7. WATER SOURCE DEVELOPMENT

7.3 Groundwater Sources

7.3.2 Groundwater Availability in the Province

(1) Major Information and References

The Groundwater Availability Map was prepared using the following information and reference (detailed list of reference is presented in Table 7.1.2, Data Report):

- Administrative and Topographical Maps of the Province published by NAMRIA with scales of 1:250,000 and 1:50,000, respectively.
- Geological Map of the Philippines published by BMGS with a scale of 1:1,000,000.
- Water Resource Investigation conducted by NWRB, 1986.
- Well Inventory Database prepared by NWRB, LWUA and DPWH.
- Well Inventory Database in the province.
- General information on groundwater condition by DPWH-DEO and PPDO.
- Well Log Data by DPWH-DEO and PEO.
- Water source information by Water Districts.

(2) Approach and Methodology

The procedure in preparing the Groundwater Availability Map is explained below with workflow depicted in Figure 7.3.1.

1) Prepare a base map with an approximate scale of 1:250,000 (fit to the A4 map size). The topographical map of NAMRIA (1:250,000) was used as a reference map. Basic information including rivers and provincial and municipal boundaries are indicated in the prepared base map.

2) The groundwater potential areas, based on the geology of the province, are delineated on the base map. The Recent alluvial and/or beach deposits, Pliocene-Quaternary sedimentary formation (clay, silt, sand and gravel) and Pliocene-Quaternary volcanic rock units (pyroclastics, debris flow and tuff) are regarded as possible aquifers considering their high porosity and permeability.

Boundaries between groundwater development potential area and difficult area were defined and delineated as presented in Figure 7.3.1, Main Report.

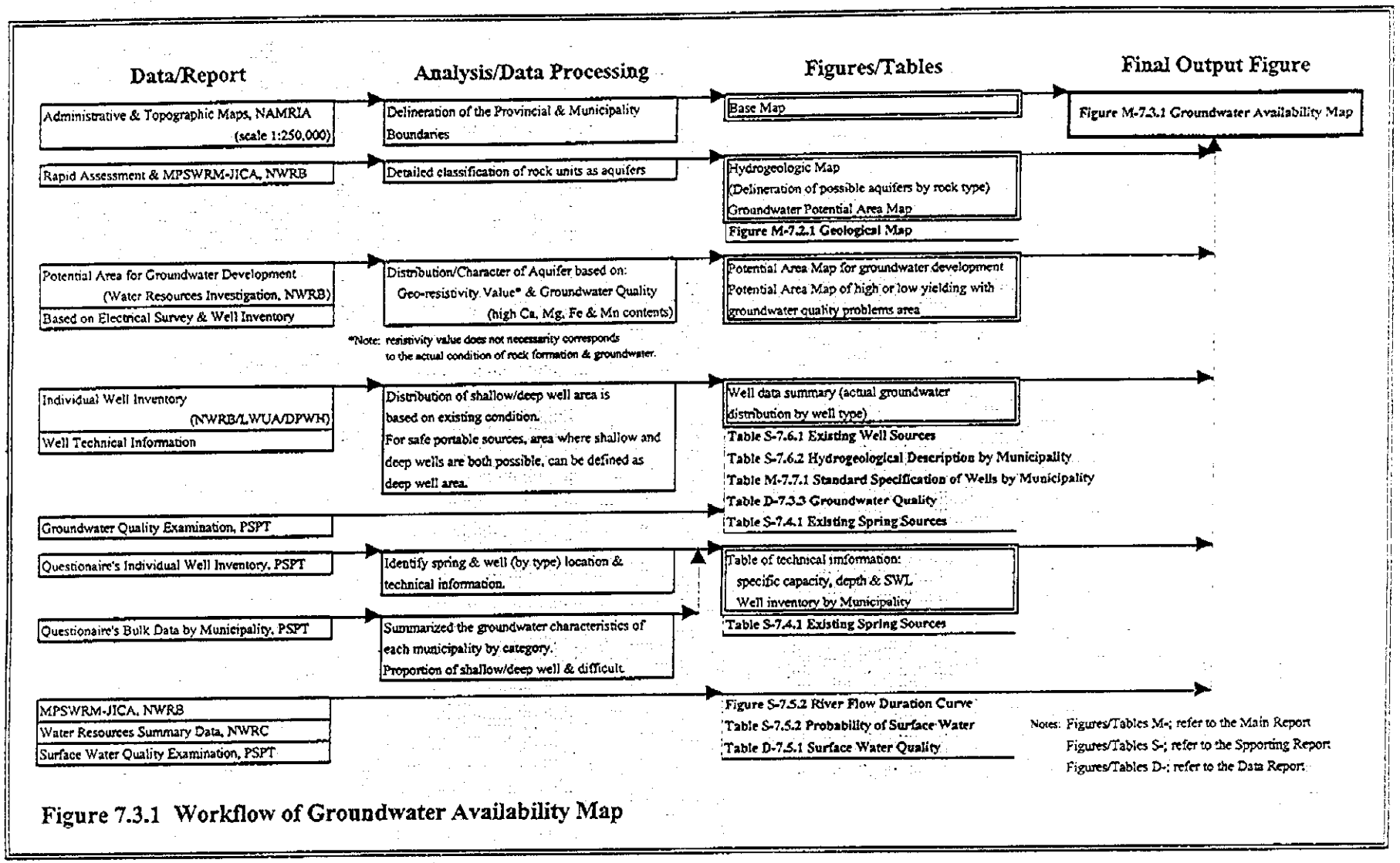


Figure 7.3.1 Workflow of Groundwater Availability Map

3) Areas with potential high yielding aquifer in the Water Resources Investigation of NWRB, are reflected in the defined groundwater potential areas.

Based on the results of electric resistivity survey of the above investigation, resistivity values from 20 to 210 ohm-meter indicate a potential high yielding formation. Values less than 10 ohm-meter suggest clayey layer. Figure 7.3.1, Main Report, shows the boundaries of areas with high and low yielding aquifers.

4) Delineate shallow and deep well areas based on well database of NWRB and DPWH central office, well inventory of DPWH-DEO and rock distribution. Figure 7.3.2 presents the categorization in terms of groundwater utilization.

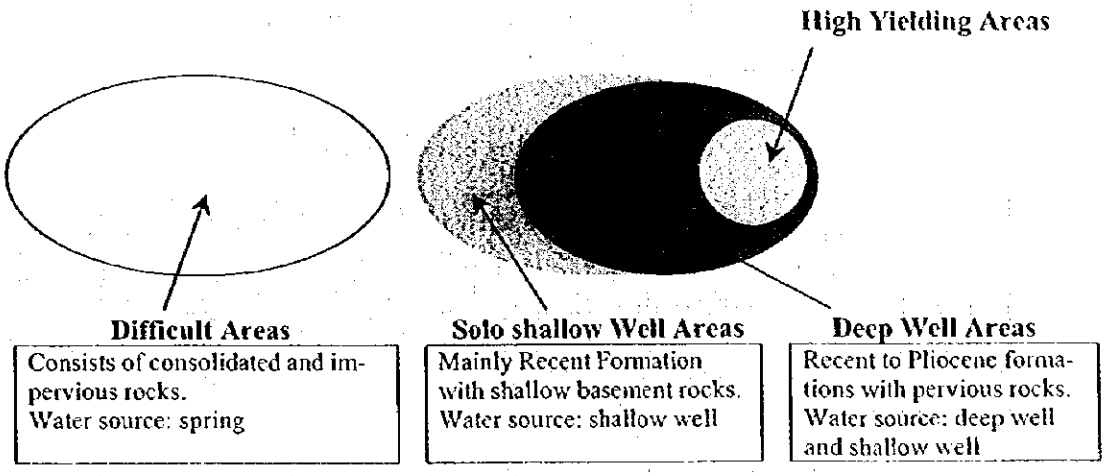


Figure 7.3.2 Area Category by Groundwater Utilization

Solo shallow well areas are defined on the following basis:

(a) Predominance of serviceable shallow wells and presence of deep wells with water quality problem and/or low yielding aquifers.

(b) Occurrence of impervious rocks beneath the Recent formation at shallow depth.

5) Based on the information provided by NWRB's well inventory and the data obtained through the questionnaires, well specification for each municipality is established as shown in the map. These specifications are used as references in evaluating the groundwater availability in each locality. Individual well locations with technical information are presented in Figure 7.6.1, Data Report.

(3) Future Updating and Utilization of the Map

For future updating of the map, the following procedure shall be employed.

1) Referring to the results of any supplementary water sources investigation by various agencies, re-define the potential area for groundwater development by applying the aforementioned procedures.
2) Update the provincial database using the questionnaire made for the study to make necessary revision of the delineated boundaries of groundwater categories.

7.4 Spring Sources

The numbers and discharge of developed and untapped springs by municipality are shown in Table 7.4.1. The dividing discharge of 2.0 lps for existing developed spring sources means that this capacity is enough for Level II water supply and can be applied to upgrade small Level III water supply. The data are derived from the questionnaires and Table 7.1.1 Water Source Information, Data Report. In addition to this, untapped spring information was not available during this study period.

Table 7.4.1 Existing Spring Sources

Municipality	No. of Developed Spring		Untapped Spring (not available at present)		
	Q<2.0 lps	Q>2.0 lps	No.	Ave. lps	Range lps
Almeria	0	0	-		~
Biliran	0	2	-		~
Cabucgayan	0	0	-		~
Caibiran	14	0	-		~
Culaba	0	14	-		~
Kawayan	0	0	-		~
Maripipi	3	1	-		~
Naval	0	0	-		~

Note: Ave. lps & Range lps mean the average discharge and the range of discharges in lps (liter/second), respectively.

7.5 Surface Water Sources

The major rivers in the province were selected to evaluate their potential as water supply sources to meet the future water needs of the province. The following criteria were adopted for the selection:

- rivers which have been utilized for domestic purpose,
- rivers which mouth is located in the vicinity of urban area,
- rivers which have gauging stations, and
- rivers with watershed of 10 km^2 or more.

Based on the above criteria, the selected major rivers are Anas (Kawayan), Amambahag, Mapula, Cabuegayan, Santol, Caray-caray, Anas (Naval) and Bagombong Rivers as shown in Figure 7.5.1 River Network Map.

There is no gauging station in the province of Biliran. Two gauging stations in the province of Leyte are selected with due consideration of the same climate pattern of Biliran Island, since the specific discharges of 2 gauging stations were applied for the said figures of major rivers in the province. The runoff records are obtained from the "Philippine Water Resources Summary Data" prepared by the NWRC in 1980. The information on the present uses (water rights) of the major rivers in the province is summarized in Table 7.5.1.

(1) Surface Water Utilization/Water Rights

As seen in Table 7.5.1, the present water uses in the watershed of major rivers total to 0.04 m^3/sec (about 3,500 m^3/day). The diversions for major flume, which are operated by private associations, are located at Naval, Caray-caray River. These water rights were registered in the 1970's.

(2) River Flow Analysis

The flow duration curves of major rivers in the province of Leyte, derived from the available runoff records, are shown in Figure 7.5.2.

The stream flow, maintenance flow, diversion flow and return flow are usually used to estimate the exploitable surface water potential. In this study, the stream flow was considered as the flow potential for domestic use and the diversion flow value was treated as the equivalent to the discharge of water rights registration in surface water use. No detailed study on the return flow has been performed yet due to the difficulties in investigating the irrigation, evapotranspiration and recharge value to groundwater, etc. within the entire watersheds in the province. Therefore, the return flow was not considered for the estimation of exploitable potential.

It is generally accepted that to secure the required volume for water supply, each water use sector adopts the different return periods. Usually, the dependability of domestic water supply is taken to be 90% or higher (10-year or longer return-period) of the whole hydrological period.

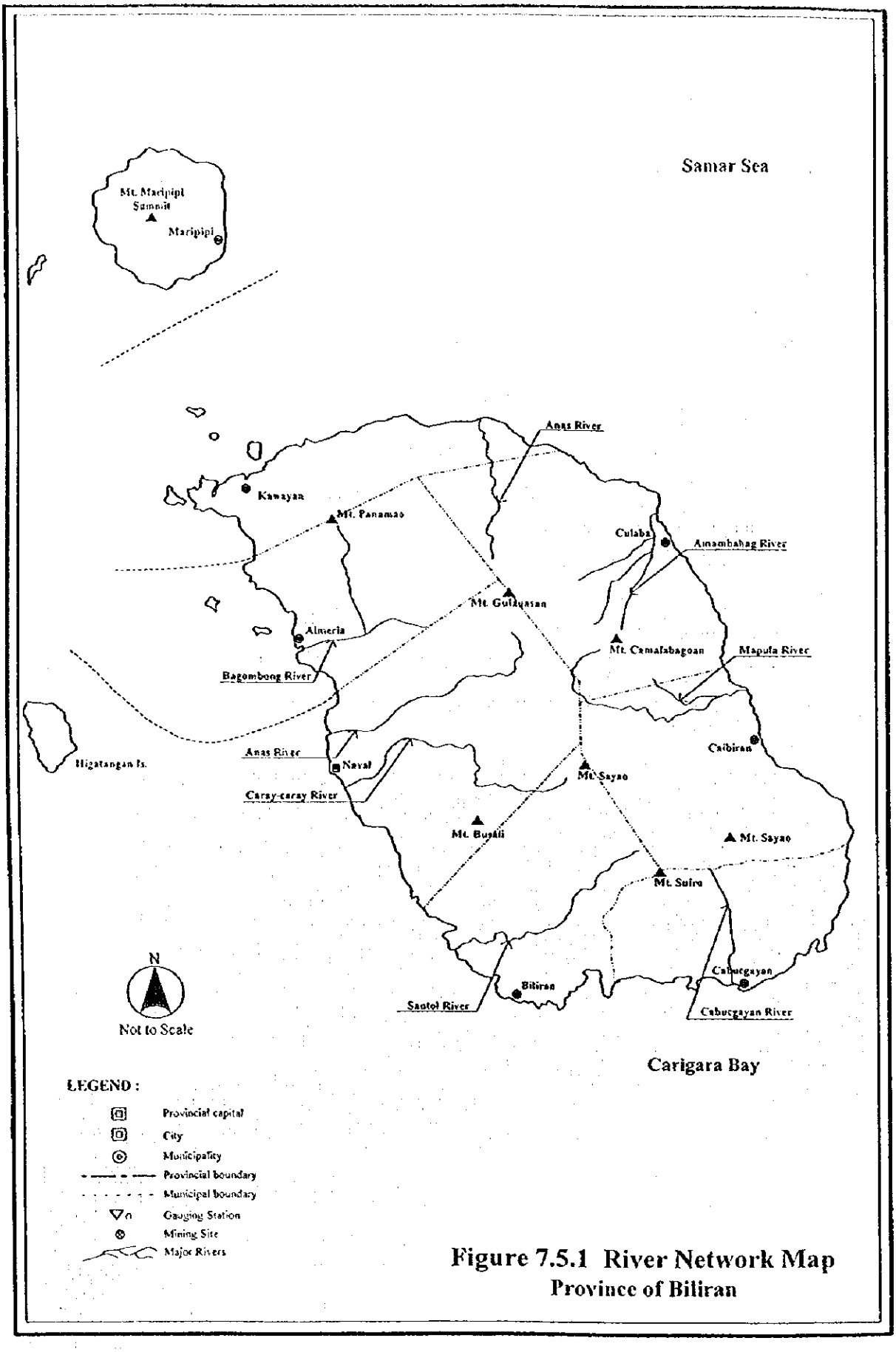


Figure 7.5.1 River Network Map
Province of Biliran

Table 7.5.1 Gauging Station & River Water Use by Major River Basin

River Basin		Information from Gauging Station						Surface Water Use (Water Rights) in Watershed				
Major River	Stream & Main Systems	Drainage*1 sq.km	Location No. in Figure 7.5.1	River Flow Rate (Q: cum/sec) Peak Qp	Max. Qdx	Mini. Qdn	Data Period	Municipality in watershed	Domestic cum/sec	Industrial cum/sec	Irrigation cum/sec	Others*3 cum/sec
Anas		No gauging station exists.						Claba	NR*4	NR*4	NR*4	NR*4
								Kawayan	NR*4	NR*4	NR*4	NR*4
Amambahag		No gauging station exists.						Claba	NR*4	NR*4	NR*4	NR*4
Mapula		No gauging station exists.						Claba	NR*4	NR*4	NR*4	NR*4
								Caibiran	NR*4	NR*4	NR*4	NR*4
Cabucgayan		No gauging station exists.						Caibiran	NR*4	NR*4	NR*4	NR*4
								Cabucgayan	NR*4	NR*4	NR*4	NR*4
Santol		No gauging station exists.						Biliran	NR*4	NR*4	NR*4	NR*4
Caray-caray & Anas		No gauging station exists.						Biliran	NR*4	NR*4	NR*4	NR*4
								Naval	-	-	0.04	-
Bagombong		No gauging station exists.						Naval	-	-	-	-
								Almeria	NR*4	NR*4	NR*4	NR*4

Source; Philippine Water Resources Summary Data, established January 1980 by NWRC

Notes; Drainage*1 : Watershed Area at Gauging Station
NA*2 : Recorded River Gauge Hight only
Others*3 : Including Livestock, Recreation & Fisheries
NR*4 : Surface water utilization was not registered in NWRB Database, as of March 1997.
Qp : Peak Discharge of Daily Maximum Discharge
Qdx : Maximum Daily Discharge of Weighted Daily Discharge
Qdn : Minimum Daily Discharge of Weighted Daily Discharge

In determining the river maintenance flow, such factors as runoff characteristics, navigation, fishing, picturesque scenery, salt water intrusion, clogging of river mouth, riparian structures, groundwater table, flora and fauna, and river water quality shall be considered to maintain the normal function of the river. In the Philippines, 10% of the dependable flow of the river is required as minimum maintenance flow. Therefore, the maintenance flow was calculated as the dependable flow for irrigation, which equals to 80% (5-year return-period) of the whole hydrological period.

