9,451	29	6,012	1,738	7,779	40,381		64	18	82
Tibiao	Urban	4,584	982	106	645	39	790	3,668	11	66	4	80
	Rural	15,044	3,076		1,958	164	2,122	10,381		64	5	69
	Total	19,628	4,058	106	2,603	203	2,912	14,049	3	64	5	72
Tobias Forn-	Urban	4,407	825	25	195	288	508	2,733	3	24	35	62
	Rural	22,364	4,455	18	1,614	2,322	3,954	19,904		36	52	89
	Total	26,771	5,280	43	1,809	2,610	4,462	22,637	1	34	49	85
Valderrama	Urban	3,561	712		539		539	2,707		76		76
	Rural	12,917	2,553		427	1,264	1,691	8,526		17	50	66
	Total	16,478	3,265		966	1,264	2,230	11,233		30	39	68
Provincial Total	Urban	118,491	23,106	1,406	15,203	1,771	18,380	94,122	6	66	8	80
	Rural	336,561	65,759	1,413	33,774	11,311	46,498	237,907	2	51	17	71
	Total	455,052	88,865	2,819	48,977	13,082	64,878	332,029	3	55	15	73

To pursue 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 assumed. A higher increase in the urban service coverage is aimed for 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, 93% as set by the NSMP is adopted for urban household toilets, while, 90% is arranged for rural household toilets.

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 1999 (details are referred to Supporting Report).

Base year service coverage is 54% applying the standard number of public school students to be served by one (1) unit of toilet facility. A relatively high level of coverage is observed in the province.

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 Phase I and II, 80% and 90% are set, respectively.

3) Public toilets

The base year service coverage considering expected additional coverage by 1999 is shown in Table 8.2.4 (details are referred to Supporting Report).

Seventy one percent (71%) of public utilities are served with at least one sanitary toilet.

Without national targets as of now, considering the improvement of present situation, 90% and 100% coverage for Phase I and Phase II are assumed, respectively.

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

Name of Municipality	Public School Toilets			Public Toilets		
	Total Number of Public School Students (1998)	Std. No. of Public School Student that can be Served by Base Year (1998) Sanitary Toilets	Service Coverage (%)	Number of Public Utilities with Toilets in 1998	Number of Public Utility with Sanitary Toilets in Base Year (1998)	Service Coverage (%)
Anini-y	3,892	3,892	100	10	10	100
Barbaza	4,095	1,440	35	2		
Belison	2,294	2,294	100	2		
Bugasong	5,602	3,920	70	2	2	100
Caluya	4,809	1,440	30			
Culasi	6,888	3,200	46	2	2	100
Hantic	9,232	4,800	52	2	2	100
Laua-an	4,933	2,160	44	2	2	100
Libertad	3,071	1,200	39	4	2	50
Pandan	6,936	2,720	39	2	2	100
Patnongon	15,266	3,920	26	2	2	100
San Jose de Buenavista	7,415	6,640	90	6	4	67
San Remigio	6,222	2,160	35	2		
Sebaste	2,737	2,737	100	2		
Sibalóm	11,883	8,480	71	2	2	100
Tibiao	4,581	2,000	44	2	2	100
Tobias Fornier	5,338	5,338	100	2		
Valderrama	3,876	560	14	2	2	100
Provincial Total	109,070	58,901	54	48	34	71

(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 1998 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 16% of the total households in the province relied on municipal refuse collection using trucks or 60% urban household coverage. These municipalities have a total of 13 units of collection truck.

No national targets have yet been set. However, considering the improvement of present coverage, 80% urban household coverage is applied for the medium-term period (2001-2005).

Table 8.2.5 Base Year Service Coverage of Municipal Solid Waste System in 1998

Name of Municipality	Total No. of Households	No. of Urban Households	No. of Households Served	Coverage of Households (%)	Coverage of Urban Households (%)
Anini-y	3,632	135			
Barbaza	3,705	549			
Belison	2,355	907			
Bugasong	5,603	1,374	2,105	38	100
Caluya	3,375	1,045			
Culasi	6,226	1,076	1,057	17	98
Hamtic	7,284	821	615	8	75
Laua-an	4,557	749	312	7	42
Libertad	2,750	421			
Pandan	5,246	643	855	16	100
Patnongon	6,241	938	1,520	24	100
San Jose de Buenavista	8,818	8,039	4,310	49	54
San Remigio	4,524	257			
Sebaste	2,495	2,054			
Sibalom	9,451	1,579	2,705	29	100
Tibiao	4,058	982			
Tobias Fornier	5,280	825	489	9	59
Valderrama	3,265	712			
Provincial Total	88,865	23,106	13,968	16	60

8.3 Projection of Frame Values

8.3.1 Population Projection

Future population for all municipalities by urban and rural areas was projected for the target years of 2005 and 2010 together with the present population in 1998 as a planning base year.

The future regional and provincial population has been projected by the NSO, while the projections at municipal levels were not available during the study. The future population of LGUs was therefore projected (details are included in the Supporting Report). Available information for the study at present is as follows:

NSO population census results from 1980 to 1995

1995 Census-based Regional and Provincial Population Projection prepared by the NSO
Provincial Physical Framework Plan/Comprehensive Provincial Land Use Plan (1996-2005) prepared by the Provincial Office

(1) 1995 Census-Based Regional and Provincial Population Projections: NSO

The NSO conducted regional and provincial projections for the period 1995-2020. The assumptions take into account future trends in the demographic processes of fertility, mortality and migration required by the cohort-component method for projecting population. The 1995 Population Census was used as the basis for the projection.

In the regional population projection, the subject region for this study; Region VI is classified as the medium-size region (at least 5 million but less than 10 million by year 2000). The following are the result of projection for the region and the province of Antique in 2000, 2005 and 2010.

Table 8.3.1 Regional and Provincial Population Projection by NSO

Year		1980	1990	1995	2000	2005	2010
Region VI	Population	4,525,615	5,393,333	5,756,623	6,328,671	6,890,447	7,428,329
	Growth Rate	-	1.77%	1.31%	1.91%	1.72%	1.51%
Antique	Population	344,879	406,361	430,363	471,514	512,755	554,797
	Growth Rate	-	1.65%	1.15%	1.84%	1.69%	1.59%

Note: Average annual growth rates: geometric growth rate

Population of the province in 1995 as of September 1, 1995 was 431,713 (1995 Census)

In the past development, annual growth rates of the region and Province between 1990 and 1995 decreased compared with those of previous census period. The growth rates for respective census period (1980-1990 and 1990-1995) in regional and provincial population show almost same tendency of decreases (about 30%). For the population projection, however, the NSO considered the experiences in the previous development both for regional and province. Thus, the growth rates of the region with 5-year interval between 1995 and 2010 are assumed at 1.91%, 1.72% and 1.51%, respectively. Likewise, those of the province are assumed at 1.84%, 1.69% and 1.59%, respectively.

(2) The Land Use Plan: Province of Antique (Planning period 1996-2005)

The population projection on the provincial total and component municipalities together with the regional population was made with a base year 1990. The population for the year 2005 was projected using a uniform growth rate between 1990 and 2005 referring to the experience from 1980 to 1990 (census years).

In comparison between Land Use Plan and NSO's projection for year 2005, there is no significant difference both in regional and provincial population.

On the other hand, regarding the projected municipal population in 1995, that of eleven (11) out of 18 municipalities is higher than census results with a range of 1% to 16%, while that of remaining seven (7) municipalities is lower with a range of -2% to -13%.

Thus, future projection shall be made using 1995 census results as a base year. While, the regional and provincial population projected by the NSO may be adopted in this

PW4SP, since the differences between population projected for the medium-term by Land Use Plan and by the NSO is less than 3%.

