without toilet facilities, and students unserved (based on the standard ratio) even though they have access to sanitary toilets. Service coverage of adequately served students was estimated both for public and private schools by municipality. Figure 4.2.2, Supporting Report shows a standard structure of a school toilet facility adopted by the DOH through the JICA-DPWH and DOH Rural Environmental Sanitation Project.

For public utilities toilets, the service level is classified into: 1) served - utilities that have at least one (1) sanitary toilet, and 2) underserved and/or unserved - utilities that have unsanitary or without toilet facilities. Service coverage of public utilities was estimated as a percentage of sanitary facilities to the total number of utilities.

4.2.3 Sanitation Facilities and Service Coverage

(1) Household Toilets

The service coverage of sanitary toilets in the province is 91% of the total number of households. The rest is underserved and/or unserved, of which more than half (58%) is without toilet facilities (refer to Table 4.2.1, Supporting Report and 4.2.3 Sanitation Facilities and Service Coverage, Data Report). The existence of households without toilet can be attributed to those households sharing the same facility with their relatives or neighbors as well as using the public toilets. The province has a large number of public toilets. According to PHO, about 80% of the households without toilet is considered as "shared users".

In urban areas, approximately 96% of the total households is served. A lower served households of 88% exists in rural area comparing with urban area. Table 4.2.1 shows the municipal breakdown in the number of urban and rural household toilets by category, and service coverage. Figures 4.2.1 and 4.2.2 reflect the provincial service coverage of household toilet facilities for urban and rural areas.

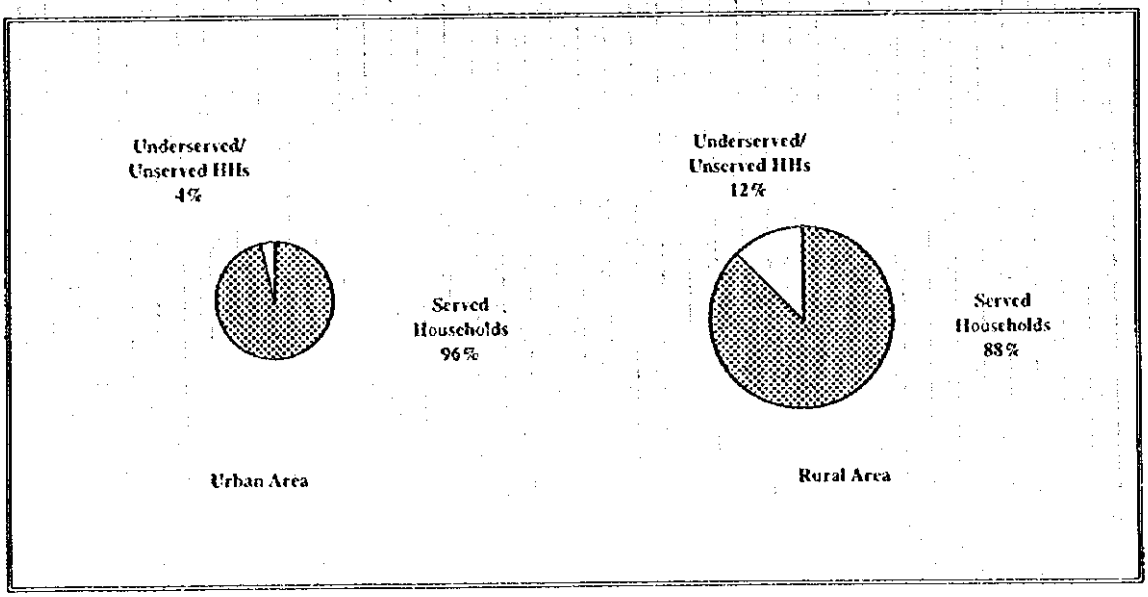
(2) School and Public Toilets

Toilet facilities in elementary and secondary schools for both public and private schools were investigated. The province has a total of 1,754 toilet units found in 429 schools. About 80% of the students is adequately served by sanitary toilets. The rest, 20% is underserved and/or unserved.

Table 4.2.1 Sanitation Facilities and Service Coverage of Household Toilets, Urban and Rural, 1995

Municipality	Households 1995			Household Toilet Facilities and Service Coverage											
				Urban				Rural				Municipal Total			
	Urban	Rural	Total	Households Served by Sanitary Toilets		Underserved/ Unserved HHs		Households Served by Sanitary Toilets		Underserved/ Unserved HHs		Households Served by Sanitary Toilets		Underserved/ Unserved HHs	
				Number	% of HH	Number	% of HH	Number	% of HH	Number	% of HH	Number	% of HH	Number	% of HH
Adams	0	213	213	0	0	0	0	174	82	39	18	174	82	39	18
Bacarra	1,798	4,149	5,947	1,701	95	97	5	3,790	91	359	9	5,491	92	456	8
Badoc	358	5,098	5,456	333	93	25	7	4,849	95	249	5	5,182	95	274	5
Bangui	794	2,049	2,843	772	97	22	3	1,791	87	258	13	2,563	90	280	10
Batac	2,700	6,351	9,051	2,595	96	105	4	5,241	83	1,107	17	7,839	87	1,212	13
Borgos	285	1,390	1,675	250	88	35	12	970	70	420	30	1,220	73	455	27
Carassi	0	159	159	0	0	0	0	84	53	75	47	84	53	75	47
Currimao	219	1,844	2,063	124	57	95	43	1,425	77	419	23	1,549	75	514	25
Dingras	1,179	5,199	6,378	1,160	98	19	2	5,149	99	50	1	6,309	99	69	1
Dumalneg	0	183	183	0	0	0	0	183	100	0	0	183	100	0	0
Espiritu	649	2,566	3,215	649	100	0	0	2,533	99	33	1	3,182	99	33	1
Laoag City (Capital	8,540	9,956	18,496	8,402	98	138	2	8,993	90	963	10	17,395	94	1,101	6
Marcos	291	2,552	2,843	291	100	0	0	2,345	92	207	8	2,636	93	207	7
Nueva Era	266	934	1,200	188	71	78	29	593	63	341	37	781	65	419	35
Pagudpud	806	2,575	3,381	729	90	77	10	2,322	90	253	10	3,051	90	330	10
Paoay	1,419	2,933	4,352	1,419	100	0	0	2,859	97	74	3	4,278	98	74	2
Pasuquin	1,184	3,556	4,740	994	84	190	16	2,392	67	1,164	33	3,386	71	1,354	29
Piddig	646	3,081	3,727	643	100	3	0	3,006	98	75	2	3,649	98	78	2
Pinili	387	2,626	3,013	385	99	2	1	2,394	91	232	9	2,779	92	234	8
San Nicolas	4,089	1,915	6,004	4,083	100	6	0	1,816	95	99	5	5,899	98	105	2
Sarrat	1,487	3,160	4,647	1,487	100	0	0	3,116	99	44	1	4,603	99	44	1
Solsona	673	3,539	4,212	645	96	28	4	3,366	95	173	5	4,011	95	201	5
Vintar	968	4,929	5,897	717	74	251	26	3,360	68	1,569	32	4,077	69	1,820	31
Provincial Total	28,738	70,957	99,695	27,567	96	1,171	4	62,754	88	8,203	12	90,321	91	9,374	9