Finally, the exploitable potential of surface water in the province was studied in the case of inflow to and outflow from the respective municipalities. The results are summarized in Table 7.5.2.

(3) Surface Water Quality

The results of water quality analysis are summarized in Table 7.5.1, Data Report. The sampling locations were selected upstream of the respective municipalities. In the said table, Class AA and Class A of the DENR "Water Quality Criteria for Fresh Water" are shown as reference for raw water evaluation. The PNSDW-1994 is also used to evaluate water quality with reference to turbidity and trace elements. The water quality of the selected rivers falls within the class "AA" or "A" standard, although the parameters tested are limited.

7.6 Future Development Potential of Water Sources

(1) Groundwater

A well inventory covering all the municipalities shows that there are 159 existing wells in the province, while 14 shallow wells are recorded in the inventory prepared by PSPT (See Table 7.1.1 and 7.3.1, Data Report). Despite the smaller number of wells included in the PSPT data, these were used in the analysis, since these provided technical information. All 14 shallow wells have complete information on depth and static water level. The specific capacity of these shallow wells was not available during the study period. Data are summarized in Table 7.6.1 Existing Well Sources.

Considering the shallow well information, geologic and hydrogeologic background, and topographic features, the most productive wells may be those with the depth ranging from 5m to 18m and from 20m to 60m. The good yielding wells in alluvial fans may have static water level of about 10 mbgs and specific capacity of about 1.0 lpsm.

Percent of Time (%) (No. in Figure 7.5.1)	Specific Discharge (cum/sec/100sq km) Sangpultan-Dapdap Leyte	Binahaan-Lingayon Leyte
10%	16.04	21.88
20%	9.43	16.98
30%	7.15	12.68
40%	4.80	10.64
50%	4.00	9.19
60%	3.02	8.40
70%	2.44	7.70
80%	2.06	6.70
90%	1.63	5.54
100%	0.70	1.20
Data Period	1952-'68	1948-'70

Source; Philippine Water Resources Summary Data, as of Jan. 1980 by NWRC

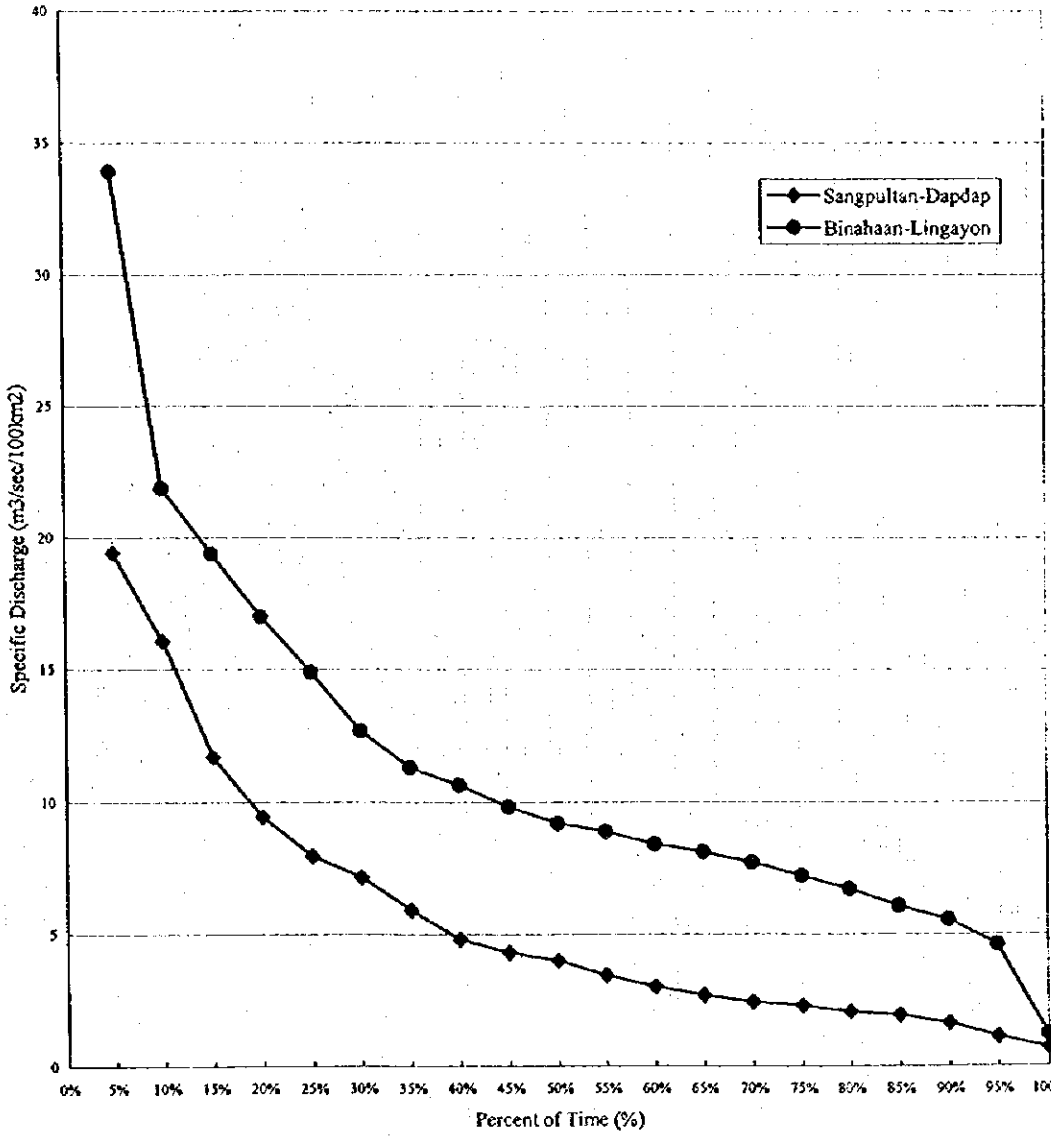


Figure 7.5.2 River Flow Duration Curve

Table 7.5.2 Probability of Surface Water

Surface Water Sources		Related Data					Probability of Surface Water (10-year returen-period)							
			Watershed Area in		Sp. D (return-period)		Inlet Flow to Municipality				Outlet Flow from Municipality			
Major River Water	System & Main	Location Municipality & other Province	River Connection	Location (1)	Upstream (2)	10-year (3)	5-year (4)	S/Flow (5) (7)x(3)/100	M/Flow (6) (5)x(4)/100x10%	Use (7)	Potential (8) (5)x(6)-(7)	S/Flow (9) (5)-(1)x(3)/100	M/Flow (10) (6)+(1)x(4)/100x10%	Use (11)	Potential (12) (9)-(10)+(11)
		upstream to down	outlet or inlet	sq.km	sq.km	Q	Q	cu.m/sec	cu.m/sec	cu.m/sec	cu.m/sec	cu.m/sec	cu.m/sec	cu.m/sec	cu.m/sec
Anas		Claba		21.3	0.0	1.63	2.06	0.00	0.00	0.00	**0.00**	0.35	0.04	0.00	**0.30**
		Kawayan		2.5	21.3	1.63	2.06	0.35	0.04	0.00	**0.30**	0.39	0.05	0.00	**0.34**
Amambahag		Claba		24.5	0.0	1.63	2.06	0.00	0.00	0.00	**0.00**	0.40	0.05	0.00	**0.35**
Mapula		Claba		16.1	0.0	1.63	2.06	0.00	0.00	0.00	**0.00**	0.26	0.03	0.00	**0.23**
		Caibiran		16.6	16.1	1.63	2.06	0.26	0.03	0.00	**0.23**	0.53	0.07	0.00	**0.47**
Cabucgayan		Caibiran		1.2	0.0	1.63	2.06	0.00	0.00	0.00	**0.00**	0.02	0.00	0.00	**0.02**
		Cabucgayan		9.0	1.2	1.63	2.06	0.02	0.00	0.00	**0.02**	0.17	0.02	0.00	**0.15**
Santol		Biliran		33.6	0.0	1.63	2.06	0.00	0.00	0.00	**0.00**	0.55	0.07	0.00	**0.48**
Caray-caray & Anas		Biliran		13.5	0.0	1.63	2.06	0.00	0.00	0.00	**0.00**	0.22	0.03	0.00	**0.19**
		Naval		71.6	13.5	1.63	2.06	0.22	0.03	0.00	**0.19**	1.39	0.18	0.04	**1.18**
Bagombong		Naval		6.5	0.0	1.63	2.06	0.00	0.00	0.00	**0.00**	0.11	0.01	0.00	**0.09**
		Almeria		36.5	6.5	1.63	2.06	0.11	0.01	0.00	**0.09**	0.70	0.09	0.00	**0.61**

Notes; Sp. D (Specific Discharge) was analyzed by montly mean flow records from gauging station.
S/Flow (Stream Flow) was estimated specific diacharge (10-year return-period) multilied by upstream area.
M/Flow (Maintenance Flow) was estimated 10% of river flow in case of 5-year return-period.
Sp.D (10-year or 5-year return-period) without gauging station was adopted by the other analysis result from near gauging station.
Inlet & outlet "Use" (Water Rights) are summed up by NWRB Database, as of March 1997.
Unit Q for Specific Discharge is cu.m/sec/100 sq.km.
S/Flow, M/Flow & Use in final outlet flow of each stream system was added to respective inlet flows' of main system.

Table 7.6.1 Existing Well Sources

Municipality	Type	No.	Depth (m)		SWL (mbgs)		Sp. Cap. (lpsm)	
			Ave.	Range	Ave.	Range	Ave.	Range
Almeria	DW	0	-	-	-	-	-	-
	SW	0	-	-	-	-	-	-
Biliran	DW	0	-	-	-	-	-	-
	SW	0	-	-	-	-	-	-
Cabucgayan	DW	0	-	-	-	-	-	-
	SW	0	-	-	-	-	-	-
Caibiran	DW	0	-	-	-	-	-	-
	SW	0	-	-	-	-	-	-
Culaba	DW	0	-	-	-	-	-	-
	SW	2	16.9	16.0 - 18.0	3.0	3.0 - 3.0	-	-
Kawayan	DW	0	-	-	-	-	-	-
	SW	2	10.0	10.0 - 10.0	3.0	3.0 - 3.0	-	-
Maripipi	DW	0	-	-	-	-	-	-
	SW	1	8.0	8.0 - 8.0	3.0	3.0 - 3.0	-	-
Naval	DW	0	-	-	-	-	-	-
	SW	9	5.1	5.0 - 6.0	3.0	3.0 - 3.0	-	-

Notes; The values of "Ave. depth, SWL and Sp.Cap." by municipality are estimated using the weighted average based on 1995 census population in respective barangays at well location.
Legend; SWL=static water level, Sp.Cap.=specific capacity, Ave.=average, SW=shallow well and DW=deep well

Based on the hydraulic characteristics and location of wells in Biliran, aquifers are distributed around volcanic mountains and coastal areas of Biliran, Maripipi and Higatangan Islands. Shallow well area is distributed in the western coast of the Biliran Island. The Miocene and older rock units, and volcanic cones are distributed in the western hilly area of Biliran Island and the central parts of 3 islands that are classified as difficult area for groundwater development.

As indicated in Figure 7.3.1 Main Report, alluvial fans are high yielding potential areas covering the eastern slope sides of Mt. Guiauasan. However, much numbers of shallow and deep wells in the municipalities of Culaba, Kawayan and Maripipi are intruded by saline water.

As alternative water sources, the untapped springs can be developed for future use. These are the most reliable sources for water supply in the province, because groundwater in populated

areas have water quality problem of saline water and these areas belong to solo shallow well area or low yielding deep well area. Existing spring sources are utilized for water supply and they originate from the volcanic mountains of the province. Even the information on untapped spring source was not available at present, such springs shall be sought for future water source development in the mountain areas.

The iron removal facilities shall be considered for Level-I deep well facilities in case there are no alternative spring sources in deep well area with water quality problem of ironic groundwater. However, there are numerous spring sources in the province. Thus, the proportion of the iron removal facilities to be constructed for Level-I deep well facilities covering entire province is assumed at 0% at present.

The detailed hydrogeological characteristics of each municipality are summarized in Table 7.6.2, while individual well locations with technical information are shown in Figure 7.6.1 individual Well Location and Specification Map, Data Report.

Additional wells shall be designed employing "gravel packed well" with a thickness of about 50mm or more depending on the grain sizes of aquifers and pumping capacity. While, natural gravel packed well may be adopted within the areas where well-sorted natural gravel formation is distributed at the expected aquifer. Such areas are usually the upstream areas of alluvial fans or plains in the province. The application of such method for Level I well is also justifiable, since inflow velocity of groundwater through the screen is very low because of minimal pumping rate by means of hand-pump operation.

Generally, shallower well has a higher possibility to be constructed by the natural gravel packed method than the deeper one in areas formed by recent deposits. This is because the layers at different depths of alluvial plain or fan deposits had been formed by different situations of transportation and sedimentation between varied grain sizes. The adaptability of the natural packed well development in the province is experimentally assumed referring to the limited information such as topography, geology, static water levels, etc., as shown in Table 7.6.3.

Table 7.6.2 Hydrogeological Descriptions by Municipality

Municipality	Ground Information								Well Information						Groundwater Information						
	Topography			Geology					Depth		SWL		Sp.Cap.	L-III	Availability			Potential		Quality	
	Area Proportion (%)			Lithofacies (Major Aquifers)	Stratigraphy of Geological Age*				m		mbgs		lpsm		Area Proportion (%)			Comparative		Area Feature	
	Plain-Plateau	Hilly-Piedmont	Mountain		Q	Tertiary		C	mini.	max.	mini.	max.	ave.	well	SW	DW	Diff.	Wells	Springs	Problem	Pollutants
						Neo.	Paleo.														
Almeria	4%	62%	34%	recent deposit & limestone	x	x	x							0	4%	62%	34%	fair	few		
Biliran	9%	54%	37%	recent deposit & limestone	x	x	x							0	9%	54%	37%	fair	few		
Cabucgayan	1%	90%	9%	limestone		x	x		5	6	3.0	3.0	-	0	0%	91%	9%	poor	few	acidic & ironic	
Caibiran	2%	82%	16%	limestone		x	x							0	0%	84%	16%	poor	rich	acidic & ironic	
Culaba	11%	40%	49%	recent deposit & limestone	x	x	x		16	18	3.0	3.0	-	0	11%	40%	49%	fair	rich	acidic & saline	
Kawayan	11%	75%	14%	recent deposit & limestone	x	x	x		10	10	3.0	3.0	-	0	11%	75%	14%	fair	few	acidic & saline	
Maripipi	3%	0%	97%	volcanic rocks	x				8	8	3.0	3.0	-	0	0%	3%	97%	fair	rich	saline	
Naval	21%	73%	6%	recent deposit & limestone	x	x	x							0	21%	73%	6%	fair	few	saline (Higatan gon's)	

Legend; Geological Age, Q=Quaternary, Neo.=Neogene, Paleo.=Paleogene, C=Cretaceous
Well Information, SWL=static water level, Sp.Cap.=specific capacity, L-III=wells operated for L-III service
Groundwater Information, SW=solo shallow well area, DW=deep well area, Diff.=difficult area, ff = free flowing

Table 7.6.3 Proportion of Gravel Packed and Natural Gravel Packed Wells

Municipality (only potential area)	Proposed Well Depth	Proportion (%) of Level I Deep Wells	
		Gravel Packed	Natural Gravel Packed
Culaba	40 m	Almost 100%	Only few %
Kawayan	40 m	Almost 100%	Only few %

Examination on the effective grain sizes and uniformity coefficient by sieve analysis at the influential aquifers (composed of coarse sand and/or fine gravel) should be conducted during the implementation period. Such analysis and actual well construction results are very helpful to apply the natural gravel packed method in future planning.