(3) Population Projection of the Province

The following conditions are considered in the population projection.

Regional and Provincial Population

For the regional and provincial population in the study, the projection conducted by NSO shall be adopted. Table 8.3.2 shows the projected population of the region VI and component provinces.

Table 8.3.2 Projected Population by the NSO

Province	Census	Projected Population/Growth Rate					
	Population	Population			Average Annual Growth Rate		
	1995	1998	2005	2010	1995-2000	2000-2005	2005-2010
Aklan	408,949	432,359	487,839	528,072	1.84%	1.72%	1.60%
Antique	430,363 (431,713)	455,051 (451,136)	512,755 (501,514)	554,797 (540,540)	1.84% (1.51%)	1.69% (1.51%)	1.59% (1.51%)
Capiz	622,034	657,975	742,312	801,742	1.86%	1.71%	1.55%
Guimaras	126,034	133,422	150,680	162,774	1.88%	1.72%	1.56%
Iloilo	1,743,302	1,847,328	2,086,833	2,249,494	1.91%	1.72%	1.51%
Negros Occidental	2,425,941	2,573,658	2,910,028	3,131,450	1.95%	1.72%	1.48%
Region VI	5,756,623	6,099,793	6,890,447	7,428,329	1.91%	1.72%	1.51%

(): PPDO Projection using uniform growth rate (1.51%)

Municipal Population

- 1) The total population of the province in 1998, 2005 and 2010 was fixed.
- 2) Municipal population for short/medium-term target years (1998 and 2005) is estimated using the experienced growth rates between 1990 and 1995. The municipal population estimated initially is adjusted in proportion to the population size of each municipality to the total provincial population, to meet the above mentioned provincial population fixed for the years 1998 and 2005. In this adjustment, the population of Tibiao in 1995 was fixed to avoid negative population growth.

For the year 2010 in the long-term, it is assumed that the tendency of population growth of respective municipalities between 1980 and 1995 will not change drastically in the future. Thus, recorded growth rate between 1980 and 1995 by municipality is firstly applied to project 2010 population from the year 2005. Then, the municipal population estimated initially is adjusted in the same manner mentioned above.

Table 8.3.3 presents census results (1980, 1990 and 1995) and projected population of the municipalities.

Table 8.3.3 Census results and Projected Population of Municipalities

Municipality	Census Result					Projected Population/Growth Rate								
	1980	1990	1995	GR		1998			2005			2010		
				1990-1995	1980-1995	Population		GR	Initial	Ad-	GR	Initial	Ad-	GR
						Initial	Ad-							
Anini-y	13,480	16,851	18,657	2.06%	2.19%	19,832	20,141	2.58%	22,870	23,932	2.52%	26,670	26,720	2.23%
Barbaza	14,703	14,984	17,313	2.93%	1.10%	18,881	19,175	3.46%	23,113	24,186	3.40%	25,540	25,588	1.13%
Belison	8,626	10,095	11,174	2.05%	1.74%	11,876	12,061	2.58%	13,690	14,326	2.52%	15,617	15,646	1.78%
Bugasong	21,619	24,537	26,721	1.72%	1.42%	28,124	28,561	2.25%	31,689	33,160	2.18%	35,587	35,653	1.46%
Calaya	10,901	16,243	17,101	1.03%	3.05%	17,637	17,912	1.56%	18,955	19,835	1.49%	23,047	23,090	3.69%
Culasi	25,674	29,719	30,431	0.47%	1.14%	30,866	31,347	0.99%	31,907	33,388	0.93%	35,334	35,400	1.18%
T. Fornier	22,511	25,816	26,155	0.26%	1.01%	26,361	26,771	0.78%	26,846	28,093	0.72%	29,533	29,588	1.04%
Hamtic	28,526	34,394	36,167	1.01%	1.59%	37,274	37,855	1.53%	39,992	41,848	1.47%	45,293	45,378	1.63%
Leau-an	18,785	19,865	21,069	1.18%	0.77%	21,826	22,166	1.71%	23,700	24,800	1.64%	25,767	25,815	0.81%
Libertad	9,870	11,049	13,274	3.74%	2.00%	14,819	15,049	4.27%	19,158	20,048	4.21%	22,129	22,170	2.03%
Pandan	20,396	23,894	24,978	0.89%	1.36%	25,652	26,051	1.41%	27,296	28,563	1.35%	30,559	30,616	1.40%
Pamongon	24,262	27,376	29,235	1.32%	1.25%	30,410	30,884	1.85%	33,340	34,888	1.78%	37,125	37,194	1.29%
San Jose	30,266	40,267	42,927	1.29%	2.36%	44,607	45,301	1.81%	48,786	51,050	1.75%	57,357	57,464	2.40%
San Remigio	19,208	21,683	22,869	1.07%	1.17%	23,612	23,980	1.59%	25,442	26,622	1.53%	28,216	28,269	1.21%
Sebaste	10,369	12,553	12,438	-0.18%	1.22%	12,370	12,562	0.33%	12,211	12,778	0.27%	13,577	13,602	1.26%
Sibakom	35,515	42,647	46,143	1.59%	1.76%	48,377	49,130	2.11%	54,018	56,526	2.05%	61,680	61,795	1.80%
Tibiao	17,200	20,192	19,628	-0.56%	0.88%	19,397	19,628	0.00%	18,547	19,628	0.00%	20,511	20,549	0.92%
Varderrama	12,968	14,197	15,433	1.65%	1.17%	16,226	16,478	2.21%	18,237	19,084	2.15%	20,223	20,261	1.20%
Province	344,879	406,361	431,713	1.22%	1.51%	448,046	455,05	1.77%	489,799	512,75	1.74%	553,768	554,797	1.59%

Note: Growth rates in 1998, 2005 and 2010 were calculated using geometric formula.

Population by Urban and Rural Area

1) Past population development

With regards to the ratios of the urban population of the province to the total population, the provincial averages in 1980 and 1990 were 20.7% and 28.9%, respectively. While it decreased to 26.1% in 1995. The provincial growth rate of 5.14% between 1980 and 1990 also decreased to -0.83% in 1995. On the contrary, the growth rates of rural population as the provincial average increased from 0.54% (1980 - 1990) to 2.01% (1990 - 1995).

The reason of the negative population growth of urban area between 1990 and 1995 is explained that classification of urban/rural barangays in the municipalities of Hamtic, Pandan, San Jose, etc. was considerably changed from that in 1990 Census time.

2) Projection of urban and rural population for the years 1998, 2005 and 2010

Urban population by municipality for the target years was at first projected and rural population was calculated to meet aforementioned total population fixing the urban population.

In the projection of municipal urban population, the followings are assumed by short/medium-term and long-term.

Short/Medium-term target: 1998 and 2005

The share of urban population in 1995 in terms of the profile of urban population to total population by municipality were basically adopted, assuming that the latest profile will not change drastically in short/medium-term period.

Long-term target: 2010

For the long-term projection, the recorded growth rates of urban population between 1980 and 1995 may be applied for the municipal population in 2010, assuming that the tendency of urban population in the long-term period will be stable reflecting the experiences in the past long term.

Under the above assumptions, provincial average share of urban population for the year 2010 arrived at 26.1%, same as the share in 1995. Table 8.3.4 presents projected urban and rural population. The growth rates and shares on rural population are calculated using estimated rural population.

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. 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 by year 2010.