Figure 4.2.1 Provincial Service Coverage of Household Toilet Facilities, 1995



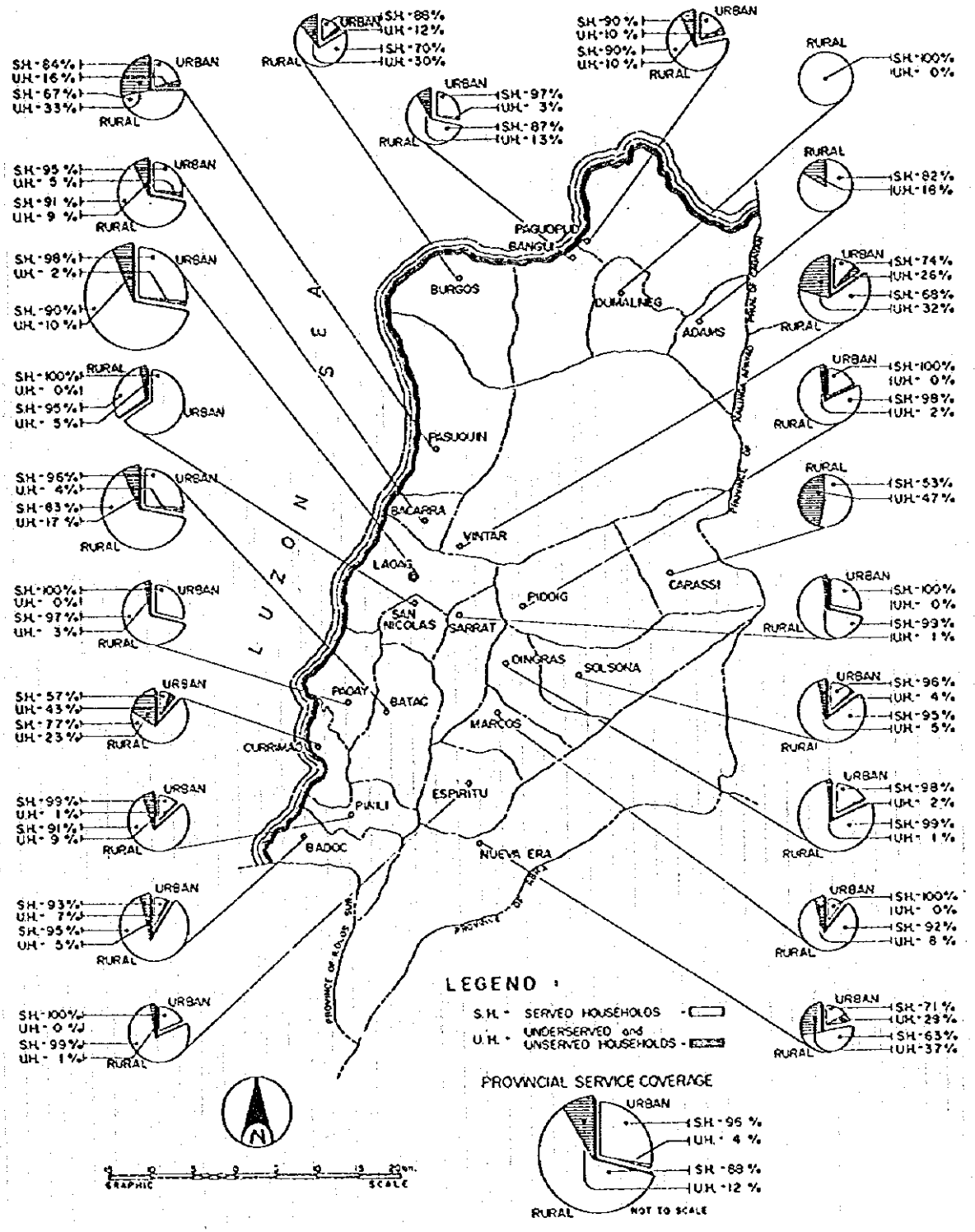


FIGURE 4.2.2
EXISTING HOUSEHOLD TOILETS SERVICE COVERAGE MAP

There are 63 public markets, bus/jeepney/airport terminals and parks/playgrounds in the province. All the public utilities have sanitary toilets. Table 4.2.2 and Table 4.2.3 provide the number and service coverage of toilet facilities of schools and public utilities, respectively.

(3) Problem Areas

Compared to the national service coverage of sanitary household toilets of 77%, the province showed a higher sanitation level.

The number of sanitary school toilets is slightly low to meet the service level standard of 50 students per sanitary facility. At present, the average ratio is 56 students per sanitary toilet.

Public toilets at markets, bus/jeepney terminals and parks/playgrounds, although culturally acceptable, are improperly used and maintained resulting in unsanitary conditions. In most cases, no specific arrangements are made for the operation and maintenance and for the collection of fees to cover such costs. Although it is considered as sanitary because of its structure, majority of these facilities have unsanitary conditions.

Even if a high percentage of sanitary toilets is revealed, problems arise from the unsatisfactory disposal of the effluent from the septic tanks, or the direct discharge of wastewater to the local drains. Generally, there is little concern about the unsatisfactory disposal of wastes once it is outside their dwelling units. Practically, almost all the households dispose their wastes in the manner that poses risks to public health.

4.2.4 Sewerage Facilities

There are no existing sewerage facilities in the province. Most of the wastewater from the dwelling units with acceptable facilities finds its way to open drains and watercourses. These deficiencies are the major contributing factors to the poor condition of the water environment in some areas of the province.

Table 4.2.2 School Toilet Facilities and Service Coverage in 1995

Municipality	Number of Schools			Number of Students			Number of Toilet Units						Total Units	Service Coverage											
							Sanitary			Unsanitary				Served						Underserved/Unserved					
														Public		Private		Total		Public		Private		Total	
	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Adams	2	0	2	379	0	379	10	0	10	0	0	0	10	379	100	0	0	379	100	0	0	0	0	0	0
Bacarra	22	2	24	6,199	564	6,763	108	10	118	0	0	0	118	5,400	80	500	7	5,900	87	799	12	64	1	863	13
Badoc	20	4	24	3,906	1,182	5,088	84	12	96	0	0	0	96	3,906	77	600	12	4,506	89	0	0	582	11	582	11
Bangui	18	1	19	3,157	82	3,239	113	4	117	0	0	0	117	3,157	97	82	3	3,239	100	0	0	0	0	0	0
Batac	25	6	31	7,340	1,955	9,295	147	10	157	0	0	0	157	7,340	79	500	5	7,840	84	0	0	1,455	16	1,455	16
Burgos	12	0	12	2,136	0	2,136	51	0	51	0	0	0	51	2,136	100	0	0	2,136	100	0	0	0	0	0	0
Carasi	3	0	3	105	0	105	9	0	9	0	0	0	9	105	100	0	0	105	100	0	0	0	0	0	0
Currimao	10	0	10	2,267	0	2,267	60	0	60	0	0	0	60	2,267	100	0	0	2,267	100	0	0	0	0	0	0
Dingras	22	1	23	4,724	328	5,052	101	7	108	0	0	0	108	4,724	94	328	6	5,052	100	0	0	0	0	0	0
Dumalneg	2	0	2	236	0	236	6	0	6	0	0	0	6	236	100	0	0	236	100	0	0	0	0	0	0
Espiritu	22	1	23	4,487	362	4,849	84	4	88	0	0	0	88	4,200	87	200	4	4,400	91	287	6	162	3	449	9
Laoag City (Capital)	38	11	49	15,404	3,820	19,224	154	30	184	0	0	0	184	7,700	40	1,500	8	9,200	48	7,704	40	2,320	12	10,024	52
Marcos	16	0	16	2,335	0	2,335	39	0	39	0	0	0	39	1,950	84	0	0	1,950	84	385	16	0	0	385	16
Nueva Era	10	0	10	1,390	0	1,390	20	0	20	0	0	0	20	1,000	72	0	0	1,000	72	390	28	0	0	390	28
Paoay	21	1	22	3,661	500	4,161	92	4	96	0	0	0	96	3,661	88	200	5	3,861	93	0	0	300	7	300	7
Pasuquin	15	2	17	2,436	393	2,829	60	4	64	0	0	0	64	2,436	86	200	7	2,636	93	0	0	193	7	193	7
Piddig	22	2	24	4,894	164	5,058	71	7	78	0	0	0	78	3,550	70	164	3	3,714	73	1,344	27	0	0	1,344	27
Pinili	17	2	19	2,992	692	3,684	101	8	109	0	0	0	109	2,992	81	400	11	3,392	92	0	0	292	8	292	8
San Nicolas	17	1	18	2,723	323	3,046	48	4	52	0	0	0	52	2,400	79	200	7	2,600	85	323	11	123	4	446	15
San Nicolas	11	2	13	5,616	694	6,310	114	8	122	0	0	0	122	5,616	89	400	6	6,016	95	0	0	294	5	294	5
Sarrat	14	0	14	3,035	0	3,035	61	0	61	0	0	0	61	3,035	100	0	0	3,035	100	0	0	0	0	0	0
Solsona	14	1	15	3,917	433	4,350	57	4	61	0	0	0	61	2,850	66	200	5	3,050	70	1,067	25	233	5	1,300	30
Vintar	37	2	39	3,805	328	4,133	46	2	48	0	0	0	48	2,300	56	100	2	2,400	58	1,505	36	228	6	1,733	42
Provincial Total	390	39	429	87,144	11,820	98,964	1,636	118	1,754	0	0	0	1,754	73,340	74	5,574	6	78,914	80	13,804	14	6,246	6	20,050	20