In the Leyte Valley, it is reported by DPWH/DEO of Leyte that numerous deep wells present high Fe contents (PNSDW; Fe<1.0ppm). The results of groundwater quality examination, conducted by the Leyte PSPT, show their characteristics with slightly higher Fe and acid pH. Such groundwater quality characteristics may apply for Biliran Island with due consideration of hydrogeologic condition between the provinces of Biliran and Leyte. The deep well area with acidic groundwater may be found in eastern piedmont of volcanic mountains. Ironic water pumped from deep wells is caused by groundwater itself, well materials eluded in acid water, or combination of groundwater and well materials. There are four cases on water quality problem in terms of Fe and pH value as follows:

(1) Iron concentration is less than the PNSDW(1 ppm) and the pH value of groundwater indicates neutral to alkaline side. There is a low possibility of iron contamination through the future.
(2) Although iron concentration is within the standard value, groundwater shows an acid pH value. There is a possibility of iron contamination from steel materials.
(3) Iron concentration exceeds the standard value and groundwater shows neutral to alkaline pH value. There is iron contamination caused by groundwater itself.
(4) Iron concentration exceeds standard value and groundwater shows acid pH side. There is a possibility of iron contamination caused by groundwater and/or well materials.

Where groundwater has high Fe contains, the Iron Removal Facility shall be additionally installed. Where the parameter of groundwater indicates acid pH side, the well casing shall be designed to use anti-corrosive materials, such as polyvinyl chloride (PVC) or stainless steel (SUS) materials.

Generally, shallower well presents water quality with alkalinity parameter. This is because the shallow wells are usually constructed in alluvial plain or fan deposits. The well materials of the said anti-corrosive shall be used for deep wells. The development of deep wells using anti-corrosive materials is experimentally assumed referring to the limited information such as results of water quality examination (refer to Table 7.3.2, Data Report), and water quality trend based on the results from the province of Leyte, geology, etc., as shown in Table 7.6.4.

Table 7.6.4 Proportion of Wells to be Constructed by Different Materials

Municipality (only potential area)	Proposed Well Depth	Proportion (%) of Level-I Deep Wells	
		GI Casing Pipes	PVC Casing Pipes
Cabuegayan	80 m	Almost 100 %	Only few %
Caibiran	80 m	Almost 100 %	Only few %
Culaba	80 m	Almost 100 %	Only few %
Kawayan	80 m	Almost 100 %	Only few %

Water quality examination on Fe and pH parameters should be conducted during the implementation period. Such groundwater quality analysis is very helpful to design the well materials in future planning.

(2) Spring

Untapped spring sources were not available during the study period. Data collection including barangay name, owner, discharge, transmission pipeline length and relative elevation shall be started immediately (refer to Table 7.6.5 as reference form).

Table 7.6.5 Untapped Spring Source Identification

Location		Identification of Untapped Spring			
Municipality	Barangay	Owner	Discharge (lps)	T.L.L.* (km)	Elevation Difference (m)
NA					

Note: T.L.L. - Transmission line length
NA - Data not available

7.7 Water Source Development for Medium-Term Development Plan

7.7.1 Detailed Groundwater Investigation Required

(1) Groundwater Database covering the entire Province

There is no sufficient groundwater data/information available during the study period. The additional collection of data/information covering all types of water sources (deep well, shallow well and untapped spring) is urgent matter. Database preparation and study on groundwater sources shall be done accordingly. The requirements for the purpose are enumerated below.

Deep Well & Shallow Well (functional source)

- General Information; location, service level, present utilization & ownership
- Well Information; well depth, well diameter, screen position, static water level, water quality and completion year
- Operational Information; discharge, draw-down, operation hour

Untapped Spring

- General Information; location, present utilization & ownership
- Spring Information; fluctuation of discharge and water quality
- System Information; location map include expected service barangay, distance of pipeline route between source and service area and relative elevation for gravity supply between source and service area

(2) Water Quality Examination of Well & Spring

Both well and spring are potential water sources in the province of Biliran. Deep well area covers the eastern slope of volcanic mountains of Biliran Island and the coastal belt of the other 2 islets, while shallow well area is distributed in the western coast of Biliran Island including Naval, the provincial capital. Spring source can be developed in all municipalities.

Deep Well

Deep well area may have water quality problem with acidic groundwater and/or high Fe contents locally, based on the water quality examination results in the province of Leyte and geologic condition compared with northern Leyte. Water quality examination at deep well sites shall be conducted, since no data was available during the study period. The study area and examination parameters are as follows:

- Study Area; Cabucgayan, Caibiran, Culaba & Kawayan
- Examination Parameter; Fe, Mn, pH, Color, Turbidity, etc.

Shallow Well

Numerous numbers of shallow wells are used for drinking purpose in eastern coast of Biliran Island. These shallow wells are exposed to water quality problems affected by surface water. Water quality examination at shallow well sites shall be conducted, since no data were available during the study period. The study area and examination parameters are as follows:

- Study Area; Cabucgayan, Caibiran, Culaba & Kawayan
- Examination Parameter; pH, Color, Turbidity, Bacteria & Coliform, etc.

Developed & Untapped Spring

Major water sources in the western coast is privately owned shallow wells and public springs. Water quality of springs is reported as potable, but only bacteriological examinations were conducted at present. Additional water quality test is recommended entailing the following:

- Study Area; Almeria, Biliran & Naval
- Examination Parameter

Physical;	Turbidity, Color & TDS
Chemical;	pH, Total Hardness, Alkalinity & Acidity
Bacteriological;	Bacteria & Coliform
Major Cation;	Na^+, K^+, Ca^+ & Mg^+
Major Anion;	CO_3^-, HCO_3^-, Cl^- & SO_4^-
Trace Element;	Fe & Mn

7.7.2 Spacing Allocation for Level II and III Wells

The pumping rates required for Level I facilities are fairly lower than that for Level II and III systems. The well interference in Level I facilities need not to be studied in terms of spacing of wells and production rate, since most formations in shallow and deep well areas generally have enough groundwater development potential. As Level II and III wells are usually expected to produce larger discharge to meet the water demand, the spacing of wells to avoid well interference has to be considered. Spacing allocation for Level II and III wells was examined considering specific capacity, pumping rate, and assumed drawdown of 1cm at the interference radius for a pumping duration of 16 hours.

(1) Specific Capacity

According to the existing well source information, specific capacity was considered with ranges from 0.5 lpsm to 6.5 lpsm. To simplify the calculation, an average value in each range is adopted in the calculation of interference radius.

(2) Pumping Rate

The pumping rate was estimated by assuming a drawdown of 10m with the average value of specific capacity and pump operation of 16 hours/day. The formula used to determine proper well spacing is the Jacob modified equation. Drawdown at the interference boundary is assumed at 1cm after a pumping duration of 16 hours.

Table 7.7.1 presents the estimated spacing requirements and number of wells to be constructed within a well field of one km^2. The spacing interval between adjacent wells to avoid well interference is planned to be more than twice the distances of the calculated interference radius.

Table 7.7.1 Spacing Arrangements for Planned Wells

Range of Specific Capacity (lpsm)	Estimated Pumping Rate (m^3/day)	Estimated Interference Radius (m)	Estimated Number of Wells/km^2
0.5 - 1.5	500	80	45
1.5 - 3.0	1,000	120	20
3.0 - 4.5	2,000	160	11
4.5 - 6.0	2,500	200	7
> 6.0	>2,500	>200	>7

B

FUTURE REQUIREMENTS AND DEVELOPMENT PLAN

8. FUTURE REQUIREMENTS IN WATER SUPPLY AND SANITATION IMPROVEMENT

8.2 Targets of Provincial Sector Plan

Table 8.2.1 Estimation of Base Year Service Coverage of Water Supply

Name of Municipality	Area	Population (1998)	Population Served by 1998 Facilities				Population Served by Planned/On-going Projects				Population Served in the Base Year (1998)				
			Level III	Level II	Level I	Total	Level III	Level II	Level I	Total	Level III	Level II	Level I	Total	Percentage Coverage
Almeria	Urban	2,857	2,567			2,567					2,567			2,567	90
	Rural	11,023	6,573	2,011	344	8,928					6,573	2,011	344	8,928	81
	Total	13,880	9,140	2,011	344	11,495					9,140	2,011	344	11,495	83
Biliran	Urban	4,799	1,920	330	2,483	4,733					1,920	330	2,483	4,733	99
	Rural	9,710		3,501	5,395	8,896						3,501	5,395	8,896	92
	Total	14,509	1,920	3,831	7,878	13,629					1,920	3,831	7,878	13,629	94
Cabucgayan	Urban	8,972	1,600	770	3,107	5,477					1,600	770	3,107	5,477	61
	Rural	7,937	2,000	1,320	996	4,316					2,000	1,320	996	4,316	54
	Total	16,909	3,600	2,090	4,103	9,793					3,600	2,090	4,103	9,793	58
Caibiran	Urban	6,053	3,816	30		3,846					3,816	30		3,846	64
	Rural	12,851	324	1,611	6,647	8,582					324	1,611	6,647	8,582	67
	Total	18,904	4,140	1,641	6,647	12,428					4,140	1,641	6,647	12,428	66
Culaba	Urban	4,447	2,128			2,128					2,128			2,128	48
	Rural	9,198	1,874	1,981	2,422	6,277					1,874	1,981	2,422	6,277	68
	Total	13,645	4,002	1,981	2,422	8,405					4,002	1,981	2,422	8,405	62
Kawayan	Urban	1,844	1,033	725		1,758					1,033	725		1,758	95
	Rural	15,027	3,023	6,525	4,251	13,799					3,023	6,525	4,251	13,799	92
	Total	16,871	4,056	7,250	4,251	15,557					4,056	7,250	4,251	15,557	92
Maripipi	Urban	1,434		366	779	1,145						366	779	1,145	80
	Rural	6,717		1,578	3,246	4,824						1,578	3,246	4,824	72
	Total	8,151		1,944	4,025	5,969						1,944	4,025	5,969	73
Naval (Capital)	Urban	10,559	9,630			9,630					9,630			9,630	91
	Rural	23,423	3,850	1,825	8,523	14,198					3,850	1,825	8,523	14,198	61
	Total	33,982	13,480	1,825	8,523	23,828					13,480	1,825	8,523	23,828	70
Provincial Total	Urban	40,965	22,694	2,221	6,369	31,284					22,694	2,221	6,369	31,284	76
	Rural	95,886	17,644	20,352	31,824	69,820					17,644	20,352	31,824	69,820	73
	Total	136,851	40,338	22,573	38,193	101,104					40,338	22,573	38,193	101,104	74

Table 8.2.2 Population Coverage in Phase I Provided by Served Population in the Base Year (Water Supply)

Name of Municipality	Area	Population Served by 1998 Facilities				1998		2004	
		Level III	Level II	Level I	Total	Total Population	Coverage (%)	Total Population	Coverage (%)
Almeria	Urban	2,567			2,567	2,857	90	3,540	73
	Rural	6,573	2,011	344	8,928	11,023	81	11,302	79
	Total	9,140	2,011	344	11,495	13,880	83	14,842	77
Biliran	Urban	1,920	330	2,483	4,733	4,799	99	5,460	87
	Rural		3,501	5,395	8,896	9,710	92	10,584	84
	Total	1,920	3,831	7,878	13,629	14,509	94	16,044	85
Cabucgayan	Urban	1,600	770	3,107	5,477	8,972	61	14,642	37
	Rural	2,000	1,320	996	4,316	7,937	54	3,127	100 *
	Total	3,600	2,090	4,103	9,793	16,909	58	17,769	55
Caibiran	Urban	3,816	30		3,846	6,053	64	6,593	58
	Rural	324	1,611	6,647	8,582	12,851	67	12,985	66
	Total	4,140	1,641	6,647	12,428	18,904	66	19,578	63
Culaba	Urban	2,128			2,128	4,447	48	5,403	39
	Rural	1,874	1,981	2,422	6,277	9,198	68	10,212	61
	Total	4,002	1,981	2,422	8,405	13,645	62	15,615	54
Kawayan	Urban	1,033	725		1,758	1,844	95	1,862	94
	Rural	3,023	6,525	4,251	13,799	15,027	92	15,945	87
	Total	4,056	7,250	4,251	15,557	16,871	92	17,807	87
Maripipi	Urban		366	779	1,145	1,434	80	1,434	80
	Rural		1,578	3,246	4,824	6,717	72	7,339	66
	Total		1,944	4,025	5,969	8,151	73	8,773	68
Naval (Capital)	Urban	9,630			9,630	10,559	91	12,988	74
	Rural	3,850	1,825	8,523	14,198	23,423	61	23,145	61
	Total	13,480	1,825	8,523	23,828	33,982	70	36,133	66
Provincial Total	Urban	22,694	2,221	6,369	31,284	40,965	76	51,922	60
	Rural	17,644	20,352	31,824	69,820	95,886	73	94,639	74
	Total	40,338	22,573	38,193	101,104	136,851	74	146,561	69

Table 8.2.3 Number of Households Served by Sanitary Toilets in the Base Year (1998)

Name of Municipality	Area	Population (1998)	Number of Households (1998)	Households Using Sanitary Toilets in 1998				Recipient HHs of Planned/On-going Projects				Households Using Sanitary Toilets in the Base Year (1998)							
												Number				Coverage (%)			
				Flush Toilets	Pour Flush	VIP/Dry	Total	Flush	Pour Flush	VIP/Dry	Total	Flush	Pour Flush	VIP/Dry	Total	Flush	Pour Flush	VIP/Dry	Total
Almeria	Urban	2,857	547		382		382						382		382		70		70
	Rural	11,023	2,170		1,886		1,886						1,886		1,886		87		87
	Total	13,880	2,717		2,268		2,268						2,268		2,268		83		83
Biliran	Urban	4,799	858	336	171	52	559					336	171	52	559	39	20	6	65
	Rural	9,710	1,722	476	235	83	794					476	235	83	794	28	14	5	46
	Total	14,509	2,580	812	406	135	1,353					812	406	135	1,353	31	16	5	52
Cabucgayan	Urban	8,972	1,649		889		889						889		889		54		54
	Rural	7,937	1,556		782		782						782		782		50		50
	Total	16,909	3,205		1,671		1,671						1,671		1,671		52		52
Caibiran	Urban	6,053	1,127	303	59		362					303	59		362	27	5		32
	Rural	12,851	2,411	864	243		1,107					864	243		1,107	36	10		46
	Total	18,904	3,538	1,167	302		1,469					1,167	302		1,469	33	9		42
Culaba	Urban	4,447	731		80		80						80		80		11		11
	Rural	9,198	1,546		649		649						649		649		42		42
	Total	13,645	2,277		729		729						729		729		32		32
Kawayan	Urban	1,844	388		369		369						369		369		95		95
	Rural	15,027	3,105		2,226		2,226						2,226		2,226		72		72
	Total	16,871	3,493		2,595		2,595						2,595		2,595		74		74
Maripipi	Urban	1,434	294		101		101						101		101		34		34
	Rural	6,717	1,320		671		671						671		671		51		51
	Total	8,151	1,614		772		772						772		772		48		48
Naval (Capital)	Urban	10,559	2,137		1,820		1,820						1,820		1,820		85		85
	Rural	23,423	4,942		2,879		2,879						2,879		2,879		58		58
	Total	33,982	7,079		4,699		4,699						4,699		4,699		66		66
Provincial Total	Urban	40,965	7,731	639	3,871	52	4,562					639	3,871	52	4,562	8	50	1	59
	Rural	95,886	18,772	1,340	9,571	83	10,994					1,340	9,571	83	10,994	7	51		59
	Total	136,851	26,503	1,979	13,442	135	15,556					1,979	13,442	135	15,556	7	51	1	59

Table 8.2.4 Number of Public School Student Served by School Toilets in Base Year (1998)

