

Appendix 7 Procedure of Projections of Population  
and Water Demand <sup>1/</sup>

A. Population Projection

General

To estimate the study area population which is one of the basic factors of water requirement, the past census made by the National Census and Statistics Office (NCSO) is used as the most reliable demographic data.

The total study area population is projected on the basis of separate projections for the city core or poblacion and for the rural barangays within the study area. The method of past trend extrapolation is applied for population projection of such "micro-economic" areas of barangays in this study.

To determine future growth rates for each barangay the following factors are considered:

1. Existing and proposed land use plans, (residential, commercial, industrial, institutional and agricultural zones)
2. Physical limits (barriers) to the geographical development of the area.
3. Population density. (persons per ha)
4. Housing patterns.
5. Existing and proposed transportation and communication facilities. (road network, etc)
6. Possible migrations within the municipality and the region.
7. Family planning program of the Government.

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Remarks: <sup>1/</sup> In the course of the work of preparing the master plan for water supply of the four WDs in the three provincial areas (Ilocos Norte WD in Ilocos Norte Province, Legaspi City WD and Daraga WD in Albay Province, and Tagbilaran WD in Bohol Province), this procedure of projections of population and water demand is established as a general concept to be applied to the four WDs.

Total Municipal Population

In projecting the municipal population, the following steps are observed:

1. Using available past census data, a trend analysis on past growth rates and the factors which might have influenced them is performed. Past population trend of the municipality is shown in Table 1.2.2 thru Table 1.2.6. (See 2.2 Population, Part One: General)
2. Future growth rates up to the design year are projected based on the field conditions and future development as well as data obtained in step 1 above.
3. The population for each design year is obtained using the projected average annual growth rates in step 2 above. The population in each design year is tabulated as shown in Table 2.3.1. The past and future trends are graphically shown in Fig. 2.3.1. (See 3.1 Population Projection, Part Two: Master Plan)

Barangay Population

1. Using the same method outlined for municipal population projections, the population for each barangay covered by the municipality is projected.
2. Since the total annual population of all the barangays should equal to the total annual municipal population, barangay population is revised where applicable and necessary. Population projection for each barangay is shown in Table 2.3.2 thru Table 2.3.6. (See 3.1 Population Projection, Part Two: Master Plan)
3. Population density of each barangay is checked.

As an example of the high growth of population in the study area, the high series of NEDA-POPCOM projection is introduced herein, which is considered to be a useful data for a sensitivity analysis of the population projection. While the low growth of population in the study area is projected with an assumption that the average growth rates from one design year to another design year may differ by 10 to 20 per cent from the medium growth of projection made in this study. The high and low growth of populations are shown in Table 2.3.7 and Table 2.3.8. (See 3.1 Population Projection, Part Two: Master Plan)

#### Served Population

At present, the served area of the city/municipality is mostly concentrated on the poblacion or the central urban area, where the middle-high income groups are usually found.

A percentage of population served is estimated in each design year based on the present population served, data gathered in the field, cost and availability of the water from sources. The served population as well as the served area <sup>1/</sup> for Phase I (1987) is decided based on a concept that the purpose of this Phase project is to satisfy the present water requirement which has not been met in recent years due to deterioration of the water supply facilities, by rehabilitation, improvement and some additional works, within as short a period as possible. It is the goal of this study, however, to be able to extend improved water services (Level III system services to no less than 70 percent and 80 percent of the population in the served area by Phase II (1993) and the master plan period (2010) respectively.

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Remarks: <sup>1/</sup> Served area for this study is discussed in 2.2 Served Area, Part Two: Master Plan.

B. Water Demand Projection

General

Future water demand is projected by category of water use and area of water demand. The categories adopted are 1) domestic, 2) commercial and industrial and 3) institutional water demands. Unaccounted-for-water is also estimated and totalled to the above demands. The water demand areas adopted for projection are poblacion or urban area and rural barangays. The urban area includes the neighboring barangays of the poblacion where applicable.

Historical consumption data are not available because the current supply does not cover all the consumers with service connections and no records of meter reading are obtained. Therefore, potential/theoretical demand for the study area is considered as for the present consumption.

The potential demand as an average per capita demand for the study area is estimated based on the similar WDs records <sup>1/</sup> of consumption and the classification of WDs stipulated in the Design Manual of LWUA. The result of classification of WDs for the present study is shown in Table A.7.3. The average per capita water demands for the urban and rural areas are estimated respectively and shown in Table A.7.4 and Table A.7.5.