The number of public school students by target year is then derived from the projected number of children who will attend school. With regard to the participation rate for public school enrollment, the existing participation rate (88%) of public school students to the total school age

Table 8.3.4 Population Projection by Urban and Rural Area:1998, 2005 and 2010

Municipality		1998		2005			2010			
		Total	Urban/ Rural	Total	Urban/ Rural	Share (%)	Total	Urban/ Rural	G.R. (%)	Share (%)
Urban Area	Anini-y	20,141	765	23,932	909	3.8%	26,720	1,014	2.19%	3.8%
	Barbaza	19,175	2,924	24,186	3,688	15.2%	25,588	3,895	1.10%	15.2%
	Belison	12,061	4,809	14,326	5,712	39.9%	15,646	6,226	1.74%	39.8%
	Bugasong	28,561	7,034	33,160	8,167	24.6%	35,653	8,765	1.42%	24.6%
	Caluya	17,912	5,540	19,835	6,135	30.9%	23,090	7,128	3.05%	30.9%
	Culasi	31,347	5,444	33,388	5,798	17.4%	35,400	6,137	1.14%	17.3%
	T. Fornier	26,771	4,407	28,093	4,625	16.5%	29,588	4,862	1.01%	16.4%
	Hamtic	37,855	4,181	41,848	4,623	11.0%	45,378	5,003	1.59%	11.0%
	Laua-an	22,166	3,775	24,800	4,223	17.0%	25,815	4,388	0.77%	17.0%
	Libertad	15,049	2,218	20,048	2,954	14.7%	22,170	3,261	2.00%	14.7%
	Pandan	26,051	3,126	28,563	3,427	12.0%	30,616	3,667	1.36%	12.0%
	Patnongon	30,884	4,739	34,888	5,353	15.3%	37,194	5,697	1.25%	15.3%
	San Jose	45,301	41,483	51,050	46,748	91.6%	57,464	52,523	2.36%	91.4%
	San Remigio	23,980	1,236	26,622	1,373	5.2%	28,269	1,455	1.17%	5.1%
	Sebaste	12,562	10,311	12,778	10,488	82.1%	13,602	11,144	1.22%	81.9%
	Sibalom	49,130	8,354	56,526	9,611	17.0%	61,795	10,488	1.76%	17.0%
	Tibiao	19,628	4,584	19,628	4,584	23.4%	20,549	4,790	0.88%	23.3%
	Varderrama	16,478	3,561	19,084	4,124	21.6%	20,261	4,370	1.17%	21.6%
	Province	455,051	118,491	512,755	132,542	25.8%	554,797	144,811	1.79%	26.1%
Rural Area	Anini-y	20,141	19,376	23,932	23,023	96.2%	26,720	25,706	2.23%	96.2%
	Barbaza	19,175	16,251	24,186	20,498	84.8%	25,588	21,693	1.14%	84.8%
	Belison	12,061	7,252	14,326	8,614	60.1%	15,646	9,419	1.80%	60.2%
	Bugasong	28,561	21,527	33,160	24,994	75.4%	35,653	26,889	1.47%	75.4%
	Caluya	17,912	12,372	19,835	13,701	69.1%	23,090	15,962	3.10%	69.1%
	Culasi	31,347	25,903	33,388	27,589	82.6%	35,400	29,263	1.19%	82.7%
	T. Fornier	26,771	22,363	28,093	23,468	83.5%	29,588	24,726	1.05%	83.6%
	Hamtic	37,855	33,673	41,848	37,226	89.0%	45,378	40,374	1.64%	89.0%
	Laua-an	22,166	18,391	24,800	20,577	83.0%	25,815	21,427	0.81%	83.0%
	Libertad	15,049	12,832	20,048	17,094	85.3%	22,170	18,909	2.04%	85.3%
	Pandan	26,051	22,925	28,563	25,136	88.0%	30,616	26,949	1.40%	88.0%
	Patnongon	30,884	26,145	34,888	29,534	84.7%	37,194	31,497	1.30%	84.7%
	San Jose	45,301	3,818	51,050	4,303	8.4%	57,464	4,941	2.80%	8.6%
	San Remigio	23,980	22,743	26,622	25,250	94.8%	28,269	26,814	1.21%	94.9%
	Sebaste	12,562	2,251	12,778	2,290	17.9%	13,602	2,458	1.43%	18.1%
	Sibalom	49,130	40,776	56,526	46,914	83.0%	61,795	51,307	1.81%	83.0%
	Tibiao	19,628	15,044	19,628	15,044	76.6%	20,549	15,759	0.93%	76.7%
	Varderrama	16,478	12,917	19,084	14,960	78.4%	20,261	15,891	1.21%	78.4%
	Province	455,051	336,560	512,755	380,213	74.2%	554,797	409,986	1.52%	73.9%

population is assumed to be kept both for year 2005 and 2010 (details are referred to Table 8.3.6, Supporting Report).

Table 8.3.5 shows the projected number of public school students by municipality, by target year. About 122,400 and 132,100 public school students are estimated to enroll for years 2005 and 2010, respectively.

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.

Table 8.3.5 Projected Public School Enrollment and Number of Public Utilities by Municipality

Name of Municipality	Number of Public School Student			Number of Public Utilities		
	1998	2005	2010	1998	2005	2010
Anini-y	3,892	4,979	6,254	5	6	7
Barbaza	4,095	5,395	6,044	2	3	4
Belison	2,294	2,786	3,246	2	3	4
Bugasong	5,602	7,071	8,078	2	4	5
Caluya	4,809	5,029	5,855	1	2	2
Culasi	6,888	7,790	8,745	2	3	4
Hamtic	9,232	10,705	12,252	2	3	3
Laua-an	4,933	5,873	6,452	2	2	3
Libertad	3,071	4,367	5,114	2	3	4
Pandan	6,936	7,156	7,670	2	3	3
Patnongon	15,266	13,660	9,040	2	3	4
San Jose de Buenavista	7,415	8,861	10,742	4	5	6
San Remigio	6,222	7,054	7,490	2	3	3
Sebaste	2,737	3,035	3,421	2	3	4
Sibalom	11,883	14,126	15,443	2	3	4
Tibiao	4,581	4,559	5,054	2	3	3
Tobias Fornier	5,338	5,447	6,120	2	3	3
Valderrama	3,876	4,464	5,035	2	3	4
Provincial Total	109,070	122,357	132,055	40	58	70

A total of eighteen (18) public utilities are planned to be constructed by year 2005 and another 12 by year 2010. Presently, the on-going ADB assisted project is proposing 3 public toilets to be constructed by year 2002, hence this is included in Phase I development. Refer to Table 8.3.5 for the 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.

Three (3) municipalities with a total urban population of about 37,000 are considered (refer to Table 8.5.4).

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

The number of urban households in 2004 is the potential households for the planning (refer to Table 8.3.5, Supporting Report).

8.4 Types of Facilities and Implementation Criteria

In principle, the types of facilities and their implementation criteria as prescribed in the NSMP and the NEDA Board Resolution No. 12 (s. 1995) are adopted to this PW4SP.

8.4.1 Water Supply

The following are the 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 in the planning, with due attention to merging of municipalities into an integrated water supply 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 as overall development strategy.

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 covering service level, utilization of existing facilities, water sources, and number of systems; and
- Recommendations for overall development strategy.

Table 8.4.1 presents a summary of the study results by municipality.

1) Review of existing water supply systems and water sources

The municipalities of Barbaza, Bugasong, Cilasi, Hamtic, Pandan, Patnongon, Sibalom and Tobias Fornier are served by WDs.

While the municipalities of Sebaste and Tibiao are served by Level III systems operated by the municipal government.

Population served by existing Level III systems range from about 2,000 persons at Patnongon WD to 24,000 persons at Pandan WD. The average size of served population is about 5,000 persons/system. Majority of the existing Level III systems in urban areas is utilizing deep well/spring sources.