Name of Municipality	1998 Total Number of Public School Student	Standard No. of Student that can be Served by 1998	No. of Student to be Served by Planned /On-going Projects	Standard No. of Students that can be Served by Toilets in Base Year (1998)	Coverage (%)
Almeria	3,583	1,040		1,040	29
Biliran	2,932	1,080		1,080	37
Cabucgayan	3,632	800		800	22
Caibiran	5,370	1,000		1,000	19
Culaba	3,088	1,280		1,280	41
Kawayan	4,411	2,640		2,640	60
Maripipi	1,950	720		720	37
Naval (Capital)	6,650	2,400		2,400	36
Provincial Total	31,616	10,960		10,960	35

Table 8.2.5 Number of Public Utilities with Sanitary Toilets in the Base Year (1998)

Name of Municipality	Type	No. of PU with Toilets in 1998	No. of PU with Sanitary Toilets in 1998	No. of PU with Sanitary Toilets in Planned/On-going Projects	No. of PU with Toilets in Base Year 1998	No. of PU with Sanitary Toilets in Base year 1998	Coverage (%)
Almeria	Public Market	1	1		1	1	100
	Bus/Jeepney Terminal						
	Parks/Playground						
	Total	1	1		1	1	100
Biliran	Public Market	1	1		1	1	100
	Bus/Jeepney Terminal	1	1		1	1	100
	Parks/Playground						
	Total	2	2		2	2	100
Cabucgayan	Public Market	1			1		
	Bus/Jeepney Terminal						
	Parks/Playground	1	1		1	1	100
	Total	2	1		2	1	50
Caibiran	Public Market						
	Bus/Jeepney Terminal	1			1		
	Parks/Playground						
	Total	1			1		
Culaba	Public Market	1	1		1	1	100
	Bus/Jeepney Terminal						
	Parks/Playground						
	Total	1	1		1	1	100
Kawayan	Public Market						
	Bus/Jeepney Terminal						
	Parks/Playground	1	1		1	1	100
	Total	1	1		1	1	100
Maripipi	Public Market						
	Bus/Jeepney Terminal						
	Parks/Playground						
	Total						
Naval (Capital)	Public Market	2	2		2	2	100
	Bus/Jeepney Terminal	2	2		2	2	100
	Parks/Playground						
	Total	4	4		4	4	100
Provincial Total	Public Market	6	5		6	5	83
	Bus/Jeepney Terminal	4	3		4	3	75
	Parks/Playground	2	2		2	2	100
	Total	12	10		12	10	83

Table 8.2.6 Households Coverage in Phase I Provided by Existing Facilities in the Base Year (Household Toilets)

Name of Municipality	Area	Number of Household Served by Existing Facilities				Coverage in 1998							Coverage in 2004						
						No. of HHs	Percentage of Served Households				Served Population		No. of HHs	Percentage of Served Households				Served Population	
		Flush	Pour Flush	VIP/Dry	Total		Flush	Pour Flush	VIP/ Dry	Total	Number	%		Flush	Pour Flush	VIP/ Dry	Total	Number	%
Almeria	Urban		382		382	547		70		70	2,000	70	678		56		56	2,108	56
	Rural		1,886		1,886	2,170		87		87	2,486	87	2,225		85		85	10,217	85
	Total		2,268		2,268	2,717		83		83	4,486	83	2,903		78		78	12,325	78
Biliran	Urban	336	171	52	559	858	39	20	6	65	3,119	65	977	34	18	5	57	3,404	57
	Rural	476	235	83	794	1,722	28	14	5	46	2,208	46	1,877	25	13	4	42	4,862	42
	Total	812	406	135	1,353	2,580	31	16	5	52	5,327	52	2,854	28	14	5	47	8,266	47
Cabucgayan	Urban		889		889	1,649		54		54	4,845	54	2,692		33		33	5,061	33
	Rural		782		782	1,556		50		50	4,486	50	613		128		128	4,192	128
	Total		1,671		1,671	3,205		52		52	9,331	52	3,305		51		51	9,253	51
Caibiran	Urban	303	59		362	1,127	27	5		32	1,937	32	1,228	25	5		29	1,977	29
	Rural	864	243		1,107	2,411	36	10		46	2,784	46	2,436	35	10		45	6,040	45
	Total	1,167	302		1,469	3,538	33	9		42	4,721	42	3,664	32	8		40	8,017	40
Culaba	Urban		80		80	731		11		11	489	11	889		9		9	546	9
	Rural		649		649	1,546		42		42	1,868	42	1,716		38		38	4,361	38
	Total		729		729	2,277		32		32	2,357	32	2,605		28		28	4,907	28
Kawayan	Urban		369		369	388		95		95	1,752	95	392		94		94	1,841	94
	Rural		2,226		2,226	3,105		72		72	1,328	72	3,294		68		68	11,401	68
	Total		2,595		2,595	3,493		74		74	3,080	74	3,686		70		70	13,242	70
Maripipi	Urban		101		101	294		34		34	488	34	294		34		34	522	34
	Rural		671		671	1,320		51		51	731	51	1,442		47		47	3,689	47
	Total		772		772	1,614		48		48	1,219	48	1,736		44		44	4,211	44
Naval (Capital)	Urban		1,820		1,820	2,137		85		85	8,975	85	2,629		69		69	9,484	69
	Rural		2,879		2,879	4,942		58		58	6,124	58	4,883		59		59	14,452	59
	Total		4,699		4,699	7,079		66		66	15,099	66	7,512		63		63	23,936	63
Provincial Total	Urban	639	3,871	52	4,562	7,731	8	50	1	59	23,605	59	9,779	7	40	1	47	24,943	47
	Rural	1,340	9,571	83	10,994	18,772	7	51		59	22,015	59	18,486	7	52		59	59,214	59
	Total	1,979	13,442	135	15,556	26,503	7	51	1	59	45,620	59	28,265	7	48		55	84,157	55

Table 8.2.7 Public School Students and Public Utilities Coverage in Phase I by Existing Facilities in the Base Year

Name of Municipalities	Public School Toilets					Public Toilets					
	Std. No. of Student that can be Served by Base Year	Coverage in 1998		Coverage in 2004		Coverage in 1998			Coverage in 2004		
		Total No. of Public School Students	%	Total No. of Public School Student	%	No. of PU with Toilets in Base Year	No. of PU with Sanitary Toilets in Base Year	%	No. of PU with Toilets	No. of PU with Sanitary Toilets in Base Year	%
Almeria	1,040	3,583	29	3,825	27	1	1	100	3	1	33.33
Biliran	1,080	2,932	37	3,570	30	2	2	100	3	2	67
Cabucgayan	800	3,632	22	4,028	20	2	1	50	4	1	25
Caibiran	1,000	5,370	19	5,570	18	1			3		
Culaba	1,280	3,088	41	3,579	36	1	1	100	3	1	33
Kawayan	2,640	4,411	60	4,482	59	1	1	100	4	1	25
Maripipi	720	1,950	37	1,989	36				3		
Naval (Capital)	2,400	6,650	36	8,627	28	4	4	100	5	4	80
Provincial Total	10,960	31,616	35	35,670	31	12	10	83	28	10	36

8.3 Projection of Frame Values

8.3.1 Review of Past Population Development and Population Projection

Since the NSO has not yet prepared/issued future population of the provinces, the provincial population for the years 1998 (planning base year), 2004 (medium-term target year) and 2010 (long-term target year) were projected. Available information for the study at present is as follows:

- NSO population census results from 1903 to 1995 (conducted 10 times)
- 1995 Census-based National and Regional Population Projection prepared by the NSO
- 1995 Census-based Regional and Provincial Population Projection prepared by the NEDA Regional Office-VIII
- Provincial Physical Framework Plan/Comprehensive Provincial Land Use Plan (1993-2002) prepared by the Provincial Office (hereafter referred to as "the Land Use Plan")

(1) Comparison of regional population projected by NSO and NEDA

The NSO conducted the national population projections for the period 1995-2040 and the regional 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.

In the regional population projection of Region VIII (Eastern Visayas), the subject region composed of the 3rd batch provinces of this study is classified as medium-sized region (projected population of at least 5 million but less than 10 million by year 2020).

On the other hand, the NEDA Regional Office-VIII projected the regional population together with the provincial population for year 2006 based on the 1995 census result.

Table 8.3.1 shows the comparison between the two agencies' projection on the regional population for the years 2000, 2005 and 2010. In the past development, the annual growth rate between 1990 and 1995 drastically increased compared with that of the previous census period. The NSO considered the latest development for its projection. Thus, the growth rates with 5-year interval for the years 1995, 2005 and 2010 are assumed at 2.21%, 2.00% and 1.82%, respectively.

The NEDA Regional Office also projected the population for year 2006 based on the 1995 census result. In this study, the annual growth rate between the two years was calculated at 1.00% using the compounded formula for the purpose of comparison with

NSO projection. Thus, the population in a 5-year interval from year 1995 was estimated as shown below applying 1.00% as annual growth rate. Comparing with the projected population by NSO, the NEDA projection is rather conservative in consideration of the past trend between 1948 and 1995 as shown in Table 8.3.1 and Figure 8.3.1.

Year	Population	Source/Growth Rate
1995	3,366,917	Census result
2000	3,538,664	Estimated/ 1.00% (1995 - 2006)
2005	3,719,171	Estimated/ 1.00% (1995 - 2006)
2006	3,756,193	NEDA projection/ 1.00% (1995 - 2006)

Table 8.3.1 Comparison of Regional Population Projection by the NSO and NEDA

Year		1980	1990	1995	2000	2005	2010
Census	Population	2,799,534	3,054,490	3,366,917			
	Growth Rate		0.88%	1.97%			
NSO Projection	Population			3,356,854	3,743,895	4,132,242	4,523,762
	Growth Rate				2.21%	2.00%	1.82%
NEDA Projection	Population			3,366,917	3,538,664	3,719,171	
	Growth Rate				1.00%	1.00%	

Notes: The 1995 population as of July 1995 was used as a basis for NSO population projection.
The NEDA population in 2000 and 2005 were estimated in the study.

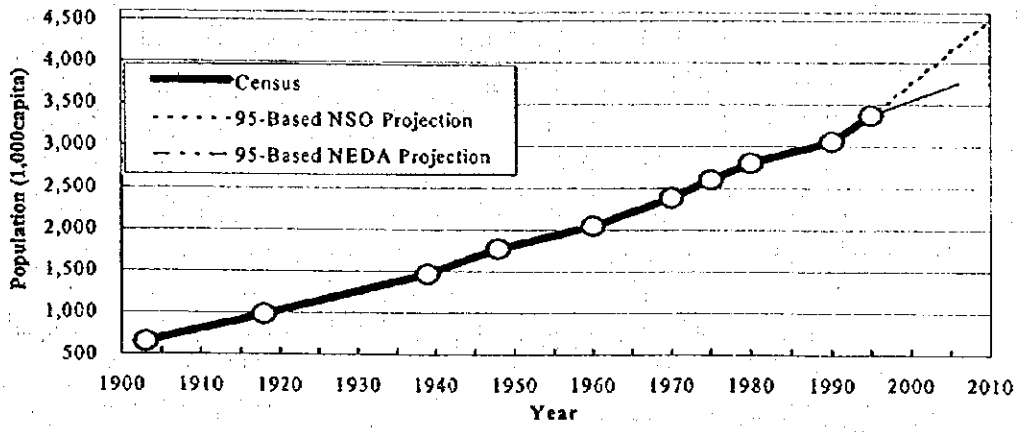


Figure 8.3.1 Past (Census) and Projected Population (prepared by NSO and NEDA) of Region-VIII

(2) The Land Use Plan: Province of Biliran (Planning period 1993-2002)

The provincial and municipal population for the year 2002 was projected with 1990 as base year. The population growth rate by municipality experienced between 1980 and 1990 was basically adopted for the projection. The provincial growth rate was 0.58%

between 1980 and 1990. While the experienced and projected growth rates of Region VIII are 0.88 % between 1980 and 1990 and 0.95 % between 1990 and 2002.

The population projection on the provincial total and component municipalities was made with 1990 as base year. The population for the year 2002 was projected using a uniform growth rate between 1990 and 2002 referring to the experience from 1980 to 1990 (census years).

Table 8.3.2 shows the past population developments in census years (1980-1995) and projections for the years 1995 and 2002 with 1990 as the base year applying the assumed growth rates for the period 1990 to 2002 in the said comprehensive Provincial Land Use Plan.

Table 8.3.2 Census Population and Projected Population in Land Use Plan

Municipality	Census Population					Land Use Plan		
	1980	1990	Growth Rate (1980-1990)	1995	Growth Rate (1990-1995)	1995*	2002	Growth Rate (1980-2002)
Almeria	10,409	12,013	1.44%	13,420	2.24%	12,903	14,261	1.44%
Biliran	10,989	11,531	0.48%	13,775	3.62%	11,810	12,213	0.48%
Cabucgayan	13,034	15,240	1.58%	16,498	1.60%	16,482	18,394	1.58%
Caibiran	17,004	17,596	0.34%	18,582	1.10%	17,897	18,327	0.34%
Culaba	9,924	9,822	-0.10%	12,703	5.28%	9,773	9,705	-0.10%
Kawayan	16,183	15,056	-0.72%	16,424	1.75%	14,522	13,805	-0.72%
Maripipi	7,379	6,943	-0.61%	7,853	2.49%	6,734	6,451	-0.61%
Naval	26,499	29,811	1.18%	32,954	2.02%	31,612	34,317	1.18%
Province	**111421**	**118,012**	**0.58%**	**132,209**	**2.30%**	**121,733**	**127,473**	**0.64%**

Note: * Population in 1995 was estimated using growth rate employed in Land Use Plan

Comparing the census and the projected population in 1995, the provincial population based on the census is about 9% higher than the projected. Regarding the municipal census population in 1995, all municipalities were higher with a range of 0.1% to 30.0% comparing with the projected figures. In addition to this, the province is presently updating its Land Use Plan using the NEDA projection based on the 1995 census population. Thus, the future projection shall be made using the 1995 census results as the base year.

(3) Population Projection of the Province

The following conditions are considered in the population projection.

Regional Population

For the regional population in the study, the projection conducted by the NEDA Regional Office may be adopted assuming that a rather conservative population growth will be realized comparing with that of the NSO projection.

1) The regional population projected by the NEDA for the year 2006 is referred to for the short and medium-term periods. The annual growth rate of 1.00% between 1995 and 2006 will be adopted for the projection in 1998 and 2004 using the compounded formula with 1995 as the base year.

2) For the long-term projection, it is assumed that the annual growth rates will decrease gradually as adopted in the NSO projection. The annual growth rates adopted in the NSO projection decline from 2.00% (2000 - 2005) to 1.82% (2005 - 2010), which indicate that the relative reduction rate is 0.09%. In this study, the same reduction rate may be used to the NEDA projected growth rate of 1.00% (2000 - 2005). Thus, the population in year 2010 is estimated at 3,891,501 applying the growth rate of 0.91% from year 2005. The growth rates adopted in the study correspond to half of the figures employed by NSO.

Year	Population	Growth Rate
1995	3,366,917	Census result
1998	3,468,938	1.00% (1995 - 1998)
2004	3,682,348	1.00% (1995 - 2004)
2005	3,719,171	1.00% (1995 - 2005)
2010	3,891,501	0.91% (2005 - 2010)

Provincial Population

In the NEDA projection, the regional population to be increased from 1995 to 2006 was distributed to each province in proportion to the share of the provincial population increase to the regional population experienced between 1990 and 1995. In this study, it is assumed that the tendency of the population growth by province will not drastically change. Thus, the same manner as adopted by the NEDA projection was employed both for short/medium-term and long-term periods in the population distribution from the regional population to those for concerned provinces. The distribution of the regional

population to be increased to the provincial population was made between the respective base/target years. Table 8.3.3 shows the projected population in years 1998, 2004 and 2010 together with the NEDA projection.

Table 8.3.3 Projected Population of the Province

Province	NEDA Projection				Projected Population		
	Population		Population Increase				
	1995	2006	Number	Share	1998	2004	2010
Biliran	132,209	149,921	17,712	4.55%	136,851	146,561	156,077
Eastern Samar	362,324	403,509	41,185	10.58%	373,118	395,697	417,825
Leyte	1,511,251	1,689,501	178,250	45.79%	1,557,966	1,655,686	1,751,458
Northern Samar	454,195	542,288	88,093	22.63%	477,282	525,577	572,908
Samar	589,373	658,859	69,486	17.85%	607,584	645,678	683,012
Southern Leyte	317,565	312,115	-5,450	-1.40%	316,137	313,149	310,221
Region	3,366,917	3,756,193	389,276	100.00%	3,468,938	3,682,348	3,891,501

Municipal Population

1) The total population of the province in 1998, 2004 and 2010 was fixed.