Table 4.2.3 Public Toilet Facilities and Service Coverage in 1995

Municipality	Public Markets			Jeepney/Bus Terminals			Parks/Playgrounds			Total Toilets	Served		Underserved	
	No. of Sanitary Toilets	Number of Unsanitary Toilets	Sub-total	No. of Sanitary Toilets	Number of Unsanitary Toilets	Sub-total	No. of Sanitary Toilets	Number of Unsanitary Toilets	Total		No. of Sanitary Toilets	%	Number of Unsanitary Toilets	%
Bangued (Capital)	1	0	1	5	0	5	2	0	2	8	8	100	0	0
Boliney	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Bucay	1	0	1	0	0	0	0	0	0	1	1	100	0	0
Bucloc	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Daguioman	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Danglas	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Dolores	1	0	1	0	0	0	0	0	0	1	1	100	0	0
Lacub	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Lagangilang	1	0	1	0	0	0	0	0	0	1	1	100	0	0
Lagayan	0	0	0	0	0	0	2	0	2	2	2	100	0	0
Langiden	0	0	0	0	0	0	0	0	0	0	0	0	0	100
La Paz	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Licuan	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Luba	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Malibcong	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Manabo	1	0	1	0	0	0	0	0	0	1	1	100	0	0
Penarrubia	1	0	1	0	0	0	2	0	2	3	3	100	0	0
Pidigan	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Pilar	0	0	0	0	0	0	2	0	2	2	2	100	0	0
Sal-lapadan	0	0	0	0	0	0	0	0	0	0	0	0	0	100
San Isidro	0	0	0	0	0	0	0	0	0	0	0	0	0	100
San Juan	1	0	1	0	0	0	0	0	0	1	1	100	0	0
San Quintin	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Tayum	0	0	0	0	0	0	2	0	2	2	2	100	0	0
Tineg	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Tubo	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Villaviciosa	0	0	0	0	0	0	0	0	0	0	0	0	0	100
Provincial Total	7	0	7	5	0	5	10	0	10	22	22	100	0	0

Chapter 5

EXISTING SECTOR ARRANGEMENTS AND INSTITUTIONAL CAPACITY

5. EXISTING SECTOR ARRANGEMENTS AND INSTITUTIONAL CAPACITY

5.1 General

Much has happened in the sector since 1987 when the national master plan was initially prepared. The water supply, sewerage and sanitation sector today is in a transition stage. The Local Government Code (LGC) has essentially re-defined the role, relationship and linkages of central, provincial, municipal and barangay institutions in the provision of basic services, including water and sanitation. The responsibility for water supply and sanitation functions were lodged with various national agencies. The new direction mandates the LGUs to play a larger role in planning and implementing water supply and sanitation projects. This raises serious institutional capacity and resource reallocation issues.

Chapter Five provides an overview of existing sector policies and arrangements as a basis for formulating modifications and improvements. It identifies current capacity building issues which need to be addressed in the early stages of master plan implementation. Most importantly, it assesses the impact of the present centralized delivery system at the local levels.

5.2 Sector Reforms

The GOP has set the future agenda for sector reform. These initiatives followed the completion of the Water Supply Sector Reform Study and the National Urban Sewerage and Sanitation Strategy Study. The GOP has endorsed the major recommendations of these studies through the following NEDA resolutions:

(1) NEDA Resolution No. 4 (series of 1994): LGUs, in the context of the LGC and related decentralization efforts, now play a lead role in service delivery. The resolution allows LGUs to implement all levels of water supply projects and redefines the roles of other sector agencies. LWUA shall implement only financially viable Level III water supply projects in areas outside the MWSS jurisdiction. DILG's participation will consist of general administration and institution building, such as assistance to the LGUs in the formation of Rural and/or Barangay Waterworks and Sanitation Association and in the identification of water supply systems. *DPWH, together with DILG and DOH, will provide technical assistance (within a period of about 2 years) to LGUs in the planning, implementation and operation and maintenance of water supply facilities.*

(2) NEDA Resolution No. 5 reaffirms the principle of provision of sewerage and sanitation services on the basis of willingness-to-pay. The resolution mandates the establishment of a Central Project Support Office (CPSO) at LWUA to assist LGUs in the formulation, preparation and implementation of sewerage and sanitation projects.

5.3 Sector Institutions

(1) Existing Institutional Arrangements

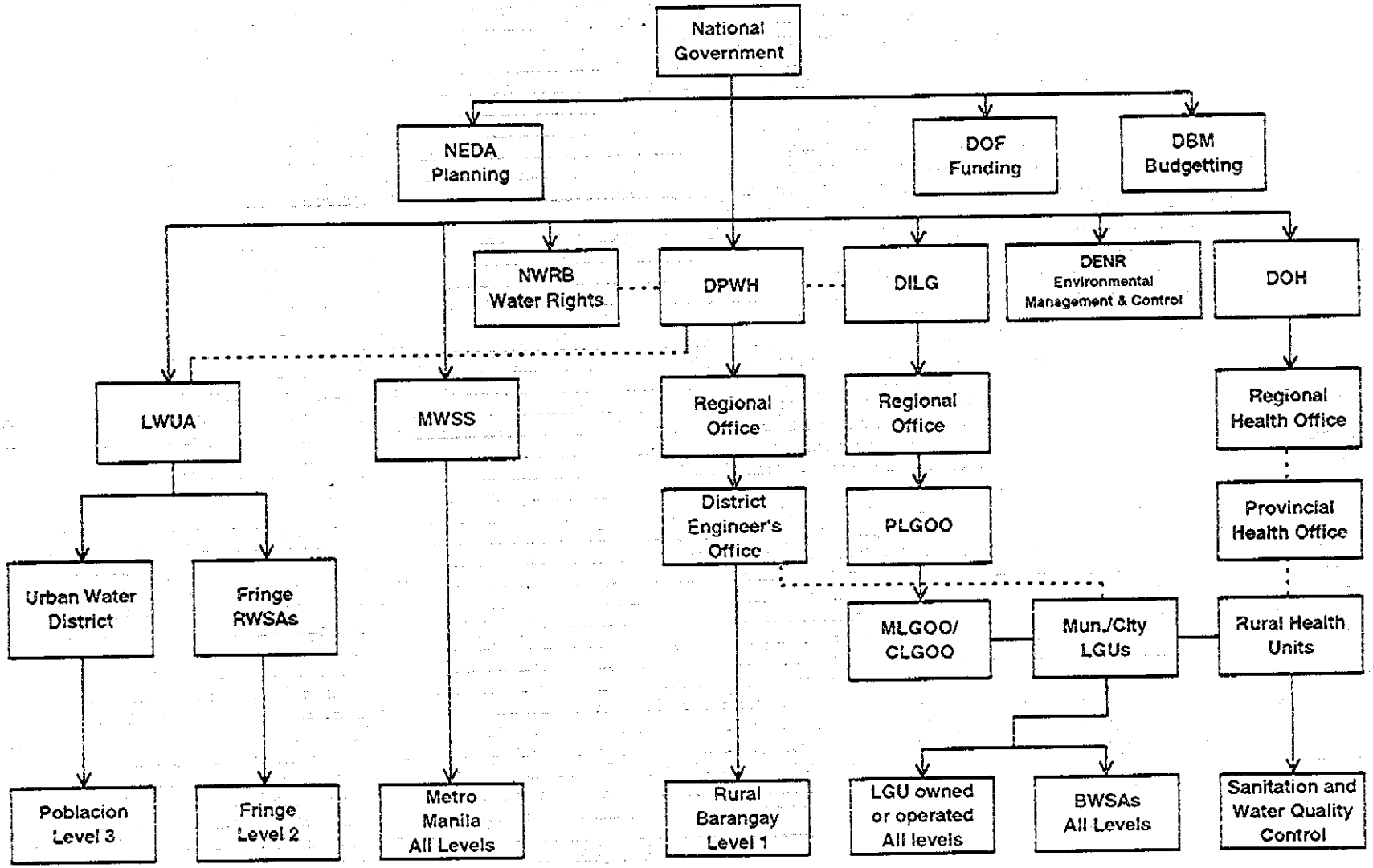
In the beginning of this chapter, it was noted that the sector is in transition. The LGC, however, mandates major changes on sector structure and performance in the future. New Implementing Rules and Regulations (IRR) reflecting the new sector role of the LGUs and national agencies are being prepared. Sector projects are still led generally by national agencies, in coordination with LGUs. The following discussion on institutional arrangements therefore presents the starting point of the transition (i.e., the existing set-up).