Domestic Demand

The projected demands for domestic water are based on the average per capita consumption and the projected served population in the study area. As mentioned in the preceding paragraph, data on present average domestic unit consumption for the study area are not available, then the consumption records of different WDs are referred

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Remarks: <sup>1/</sup> Ref. Table A.7.1 Per Capita Consumption in Existing Water District (1978) and Table A.7.2 Average Unit Consumption by WD classification in 1978.

so that present unit consumption in the similar city/municipality is to be applied for the potential unit consumption for the study area. The future unit consumption which will represent an average consumption in the urban area are projected based on the said potential consumption as shown below:

<u>City/Municipality</u>	<u>1978</u> (lpcd)	<u>1987</u> (lpcd)	<u>1993</u> (lpcd)	<u>2010</u> (lpcd)
Ilocos Norte				
Laoag	128	128	135	155
Pasuquin	100	105	115	140
Bacarra	100	105	115	140
Vintar	100	105	115	140
Paoay	100	105	115	140
Legaspi	135	135	148	175
Daraga	135	135	148	175
Tagbilaran	128	128	135	155

Domestic consumption projections for the rural area are projected using the same method for the urban area projections, however, only a single series unit domestic consumption is estimated to adopt for all the study areas. The domestic unit consumptions are projected as follows:

	<u>1980</u> (lpcd)	<u>1987</u> (lpcd)	<u>1993</u> (lpcd)	<u>2010</u> (lpcd)
All rural area	60	69	78	100

The potential unit consumption in 1980 is estimated based on the experiences in the rural water supply programs in the Southeast Asian countries. Future unit consumptions are projected on the basis that the unit consumptions will increase at a growth rate of 2.0% per annum in the period 1980-1993 and 1.5% per annum in the period 1993-2010, respectively.

Commercial and Industrial Demand

Reliable data on present commercial and industrial water consumption of the study area are not available. Therefore, the following assumptions are employed for the future demand projections. According to the experience in the Philippines, there is a relation between the level of commercial and industrial activities and the service area population. These ratios vary from a minimum level of 0.3 commercial and industrial connections per 100 inhabitants to a maximum level of 1.2 connections per 100 inhabitants.

To estimate future commercial and industrial demands in the study area the following connection densities and unit consumptions are assumed:

Connection Density Ratio

	<u>Group II</u>	<u>Group III</u>	<u>Group IV</u>
(a) 1980 Density Ratio	-	-	-
(b) Density Increase Coefficient for year			
1987	1.4	1.2	1.0
1993	1.6	1.4	1.0
2010	2.5	2.0	1.2

Group II : Legaspi and Daraga

Group III : Laoag and Tagbilaran

Group IV : Bacarra, Pasuquin, Vintar and Paoay

Unit Consumption per Connection

<u>Years</u>	<u>Unit Water Consumption (m<sup>3</sup>/day)</u>
1987	1.2
1993	1.5
2010	2.0

Based on the above assumptions, unit commercial and industrial consumptions as per capita consumptions for the future design years are obtained and shown below:

Commercial and Industrial Consumptions (lpcd)

<u>Years</u>	<u>Group II</u>	<u>Group III</u>	<u>Group IV</u>
1987	17 (13)	14 (11)	12 (11)
1993	24 (16)	21 (16)	14 (12)
2010	50 (29)	41 (26)	24 (17)

( ) Percentage to the per capita domestic consumption

Institutional Water Demand

Institutional water consumers include schools, churches, public administration buildings and hospitals. It can be assumed that all institutional establishments within the future service area will be connected. Based on this consideration and referring to the socio-economic data, one institutional connection per 2000 inhabitants is employed to be served in the study area. Unit consumption for the institutional connection will be as follows:

<u>Year</u>	<u>1987</u>	<u>1993</u>	<u>2010</u>
Unit Institutional consumption (m <sup>3</sup> /day)	4.0	6.0	8.0
Coverted to per capita consumption (lpcd)	2.0	3.0	4.0

Unaccounted-for-Water

Unaccounted-for-water including wastage, leakage and water losses are estimated as follows. During the field investigation the unaccounted-for-water measurement in the study area was not able to undertake because the supply capacity had not fully met with the requirement and no water condition in the distribution network was chronically observed.

Based on the experience, the following values for unaccounted-for-water (percentage of the total water production) may be assumed for the future design years:

<u>Year</u>	<u>1987</u>	<u>1993</u>	<u>2010</u>
System with old and new pipelines in 1987	34	25	20
System with new pipelines in 1987	22	20	20

Total Water Demand

The projected unit consumption figures for domestic, commercial and industrial, institutional, and unaccounted-for-water have been presented in the preceding sections. The compiled projected unit consumption and supply requirements are listed in Table A.7.4 and Table A.7.5.

The average day demand and supply requirements for the study area are projected based on the above unit consumption and supply requirements and the projected served population. The consolidated projection of average day water demands for the study area are shown in 3.2 Water Demand, Part Two: Master Plan.