2) For the population projection by municipality, the same method employed in NEDA projection for the distribution of regional population to provincial population was applied. The provincial population to be increased in respective planning years was distributed to each municipality in proportion to the share of the population increase of each municipality to the provincial total experienced between 1990 and 1995. Table 8.3.4 presents the census results (1990 and 1995) and the projected population of the municipalities.

Table 8.3.4 Census Results and Projected Population of Municipalities

Municipality	Census Result				Projected Population					
	1990	1995	Population Growth	Share to Provincial Population Growth/ Provincial Pop.	1998		2004		2010	
					Population	GR	Population	GR	Population	GR
Almeria	12,01	13,420	1,407	9.9%	13,880	1.13%	14,842	1.12	15,785	1.03%
Biliran	11,53	13,775	2,244	15.8%	14,509	1.75%	16,044	1.69	17,548	1.50%
Cabucgayan	15,24	16,498	1,258	8.9%	16,909	0.82%	17,769	0.83	18,612	0.78%
Caibiran	17,59	18,582	986	6.9%	18,904	0.57%	19,578	0.59	20,239	0.55%
Culaba	9,822	12,703	2,881	20.3%	13,645	2.41%	15,615	2.27	17,546	1.96%
Kawayan	15,05	16,424	1,368	9.6%	16,871	0.90%	17,807	0.90	18,724	0.84%
Maripipi	6,943	7,853	910	6.4%	8,151	1.25%	8,773	1.23	9,383	1.13%
Naval	29,81	32,954	3,143	22.1%	33,982	1.03%	36,133	1.03	38,240	0.95%
Province	118,0	132,20	14,197	100.0%	136,851	1.16	146,561	1.15	156,077	1.05%

Notes: Growth rates in 1998, 2004 and 2010 were calculated using compounded formula. GR - Growth Rate

Population by Urban and Rural Area

1) Past population development

Table 8.3.5 shows the urban and rural population with growth rates in census years (1980-1995) by municipality. With regard to the ratio of the urban population of the province to the total population, the provincial averages in 1980 and 1990 were 20.9% and 21.1% and it increased to 27.8% in 1995. The provincial growth rate of 0.69% between 1980 and 1990 increased to 8.03% in 1995. While, the rural population by municipality was decreased from 0.55% (1980 - 1990) to 0.52% (1990 - 1995) as a provincial average.

Table 8.3.5 Past Population Development by Urban and Rural Area

	Municipality	1980			1990				1995			
		Total	Urban/ Rural	Share (%)	Total	Urban/ Rural	G.R. (%)	Share (%)	Total	Urban/ Rural	G.R. (%)	Share (%)
Urban Area	Almeria	10,409	1,905	18.3%	12,013	2,147	1.20%	17.9%	13,420	2,567	3.64%	19.1%
	Biliran	10,989	3,596	32.7%	11,531	4,040	1.17%	35.0%	13,775	4,499	2.18%	32.7%
	Cabucgayan	13,034	2,064	15.8%	15,240	2,333	1.23%	15.3%	16,498	7,023	24.66%	42.6%
	Caibiran	17,004	4,306	25.3%	17,596	5,401	2.29%	30.7%	18,582	5,800	1.44%	31.2%
	Culaba	9,924	2,479	25.0%	9,822	2,377	-0.42%	24.2%	12,703	4,034	11.16%	31.8%
	Kawayan	16,183	1,792	11.1%	15,056	853	-7.15%	5.7%	16,424	1,835	16.56%	11.2%
	Maripipi	7,379	1,472	19.9%	6,943	1,444	-0.19%	20.8%	7,853	1,434	-0.14%	18.3%
	Naval	26,499	5,674	21.4%	29,811	6,361	1.15%	21.3%	32,954	9,521	8.40%	28.9%
	Province	**111421**	**23,288**	**20.9%**	**118,01**	**24,956**	**0.69%**	**21.1%**	**132,20**	**36,713**	**8.03%**	**27.8%**
Rural Area	Almeria	10,409	8,504	81.7%	12,013	9,866	1.50%	82.1%	13,420	10,853	1.93%	80.9%
	Biliran	10,989	7,393	67.3%	11,531	7,491	0.13%	65.0%	13,775	9,276	4.37%	67.3%
	Cabucgayan	13,034	10,970	84.2%	15,240	12,907	1.64%	84.7%	16,498	9,475	-6.00%	57.4%
	Caibiran	17,004	12,698	74.7%	17,596	12,195	-0.40%	69.3%	18,582	12,782	0.94%	68.8%
	Culaba	9,924	7,445	75.0%	9,822	7,445	0.00%	75.8%	12,703	8,669	3.09%	68.2%
	Kawayan	16,183	14,391	88.9%	15,056	14,203	-0.13%	94.3%	16,424	14,589	0.54%	88.8%
	Maripipi	7,379	5,907	80.1%	6,943	5,499	-0.71%	79.2%	7,853	6,419	3.14%	81.7%
	Naval	26,499	20,825	78.6%	29,811	23,450	1.19%	78.7%	32,954	23,433	-0.01%	71.1%
	Province	**111421**	**88,133**	**79.1%**	**118,01**	**93,056**	**0.55%**	**78.9%**	**132,20**	**95,496**	**0.52%**	**72.2%**

G.R. - Growth Rate

2) Projection of urban and rural population for the years 1998, 2004 and 2010

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

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

- Short/Medium-term target: 1998 and 2004

  Growth rates between 1990 and 1995 in terms of the profile of urban population to total population by municipality were basically adopted. However, for those municipalities having drastic changes of growth rates between the two census periods (1990 - 1995 and 1980 - 1990), the average growth rates between 1980 and 1995 were employed. These municipalities are Cabucgayan, Culaba, Kawayan and Naval.

  In addition, some modifications were made as follows:

  - Municipality of Maripipi; Population in 1995 was fixed for short/medium-term to avoid negative growth rate.

- Long-term target: 2010

  For the long-term projection, the adopted share of urban/rural population in 2004 may be applied for the municipal population in 2010, assuming that the share of urban/rural population in the medium-term period will not drastically change.

Under the above assumptions, the provincial average share of urban population for the year 2010 was arrived at 35.4%, higher than the figures in 1995 (27.8%) and 1990 (21.1%). Table 8.3.6 presents the projected urban and rural population. The growth rates and shares on rural population were calculated using the estimated rural population.

Table 8.3.6 Population Projection by Urban and Rural Area:1998, 2004 and 2010

	Municipality	1998				2004				2010			
		Total	Urban/ Rural	G.R. (%)	Share (%)	Total	Urban/ Rural	G.R. (%)	Share (%)	Total	Urban/ Rural	G.R. (%)	Share (%)
Urban Area	Almeria	13,880	2,857	3.63%	20.6%	14,842	3,540	3.64	23.9%	15,785	3,765	1.03%	23.9%
	Biliran	14,509	4,799	2.18%	33.1%	16,044	5,460	2.17	34.0%	17,548	5,972	1.51%	34.0%
	Cabucgayan	16,909	8,972	8.51%	53.1%	17,769	14,642	8.51	82.4%	18,612	15,337	0.78%	82.4%
	Caibiran	18,904	6,053	1.43%	32.0%	19,578	6,593	1.43	33.7%	20,239	6,816	0.56%	33.7%
	Culaba	13,645	4,447	3.30%	32.6%	15,615	5,403	3.30	34.6%	17,546	6,071	1.96%	34.6%
	Kawayan	16,871	1,844	0.16%	10.9%	17,807	1,862	0.16	10.5%	18,724	1,958	0.84%	10.5%
	Maripipi	8,151	1,434	0.00%	17.6%	8,773	1,434	0.00	16.3%	9,383	1,534	1.13%	16.3%
	Naval	33,982	10,559	3.51%	31.1%	36,133	12,988	3.51	35.9%	38,240	13,745	0.95%	35.9%
	Province	**136,851**	**40,965**	**3.72**	**29.9%**	**146,561**	**51,922**	**4.03**	**35.4%**	**156,077**	**55,198**	**1.02%**	**35.4%**
Rural Area	Almeria	13,880	11,023	0.52%	79.4%	14,842	11,302	0.42	76.1%	15,785	12,020	1.03%	76.1%
	Biliran	14,509	9,710	1.54%	66.9%	16,044	10,584	1.45	66.0%	17,548	11,576	1.50%	66.0%
	Cabucgayan	16,909	7,937	-	46.9%	17,769	3,127	-	17.6%	18,612	3,275	0.77%	17.6%
	Caibiran	18,904	12,851	0.18%	68.0%	19,578	12,985	0.17	66.3%	20,239	13,423	0.55%	66.3%
	Culaba	13,645	9,198	1.99%	67.4%	15,615	10,212	1.76	65.4%	17,546	11,475	1.96%	65.4%
	Kawayan	16,871	15,027	0.99%	89.1%	17,807	15,945	0.99	89.5%	18,724	16,766	0.84%	89.5%
	Maripipi	8,151	6,717	1.52%	82.4%	8,773	7,339	1.49	83.7%	9,383	7,849	1.13%	83.7%
	Naval	33,982	23,423	-	68.9%	36,133	23,145	-	64.1%	38,240	24,495	0.95%	64.1%
	Province	136,851	95,886	0.14	70.1%	146,561	94,639	-	64.6%	156,077	100,879	1.07%	64.6%

Table 8.3.7 Projected Number of Households by Urban and Rural Area by Municipality by Target Year

Name of Municipality	Household Size			Number of Households											
	1995			1995			1998			2004			2010		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Almeria	5.22	5.08	5.11	492	2,135	2,627	547	2,170	2,717	678	2,225	2,903	941	3,005	3,946
Biliran	5.59	5.64	5.62	805	1,646	2,451	858	1,722	2,580	977	1,877	2,854	1,493	2,894	4,387
Cabucgayan	5.44	5.10	5.24	1,290	1,857	3,147	1,649	1,556	3,205	2,692	613	3,305	3,834	819	4,653
Caibiran	5.37	5.33	5.34	1,081	2,399	3,480	1,127	2,411	3,538	1,228	2,436	3,664	1,704	3,356	5,060
Culaba	6.08	5.95	5.99	663	1,456	2,119	731	1,546	2,277	889	1,716	2,605	1,518	2,869	4,387
Kawayan	4.75	4.84	4.83	386	3,016	3,402	388	3,105	3,493	392	3,294	3,686	490	4,192	4,682
Maripipi	4.88	5.09	5.05	294	1,260	1,554	294	1,320	1,614	294	1,442	1,736	384	1,962	2,346
Naval (Capital)	4.94	4.74	4.80	1,926	4,940	6,866	2,137	4,942	7,079	2,629	4,883	7,512	3,436	6,124	9,560
Provincial Total	5.29	5.10	5.16	6,937	18,709	25,646	7,731	18,772	26,503	9,779	18,486	28,265	13,800	25,221	39,021

8.3.2 School Enrollment Projection

Table 8.3.8 Projected School Enrollment by Municipality by Target Year

Name of Municipality	1998					2004					2010				
	School Age Population	Total Enrollment		Public Sch. Enrollment		School Age Population	Total Enrollment		Public Sch. Enrollment		School Age Population	Total Enrollment		Public Sch. Enrollment	
		Number	Participation Rate	Number	Participation Rate		Number	Participation Rate	Number	Participation Rate		Number	Participation Rate	Number	Participation Rate
Almeria	3,650	3,583	98	3,583	98	3,903	3,825	98	3,825	98	4,151	3,943	95	3,943	95
Biliran	4,035	2,932	73	2,932	73	4,462	3,570	80	3,570	80	4,880	4,148	85	4,148	85
Cabucgayan	4,791	3,632	76	3,632	76	5,035	4,028	80	4,028	80	5,274	4,483	85	4,483	85
Caibiran	5,661	5,370	95	5,370	95	5,863	5,570	95	5,570	95	6,061	5,758	95	5,758	95
Culaba	3,680	3,088	84	3,088	84	4,211	3,579	85	3,579	85	4,732	4,259	90	4,259	90
Kawayan	4,470	4,411	99	4,411	99	4,718	4,482	95	4,482	95	4,961	4,713	95	4,713	95
Maripip	1,946	1,950	100	1,950	100	2,094	1,989	95	1,989	95	2,240	2,128	95	2,128	95
Naval (Capital)	9,014	7,026	78	6,650	74	9,585	8,627	90	8,627	90	10,144	9,637	95	8,622	85
Provincial Total	37,247	31,992	86	31,616	85	39,871	35,670	89	35,670	89	42,443	39,069	92	38,054	90

Table 8.3.9 Projected Number of Public Utilities by Municipality by Target Year

Name of Municipality	Type	1998	2004		2010	
		No. of Public Utilities	Proposed Construction	Total	Proposed Construction	Total
Almeria	Public Market	1		1		1
	Bus/Jeepney Terminal		1	1		1
	Parks/Playground		1	1	1	2
	Total	1	2	3	1	4
Biliran	Public Market	1		1		1
	Bus/Jeepney Terminal	1		1	1	2
	Parks/Playground		1	1		1
	Total	2	1	3	1	4
Cabucgayan	Public Market	1		1		1
	Bus/Jeepney Terminal		1	1		1
	Parks/Playground	1	1	2		2
	Total	2	2	4		4
Caibiran	Public Market		1	1		1
	Bus/Jeepney Terminal	1		1		1
	Parks/Playground		1	1	1	2
	Total	1	2	3	1	4
Culaba	Public Market	1		1		1
	Bus/Jeepney Terminal		1	1		1
	Parks/Playground		1	1	1	2
	Total	1	2	3	1	4
Kawayan	Public Market	1		1		1
	Bus/Jeepney Terminal		1	1		1
	Parks/Playground	1	1	2		2
	Total	2	2	4		4
Maripipi	Public Market	1		1		1
	Bus/Jeepney Terminal		1	1		1
	Parks/Playground		1	1		1
	Total	1	2	3		3
Naval (Capital)	Public Market	2		2		2
	Bus/Jeepney Terminal	1	1	2		2
	Parks/Playground		1	1	1	2
	Total	3	2	5	1	6
Provincial Total	Public Market	8	1	9		9
	Bus/Jeepney Terminal	3	6	9	1	10
	Parks/Playground	2	8	10	4	14
	Total	13	15	28	5	33

8.4 Types of Facilities and Implementation Criteria

8.4.1 Water Supply

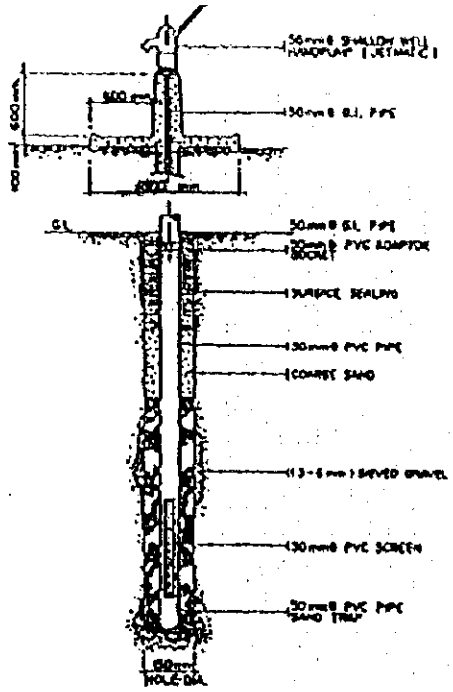
(1) Urban water supply

With regard to development/expansion of urban water supply by municipality, existing conditions, future requirements and planned/on-going projects were reviewed in preparation of this PW4SP. Potential water source for future development was also evaluated in Chapter 7, taking into account the possibility to utilize untapped spring sources. Location of urban area of respective municipalities/city was referred to Figure 3.4.1 in Chapter 3. Table 8.4.1 presents basic figures on existing service coverage, water sources and future requirements.