At the central level, there are three (3) line departments (DILG, DPWH and DOH) and two (2) government owned and controlled corporations (LWUA and MWSS) responsible for planning and implementation (refer to Figure 5.3.1, Functional Relationship). Other GOP departments are concerned with macro-planning, national resource allocation decisions, as well as exercise of regulatory powers for tariff setting, and environmental protection and management issues.

At the provincial and municipal levels, there are central agency field offices (of DPWH and DILG) and LGU offices working in the sector. DOH field offices have since been devolved and most of its resources are already under LGU supervision. Water districts, RWSAs and BWSAs have been organized to deal with the actual delivery of services. Some LGUs continue to operate municipal or provincial water and sanitation systems. As the LGC is gradually put into operation, many of the responsibilities and resources currently administered by central departments may be devolved to LGUs. Project management offices (PMOs, at the central level), *ad hoc* inter-agency committees and task forces have been organized to address coordination issues.

There are many water and sanitation activities outside the government realm. The private sector, NGOs and community-based organizations (CBOs), out of necessity, are rehabilitating publicly-installed, non-operating facilities or constructing new ones.

Figure 5.3.1 - Functional Relationships



The current major institutional issues are those of management of the transition process and of re-establishing leadership in the sector. Major resource realignments and capacity building initiatives are needed. The formulation of a new set of implementing rules and regulations will be started shortly.

(2) Sector finance

The water sector reform study reports that in order to increase nationwide water supply coverage to about 87% by 1998, new investments of about ₱39.3 B will be needed. Of this, only ₱12.8 B has been secured, i.e., carried over from existing projects. In addition, the level of public investment in water supply has declined in real terms in recent years. During the period 1988 through 1992, ₱17.268 B was allocated of which only ₱10.453 B was disbursed. Despite the declining trend in investments, the water sector fund utilization rate is only 60.5% - indicating serious institutional planning and implementation capacity issues. The delay in the institutional response to the policy shifts has invariably contributed to this decline in activity level.

If the new arrangements are to flourish, the issue of LGU access to external sources of capital development funds (backed by GOP guarantees) needs to be addressed.

5.4 Sector Agencies at the National Level

(1) Department of the Interior and Local Government (DILG)

Responsibility: The Department has the mandate of strengthening local capacity for delivery of basic services, including water and sanitation. It is responsible for providing general administration and institution-building support to LGUs including assistance in the formation and training of BWSAs; coordination of master plan preparation; sourcing of external funds; formulation and installation of sector management systems, including O&M and BWSA financial management systems. Ultimately, DILG is geared to provide a range of support activities to develop the capability of LGUs to provide, manage, operate and maintain water supply projects either directly or through community-based organizations, like BWSAs.

Current Activities: On a transitory basis, interagency provincial and municipal water task forces have been established in some provinces. These task forces (TFs) are the

current sector entry point of DILG. Through the TFs, barangays needing improved water supply and households needing sanitation improvements are identified and organizations are formed. Training activities are also done with the TFs. Conferences are held regularly to assess performance and review sector experiences. Training generally follows the cascade approach from the national up to the barangay level.

Resources: The PMO for Water Supply and Sanitation is established under the Assistant Secretary for Plans and Programs. About sixty (60) staff members comprise the PMO. It has four (4) operating divisions (Administration; Finance and Procurement; Project Planning; and Field Operations). Its Work Program is integrated with the DILG Annual Plan of Implementation. Like other line Departments, DILG's annual budget allocation goes through the general appropriations review and approval process in Congress which usually requires a one-year lead time. Action officers are assigned for every active province. Monitoring and evaluation of project implementation are done by the provincial (and municipal) local government operations officers (PLGOOs/ MLGOOs). Funds for sector training and BWSA formation are channeled through the regional and provincial DILG offices.

(2) Local Water Utilities Administration (LWUA)

Responsibility: LWUA is a specialized lending institution mandated to promote and oversee the development of provincial water utilities based on financial viability of projects. Most water utilities were under the LGUs until 1973, when some LGUs opted to waive their control over the utility and organize water districts (WDs) to qualify under the LWUA program. In 1987, LWUA responsibilities were expanded to include assistance to Level II Rural Waterworks and Sanitation Associations (RWSAs). The provision of Level II and III services and of wastewater disposal systems in communities outside Metropolitan Manila are largely coordinated through the LWUA. The WDs currently serve about 18.43 M consumers in about 703 cities and municipalities. NEDA Resolution No. 4 directs LWUA to focus on its development banking role and to finance only viable WDs. Since its establishment in 1972, LWUA has formed 544 WDs (486 of which have availed of loans totaling P 4.0 B). It has completed over 880 water supply projects.

Activities: LWUA has since developed a wide array of support services for WD development.

Institutional development services for WDs and RWSAs include: formation, management advisory services, training programs, management audits and operations reviews, installation of uniform commercial practices systems; information and marketing support.

Financial services include: economic and financial analysis, tariff analysis and fund sourcing. Various types of loans are available to finance the construction of water systems; reactivation of non-operating systems, rehabilitation and expansion of facilities; and training. Special loans finance watershed management projects; construction of administration buildings; purchase of service vehicles, communication and computer facilities; restoration of facilities damaged by calamities; initial or emergency operational needs. Commodity loans support generation of additional service connections.

Technical services: LWUA oversees the planning, design, construction, and control of quality standards to improve the water system facilities of WDs and RWSAs. LWUA formulates uniform standards for design, materials and construction to lower project costs and disseminates periodic water supply industry performance indicators.

LWUA consults with interested LGUs on the formation of WDs and RWSAs. Public hearings are held prior to the formation of WDs and tariff adjustments. Where tariff increases are not accepted, improvement projects are either reviewed or shelved altogether. LWUA collaborates with LGUs and consumers on all phases of WD improvement programs especially during the construction of water supply facilities.