Table 8.4.1 Summary of Urban Water Supply Development by Municipality/City (Antique)

Municipality	Existing Condition	On-going/Planned Project	Water Source Availability	Future Requirements
Anini-y	There is no Level III system.		DW: not sufficient discharge (acidic) SP: scattered & limited yield (potable) Future development: grouped springs	A new Level III system in use of spring sources is necessary.
Barbaza	There exists one WD, water source of which is the spring. This system serves two urban barangays for a total population of 3,366 and six rural barangays for 5,122 population.		DW: high yield & free flowing (slightly ironie), SP: sufficient but far from populated area (potable) Future development: priority to spring development, but DW is also available	Expansion of existing system with either spring or DW sources
Belison	There is no Level III system.		DW: high yield & free flowing (slightly ironie), SP: sufficient but far from populated area (potable) Future development: priority to spring, but DW is also available	A new Level III system in use of spring /deep well sources is necessary.
Bugason	The WD serves three urban barangays (4,866 people) and four rural barangays (4,078 people) in use of deep well source.		DW: high yield & free flowing (potable), SP: sufficient but far from populated area (potable) Future development: priority to spring development, but DW is also available	Expansion of existing system using existing DW source
Caluya	There exists no Level III system.		DW: risky (only shallow well), SP: only potential source Future development: SP, then radial well and/or surface water with due consideration of water quality	A new Level III system is necessary. Water source may be spring, while radial well is secondary choice.
Culasi	There are one each of WD and WWs, both of which use spring sources. These systems serve three urban barangays (5,603 people) and six rural barangays (5,700 people).		DW: high yield (potable) SP: sufficient discharge but far from populated area (potable) Future development: select thr. cost comparison between DW and SP	Expansion of existing system with the augmentation of spring sources
Hamtic	There exist one each of WD and WWs, both of which use deep wells (free flowing). The WD serves five poblacion barangays (3,995 people) and the WWs one rural barangay (1,243 people).		DW: high yield & free flowing (slightly ironie locally) SP: limited yield & far from populated area Future development: DW	Expansion of existing system with augmentation of deep well sources.
Laua-an	There is no Level III system.		DW: high yield (high iron content in the hilly area) SP: sufficient but far from populated area (potable) Future development: SP	A new system is necessary. Water source shall be determined through cost comparison between spring and deep well.
Libertad	There is no Level III system.		DW: not sufficient discharge (ironie locally) SP: scattered & limited yield (potable) Future development: grouped springs	A new system is necessary. A group of springs may be used.

Table 8.4.1 Summary of Urban Water Supply Development by Municipality/City (Antique) (Cont'd)

Municipality	Existing Condition	On-going/Planned Project	Water Source Availability	Future Requirements
Pandan	Newly constructed WD is servicing barangay poblacion, which utilizes spring source.		DW: low yield (ironic problem locally) SP: scattered, limited yield & far from populated area (potable) Future development: grouped springs together with deep wells	Expansion of existing system. A group of springs in combination of deep wells may be used.
Patnongon	One WD exists, water source of which is deep well. This system serves one urban barangay (4,699 people) and three rural barangays (3,226 people).		DW: high yield & free flowing (slightly ironic), SP: sufficient but far from populated area (potable) Future development: existing DW has enough capacity for expansion	Expansion of existing system. Existing deep well may be used for the purpose.
San Jose (capital)	The WWs utilizing spring source serves for nine urban barangays (19,285 people).		DW: high yield (salinity in the coast area), SP: sufficient but far from populated area (potable) Future development: DW	Expansion of existing system, water source of which shall be augmented by deep well.
San Remigio	There is no Level III system.		DW: high yield & free flowing (slightly ironic) SP: sufficient (potable) Future development: SP	A new system in use of spring source is necessary.
Sebasti	There is one WW which utilizes spring source. This system serves the barangay poblacion (2,885 people).		DW: high yield (slimy in the coast) SP: sufficient but far from populated area (potable) Future development: SP	Expansion of existing system entailing the augmentation of spring sources.
Sibalom	There is one WD, water source of which is deep well. This system serves two urban barangays (7,297 people) and four rural barangays (4,614 people).		DW: high yield & free flowing (ironic) SP: sufficient & near populated area (potable) Future development: SP	Expansion of existing system using DW/spring sources.
Tibiao	There exists one WWs, water source of which is the spring. This system serves two urban barangays (5,391 people) and one rural barangay (192 people).		DW: high yield (potable) SP: sufficient but far from populated area (potable) Future development: select thr. cost comparison between spring and DW	Expansion of existing system in either use of spring or deep well.
Tobias-Fornier	There exists one WD, water sources of which are the spring and DW. This system serves three urban barangays (3,683 people) and one rural barangay (394 people).		DW: not sufficient (ironic locally) SP: scattered & limited yield (potable) Future development: grouped springs	Expansion of existing system with the augmentation of spring sources.
Valderrama	There is no Level III system.		DW: risky SP: only potential source (potable) Future development: SP	A new system is necessary using spring source.

The remaining 7 municipalities, out of the total 18 municipalities have no Level III system in their urban areas and are presently served by Level II systems and/or Level I facilities.

2) Review of planned/on-going projects

There is no available information on planned/on-going projects during the course of PW4SP preparation.

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, 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 in the future to exclude, as individual cases, Level I and II facilities from being implemented in urban area.

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 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.

d. Number of systems

In principle, one (1) Level III system is considered for urban area of every municipality. In the municipalities with an 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 the respective systems of

the municipalities.

Possibility and necessity to merge service area of some neighboring municipalities to an urban water supply system were also studied from the viewpoint 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.

Any rural barangay/s being served by an existing urban Level III system are considered to continue throughout the future.

c. Rehabilitation

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

4) Overall development strategy

Expansion of the existing system/s was planned for those with WD/Level III, while creation of the system is considered for those without systems at present.

Merging of municipal systems (physical arrangement) in the long-term is considered. Integrated management systems shall also be sought. Conditions to be studied include; water source availability, willingness by concerned municipalities and technical study on cost recovery/economic construction.

Integration of small Level III systems for operation and management shall be sought, although these systems are currently managed individually.

Some municipalities may have high potential for spring development, however, a detailed survey to ensure appropriate development of spring sources shall be conducted in the implementation of the projects.

(2) Rural water supply

1) Service level

Level I systems (deep well/shallow well/developed spring) are generally planned for rural areas where houses are scattered. In the PW4SP, all of the required Level I facilities will be implemented under the on-going ADB-assisted project.

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 are 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 8.4.2 based on the water source evaluation results presented in Chapter 7. Conventional construction method (driven well) may be employed under favorable substrata or hydrogeological conditions. The standard structure of wells in application of "open-hole drilling and gravel pack" is presented in Figure 8.4.1, Supporting Report. In addition to this, for deep well with high iron content, application of iron removal facility is recommended. The standard structure of iron removal facility is presented in Figures 8.4.2 (a) and 8.4.2 (b), Supporting Report.

Table 8.4.2 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 by adopting ADB-assisted project.

For Level II systems, only untapped springs suitable for water supply purpose are considered. However, there was no information available for untapped springs during the course of PW4SP preparation.

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 yield of ground water 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 hydrogeological condition including existence of natural gravel at the expected aquifer.

It is important to study the potential areas 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 riser pipe 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 the Malawi type deep well pump with a cylinder that is currently used in the Philippines has operation experience of up to 40m in pumping water level, the diameter of riser pipe must be adjusted between 1" to 2-1/2" in order to lower required power at the pump handle (calculating required power under the specific pumping water level).

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

4) Number of systems/facilities

The number of Level I wells and spring development is estimated based on the service level standard; while the number of Level II systems coincides with the number of untapped springs.