Table A.7.1 Per Capita Consumption in Existing Water District (1978)

Water District	Total Population (1978)	Served Population (1978)	Number of Service Connection	Average Consumer per Connection	Average Metered Use per Connection (m <sup>3</sup> /month)	Per Capita Consumption (lpcd)	Water District Group
1. Bacolod	222,740	47,410	4,375	10.8	46.8	144	I
2. Bayao	482,230	33,672	5,466	6.2	37.6	202	I
3. Zamboanga	261,980	37,846	9,818	3.9	50.0	427	II
4. Cebu	625,350	85,358	12,496	6.8	42.9	210	I
5. Lipa	105,940	9,066	1,273	7.1	30.1	141	II
6. Tarlac	158,340	5,615	942	6.0	26.7	148	II
7. Cabanatuan	113,810	21,327	2,848	7.5	42.2	188	II
8. Gapan	53,840	4,750	589	8.0	13.5	56	IV
9. Bislig	56,840	4,284	865	5.0	23.3	155	III
10. Urdaneta	64,880	3,203	441	7.3	25.1	115	III
11. Silay	104,550	6,142	984	6.2	39.8	214	III
12. Calamba	96,310	6,174	1,135	5.4	26.3	162	II
13. Cotabato	66,756	14,586	1,900	7.7	28.4	123	III
14. Roxas	71,049	8,240	1,028	8.0	32.8	134	III
15. Baybay	66,596	5,138	1,153	4.5	16.2	120	III
16. San Fernando	97,800	10,632	1,445	7.4	26.4	119	II
17. Olongapo	143,279	43,806	6,375	6.9	42.2	204	I
Average				6.7	32.4	168.4	

Tagbilaran

Table A.7.2 Average Unit Consumption by WD Classification in 1978

<u>WD Group<sup>1/</sup></u>	<u>Accounted- for-water<sup>2/</sup></u> (lpcd)	<u>Unaccounted- for-water<sup>3/</sup></u> (lpcd)	<u>Total</u> ( lpcd )
I	190	127	317
II	152	101	253
III	144	96	240
IV	112 <sup>4/</sup>	75	187

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1/ Refer to Design Manual of LWUA

2/ Based on records of different WDs

3/ 40% of the total is applied

4/ No data but estimated

Table A.7.3 Classification of Water Districts According to Future Requirements

City/Municipality	1975 Urban Income	Urban Households with Refri-gerators	Urban Households with Flush Toilets	1975 Business Index	1980 Cost of Water Supply	1980 Served Population	Total Points	Group
Ilocos Norte								
Laoag	10	8	6	11	14	8	57	III
Pasuguin	6	7	6	4	20	5	48	IV
Bacarra	8	7	6	4	17	5	47	IV
Vintar	6	6	5	4	14	5	40	IV
Paoyay	6	6	5	2	11	5	35	V
Legaspi	10	8	6	16	20	9	69	II
Darage	6	8	6	16	20	8	64	II
Tagbilaran	10	8	6	16	11	8	59	III

Note: The grouping of WDs, based on the range of total points under the 5 criteria, is as follows:

Group	Total Points
I	70 and above
II	60 - 69
III	50 - 59
IV	40 - 49
V	39 and below

Tagbilaran

Tagbilaran

Table A.7.4 Tagbilaran (Group III)  
Average Unit Consumption and Supply Requirement

<u>Category/Year</u>	<u>1978</u>	<u>1987</u>	<u>1993</u>	<u>2010</u>
Domestic, lpcd	128	128	135	155
Commercial/Industrial, lpcd	14	14	21	41
(% of domestic)	(11)	(11)	(16)	(26)
Institutional, lpcd	2	2	3	4
Accounted-for-water, lpcd	144 <sup>1/</sup>	144	159	200
Unaccounted-for-water, lpcd	96	74	53	50
(% of production)	(40)	(34)	(25)	(20)
Total unit demand require- ment, lpcd	240 <sup>2/</sup>	218	212	250

<sup>1/</sup> Based on records of different WDs.

<sup>2/</sup> Estimated as potential/theoretical requirement.

Table A.7.5 Rural Barangays  
Average Unit Consumption and Supply Requirement

<u>Category/Year</u>	<u>1980</u>	<u>1987</u>	<u>1993</u>	<u>2010</u>
Domestic, lpcd	60 <sup>1/</sup>	69	78	100
Institutional, lpcd	2	2	3	4
Accounted-for-water, lpcd	62	71	81	104
Unaccounted-for-water, lpcd	21	20	20	26
% of Production	(25)	(22)	(20)	(20)
Total unit demand requirement, lpcd	83	91	101	130

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1/ Potential/theoretical requirement











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