Resources: LWUA maintains and fields a pool of management advisors, trainers, engineers and other professionals to give WDs and RWSAs proper guidance in their operation and administration. In addition, the Central Sewerage and Sanitation Program Support Office (CPSO) was recently established at LWUA to coordinate the implementation of sewerage and sanitation projects at the national level and to assist LGUs and WDs plan and manage sewerage and sanitation projects and programs at the local level.

LWUA training programs embrace efforts directed at the training and education needs of those who manage and operate water supply systems and those who provide assistance from the national level so that the water systems will succeed. Training for the water districts comprise about 20 technical and 20 management courses, while in-house courses cover cadetship training for fresh engineering graduates, management advisors, and

supervisors courses on construction project management, and computer education are also conducted.

(3) Department of Public Works and Highways (DPWH)

Responsibility: The Department is responsible for the construction and major repair/rehabilitation of rural water supply systems (Level 1) and for the planning and execution of sewerage projects in some cities and larger poblaciones in the country with participation of LGUs.

Activities: The actual construction of the projects are done through contract or force account by the regional and district offices of the Department or other designated agencies under supervision of the PMO and in accordance with approved work programs. The following describes the current project planning and programming process for water supply projects. The central office advises regional office that funding will be available and requests for proposals for a specified number of projects. The regional office allocates the total number of projects among the district offices and directs preparation of a Program of Work (PoW) with a listing of sites. A draft PoW is submitted to the PPDO for comments. In most instances, this is reviewed by the Provincial Board. PPDO endorses the PoW to the DPWH Regional Office. The PoW is sent to the PMO-RWS at the central office which authorizes the release of budget allotment. DEO is now cleared to start construction. Reporting is done based on accomplishments.

Resources: The PMO for Rural Water Supply was established in 1981 (Ministry Order 14) to "manage and direct the planning, design, construction, organization and maintenance of foreign-assisted rural water supply projects" of the Department. It consists of a 44 technical and 26 administrative staff (regular). In addition, as the loan project packages may require, project staff are recruited on contract. At the field level, the Department maintains about 92 District Engineering offices. Most of the DEOs are staffed with a water engineer, drilling crews and equipment. In some DEOs, staff have been assigned to oversee BWSA formation and training activities.

(4) Department of Health (DOH)

Responsibility: The Department is the principal health policy-making and implementing agency. Its main function is to develop and implement sanitation programs nationwide

and administer health education aimed at reducing morbidity due to, among others, waterborne and sanitation related illness specifically diarrhea diseases which ranked second leading cause of morbidity among the population in the past years. Its role in the water supply program is in the promotion of safe water supplies through water quality surveillance.

Activities: A major program of DOH (Environmental Health Service) is the improvement of the environmental sanitation conditions to make it more conducive to promotion and maintenance of the health of the people. The priority program components include water supply and sanitation (water treatment and disinfection, quality monitoring and surveillance), excreta and sewage disposal, wastewater collection and disposal. DOH also implements *Water for Life* project which calls for spring development for use in Level I systems and for organizing BWSAs. DOH is also responsible for the provision of sanitation facilities in rural areas.

Operating budgets come from general appropriations in the national budget. Capital expenditure funds to support construction of excreta and waste disposal systems come from project funds. Under the First Water Supply, Sewerage and Sanitation Sector Project, DOH administered a project subsidy of P105.00 (cost of the bowl) per toilet. Similar arrangements are ongoing with the IBRD-assisted FW4SP. In addition, it supervises the construction of public school toilets, sullage removal units and the distribution of household toilet bowls.

Resources: The health care system is delivered through five organizational levels: Central headquarters; Regional Health Offices and general and special hospitals; Provincial Health Offices, including provincial and district hospitals; Municipal Health Offices; and, Rural Health Units/Barangay Health Stations. Its unique structure enables the Department to reach up to the barangay level through its grassroots network of barangay health workers and volunteers. DOH manages regional and provincial laboratories with technicians who carry out water quality tests. It should be noted that substantial segments of its institutional structure (from the provincial level downwards) have been devolved and are now supervised by the respective LGU.

Through its far-reaching network, DOH conducts health education campaigns which focus on women and children health in rural communities. The program is supported by centrally-produced information, education and communication materials. Enrichment of

hygiene education lesson plans for the school curricula is undertaken by DECS and DOH. Together with UNICEF, CIDA and other bilateral agencies, DOH has produced and distributed IEC materials with key messages on water supply, sanitation and hygiene behavior.

DOH provides training focused on skills development of its health workers, volunteers and community artisans. Its training programs are either conducted by in-house staff or commissioned through non-government organizations (NGOs). Provincial and district sanitary engineers and inspectors are trained on skills development and planning. Chemists and laboratory technicians are trained on tools and techniques to support on-going drinking water quality programs. BWSAs are instructed, among others, on protection and disinfection of water supply sources, constructing and maintaining toilets.

(5) Other National Agencies

Other national agencies provide macro-planning, funding and support, and regulatory guidelines for the water supply and sanitation sector.

The National Economic Development Authority (NEDA), as the central planning office, ensures that all agency plans and programs are consistent with national priorities in the Medium-Term Public Investment Program and the Priority Sub-Sector Activity Layout. External grants and loan proposals are reviewed and approved at NEDA. It also coordinates the establishment of a system for national sector master planning and the monitoring system (with DILG).

The Department of Finance (DOF) is responsible for the generation and management of the financial resources of the government. It reviews and approves all public sector debt; oversees the fiscal soundness of public investments based on equity, cost recovery and economic growth, and sets the fiscal deficit of major government corporations, as part of the public sector borrowing program.

The Department of Budget and Management (DBM) plans the budget allocations for the government agencies, including capital and operating expenditures, equity infusion to public corporations, grants and subsidies for Congressional approval. DBM also ensures that budget releases conform with approved plans and programs.

The Department of Environment and Natural Resources (DENR) formulates and enforces policies and guidelines for environmental protection and pollution control. It is responsible for watershed protection and water resources management. It checks compliance of major projects with environmental guidelines. DENR works with all environmental management agencies and special regulatory bodies.

The Department of Education, Culture and Sports (DECS) implements hygiene education programs through schools using the *Teacher-Child-Parent (TCP)* approach. Health and sanitation messages are integrated in the curricula and special activities are designed to make the parents and other family members learn and put them into practice. The program is supplemented by a wide range of learning materials (workbooks) while prototypes of safe water sources and water-sealed toilets are set up in schools. DECS assists in the GOP school toilet building project by identifying priority schools and by supporting DOH's integrated health information, education and communication campaign using the formal and non-formal educational system.

The National Water Resources Board (NWRB) coordinates the overall policy framework for water resources development and management. NWRB was created to guide an orderly and scientific development of all water resources in the Philippines consistent with the principles of optimum utilization, conservation and protection to meet present and future needs. NWRB also deals with water rights issues. NEDA Board Resolution No. 4 strengthens the NWRB by increasing its control over the private extraction of groundwater.

The Metropolitan Waterworks and Sewerage System (MWSS) provides for the potable water supply and sewerage needs of Metropolitan Manila and its contiguous areas.

5.5 Sector Agencies at the Local Level

(1) Provincial Level

Under Sec. 17 of the Local Government Code, the LGU is responsible for the sector functions including: delivery of health services and infrastructure facilities intended to service the needs of the province, such as inter-municipal waterworks, drainage and sewerage, among others.

1) The Provincial Planning and Development Office (PPDO) is primarily tasked to formulate an integrated economic, social, physical and other development plans and policies of the provincial government. To undertake its task, PPDO conducts a continuing studies, researches and training programs necessary to evolve plans and programs for implementation. As secretariat of the Provincial Development Council, the Office integrates and coordinates all sector plans and studies undertaken by the different functional groups or agencies and monitors and evaluates the implementation of such plans.