5) Rehabilitation

Rehabilitation of existing Level I wells is not considered, since most of the wells constructed by driving method are not suitable for rehabilitation to recover their functions. Still, minor repair work for hand-pump 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 and/or VIP 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 taken into account.

(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. Since DECS is currently promoting the "one classroom-one toilet" concept, the PW4SP also adopts this concept on a 50-50 basis, that is 50% of the school toilet requirements will be allocated using the JICA-RESP design and the other 50% will be adopting the new concept.

(3) Public toilets

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

The standard design of DOH 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 at 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 2005. 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 & 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;
- physical targets under on-going ADB-assisted project;
- 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.

With regard to development of rural water supply, the on-going ADB-assisted Rural Water Supply and Sanitation Sector Project (RW3SP) is considered as a major role in the medium-term plan of PW4SP.

The physical targets of the province under the ADB-assisted project are construction of shallow well (195 units), deep well (113 units) and developed spring (28units). Although a total of 336 units were allocated to the recipient municipalities, the actual construction has not yet started to date. Accordingly, these physical targets may be included in the Phase I requirements of this plan (details are referred to Supporting Report).

Although utilization of untapped springs for Level II systems is given priority for rural water supply in this plan, Level I facilities under the ADB-assisted project are solely considered for rural water supply (Level II systems are excluded from proposed project).

Table 8.5.1 presents the service coverage by target year and by level of service as well as the additional population to be served (details are referred to Supporting Report).

Through Phase I development, approximately 41,400 persons in the province will be served by additional water supply services, of which 11,200 persons or 27% of the total will be urban population and 30,200 persons or 73% will be rural population.

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

Name of Municipality	Area	Phase I Coverage (2005)						Phase II Coverage (2010)					
		Total Population			Additional Population to be Served			Total Population			Service Coverage		
		Level III	Level II	Level I	Level III	Level II	Level I	Level III	Level II	Level I	Level III	Level II	Level I
Anini-y	Urban	909	499	598	99			99	1,014	963	864		864
	Rural	23,023	12,450	13,400			1,620	1,620	25,706	23,907		950	10,507
	Total	23,932	12,949	13,998	99		1,620	1,719	26,720	24,870	864	950	10,507
Barbaza	Urban	3,688	1,171	1,087	401			401	3,895	3,700	2,529		2,529
	Rural	20,498	9,536	11,538			1,350	1,350	21,693	20,027		18,172	8,636
	Total	24,186	10,713	12,625	401		1,350	1,751	23,586	20,744	2,529	18,172	8,636
Bellison	Urban	5,712	620	4,103	620			620	6,226	5,915	5,295		5,295
	Rural	8,614	4,981	5,631			90	90	9,420	8,761		650	3,130
	Total	14,326	9,084	10,354	620		90	1,010	15,646	14,521	5,295	650	3,130
Bugaong	Urban	8,167	5,753	991	887			887	8,765	8,327	2,574		2,574
	Rural	24,993	10,443	16,896			2,250	2,250	26,888	25,006		2,375	8,110
	Total	33,160	16,196	23,640	887		2,250	3,137	35,653	33,333	2,574	2,375	8,110
Caluya	Urban	6,135	5,107	5,107					7,128	6,772	6,772		6,772
	Rural	13,700	8,221	8,221			360	360	15,962	14,845		14,845	6,624
	Total	19,835	13,328	13,328			360	23,090	22,607	21,617	6,772	14,845	13,396
Culasi	Urban	5,798	5,085	5,085	630			630	6,137	5,830	745		745
	Rural	27,590	2,174	17,413	20,787			3,510	29,263	21,744	1,200	1,200	6,428
	Total	33,388	7,259	24,826	22,874			3,510	38,400	33,045	745	1,200	6,428
Hamtic	Urban	4,623	2,077	2,077	502			502	5,003	4,753	2,676		2,676
	Rural	37,225	617	18,747	21,489			810	40,375	37,549		2,125	16,060
	Total	41,848	2,694	20,824	22,976			810	45,375	42,302	2,676	2,125	18,736
Laua-an	Urban	4,223	459	3,009	459			459	4,388	4,169	3,710		3,710
	Rural	20,577	1,693	12,677	16,911			630	25,815	24,096	3,710	3,775	6,484
	Total	24,800	2,392	15,674	18,432			630	30,230	28,815	7,420	7,550	10,194
Libertad	Urban	17,094	321	6,557	8,532			450	18,909	17,585		1,975	9,053
	Rural	20,048	321	8,250	10,546			450	22,170	20,683	2,777	1,975	9,053
	Total	37,142	642	14,807	19,078			900	41,079	38,268	5,554	3,950	18,147
Pandani	Urban	3,427	2,883	2,883					3,667	3,484	601		601
	Rural	25,136	21,160	25,995			3,960	3,960	26,949	25,995		875	601
	Total	28,563	24,043	28,878			3,960	30,616	30,616	29,479	601	875	601
Pamompon	Urban	5,353	2,416	1,718	4,134			581	5,697	5,412	2,996		2,996
	Rural	29,535	165	15,219	19,834			3,150	31,497	29,292		4,450	9,458
	Total	34,888	2,581	16,937	23,968			3,150	37,194	34,704	2,996	4,450	12,454
San Jose de Buenavista (Capital)	Urban	46,748	15,038	150	38,333			5,078	52,523	49,897	34,859		34,859
	Rural	4,302	3,603	3,753			90	90	4,941	4,445	842	150	842
	Total	51,050	18,641	153,783	38,333		90	5,168	57,464	54,342	35,701	150	35,701
San Remigio	Urban	1,373	149	989	149			149	1,455	1,382	1,233		1,233
	Rural	25,249	20,697	23,147			4,950	4,950	26,814	22,487		2,450	1,790
	Total	26,622	21,846	24,285	149		4,950	5,099	28,269	24,974	1,233	2,450	1,790
Sebasti	Urban	10,488	2,885	800	5,231			1,144	10,587	10,587	7,702		7,702
	Rural	2,290	75	3,002	3,077			1,530	2,458	3,077		75	3,077
	Total	12,778	3,937	11,993	8,308			2,664	13,045	13,664	7,702	75	7,702

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

Name of Municipality	Area	Phase I Coverage (2005)						Phase II Coverage (2010)					
		Total Population			Service Coverage			Additional Population to be Served			Service Coverage		
		Level III	Level II	Total	Level III	Level II	Total	Level III	Level II	Total	Level III	Level II	Total
Sibolom	Urban	9,611	5,658	75	2,375	8,108	1,044	810	810	1,044	9,964	4,306	4,306
	Rural	46,915	486	23,662	27,148		810	810		810	44,230	47,716	20,568
	Total	56,526	6,144	3,075	26,037	35,256	1,044	1,854	810	1,854	44,230	57,680	24,874
Tibiao	Urban	4,584	1,228	2,561	3,789		720	720		720	4,551	3,323	3,323
	Rural	15,044	1,318	2,650	7,745	11,713		720	720		10,688	14,656	2,943
	Total	19,628	2,546	10,306	15,502		720	720		720	10,688	14,656	2,943
Tobias Fornier	Urban	4,625	3,683	150	3,833						4,619	936	936
	Rural	23,468	394	13,251	17,595		3,600	3,600	3,600	3,600	18,651	22,995	5,400
	Total	28,093	4,077	4,100	21,428		3,600	3,600	3,600	3,600	18,651	27,614	936
Valderama	Urban	4,124	448	2,178	2,626	448		448		448	4,152	3,704	3,704
	Rural	14,960		7,574	7,574		360	360	360	360	14,779	14,779	7,205
	Total	19,084	448	9,752	10,200	448	808	808	808	808	14,779	18,931	3,704
Provincial Total	Urban	132,542	49,973	1,375	54,686	106,034	11,219	11,219	11,219	11,219	137,575	87,602	87,602
	Rural	380,213	32,394	196,729	259,773		30,240	30,240	30,240	30,240	319,967	383,011	123,238
	Total	512,755	82,367	32,025	251,415	365,807	11,219	30,240	41,459	554,798	169,969	520,586	123,238

For Phase II period, a total of 210,800 persons, of which 87,600 persons or 42% in urban area and 123,200 persons or 58% in rural area, will be further benefited by water supply services. This additional service coverage in urban area includes the upgrade of service level for 56,000 persons served by Level I and II facilities in 1998.