Table 8.4.1 Existing Condition and Future Requirements of Urban Water Supply by Municipality

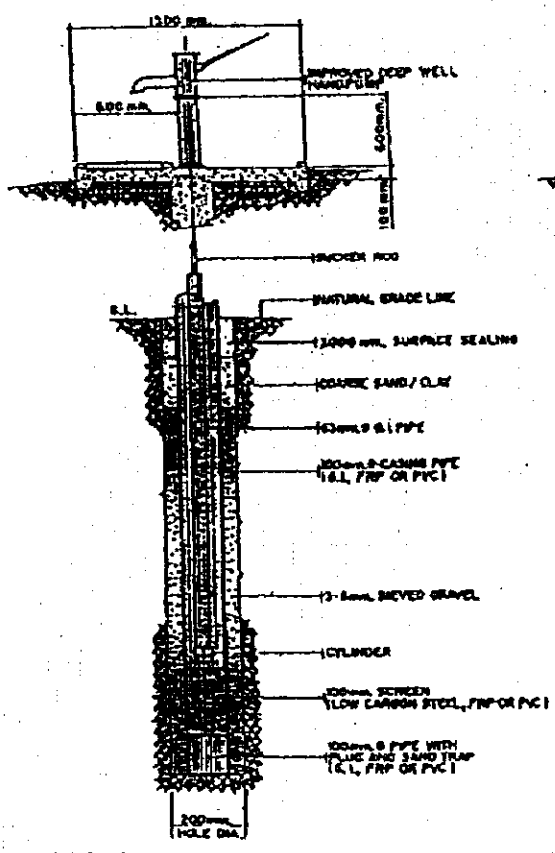
Name of Municipality	Existing Condition (1998)									Phase I (2004)									Phase II (2010)					
	Urban Population (1998)	Existing Level III System and Others						L-III Water Source		Urban Population (2004)	Pop. Served by Level III and Others						Newly Developed/Additional Water Source (m3/d)	Total Water Source Required (m3/d)	Urban Population (2010)	Pop. Served by Level-III			Newly developed/ Additional Water source (m3/d)	Total Water Source Required (m3/d)
		No. of Level-III and Operating Body	Pop. Served by Level-III	%	Pop. Served by Level-VII	Total Pop. Served	Total (%)	Type	Production (m3/d)		Additional Pop. Served by L-III	Total Pop. Served by Level-III	%	Additional Pop. Served by Level-VII	Total Pop. Served	%				Additional Pop. Served	Total	%		
Almeria	2,857	1(Mun)	2,567	90%		2,567	90%	SP	N.A.	3,540	123	2,690	76%	None	2,690	76%	100	400	3,765	886	3,577	95%	200	600
Biliran	4,799	1(Mun)	1,920	40%	2,813	4,733	99%	SP	360	5,460		1,920	35%	None	4,733	87%	100	300	5,972	3,753	5,673	95%	400	700
Cabucgayan	8,972	1(Asc)	1,600	18%	3,877	5,477	61%	N.A.	N.A.	14,642	4,856	6,456	44%	None	10,333	71%	700	900	15,337	8,116	14,570	95%	900	1,500
Caibiran	6,053	2(Asc)	3,816	63%	30	3,846	64%	SP	N.A.	6,593	1,165	6,981	76%	None	5,011	76%	200	700	6,816	1,495	6,475	95%	200	900
Culaba	4,447	1(Asc)	2,128	48%		2,128	48%	SP	2,640	5,403	1,792	3,920	73%	None	3,920	73%	300	600	6,071	1,848	5,767	95%	300	900
Kawayan	1,844	2(Asc)	1,033	56%	725	1,758	95%	SP	N.A.	1,862		1,033	55%	None	1,758	94%	100	200	1,958	828	1,860	95%	200	400
Maripipi	1,434	None			1,145	1,145	80%			1,434				None	1,145	80%			1,534	1,457	1,457	95%	200	200
Naval (Capital)	10,559	1(WD)	9,630	91%		9,630	91%	SP	2,800	12,988	241	9,871	76%	None	9,871	76%	100	1,300	13,745	3,197	13,058	95%	500	1,800
Provincial Total	40,965		22,694	55%	8,590	31,284	76%		5,800	51,922	8,177	30,870	59%		39,461	76%	1,600	4,400	55,198	21,568	52,438	95%	2,900	7,300

(Notes) WD: Water District, Prov: Province, Mun: Municipality, Asc: Association
Unit consumption: 100 lpcd
Additional population served in 2010 includes the served population that will be absorbed by Level III system.

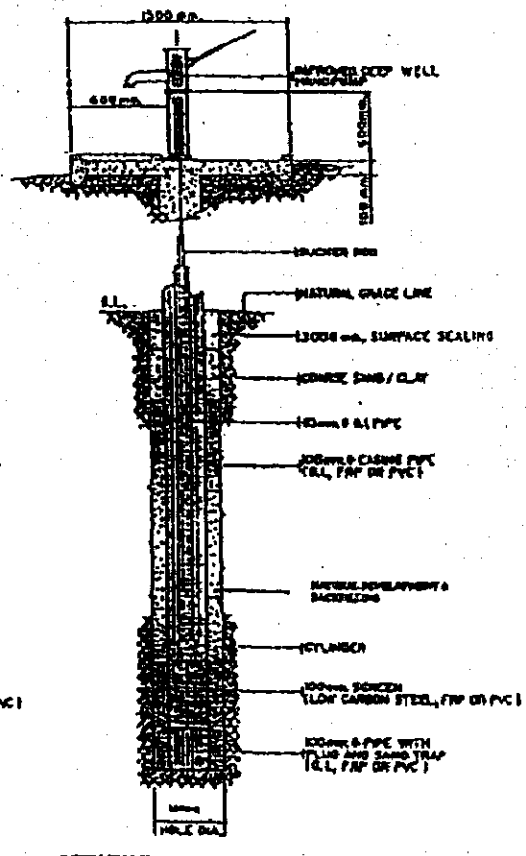


OPEN HOLE DRILLING & GRAVEL PACK METHOD

SHALLOW WELLS



OPEN HOLE DRILLING & GRAVEL PACK METHOD

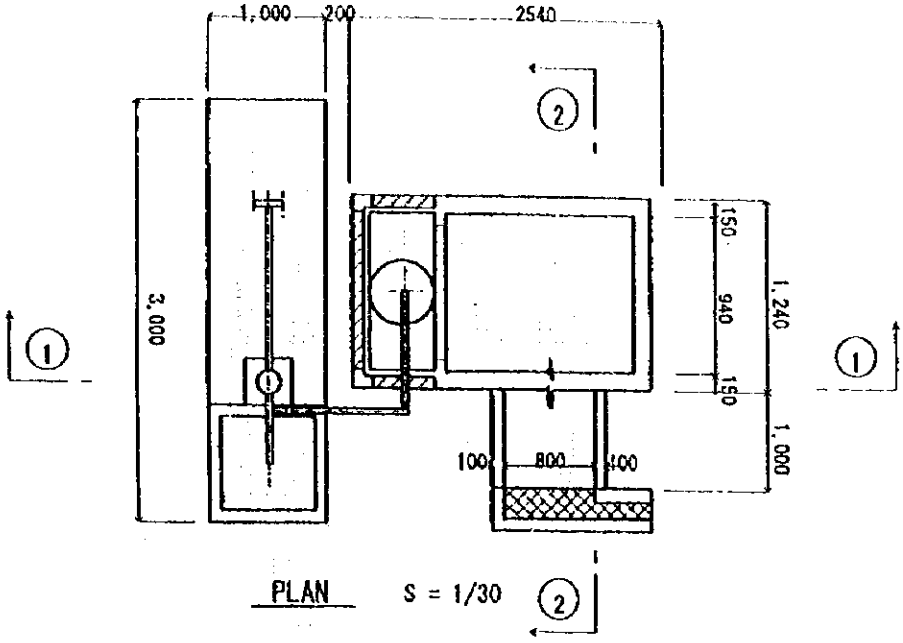


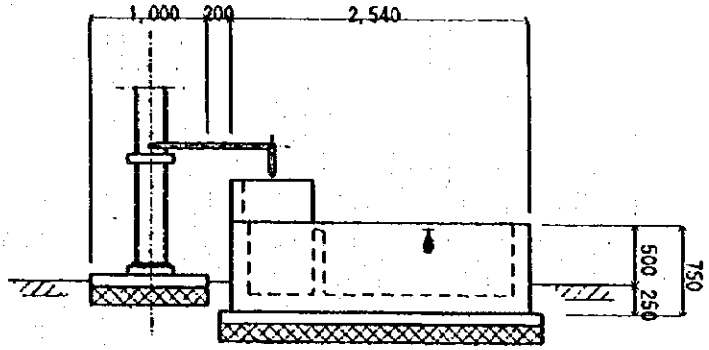
OPEN HOLE DRILLING & NATURAL GRAVEL PACK METHOD

DEEP WELLS

FIGURE 8.4.1

TYPICAL STRUCTURE OF LEVEL I WELL FACILITY





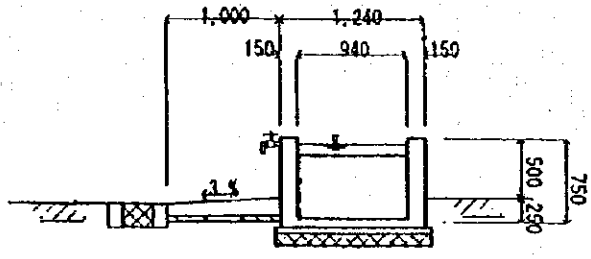


Figure 8.4.2(a) Iron Removal Facility

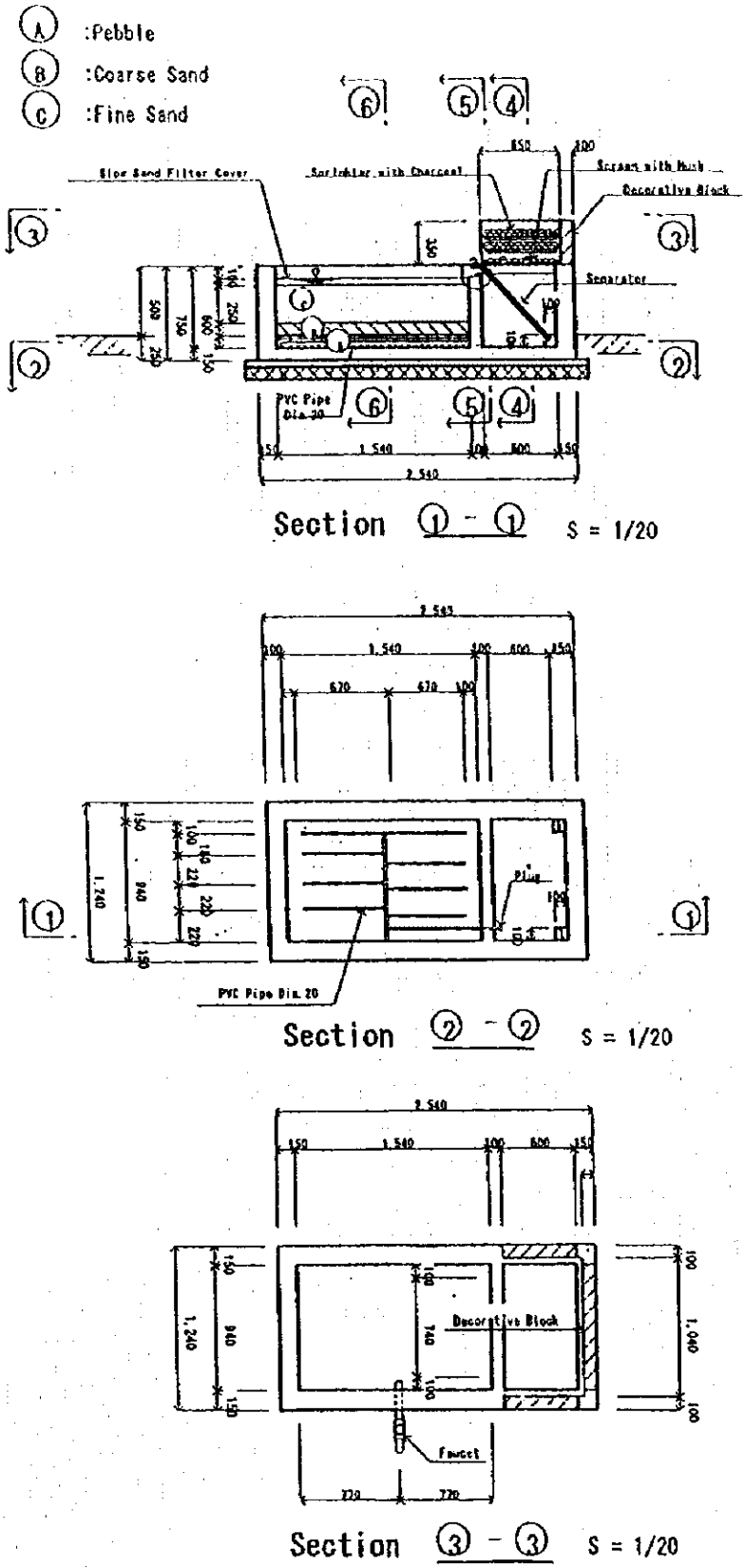


Figure 8.4.2(b) Iron Removal Facility

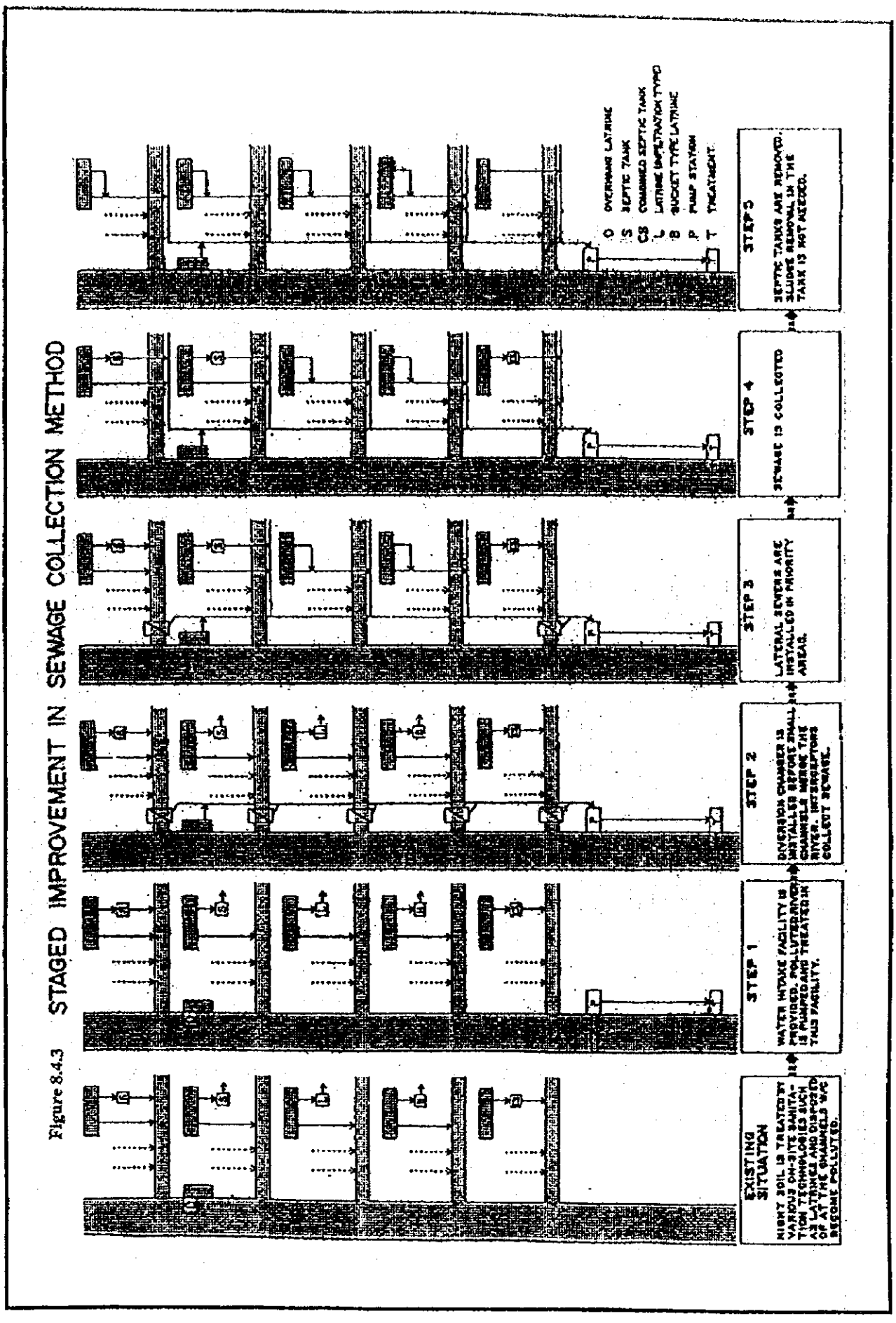

STAGED IMPROVEMENT IN SEWAGE COLLECTION METHOD
EXISTING SITUATION
NIGHT SOIL IS TREATED BY VARIOUS ON-SITE SANITATION TECHNOLOGIES SUCH AS LATRINES AND DISPOSED OF AT THE CHANNELS WHICH BECOME POLLUTED.
STEP 1
WATER INTAKE FACILITY IS PROVIDED. POLLUTED RIVER WATER IS PUMPED AND TREATED IN THIS FACILITY.
STEP 2
DIVERSION CHAMBER IS INSTALLED BEFORE SMALL CHANNELS WHERE THE RIVER INTERCEPTORS COLLECT SEWAGE.
STEP 3
LATERAL SEWERS ARE INSTALLED IN PRIORITY AREAS.
STEP 4
SEWAGE IS COLLECTED
STEP 5
SEPTIC TANKS ARE REMOVED. SLUDGE REMOVAL IN THE TANK IS NOT NEEDED.
O OVERHUNG LATRINE
S SEPTIC TANK
CS COMBINED SEPTIC TANK
L LATRINE INFILTRATION TYPE
B BUCKET TYPE LATRINE
P PUMP STATION
T TREATMENT

Figure 8.4.3

8.5 Service Coverage by Target Year

8.5.1 Water Supply

(1) Population to be served by Level I facilities under ADB-assisted project

With regard to the development of rural water supply by municipality, the ADB-assisted Rural Water Supply and Sanitation Sector Project (RW3SP) plays a major role in the medium-term plan of PW4SP. To set up the target, additional population to be served under this project shall be given due consideration.