Under its existing organizational set-up, the PPDO is composed of 17 personnel deployed in the office of the Provincial Planning and Development Coordinator (PPDC) and in four (4) divisions (refer to Figure 5.5.1, Supporting Report). Distribution of personnel is as follows:

Office of the PPDC	-	1
Plans and Programs	-	4
Research, Evaluation and Statistics	-	3
Special Projects	-	3
Administrative	-	6
Total		17

Under the 20% Development Fund, a certain amount is allotted to the Water Supply and Sanitation Sector based on the following schemes on project selection:

(a) The municipal and/or barangay government units submit list of priority projects and requests for funding

(b) Prioritization of projects is done with the application of various factors such as the number of beneficiaries, financial feasibility and project acceptability, among others.

2) The Provincial Engineer's Office (PEO) is mandated to initiate, review and recommend changes in policies and objectives, plans and programs, techniques, procedures and practices in infrastructure development and public works in the province. It administers, coordinates, supervises and controls the construction, maintenance, improvement, and repair of engineering and public works projects of the province. It has the responsibility of providing engineering services to the province, including investigation and surveys, engineering designs, feasibility studies and project management.

The Office of the Provincial Engineer has five (5) divisions under it employing 117 personnel (refer to Figure 5.5.2, Supporting Report). Distribution of personnel by division follows:

Planning and Programming	-	5
Construction	-	13
Maintenance	-	73
Motor Pool	-	16
Administrative	-	10
Total		117

The various water supply and sanitation projects implemented during the last five years (CY 1990-1994) by the PEO in coordination with the PPDO and other offices, mainly the Office of the Governor, are shown below:

Year	Sanitation		Level I		Level II		Level III	
			Shallow Well		Deep Well		Waterworks	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost
1990	2	38,623	-	-	-	-	21	1,845,583
1991	-	-	-	-	1	11,960	8	108,456
1992	4	84,036	19	60,791	-	-	16	797,544
1993	-	-	3	19,731	1	66,155	16	553,478
1994	1	5,750	-	-	3	28,585	17	799,087
Total	7	128,409	22	80,522	5	106,700	78	4,104,148

3) The Provincial Health Office (PHO) is given the power to formulate and implement plans and programs and projects geared towards the delivery of basic health services in the province. It is mandated to coordinate with other government agencies and NGOs in the execution and enforcement of all laws, ordinances and regulations relating to public health.

Under its existing organizational structure, the PHO consists of three (3) operating services -- Administrative, Hospital Services and Field Health Services (refer Figure 5.5.3, Supporting Report). The Hospital Services has the jurisdiction of six (6) district and community hospitals.

(2) Municipal Level and Barangay Level

The municipal government serves primarily as a general purpose of the government for the coordination and delivery of basic, regular and direct services and effective governance of the inhabitants within its territorial jurisdiction.

1) Municipal Planning and Development Office (MPDO)

Mandate: The MPDO is mandated by law to formulate an integrated economic, social, physical and other development plans and policies. It likewise integrates and coordinates all sector plans and studies undertaken by different functional groups and agencies.

Activities: The regular activities of MPDOs include: preparation of the municipal comprehensive plans and other planning documents; conduct of a continuing studies, researches, and training programs necessary to evolve plans and programs for implementation, assessment, monitoring and evaluation of different projects of the municipal government.

Resources: The MPDO typically consists of following personnel: Municipal Planning and Development Coordinator as head of office; Project Development Officers; Project Evaluation Officers; Researchers, Community Officers and Draftsmen.

2) Municipal Engineer's Office (MEO)

Mandate: The MEO is responsible for the administration, coordination, supervision and control of all construction, maintenance, improvement and repairs of the different public works projects in the municipality. It also initiates, reviews and recommends innovations in policies and objectives, plans, programs, techniques, procedures and practices in infrastructure development in the municipality.

Activities: The MEO conducts engineering services like investigation and survey to obtain technical data for the design, layout or construction of public works, engineering designs, feasibility studies and project management. They also inspect work of contractors based on plans and specifications.

Resources: The MEO is typically composed of the municipal engineer, a project development assistant, draftsman and an engineering aide.

3) Rural Health Units (RHU)

A Rural Health Unit is responsible for an effective delivery of basic health services and provision of adequate health facilities in the municipality. It develops and implements plans and strategies relative to health projects. It provides a variety of medical services like, medical application, bandaging and inoculations are administered.

A typical RHU is under the direction of a Municipal Health Officer and consists of a physician, public health nurse, sanitary inspector, midwife, dentist and a nursing aide.

4) Barangay Council (BC)

The Barangay Council is the most basic government unit in the Philippine political structure. A barangay is headed by a chairman or a captain who acts as the chief executive officer. On the other hand, the legislative branch is called as the Sangguniang Barangay. Furthermore, a development council is organized in the barangay and usually consists of members of the Sangguniang Barangay, representatives of NGOs operating in the barangay and a representative of the Congressman.

The barangay council undertakes services for, among others, the maintenance of barangay facilities related to general hygiene and sanitation and solid waste collection. It also submits recommendations to higher legislative bodies for the improvement of the barangay health and social welfare services.

(3) Field Offices of Central Sector Agencies

1) DPWH District Engineering Office (DEO)

Mandate: The DEO takes charge of the planning, design, construction and maintenance of infrastructure facilities and ensures safety of such facilities within the

province. Its activities include, among others, implementation of national school building program, construction and improvement of flood control and drainage, and construction and repair of deep wells in the province. Under the LGC, the following functions were devolved to the LGUs: public works and infrastructure projects funded out of local fund and enforcement of the Building and Structural Code.

Resources: The Office of the District Engineer's Office has five (5) sections, namely: Planning and Programming, Construction, Maintenance, Motor Pool and Administrative. There are at present, 119 personnel assigned in the different sections.

2) Local Development Council/Provincial Development Council (LDC/PDC)

The main function of the LDC is to formulate long-term, medium-term and annual socio-economic development plans and to coordinate, monitor and evaluate the implementation of development programs and projects. It assists the Sangguniang Panlalawigan in setting the direction of economic and social development.

The PDC is headed by the Governor and is composed of all municipal mayors, the provincial heads of national agencies, representatives of NGOs and heads of offices of the provincial government.

(4) Water District (WD)

A water district is a local government corporation formed pursuant to Presidential Decree No. 198 for the purpose of serving the water supply requirements of the residents within its franchise area. Technical and financial assistance (loans) are provided by LWUA to the water districts. LWUA also exercises regulatory functions vis a vis the districts.

A water district, to be self-sufficient, is operated in a business-like manner to generate enough revenues from its water sales. The income is used to meet operational expenses, debt service and reasonable reserves for contingencies.

At present, there are five (5) water districts in the province. These are the Ilocos Norte WD which covers the city of Laoag and the municipalities of Bacarra, Vintar, Pasuquin

and Paoay; Sarrat WD, Dingras WD, San Vicente WD, and Batac WD. Badoc WD has been formed but has been non-operational since 1991 due to financial constraints.

(5) Rural Waterworks and Sanitation Associations (RWSAs)

RWSAs are organized by beneficiaries to facilitate participation in the planning, construction, operations, maintenance and management of water and sanitation projects. The RWSA operates and maintains the community water supply system. The members contribute at least 10% of the project cost as local equity and pay a monthly service fee sufficient to operate, maintain and amortize the project.

At present, there are six (6) RWSAs that were formed and operational in the province. These are located in Adams, Paninaam (Bacarra), Cacapean (Dingras), Buduan (Burgos), Nagpaitan and Suyo (Dingras).

(6) Barangay Waterworks and Sanitation Associations (BWSAs)

Republic Act 6716 mandated the construction of at least one Level I (point source) water supply system in all barangays and the formation of a BWSA to operate and maintain the system/s. The association consists of at least 50 households whose goal is to improve the health and economic well-being of its members, by improving access to safe and potable water for domestic use at a reasonable cost. It is a non-stock cooperative which manages and owns the water supply facility constructed through their own resources or with external capital development assistance.