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 2005 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.

Phase I service coverage will include the proposed household toilets of the on-going ADB assisted project in the province with a total of 2,550 units of pour-flush toilets. Construction/installation is expected to complete in 2002.

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 the base year or in Phase I (details are referred to Supporting Report).

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 86,315. Additional households to be served totaled to 21,437 of which 23% is urban households

and 77% is rural households. Of this requirement, a total of 2,250 units of pour flush toilets will be absorbed by the on-going ADB assisted project. While at the end of Phase II period, the number of served households are 125,922 with additional households to be served at 42,656. Table 8.5.2 provides the number of households to be served by target year for urban and rural areas by municipality.

(2) School toilets

The service coverage or the number of public school students to be served is estimated by municipality for the years 2005 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.

Phase I development will include the proposed school toilets under the on-going ADB assisted project in the province with a total of 4 units of school toilets to be situated in each classroom.

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

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 97,886. The additional students to be served are 38,985 inclusive of about 960 students to be covered by the on-going ADB assisted project. While at the end of Phase II period, the projected number of served students are 118,853 with additional students to be served at 21,637. Table 8.5.3 summarizes the number of public school students to be served by target year.

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

Name of Municipality	Area	Phase I Coverage (2005)										Phase II Coverage (2010)									
		Total Households					No. of Served Households					Total Households					No. of Served Households				
		Flush	Pour	VIP/Dry	Total	Add'l. No. of Households to be Served	Flush	Pour	VIP/Dry	Total	Household	Flush	Pour	VIP/Dry	Total	Add'l. No. of Households to be Served	Flush	Pour	VIP/Dry	Total	Household
Amin-y	Urban	160	22	115	7	144	12	13	7	32	254	118	111	7	236	96					96
	Rural	4,156	99	2,826	608	3,533	85	483	383	951	6,437	99	5,077	608	5,784			2,251			2,251
	Total	4,316	121	2,941	615	3,677	97	496	390	983	6,681	217	5,188	615	6,020	96		2,251			2,347
Barbaza	Urban	692	93	498	32	623	54	87		141	974	453	421	32	906	360					360
	Rural	3,980	169	2,706	508	3,283	104	895	272	1,271	5,423	488	3,885	508	4,881	319		1,179			1,498
	Total	4,672	262	3,204	540	4,006	158	982	272	1,412	6,397	941	4,306	540	5,787	679		1,179			1,858
Belison	Urban	1,078	146	776	48	970	136	32		168	1,557	724	676		1,448	578					578
	Rural	1,719	73	1,169	219	1,461	62	169		231	2,355	73	1,828	219	2,120	659					659
	Total	2,797	219	1,945	267	2,431	198	201		399	3,912	797	2,504	267	3,568	1,237					1,237
Bugasong	Urban	1,595	215	1,149	72	1,436	187	339		526	2,191	1,019	947	72	2,038	804					804
	Rural	4,910	209	3,339	626	4,174	99	1,707	40	1,846	6,722	605	4,819	626	6,050	396		1,480			1,876
	Total	6,505	424	4,488	698	5,610	286	2,046	40	2,372	8,913	1,624	5,766	698	8,088	1,200		1,480			2,680
Caluya	Urban	1,158	104	834	104	1,042		216	101	317	1,782	829	724	104	1,657	725					725
	Rural	2,580	104	1,794	439	2,193		422	416	838	3,991		3,153	439	3,592	1,399					1,399
	Total	3,738	208	2,588	543	3,235		638	517	1,155	5,773	829	3,877	543	5,249	2,124					2,124
Culasi	Urban	1,146	155	825	51	1,031	155	4		159	1,534	714	662	51	1,427	559					559
	Rural	5,485	314	3,750	618	4,662		2,015	70	2,085	7,316	658	5,308	618	6,584	344		1,578			1,922
	Total	6,631	469	4,555	669	5,693	155	2,019	70	2,244	8,850	1,372	5,970	669	8,011	903		1,578			2,481
Hamtic	Urban	908	123	654	40	817	50	68		135	1,251	582	541	40	1,163	459					459
	Rural	7,145	304	4,858	911	6,073	255	1,138	223	1,616	10,094	617	7,557	911	9,085	313		2,699			3,012
	Total	8,053	427	5,512	951	6,890	305	1,206	240	1,751	11,345	1,199	8,098	951	10,248	772		2,699			3,471
Laue-an	Urban	838	113	603	38	754	108	232	38	378	1,097	510	472	38	1,020	397					397
	Rural	4,260	181	2,897	543	3,621	179	626		805	5,357	181	4,097	543	4,821	1,200					1,200
	Total	5,098	294	3,500	581	4,375	287	858	38	1,183	6,454	691	4,369	581	5,841	397		1,200			1,597
Libertad	Urban	561	76	404	25	505	67	68		160	815	379	354	25	758	303					303
	Rural	3,102	132	2,110	395	2,637	128	908		1,036	4,727	132	3,727	395	4,254	1,617					1,617
	Total	3,663	208	2,514	420	3,142	195	976	25	1,196	5,542	511	4,081	420	5,012	303		1,617			1,920
Pandam	Urban	705	112	508	15	635		127		127	917	427	411	15	853	315					315
	Rural	5,047	256	3,432	602	4,290		226	388	614	6,737	606	4,855	602	6,063	350		1,423			1,773
	Total	5,752	368	3,940	617	4,925		353	388	741	7,654	1,033	5,266	617	6,916	665		1,423			2,088
Panongon	Urban	1,060	143	811		954	118	19		137	1,424	662	662		1,324	519					519
	Rural	5,991	255	4,074	763	5,092	161	705		866	7,874	165	6,159	705	7,087	2,085					2,085
	Total	7,051	398	4,885	763	6,046	279	724		1,003	9,298	827	6,821	763	8,411	519		2,085			2,604
San Jose de Buenavista (Capital)	Urban	9,060	1,223	6,523	408	8,154	404	1,145		1,549	11,331	6,106	5,698	408	12,212	4,883					4,883
	Rural	878	220	526		746		23		23	1,235	220	892		1,112	366					366
	Total	9,938	1,443	7,049	408	8,900	404	1,168		1,572	14,366	6,326	6,590	408	13,324	5,249					5,249
San Remigio	Urban	285	30	206	12	257	39	53		92	364	170	157	12	359	131					131
	Rural	4,737	243	3,221	562	4,076		1,586	106	1,692	6,704	243	5,229	562	6,034	2,008					2,008
	Total	5,022	282	3,427	574	4,283	39	1,639	106	1,784	7,068	413	5,386	574	6,373	2,139					2,139