Physical targets:

Physical targets for rural water supply are construction of shallow well (6 units), deep well (36 units) and developed spring (34 units) in the whole province. A total of 76 units were allocated by the province to the recipient municipalities as shown in Table 8.5.1.

Table 8.5.1 Proposed Number of Facility to be Constructed under ADB-Assisted RW3SP (1999-2001)

Municipality	Class	Shallow Well	Deep Well	Developed Spring	Total
Almeria	5th	0	0	2	2
Biliran	5th	3	0	0	3
Cabucgayan	5th	3	3	4	10
Caibiran	5th	0	0	15	15
Culaba	5th	0	5	4	9
Kawayan	5th	0	3	6	9
Maripipi	6th	0	25	1	26
Naval	4th	0	0	2	2
Provincial Total	4th	6	36	34	76

Current status

Implementation of the project was originally scheduled to commence in 1997 with 5 years implementation period (1997-2001). However, the construction of the facilities has not yet started as of now due to delay of fund release. In addition, delivery of the required materials has not completed for the 1st year allocation. Thus, the above physical targets under the ADB-assisted project may be a major part of the requirements in the medium-term plan (year 2000 - 2004).

Additional population to be served:

The additional population to be served under the ADB-assisted project is assumed at 6,840 persons based on the total number of physical targets (76 units) applying served population of 90 persons per one Level I facility (serving 6 persons/HH x 15 HHs/unit).

(2) Population to be served by target year

Phase I

For urban area, the additional service coverage was estimated by Level III service. For rural area, the population to be served under the ADB-assisted project is the target of rural water supply. The additional service coverage by Level II system was not considered, since Level II systems with untapped springs were not included in the ADB-assisted project.

Phase II

For urban area, the population served by Level I and II facilities in the base year was considered to be absorbed by Level III service aside from the additional service coverage to be estimated by the sector target. For rural area, all existing facilities in Phase I were assumed to be utilized throughout the future.

The population to be served by target year is exhibited in Table 8.5.2 and Table 8.5.3.

Table 8.5.2 Population to be Served in Phase I (Water Supply)

Name of Municipality	Area	Population Served in the Base Year				Phase I Coverage (2004)									ADB Assisted Project
						Total Population	Service Coverage				Additional Population to be Served				
		Level III	Level II	Level I	Total		Level III	Level II	Level I	Total	Level III	Level II	Level I	Total	
Almeria	Urban	2,567			2,567	3,540	3,238			3,238	671			671	
	Rural	6,573	2,011	344	8,928	11,302	6,573	2,011	524	9,108			180	180	180
	Total	9,140	2,011	344	11,495	14,842	9,811	2,011	524	12,346	671		180	851	
Biliran	Urban	1,920	330	2,483	4,733	5,460	1,920	330	2,483	4,733					
	Rural		3,501	5,395	8,896	10,584		3,501	5,665	9,166			270	270	270
	Total	1,920	3,831	7,878	13,629	16,044	1,920	3,831	8,148	13,899			270	270	
Cabucgayan	Urban	1,600	770	3,107	5,477	14,642	4,374	770	3,107	8,251	2,774			2,774	
	Rural	2,000	1,320	996	4,316	3,127	2,000	1,320	1,896	5,216			900	900	900
	Total	3,600	2,090	4,103	9,793	17,769	6,374	2,090	5,003	13,467	2,774		900	3,674	
Caibiran	Urban	3,816	30		3,846	6,593	5,065	30		5,095	1,249			1,249	
	Rural	324	1,611	6,647	8,582	12,985	324	1,611	7,997	9,932			1,350	1,350	1,350
	Total	4,140	1,641	6,647	12,428	19,578	5,389	1,641	7,997	15,027	1,249		1,350	2,599	
Culaba	Urban	2,128			2,128	5,403	3,151			3,151	1,023			1,023	
	Rural	1,874	1,981	2,422	6,277	10,212	1,874	1,981	3,232	7,087			810	810	810
	Total	4,002	1,981	2,422	8,405	15,615	5,025	1,981	3,232	10,238	1,023		810	1,833	
Kawayan	Urban	1,033	725		1,758	1,862	1,033	725		1,758					
	Rural	3,023	6,525	4,251	13,799	15,945	3,023	6,525	5,061	14,609			810	810	810
	Total	4,056	7,250	4,251	15,557	17,807	4,056	7,250	5,061	16,367			810	810	
Maripipi	Urban		366	779	1,145	1,434		366	779	1,145					
	Rural		1,578	3,246	4,824	7,339		1,578	5,586	7,164			2,340	2,340	2,340
	Total		1,944	4,025	5,969	8,773		1,944	6,365	8,309			2,340	2,340	
Naval (Capital)	Urban	9,630			9,630	12,988	12,090			12,090	2,460			2,460	
	Rural	3,850	1,825	8,523	14,198	23,145	3,850	1,825	8,703	14,378			180	180	180
	Total	13,480	1,825	8,523	23,828	36,133	15,940	1,825	8,703	26,468	2,460		180	2,640	
Provincial Total	Urban	22,694	2,221	6,369	31,284	51,922	30,871	2,221	6,369	39,461	8,177			8,177	
	Rural	17,644	20,352	31,824	69,820	94,639	17,644	20,352	38,664	76,660			6,840	6,840	6,840
	Total	40,338	22,573	38,193	101,104	146,561	48,515	22,573	45,033	116,121	8,177		6,840	15,017	

Table 8.5.3 Population to be Served in Phase II (Water Supply)

Name of Municipality	Area	Population Served in 2004				Phase II Coverage (2010)							
						Total Population	Service Coverage				Additional Population to be Served			
		Level III	Level II	Level I	Total		Level III	Level II	Level I	Total	Level III	Level II	Level I	Total
Almeria	Urban	3,238			3,238	3,765	3,577			3,577	339			339
	Rural	6,573	2,011	524	9,108	12,020	6,573	2,011	2,595	11,179			2,071	2,071
	Total	9,811	2,011	524	12,346	15,785	10,150	2,011	2,595	14,756	339		2,071	2,410
Biliran	Urban	1,920	330	2,483	4,733	5,972	5,673			5,673	3,753			3,753
	Rural		3,501	5,665	9,166	11,576		3,501	7,265	10,766			1,600	1,600
	Total	1,920	3,831	8,148	13,899	17,548	5,673	3,501	7,265	16,439	3,753		1,600	5,353
Cabucgayan	Urban	4,374	770	3,107	8,251	15,337	14,570			14,570	10,196			10,196
	Rural	2,000	1,320	1,896	5,216	3,275	2,000	1,320	1,896	5,216				
	Total	6,374	2,090	5,003	13,467	18,612	16,570	1,320	1,896	19,786	10,196			10,196
Caibiran	Urban	5,065	30		5,095	6,816	6,475			6,475	1,410			1,410
	Rural	324	1,611	7,997	9,932	13,423	324	1,611	10,548	12,483			2,551	2,551
	Total	5,389	1,641	7,997	15,027	20,239	6,799	1,611	10,548	18,958	1,410		2,551	3,961
Culaba	Urban	3,151			3,151	6,071	5,767			5,767	2,616			2,616
	Rural	1,874	1,981	3,232	7,087	11,475	1,874	1,981	6,817	10,672			3,585	3,585
	Total	5,025	1,981	3,232	10,238	17,546	7,641	1,981	6,817	16,439	2,616		3,585	6,201
Kawayan	Urban	1,033	725		1,758	1,958	1,860			1,860	827			827
	Rural	3,023	6,525	5,061	14,609	16,766	3,023	6,525	6,044	15,592			983	983
	Total	4,056	7,250	5,061	16,367	18,724	4,883	6,525	6,044	17,452	827		983	1,810
Maripipi	Urban		366	779	1,145	1,534	1,457			1,457	1,457			1,457
	Rural		1,578	5,586	7,164	7,849		1,578	5,722	7,300			136	136
	Total		1,944	6,365	8,309	9,383	1,457	1,578	5,722	8,757	1,457		136	1,593
Naval (Capital)	Urban	12,090			12,090	13,745	13,058			13,058	968			968
	Rural	3,850	1,825	8,703	14,378	24,495	3,850	1,825	17,105	22,780			8,402	8,402
	Total	15,940	1,825	8,703	26,468	38,240	16,908	1,825	17,105	35,838	968		8,402	9,370
Provincial Total	Urban	30,871	2,221	6,369	39,461	55,198	52,437			52,437	21,566			21,566
	Rural	17,644	20,352	38,664	76,660	100,879	17,644	20,352	57,992	95,988			19,328	19,328
	Total	48,515	22,573	45,033	116,121	156,077	70,081	20,352	57,992	148,425	21,566		19,328	40,894

Table 8.5.4 Additional Number of Households to be Served in Phase I (Household Toilets)

Name of Municipality	Area	No. of Household Served in the Based Year				Phase I Coverage (2004)							
							Household Coverage				Additional No. of HHs to be Served			
		Flush	Pour Flush	VIP/Dry	Total	Total No. of HHs	Flush	Pour Flush	VIP/Dry	Total	Flush	Pour Flush	VIP/Dry	Total
Almeria	Urban		382		382	678	115	323	23	461	115		23	138
	Rural		1,886		1,886	2,225		1,792	94	1,886			94	94
	Total		2,268		1,886	2,903	115	2,115	117	2,347	115		117	232
Biliran	Urban	336	171	52	559	977	166	465	33	664		294		294
	Rural	476	235	83	794	1,877	476	736	64	1,276		501		501
	Total	812	406	135	794	2,854	642	1,201	97	1,940		795		795
Cabucgayan	Urban		889		889	2,692	458	1,281	92	1,831	458	392	92	942
	Rural		782		782	613		743	39	782			39	39
	Total		1,671		782	3,305	458	2,024	131	2,613	458	392	131	981
Caibiran	Urban	303	59		362	1,228	209	584	42	835		525	42	567
	Rural	864	243		1,107	2,436	248	1,325	83	1,656		1,082	83	1,165
	Total	1,167	302		1,107	3,664	457	1,909	125	2,491		1,607	125	1,732
Culaba	Urban		80		80	889	151	424	30	605	151	344	30	525
	Rural		649		649	1,716	175	934	58	1,167	175	285	58	518
	Total		729		649	2,605	326	1,358	88	1,772	326	629	88	1,043
Kawayan	Urban		369		369	392		351	18	369			18	18
	Rural		2,226		2,226	3,294	336	1,792	112	2,240	336		112	448
	Total		2,595		2,226	3,686	336	2,143	130	2,609	336		130	466
Maripipi	Urban		101		101	294		190	10	200		89	10	99
	Rural		671		671	1,442		932	49	981		261	49	310
	Total		772		671	1,736		1,122	59	1,181		350	59	409
Naval (Capital)	Urban		1,820		1,820	2,629		1,729	91	1,820			91	91
	Rural		2,879		2,879	4,883	498	2,656	166	3,320	498		166	664
	Total		4,699		2,879	7,512	498	4,385	257	5,140	498		257	755
Provincial Total	Urban	639	3,871	52	4,562	9,779	1,099	5,347	339	6,785	724	1,644	306	2,674
	Rural	1,340	9,571	83	10,994	18,486	1,733	10,910	665	13,308	1,009	2,129	601	3,739
	Total	1,979	13,442	135	15,556	28,265	2,832	16,257	1,004	20,093	1,733	3,773	907	6,413

Table 8.5.5 Additional Number of Households to be Served in Phase II (Household Toilets)

Name of Municipality	Area	No. households Served in 2004				Phase II Coverage (2010)							
						Total No. of HHs	Household Coverage				Additional No. of HHs to be Served			
		Flush	Pour Flush	VIP/Dry	Total		Flush	Pour Flush	VIP/Dry	Total	Flush	Pour Flush	VIP/Dry	Total
Almeria	Urban	115	323	23	461	941	438	414	23	875	323	91		414
	Rural		1,792	94	1,886	3,005	481	1,829	94	2,404	481	37		518
	Total	115	2,115	117	2,347	3,946	919	2,243	117	3,279	804	128		932
Biliran	Urban	166	465	33	664	1,493	694	661	33	1,388	528	196		724
	Rural	476	736	64	1,276	2,894	476	1,775	64	2,315		1,039		1,039
	Total	642	1,201	97	1,940	4,387	1,170	2,436	97	3,703	528	1,235		1,765
Cabucgayan	Urban	458	1,281	92	1,831	3,834	1,783	1,691	92	3,566	1,325	410		1,735
	Rural		743	39	782	819		743	39	782				
	Total	458	2,024	131	2,613	4,653	1,783	2,434	131	4,348	1,325	410		1,735
Caibiran	Urban	209	584	42	835	1,704	793	750	42	1,585	584	166		750
	Rural	248	1,325	83	1,656	3,356	324	2,278	83	2,685	76	953		1,029
	Total	457	1,909	125	2,491	5,060	1,117	3,028	125	4,270	660	1,119		1,779
Culaba	Urban	151	424	30	605	1,518	706	676	30	1,412	555	252		807
	Rural	175	934	58	1,167	2,869	459	1,778	58	2,295	284	844		1,128
	Total	326	1,358	88	1,772	4,387	1,165	2,454	88	3,707	839	1,096		1,935
Kawayan	Urban		351	18	369	490	228	210	18	456	228			228
	Rural	336	1,792	112	2,240	4,192	671	2,571	112	3,354	335	779		1,114
	Total	336	2,143	130	2,609	4,682	899	2,781	130	3,810	563	779		1,342
Maripipi	Urban		190	10	200	384	179	168	10	357	179			179
	Rural		932	49	981	1,962		1,521	49	1,570		589		589
	Total		1,122	59	1,181	2,346	179	1,689	59	1,927	179	589		768
Naval (Capital)	Urban		1,729	91	1,820	3,436	1,598	1,506	91	3,195	1,598			1,598
	Rural	498	2,656	166	3,320	6,124	980	3,753	166	4,899	482	1,097		1,579
	Total	498	4,385	257	5,140	9,560	2,578	5,259	257	8,094	2,080	1,097		3,177
Provincial Total	Urban	1,099	5,347	339	6,785	13,800	6,419	6,076	339	12,834	5,320	1,115		6,435
	Rural	1,733	10,910	665	13,308	25,221	3,391	16,248	665	20,304	1,658	5,338		6,996
	Total	2,832	16,257	1,004	20,093	39,021	9,810	22,324	1,004	33,138	6,978	6,453		13,431

Table 8.5.6 Additional Number of Public School Students to be Served in Phases I and II (School Toilets)

Name of Municipality	Std. No. of Public School Student that can be Served in the Base Year (1998)	Projected No. of Public School Student in 2004	Phase I Coverage (2004)		Projected Number of Public School Students in 2010	Phase II Coverage (2010)	
			Public School Students Coverage	Additional No. of Public School Student to be Served		Public School Students Coverage	Additional No. of Public School Students to be Served
Almeria	1,040	3,825	2,173	1,133	3,943	3,549	1,376
Biliran	1,080	3,570	2,338	1,258	4,148	3,733	1,395
Cabucgayan	800	4,028	2,194	1,394	4,483	4,035	1,841
Caibiran	1,000	5,570	2,851	1,851	5,758	5,182	2,331
Culaba	1,280	3,579	2,541	1,261	4,259	3,833	1,292
Kawayan	2,640	4,482	2,840	200	4,713	4,242	1,402
Maripipi	720	1,989	1,309	589	2,128	1,915	606
Naval (Capital)	2,400	8,627	5,156	2,756	8,622	7,760	2,604
Provincial Total	10,960	35,670	21,402	10,442	38,054	34,249	12,847