The association is mandated 1) to operate, manage and own the water supply facility; 2) to mobilize the members' resources (financial contributions to the cooperative fund) for the construction, operation and maintenance of the system.

The organizational structure of the BWSA consists of 1) General assembly of members; 2) Board of directors; 3) Election committee; 4) Education and training committee; 5) Audit and supervisory committee and 6) Management staff.

To organize a BWSA, a community meeting is convened and the barangay leaders are informed that the barangay has been selected by the LGU for possible water supply

assistance. This is usually preceded by a resolution from the barangay requesting for the assistance. A structural survey is conducted to determine whether the barangay meets the criteria for assistance. The survey also forms the basis of the feasibility study. The LGU then prepares a preliminary engineering report and feasibility study which is presented to the barangay for approval. Upon acceptance by the people, the LGU submits the annual implementation plan (AIP), together with the FS for funding allocation.

Upon approval of the AIP, the application to organize a BWSA is filed with the PPDO who forwards the application to the Director of the Cooperative Development Authority, and the BWSA is formed.

In the province, there are at present more than 1,000 BWSAs organized by the Department of Public Works and Highways (DPWH) under R.A. 6716. However, there is no recent inventory as to how many BWSAs are presently operational and non-operational.

(7) Others (including the private sector and NGOs/CBOs)

The private sector through the NGOs are actively participating in the implementation and monitoring of projects in the province. Private sector representatives participate in the provincial pre-qualification, bids and awards committee (PBAC) proceedings. In fact, three (3) our of six (6) or 50% of the members of PBAC belong to the private sector. One is a representative of the Philippine Institute of CPAs; another is representative of retired teachers; and the other is a representative of the local entrepreneurs.

During the project implementation, members of the Provincial Monitoring Committee (PMC) visit various projects. One of the six (6) members of PMC is from the private sector, specifically from the Provincial Federation of Parent, Teachers and Community Associations (PTCA).

Furthermore, other segments of the private sector also participate in project monitoring. The print and broadcast media play an active role in project implementation by exposing flawed works.

5.6 Project Management Policies/Activities at the Local Level

(1) Project identification and priority setting.

Most sector projects are identified during the "Rang-ay Ti Barangay" (Progress in the Barangay) program, a community outreach project of the provincial government. The community residents usually bring out water and sanitation issues during dialogues/consultations with the provincial officials. Once the people identify a particular problem or concern, a project will be ascertained to form part of the solution to the problem. Projects that are conceptualized during the sorties will be included in the priority list.

(2) Project preparation and planning:

For water supply projects, the feasibility study is done by the coordinated effort of the PPDO and the Provincial Accounting Office. The design, on the other hand, is being undertaken by the PPDO and the PEO. For sanitation projects, feasibility study and plan preparation are both done by the PHO. Only projects which have been identified and priority-listed undergo feasibility study and detailed design.

(3) Project implementation.

Locally-funded projects are implemented by the provincial government through the PEO following national standards. The implementation of all infrastructure projects is the responsibility of the DPWH-DEO and the PEO. Non-infrastructure projects are handled by the concerned implementing office. Community organizing is implemented by various government agencies, such as the DILG and PPDO and NGOs which are active in the sector.

(4) Operation and maintenance.

The PPDO provides technical assistance to establish RWSAs. However, the provincial government receives technical assistance from the DOH and the DILG.

(5) Monitoring and evaluation.

Current monitoring and evaluation systems focus on measuring the physical output of the sector projects. It is, however, weak on impact evaluation. Physical accomplishment are noted, but, measurement of socio-economic benefits is difficult.

(6) Financing

The present source of local financing for the sector project is the 20% fund from the IRA of the province. There are also foreign and local donors for sector projects but general appropriation funding is generally channeled through central-level agencies.

(7) Contract administration

The government accounting and auditing manual in the procurement of goods and services and in the awarding of civil works contracts is followed by the province.

(8) Linkage with national government agencies

The province works closely with the Regional Development Council for endorsement of programs/projects requiring national or foreign funding.

5.7 External Support Agencies Active in the Sector

(1) Multilateral Agencies

The World Bank (IBRD) currently supports the First Water Supply, Sewerage and Sanitation Sector Project or FW4SP (Loan 3242PH). This project provides capital funds (US$ 58.0 M) for rural water supply in Luzon provinces and sanitation nationwide based on completed provincial master plans. The project concept calls for a community-based approach through BWSAs. The project is due to close in 1995 and preparations for a successor project, with DILG as implementing agency, will be started shortly. In addition, the Bank is preparing two new loans for LWUA implementation - the Urban Water Supply Project and the Urban Sewerage and Sanitation Project. Through its various trust fund facilities, the Bank has arranged for various technical assistance grants and other support activities.

The Asian Development Bank (ADB) supports the Second Island Provinces Project (1052-PHI-SF). The project provides US$24.0 M (loan) to a counterpart budget of Pesos 202.45 M. A small technical assistance component has been allocated for well drilling, training, water quality and installation of pumps. This DWPH-executed project was effective through 1994. Both of the island provinces projects focus on technology and

the physical installation of facilities. A follow-on third "islands project" is under discussion. ADB is also supporting the LWUA Municipal Water Supply Project which includes a technical assistance grant for institution building activities at LWUA and the eight (8) participating WDs.

The United Nations Development Programme (UNDP), through its Danish Trust Fund facilities, has actively supported the preparation of provincial master plans. In addition, its Institution Building through Decentralized Implementation of Community-Managed Water and Sanitation Projects, is assisting DILG-PMO in developing models and approaches for community-based water and sanitation in selected pilot areas. The project bears a strong poverty alleviation focus. UNDP is also in the final stages of a country project to assist GOP in strengthening the groundwater databank in the country through a US$ 682,500 grant.

The United Nations Children's Fund (UNICEF) supports the sector through the Philippines Plan of Action for Children. Apart from hardware support in priority project sites, UNICEF assists NEDA in updating of the national master plan. UNICEF works through the inter-agency committee on environmental health and through NGOs. With the World Health Organization (WHO), UNICEF is assisting in the preparation of information, education and communication (IEC) materials and in strengthening the sector monitoring system.

(2) Bilateral Agencies

The Japan International Cooperation Agency (JICA) extends technical cooperation in the basic design study for the Rural Environmental Sanitation Project (Phase III). This project, to be jointly implemented by DPWH and DOH, envisages the construction of Level I and II water systems and school toilet facilities in rural areas of ten (10) provinces through grants. With DPWH, rural water supply systems are being constructed at the evacuation centers for the Pinatubo refugees. JICA also supports the groundwater development study in Cavite province (with LWUA) and the institutional development activities at MWSS. JICA is providing the services of the Study Team preparing provincial sector plans in nine (9) provinces.

The Overseas Economic Cooperation Fund (OECF) is financing the RWS IV project through 1995. It provides a loan of up to Yen 5.08 B to counterpart funds of Pesos 400 M for the construction/rehabilitation of level I systems, construction of workshop

buildings and procurement of various equipment. OECF is supporting the Provincial Cities Water Supply Project of LWUA and the Angat Water Supply Optimization Project of MWSS.

The Australian International Development Assistance Bureau (AIDAB) is supporting the Central Visayas Water and Sanitation Project through a A$ 14.65 M grant. The project is implemented by the LGUs and the regional development council. Project components include: planning and monitoring information systems; infrastructure planning and rehabilitation; and institution building with an emphasis on community management based on experiences from other AIDAB-funded projects. The Project has been extended through 1997.