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

Name of Municipality	Area	Total Households	Phase I Coverage (2005)						Phase II Coverage (2010)					
			No. of Served Households			Add'l. No. of Households to be Served			No. of Served Households			Add'l. No. of Households to be Served		
			Flush	Pour	Total	Flush	VIP/Dry	Total	Flush	Pour	Total	Flush	VIP/Dry	Total
Sebasic	Urban	2,089	282	1,598	1,880	135		135	1,296	1,295	2,591	1,014		1,014
	Rural	448	19	305	381	19	30	49	19	478	57	554	173	173
	Total	2,537	301	1,903	2,261	154	30	184	1,315	1,773	3,088	1,588	173	1,761
Sibolom	Urban	1,817	245	1,308	1,635	229	9	238	1,219	1,137	2,356	974		974
	Rural	9,057	385	6,158	7,698	372	944	1,316	1,316	1,316	2,632	1,316		2,632
	Total	10,874	630	7,466	9,333	601	953	1,554	2,535	2,652	5,288	2,290		5,288
Tibiao	Urban	982	133	707	884	27	62	89	1,198	557	1,755	424		424
	Rural	3,076	131	2,092	2,615	131	134	265	3,940	355	4,295	707		707
	Total	4,058	264	2,799	3,499	158	196	354	5,138	912	5,230	1,131		1,131
Tobias Fornier	Urban	866	117	623	779	92	179	271	1,216	566	1,782	449		449
	Rural	4,675	199	3,179	3,974	20		20	6,182	394	6,576	1,395		1,395
	Total	5,541	316	3,802	4,753	112	179	291	7,398	960	8,358	1,844		1,844
Valderrama	Urban	825	111	594	743	111	55	166	1,093	508	1,601	397		397
	Rural	2,957	126	2,010	2,513	126	696	822	3,973	126	4,099	644		644
	Total	3,782	237	2,604	3,256	237	751	988	5,066	634	5,700	1,041		1,041
Provincial Total	Urban	25,825	3,452	18,736	23,243	1,924	2,708	4,632	36,206	16,839	53,045	13,387		13,387
	Rural	74,203	3,315	50,386	63,072	1,741	12,707	14,448	102,499	5,467	107,966	2,342		2,342
	Total	100,028	6,767	69,122	86,315	3,665	15,415	21,437	138,705	22,306	160,011	15,729		15,729

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

Name of Municipality	Phase I Coverage (2005)			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
Anini-y	4,979	5,639	1,747	6,254	5,629	
Barbaza	5,395	3,333	1,893	6,044	5,440	2,107
Belison	2,786	2,294		3,246	2,921	627
Bugasong	7,071	6,401	2,481	8,078	7,270	869
Caluya	5,029	3,205	1,765	5,855	5,270	2,065
Culasi	7,790	5,934	2,734	8,745	7,871	1,937
Hamtic	10,705	8,557	3,757	12,252	11,027	2,470
Laua-an	5,873	4,221	2,061	6,452	5,807	1,586
Libertad	4,367	2,733	1,533	5,114	4,603	1,870
Pandan	7,156	5,231	2,511	7,670	6,903	1,672
Patnongon	13,660	8,714	4,794	9,040	8,136	
San Jose de Buenavista	8,861	9,750	3,110	10,742	9,668	
San Remigio	7,054	4,635	2,475	7,490	6,741	2,106
Sebaste	3,035	2,737		3,421	3,079	342
Sibalom	14,126	13,437	4,957	15,443	13,899	462
Tibiao	4,559	3,600	1,600	5,054	4,549	949
Tobias Fornier	5,447	5,338		6,120	5,508	170
Valderrama	4,464	2,127	1,567	5,035	4,532	2,405
Provincial Total	122,357	97,886	38,985	132,055	118,853	21,637

(3) Public toilets

The service coverage of public utilities with sanitary toilet facility by municipality is estimated for the years 2005 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.

There are 32 public utilities to be constructed for the medium-term plan. Among them, the ADB assisted project proposes 3 units of public toilets in the province to be constructed within the Phase I period. Twelve (12) public toilets to be located in public

markets/bus terminals/parks are to be constructed by year 2010. Table 8.5.4 reflects the distribution of these public toilets by municipality.

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

Name of Municipality	Type	Phase I Coverage (2005)		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
Anini-v	Public Market		6		6
	Bus/JEEPNEY Terminal			1	1
	Parks/Playground	1	5		5
	Total	1	11	1	12
Barbaza	Public Market	3	3		3
	Bus/JEEPNEY Terminal				
	Parks/Playground			1	1
	Total	3	3	1	4
Belison	Public Market	2	2		2
	Bus/JEEPNEY Terminal	1	1		1
	Parks/Playground			1	1
	Total	3	3	1	4
Bugasong	Public Market	1	3	1	4
	Bus/JEEPNEY Terminal				
	Parks/Playground	1	1		1
	Total	2	4	1	5
Caluya	Public Market				
	Bus/JEEPNEY Terminal				
	Parks/Playground	1	1		1
	Total	1	1		1
Culasi	Public Market		2		2
	Bus/JEEPNEY Terminal			1	1
	Parks/Playground	1	1		1
	Total	1	3	1	4
Hamtic	Public Market		2		2
	Bus/JEEPNEY Terminal				
	Parks/Playground	1	1		1
	Total	1	3		3
Laua-an	Public Market		2	1	3
	Bus/JEEPNEY Terminal				
	Parks/Playground				
	Total		2	1	3
Libertad	Public Market	2	2	1	3
	Bus/JEEPNEY Terminal				
	Parks/Playground	1	3		3
	Total	3	5	1	6
Pandan	Public Market		2		2
	Bus/JEEPNEY Terminal				
	Parks/Playground	1	1		1
	Total	1	3		3
Patnongon	Public Market		2	1	3
	Bus/JEEPNEY Terminal				
	Parks/Playground	1	1		1
	Total	1	3	1	4
San Jose de Buenavista	Public Market	1	5		5
	Bus/JEEPNEY Terminal	2	2	1	3
	Parks/Playground				
	Total	3	7	1	8

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

(Cont'd)

Name of Municipality	Type	Phase I Coverage (2005)		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
San Remigio	Public Market	3	3		3
	Bus/JEEPNEY Terminal				
	Parks/Playground				
	Total	3	3		3
Sebasté	Public Market	3	3		3
	Bus/JEEPNEY Terminal				
	Parks/Playground			1	1
	Total	3	3	1	4
Sibalom	Public Market		2		2
	Bus/JEEPNEY Terminal	1	1		1
	Parks/Playground			1	1
	Total	1	3	1	4
Tibiao	Public Market		2		2
	Bus/JEEPNEY Terminal				
	Parks/Playground	1	1		1
	Total	1	3		3
Tobias Fornier	Public Market	2	2		2
	Bus/JEEPNEY Terminal	1	1		1
	Parks/Playground				
	Total	3	3		3
Valderrama	Public Market		2		2
	Bus/JEEPNEY Terminal			1	1
	Parks/Playground	1	1		1
	Total	1	3	1	4
Provincial Total	Public Market	17	45	4	49
	Bus/JEEPNEY Terminal	5	5	4	9
	Parks/Playground	10	16	4	20
	Total	32	66	12	78

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.

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
San Jose de Buenavista	52,523	49,897	26,262
Sebasté	11,144	10,587	5,572
Sibalom	10,488	9,964	5,244
Provincial Total	144,813	137,575	37,078

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 80% with reference to the present service coverage of 60% 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 8.5.6 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 (2005)		
		No. of Urban Households	Urban Households Coverage	Add'l. No. of Urban Households to be Served
Anini-y		160	128	128
Barbaza		692	554	554
Belison		1,078	863	863
Bugasong	2,105	1,595	2,105	
Caluya		1,158	927	927
Culasi	1,057	1,146	1,057	
Hamtic	615	908	727	112
Lava-an	312	838	671	359
Libertad		561	449	449
Pandan	855	705	855	
Patnongon	1,520	1,060	1,520	
San Jose de Buenavista	4,310	9,060	7,248	2,938
San Remigio		285	228	228
Sebaste		2,089	1,672	1,672
Sibalom	2,705	1,817	2,705	
Tibiao		982	786	786
Tobias Fornier	489	866	693	204
Valderrama		825	660	660
Provincial Total	13,968	25,825	23,848	9,880

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).