Table 8.5.7 Additional Number of Public Utilities with Sanitary Toilets in Phase I and II

Name of Municipality	Type	Coverage in Base Year (1998)		Phase I Coverage (2004)			Phase I Coverage (2010)		
		No. of PU with Toilets Facilities	No. of PU with Sanitary Toilets	No. of PU with Toilets Facilities	Add'l. No. of Public Utilities with Sanitary Toilets	No. of PU with Sanitary Toilets	No. of PU with Toilets Facilities	Add'l. No. of Public Utilities with Sanitary Toilets	No. of PU with Sanitary Toilets
Almeria	Public Market	1	1	1		1	1		1
	Bus/Jeepney Terminal			1	1	1	1		1
	Parks/Playground			1	1	1	2	1	2
	Total	1	1	3	2	3	4	1	4
Biliran	Public Market	1	1	1		1	1		1
	Bus/Jeepney Terminal	1	1	1		1	2	1	2
	Parks/Playground			1	1	1	1		1
	Total	2	2	3	1	3	4	1	4
Cabucgayan	Public Market	1		1	1	1	1		1
	Bus/Jeepney Terminal			1	1	1	1		1
	Parks/Playground	1	1	2	1	2	2		2
	Total	2	1	4	3	4	4		4
Caibiran	Public Market			1	1	1	1		1
	Bus/Jeepney Terminal	1		1	1	1	1		1
	Parks/Playground			1	1	1	2	1	2
	Total	1		3	3	3	4	1	4
Culaba	Public Market	1	1	1		1	1		1
	Bus/Jeepney Terminal			1	1	1	1		1
	Parks/Playground			1	1	1	2	1	2
	Total	1	1	3	2	3	4	1	4
Kawayan	Public Market								
	Bus/Jeepney Terminal			1	1	1	1		1
	Parks/Playground	1	1	2	1	2	2		2
	Total	1	1	3	2	3	3		3
Maripipi	Public Market								
	Bus/Jeepney Terminal			1	1	1	1		1
	Parks/Playground			1	1	1	1		1
	Total			2	2	2	2		2
Naval (Capital)	Public Market	2	2	2		2	2		2
	Bus/Jeepney Terminal	2	2	3	1	3	3		3
	Parks/Playground			1	1	1	2	1	2
	Total	4	4	6	2	6	7	1	7
Provincial Total	Public Market	6	5	7	2	7	7		7
	Bus/Jeepney Terminal	4	3	10	7	10	11	1	11
	Parks/Playground	2	2	10	8	10	14	4	14
	Total	12	10	27	17	27	32	5	32

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

8.6.1 Water Supply

(1) Required water supply facilities

Urban water supply:

Urban water supply facilities required by target year shown in Table 8.6.1 were estimated as the required number of house connections based on the additional service coverage.

As reference, the following requirements were also estimated:

- daily average water demand at 100 lpcd consumption rate, and
- number of deep wells to meet the daily maximum water demand based on the groundwater productivity.
  (daily maximum water demand = 1.3 x daily average water demand)

Information pertaining to the expansion plan of Level III systems was arranged and indicated in Table 8.6.1 and the details presented in Table 8.6.2, however, required data were not available during this PW4SP preparation.

Rural water supply:

Rural water supply facilities required by target year shown in Table 8.6.3(a) were estimated as the number of Level II systems with number of communal faucets and the number of Level I wells broken-down to deep and shallow wells. However, Level II systems shall be excluded from medium-term plan due to the absence of Level II projects under the ADB-assisted project.

Table 8.6.1 Urban Water Supply Facilities Required by Target Year

Name of Municipality	Reference on Expansion of Existing Level III System						Phase I (2004) Requirements				Phase II (2010) Requirements			
	Name of Operating Body	Area	Coverage in 1998		Type of Water Source	Plan for Expansion	Additional Population to be Served	Number of House Connections	Daily Average Water Demand (m^3/day)	Number of Spring Dev't./ Deep Well	Additional Population to be Served	Number of House Connections	Daily Average Water Demand (m^3/day)	Number of Spring Dev't./ Deep Well
			No. of Barangay Served	Served Population										
Almeria	Almeria WWS	Urban	1	2,567	SP	No	671	129	67	1	339	85	34	1
		Rural	6	6,573										
		Total	7	9,140										
Biliran	LGU-Biliran	Urban	2	1,920	SP	No					3,753	938	375	1
		Rural												
		Total	2	1,920										
Cabucgayan	Sitio Naga WWS	Urban	3	1,600		No	2,774	510	277	1	10,196	2,549	1,020	2
		Rural	2	2,000										
		Total	5	3,600										
Caibiran	Caibiran WWS (Palanay)	Urban	1	1,032	SP	No	1,249	233	125	1	1,410	353	141	1
		Rural												
		Total	1	1,032										
	Caibiran WWS (Victory, etc.)	Urban	2	2,784	SP	No								
		Rural	1	324										
		Total	3	3,108										
	Municipal Total	Urban	3	3,816										
		Rural	1	324										
		Total	4	4,140										
Culaba	Bool RWSA	Urban			SP	No	1,023	168	102	1	2,616	654	262	1
		Rural	4	1,638										
		Total	4	1,638										
	Culaba Central	Urban	3	2,128	SP	No								
		Rural												
		Total	3	2,128										
	Kalipayan	Urban			SP	No								
		Rural	1	96										
		Total	1	96										
	Pinamihagan	Urban			SP	No								
		Rural	1	140										
		Total	1	140										
	Municipal Total	Urban	3	2,128										
		Rural	6	1,874										
		Total	9	4,002										
Kawayan	Baganito	Urban			SP	No					827	207	83	1
		Rural	1	100										
		Total	1	100										
	Balite WW	Urban	1	428	SP	No								
		Rural												
		Total	1	428										
	Bilwang WW	Urban			SP	No								
		Rural	1	30										
		Total	1	30										

Table 8.6.1 Urban Water Supply Facilities Required by Target Year (Cont'd)

Name of Municipality	Reference on Expansion of Existing Level III System						Phase I (2004) Requirements				Phase II (2010) Requirements			
	Name of Operating Body	Area	Coverage in 1998		Type of Water Source	Plan for Expansion	Additional Population to be Served	Number of House Connections	Daily Average Water Demand (m^3/day)	Number of Spring Dev't./ Deep Well	Additional Population to be Served	Number of House Connections	Daily Average Water Demand (m^3/day)	Number of Spring Dev't./ Deep Well
			No. of Barangay Served	Served Population										
Kawayan	Bulalacao WW	Urban			SP	No								
		Rural	1	25										
		Total	1	25										
	Burabod WW	Urban			SP	No								
		Rural	1	175										
		Total	1	175										
	Inasuyan	Urban			SP	No								
		Rural	1	250										
		Total	1	250										
	Kansanoc WW	Urban			SP	No								
		Rural	1	100										
		Total	1	100										
	Madao WW	Urban			SP	No								
		Rural	1	250										
		Total	1	250										
	Mapuyo WW	Urban			SP	No								
		Rural	1	378										
		Total	1	378										
	Masagaosao WW	Urban			SP	No								
		Rural	1	125										
		Total	1	125										
	Masagongsong	Urban			SP	No								
		Rural	1	275										
		Total	1	275										
	Poblacion WW	Urban	1	605	SP	No								
		Rural												
		Total	1	605										
	San Lorenzo WWS	Urban			SP	No								
		Rural	1	75										
		Total	1	75										
	Tabunan-North	Urban			SP	No								
		Rural	1	75										
		Total	1	75										
	Tubig Guinoo WW	Urban			SP	No								
		Rural	1	150										
		Total	1	150										
	Tucdao WW	Urban			SP	No								
		Rural	1	540										
		Total	1	540										

Table 8.6.1 Urban Water Supply Facilities Required by Target Year (Cont'd)

Name of Municipality	Reference on Expansion of Existing Level III System						Phase I (2004) Requirements				Phase II (2010) Requirements			
	Name of Operating Body	Area	Coverage in 1998		Type of Water Source	Plan for Expansion	Additional Population to be Served	Number of House Connections	Daily Average Water Demand (m^3/day)	Number of Spring Dev't/ Deep Well	Additional Population to be Served	Number of House Connections	Daily Average Water Demand (m^3/day)	Number of Spring Dev't/ Deep Well
			No. of Barangay Served	Served Population										
Kawayan	Ungale WW	Urban												
		Rural	1	400	SP	No								
		Total	1	400										
	V. Cornejo WW	Urban												
		Rural	1	75	SP	No								
		Total	1	75										
	Municipal Total	Urban	2	1,053										
		Rural	16	3,023										
		Total	18	4,056										
Manipipi	Not Applicable	Urban	N.A.	N.A.										
		Rural	N.A.	N.A.	N.A.	N.A.					1,457	364	146	1
		Total												
Naval (Capital)	Naval WD	Urban	3	9,630										
		Rural	8	3,850	SP	No	2,460	498	246	1	968	242	97	1
		Total	11	13,480										
Provincial Total		Urban	17	22,694										
		Rural	39	17,644			8,177	1,538	817	5	21,566	5,392	2,158	9
		Total	56	40,338										

Table 8.6.2 Plan for Expansion of Existing Level III Systems

Name of Municipality	Name of Operating Body	Additional Areas Barangay to be Covered	Additional Population to be Served	Additional Water Sources	
				Type	Capacity (m^3/day)
Almeria	Almeria WWS				
Biliran	LGU-Biliran				
Cabucgayan	Sitio Naga WWS				
Caibiran	Caibiran WWS (Palanay)				
	Caibiran WWS (Victory, etc.)				
	Municipal Total				
Culaba	Bool RWSA				
	Culaba Central				
	Kalipayan				
	Pinamihagan				
	Municipal Total				
Kawayan	Baganito				
	Balite WW				
	Bilwang WW				
	Bulalacao WW				
	Burabod WW				
	Inasuyan				
	Kansanoc WW				
	Madao WW				
	Mapuyo WW				
	Masagaosao WW				
	Masagongsong				
	Poblacion WW				
	San Lorenzo WWS				
	Tabunan-North				
	Tubig Guinoo WW				
	Tucdao WW				
	Ungale WW				
	V. Comejo WW				
	Municipal Total				
Naval (Capital)	Naval WD				

Table 8.6.3(a) Rural Water Supply Facilities Required by Target Year

Name of Municipality	Phase I (2004) Requirements								Phase II (2010) Requirements					
	Level II		Level I						Level I					
	Number of System	No. of Communal Faucets	Number of Deep Wells				No. of Shallow Wells	Total	Number of Deep Wells				No. of Shallow Wells	Total
			40 m	80 m	120 m	Sub-total			40 m	80 m	120 m	Sub-total		
Almeria			1			1	1	2	14			14	21	35
Biliran			1			1	2	3	3			3	24	27
Cabucgayan				8		8	2	10						
Caibiran				11		11	4	15		31		31	12	43
Culaba				3		3	6	9		18		18	42	60
Kawayan				4		4	5	9		7		7	10	17
Maripipi			6			6	20	26	1			1	2	3
Naval (Capital)				1		1	1	2		57		57	84	141
Provincial Total			8	27		35	41	76	18	113		131	195	326

Table 8.6.3(b) Rural Water Supply Facilities Required by Target Year

Name of Municipality	Phase I (2004) Requirements								Phase II (2010) Requirements							
	Percenatge Allocated to Public Facility (100%)								Percenatge Allocated to Public Facility (70%)							
	Number of Facilities to be Constructed under ADB-Assisted Project								Percentage Allocated for Public Wells (20%) and Percentage Allocated for Public Spring Development (80%)							
	Number of Deep Wells				No. of Shallow Wells	Total	No. of Spring Dev.	Grand Total	Number of Deep Wells				No. of Shallow Wells	Total	No. of Spring Dev.	Grand Total
	40 m	80 m	120 m	Sub-total					40 m	80 m	120 m	Sub-total				
Almeria							2	2	2			2	3	5	20	25
Biliran					3	3		3	1			1	3	4	15	19
Cabucgayan		3		3	3	6	4	10								
Caibiran							15	15		5		5	1	6	24	30
Culaba		5		5		5	4	9		3		3	5	8	34	42
Kawayan		3		3		3	6	9		1		1	1	2	10	12
Maripipi		25		25		25	1	26							2	2
Naval (Capital)							2	2		8		8	12	20	79	99
Provincial Total		36		36	6	42	34	76	3	17		20	25	45	184	229

Table 8.6.4 Urban Household Toilets Required by Target Year

Name of Municipality	Phase I (2004) Requirements								Phase II (2010) Requirements							
	Additional HHs to be Served				No. of HHs to be Served				Additional HHs to be Served				No. of HHs to be Served			
	Flush	Pour Flush	VIP/ Dry	Total	Flush	Pour Flush	VIP/ Dry	Total	Flush	Pour Flush	VIP/ Dry	Total	Flush	Pour Flush	VIP/ Dry	Total
Almeria	115		23	138	115		23	138	323	91		414	323	91		414
Biliran		294		294		294		294	528	196		724	528	196		724
Cabucgayan	458	392	92	942	458	392	92	942	1,325	410		1,735	1,325	410		1,735
Caibiran		525	42	567		525	42	567	584	166		750	584	166		750
Culaba	151	344	30	525	151	344	30	525	555	252		807	555	252		807
Kawayan			18	18			18	18	228			228	228			228
Maripipi		89	10	99		89	10	99	179			179	179			179
Naval (Capital)			91	91			91	91	1,598			1,598	1,598			1,598
Provincial Total	724	1,644	306	2,674	724	1,644	306	2,674	5,320	1,115		6,435	5,320	1,115		6,435

Table 8.6.5 Rural Household Toilets Required by Target Year

Name of Municipality	Phase I (2004) Requirements								Phase II (2010) Requirements							
	Additional HHs to be Served				No. of HHs to be Served				Additional HHs to be Served				No. of HHs to be Served			
	Flush	Pour Flush	VIP/ Dry	Total	Flush	Pour Flush	VIP/ Dry	Total	Flush	Pour Flush	VIP/ Dry	Total	Flush	Pour Flush	VIP/ Dry	Total
Almeria			94	94			94	94	481	37		518	481	37		518
Biliran		501		501		501		501		1,039		1,039		1,039		1,039
Cabucgayan			39	39			39	39								
Caibiran		1,082	83	1,165		1,082	83	1,165	76	953		1,029	76	953		1,029
Culaba	175	285	58	518	175	285	58	518	284	844		1,128	284	844		1,128
Kawayan	336		112	448	336		112	448	335	779		1,114	335	779		1,114
Maripipi		261	49	310		261	49	310		589		589		589		589
Naval (Capital)	498		166	664	498		166	664	482	1,097		1,579	482	1,097		1,579
Provincial Total	1,009	2,129	601	3,739	1,009	2,129	601	3,739	1,658	5,338		6,996	1,658	5,338		6,996

Table 8.6.6 Public School Toilets Required by Target Year

Name of Municipality	Phase I (2004) Requirements			Phase II (2010) Requirements		
	Additional Public School Students to be Served	No. of Toilet Unit	No. of Toilet Facilities	Additional Public School Students to be Served	No. of Toilet Unit	No. of Toilet Facilities
Almeria	1,133	29	6	1,376	35	7
Biliran	1,258	32	7	1,395	35	7
Cabucgayan	1,394	35	7	1,841	47	10
Caibiran	1,851	47	10	2,331	59	12
Culaba	1,261	32	7	1,292	33	7
Kawayan	200	5	1	1,402	36	8
Maripipi	589	15	3	606	16	4
Naval (Capital)	2,756	69	14	2,604	66	14
Provincial Total	10,442	264	55	12,847	327	69

Table 8.6.7 Public Toilets Required by Target Year

Name of Municipality	Phase I (2004) Requirements				Phase II (2010) Requirements			
	Number of Public Toilets				Number of Public Toilets			
	Public Market	Bus/Jeepney Terminal	Parks/ Playground	Total	Public Market	Bus/Jeepney Terminal	Parks/ Playground	Total
Almeria		1	1	2			1	1
Biliran			1	1		1		1
Cabucgayan	1	1	1	3				
Caibiran	1	1	1	3			1	1
Culaba		1	1	2			1	1
Kawayan		1	1	2				
Maripipi		1	1	2				
Naval (Capital)		1	1	2			1	1
Provincial Total	2	7	8	17		1	4	5