Table 8.6.1 Water Supply Facilities Required by Target Year

Name of Municipality	Phase I (2005) 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. Water Source	No. of HHs Connection	Level II		Level I				No. of Add'l. Water Source	No. of HHs Connection	Level I				No. of Shallow Wells	Total No. of Wells						
				No. of System	No. of Communal Faucets	40 m	80 m	120 m	Sub-total			40 m	80 m	120 m	Sub-total								
Antim-y	New	1	17			10			10	19	216	88			88			88			88	176	
Barbaza	Expansion	1	75			6			6	11	632	44			44			44			44	144	
Bellison	New	1	117			1			1	1	1,324	22			22			22			22	53	
Bugasong	Expansion	1	173			6			6	23	644	28			28			28			28	136	
Caluya	N/A									5	1,693											111	
Culasi	Expansion	1	125			10			10	37	47	186	22			22			22			22	108
Hamtic	Expansion	1	99			9			9	1	10	669	242			242			242			242	268
Lau-an	New	1	91			2			2	7	9	928	22			22			22			22	109
Libertad	New	1	61			1			1	4	5	694	16			16			16			16	151
Pandan	N/A					11			11	42	53	150											
Panongon	Expansion	1	115			31			31	12	43	749	111			111			111			111	158
San Jose de Buenavista	Expansion	1	984			1			1	1	5	8,715	15			15			15			15	15
San Remigio	New	1	31			7			7	55	62	308	3			3			3			3	30
Sebasto	N/A					2			2	18	20	2	1,926										
Sibalom	Expansion	1	197			4			4	6	10	1,077	138			138			138			138	243
Tibiao	N/A					1			1	9	10	1	831	5		5			5			5	45
Tobias Fornier	N/A					44			44	4	48	1	234	81		81			81			81	90
Valderama	New	1	90			1			1	4	5	926	13			13			13			13	121
Provincial Total	Exp.-7 New-6	13	2,175			147			147	247	394	21,902	850			850			850			850	2,063

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 implemented as expansion of existing system or construction of a new system. The number of water sources was also estimated based on the 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 facilities were first 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.

As for Level I facilities, the required facilities for Phase I will be implemented by public (LGUs) under ADB-assisted project. For Phase II, 50% of the total required facilities will be implemented by public (LGUs).

(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 hand-pump 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- 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 113 Level I deep wells shall be newly constructed under ADB-assisted project and 10% of these deep wells shall be rehabilitated annually. The DEO-DPHW (in San Jose Buenavista) has one unit of rotary type drilling rig procured in 1982, but it is not operational at present.

Therefore, at least 3 sets of drilling rigs (medium size percussion type) together with 3 units of service truck for deep well construction shall be mobilized by private sector to implement ADB-assisted project. Aside from this, one set of well rehabilitation equipment and one unit of support vehicle for well rehabilitation shall be procured by the province (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 was considered to be procured in the long-term development period.

(4) Laboratory

The provincial government is a recipient of the on-going ADB-assisted project. This project will provide 3 water quality laboratories for the municipalities of Bugasong, Culasi and T. Fornier.. Aside from this, the province has a plan to establish another labo-

ratory at district hospital in Pandan for the medium term requirement. The following are the requirements:

		New Laboratory Pandan	
Item	Unit		
1. Instrument/Equipment			
Turbidity meter	set		1
Color meter	set		1
pH/Residual chlorine checker	set		1
Incubator	set		1
Refrigerator	set		1
Sterilizer	set		1
Portable water quality testing kit	set		1
Electric stove	set		1
Range hood	set		1
2. Glassware/Chemical	set		1
3. Accessory			
Sink	set		1
Working table	set		1
Shelf	set		1
Office desk	set		1
Chair	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 (refer 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 or a toilet in every classroom (50-50 sharing) and the additional students to be served by target (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.

Table 3.6.2 Sanitation Facilities Required by Target Year

Name of Municipality	Phase I (2005) Requirements										Phase II (2010) Requirements										
	Urban Sanitation					Rural Sanitation					Urban Sanitation					Rural Sanitation					
	No. of Households			No. of Public Sch. Toilets	No. of Public Toilets	No. of Households			No. of Public Sch. Toilets	No. of Households			No. of Public Sch. Toilets	No. of Households			No. of Public Toilets	No. of Households			
	Flush	Pour Flush	VIP/ Dry			Total	Flush	Pour Flush		VIP/ Dry	Total	Flush		Pour Flush	VIP/ Dry	Total		Flush	Pour Flush	VIP/ Dry	Total
Antivay	12	13	7	32		1	85	483	383	951	8	96								2,251	27
Burpaza	54	87		141	1	3	104	895	272	1,271	8	360				1	319	1,179		1,498	23
Belison	136	32		168		2	62	169		231		578				1		659		659	9
Bugamora	187	319		506	3	1	99	1,707	40	1,846	9	804					396	1,490		1,876	27
Caluya		216	101	317	3			422	416	838	6	725						1,399		1,399	18
Cubai	155	4		159	2			2,015	701	2,085	11	559	2			1	344	1,578		1,922	33
Hamac	50	68		118			255	1,138	223	1,616	17	459					313	2,699		3,012	49
Lau-an	108	232	38	378	2		179	626		805	9	397				1		1,200		1,200	24
Libertad	67	68	25	160		2	128	908		1,036	7	303					350	1,617		1,617	20
Pandan		127		127	2			226	388	614	11	315						1,773		1,773	30
Panayon	118	19		137	4		161	705	866	20	519							2,085		2,085	34
San Jose de Buenavista (C)	404	1,145		1,549	14	2		23	21	21	1	4,883				1		366		366	4
San Remigio	39	53		92		3		1,586	106	1,692	12	131						2,008		2,008	32
Serbate	135			135		3	19	30		49		1,014						173		173	3
Sibauon	229	9		238	4		372	944		1,316	21	974				1	101	3,745		3,846	58
Tibao	27	62	5	94	2		131	134	228	493	6	424					224	707		931	17
Tobias Fornier	92	179		271		1	20			20		449					195	1,395		1,590	23
Valderama	111	55	38	204	2		126	696		822	6	397						1,063		1,063	18
Provincial Total	1,924	2,708	231	4,863	41	17	5	10	1,741	12,707	2,126	16,574	152	13,387	14	4	4	2,342	27,027	29,369	449

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 is estimated for the urban area in Phase I. Thirteen (13) additional units of truck are required to meet assumed service coverage as reflected in Table 8.6.3.

Table 8.6.3 Number of Refuse Collection Trucks Required in Phase I

Name of Municipality	Additional Urban Households to be Served	Estimated Daily Amount of Refuse to be Generated, (Kg)	Number of Collection Truck Required
Anini-y	128	54	1
Barbaza	554	232	1
Belison	863	361	1
Bugasong			
Caluya	927	388	1
Culasi			
Hamtic	112	47	1
Laua-an	359	151	1
Libertad	449	188	1
Pandan			
Patnongon			
San Jose de Buenavista	2,938	1,229	1
San Remigio	228	96	1
Sebaste	1,672	699	1
Sibalom			
Tibiao	786	329	1
Tobias Fornier	204	86	1
Valderrama	660	276	1
Provincial Total	9,880	4,136	13

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 will not be discussed in the 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 future expansion work for WDs.

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