5.8 Current Community Development and Training Approaches

5.8.1 Community Development

The principal experience of the province on community mobilization for water and sanitation is with the "Rang-ay Ti Barangay" program. This is an outreach socio-economic and anti-insurgency program initiated by the provincial government. Usually the governor, together with heads of provincial and national agencies, members of Sangguniang Panlalawigan and municipal officials periodically visit barangays and conduct dialogues among the local residents. Issues and problems are raised during the dialogue and, if possible, immediate solutions are provided. Issues that need further study are included in planning and prioritized for future implementation. There were already 377 barangays visited under this program. Delivery of basic services under the program is a continuous endeavor utilizing portions of the 20% Development Fund, School Board Fund, Calamity Fund and other sources. The program aims to attain social justice and people's participation to government programs.

Issues being addressed by the program include social imbalances, inefficient delivery of basic services, environmental degradation, high criminality rate and insurgency and maintenance of discipline and order.

5.8.2 Human Resources Development & Training

Various government and other entities conduct training programs to strengthen the capability of the provincial work force. In 1994, the Department of Trade and Industry, the Department of Science and Technology and the National Manpower and Youth Council (NMYC)

conducted skills and managerial training programs, technology-related courses, trade courses, career guidance, trade testing, and entrepreneurship development program. However, very few courses were offered that dealt on technologies related to water supply and sanitation

5.8.3 Sanitation/Hygiene Education

The PHO conducted health education on environmental sanitation and this was done during the month of July to October 1994 when water related diseases were rampant in the province. Orientations were done in every municipality and were participated in by the barangay captains and health workers.

The broadcast medium (radio) was also utilized in previous health education campaign in the province. Information regarding environmental sanitation aspect especially the control of diarrhea disease. The PHO has also distributed health information, education and communication (IEC) materials different rural health units and barangay health stations. Leaflets like "Simple Household Food Sanitation Practices", "How to Construct Sanitary Toilets and "Emergency Treatment of Water" were distributed. Posters like "Enteng Ebak" and "Maghugas at Magpakulo" as well as comics materials were distributed by PHO. Streamers were also displayed during the launching of "Puksain ang mga Akyat Bahay Gang (Ipis, Lamok at Langaw) and the launching of Water for Life for the month of April 1994.

5.9 Existing Sector Monitoring

(1) National Level

The primary sources of sector data are the field office and staff of DPWH, DOH, LWUA, MWSS and NSO. Other agencies, including NEDA and LGUs, use data from these agencies. Each of these agencies runs its own project (or activity) monitoring systems largely based on required reports of its field offices. Current reporting requirements focus on physical accomplishments and capital expenditures. One serious shortcoming is the assumption that all constructed facilities are functioning and in use.

Apart from regular project monitoring, instructions are issued to conduct inventories of facilities (with actual status). The last completed inventory was done in 1990. These surveys are done in conjunction with sector or area planning studies. Only the NSO

gathers and assesses information nationwide on a regular basis as part of its Census on Population and Housing (CPH). The CPH "long form" is administered on 10% of the households once every ten years. NSO plans to increase the CPH "short form" frequency to every five years. Water and sanitation is not included in the short form.

There is wide dissatisfaction among implementors themselves over the existing monitoring system. Monitoring report preparation is seen as a nuisance to performing one's job, and is thus haphazardly done. This leads to the problem of reliability of information coming from the field. There is a need to establish a system which is perceived as having a direct link to performance, similar to project-based monitoring.

(2) Local Level

The Provincial Planning and Development Office has a team to monitor all water supply and sanitation projects being implemented in the province, whether foreign or locally funded. On-site visitation and evaluation of projects are being done by the Team to see to it that all project comply with approved plans and specifications. It also identifies problem areas and recommends immediate solutions/actions. The team also gets feedbacks from the reports submitted by different agencies.

Chapter 6

PAST FINANCIAL PERFORMANCE IN WATER SUPPLY AND SANITATION

6. PAST FINANCIAL PERFORMANCE IN WATER SUPPLY AND SANITATION

6.1 General

Locally funded programs and projects for the water supply and sanitation sector have been devolved from central government agencies to LGUs since 1992 according to the Local Government Code of 1991 and NEDA Board Resolution No. 4 (1994).

In order to clarify the flow and contents of funds to the sector under this transitional period and to apply for the planning of financial arrangements, this chapter sets forth: (1) past public investment to the sector by central government agencies and LGUs; (2) roles of the Internal Revenue Allotment (IRA) to the sector financing; (3) cost recovery and financial performances of waterworks/associations; and (4) affordability of users at present.

6.2 Past Public Investment

6.2.1 Past Public Investment by the Central Government Agencies and LGUs

The recent development of the water supply and sanitation sector in the province was mainly achieved by line agencies such as DPWH, LWUA, DILG and DOH as well as the provincial government, which is shown in Table 6.2.1.

Table 6.2.1 Previous Sector Investment to the Province by Concerned Agency

Unit: 1,000 Pesos

Funding Category		1990-94				
Agency	Funds	Level I	Level II	Level III	Sewerage	Sanitation
DILG						
DPWH	Foreign Fund 1) Local Fund 2)	235 15,129				
LWUA				92,388 3)		
DOH						505
Province	Provincial Government	187 2)	250 4)	4,104 2)		128 2)
Municipality	Municipal Government	67 4)	47 4)	583 3)		114
Others		100				25

Sources: Each central agency and the provincial government

Notes:

1) Investment in 1990 only.
2) Investment between 1990 and 1991; Locally funded projects were devolved to LGUs since 1992.
3) Investment from 1991 to 1994
4) Investment in 1994 only.
5) Countryside Development Fund (CDF)

Investments for Level I facilities from the local fund of DPWH amounted to P 15,129 thousand during the years 1990 and 1991, covering 423 shallow wells, 96 deep wells, 10 spring development and 44 rehabilitation works. DPWH had not provided any local funds to the sector since 1992.

The LWUA had released a total of P 92,388 thousand during the period of 1991 to 1994 to formulate or to improve and expand the water supply facilities of 6 Water Districts; Badoc, Batac, Dingras, Ilocos Norte, San Nicolas and Sarrat WDs.

DILG had no investment from 1991 to 1994. DOH provided P 505 thousand for sanitation from 1991 to 1994. The provincial government financed an amount of P 4,419 thousand for the relevant sector in 1990 and 1991.

According to "Philippines Water Supply Reform Study in 1993", P 311 per capita was invested on water projects in Metro Manila, P 200 per capita on projects in urban areas outside Metro Manila, and about P 30 per capita benefiting the rural population during 1990-1991.

In the province, an amount of P 33 per capita was invested by DPWH during the same period. From the fact that in 1990-91 most of the investments were allocated to Level I water supply system in the rural areas, per capita investment of the province is almost the same as the national average of P 30, even if the investments from other agencies and LGUs were disregarded.

6.2.2 Sources of Local Funds

According to the Local Government Code of 1991, 40% of the national internal revenue taxes of the 3rd fiscal year preceding the current year (from 1994 onwards) is allocated to LGUs nationwide, specifically to the administrative units of (1) province (23%); (2) city (23%); (3) municipality (34%); and barangay (20%). Further, respective Internal Revenue Allotments (IRA) in different administrative levels are allotted to all administrative units concerned according to the manner of calculation in terms of population, land area and other factors.

As shown in Table 6.2.2, IRA allotted to the province ranged from 0.8 to 1.1 % of the national total IRA between 1990 and 1994. IRA to Laoag City accounted to 0.8 - 0.9 % of the national total IRA for all cities. Moreover, the total IRA to all municipalities of the

Table 6.2.2 Past Internal Revenue Allotment to the Province of Ilocos Norte in 1990-94

Unit: Pesos

		1990	1991	1992	1993	1994
National	I National Total of IRA					
	(a) IRA to all provinces	2,031,174,331	2,697,481,707	4,571,136,402	8,445,600,000	11,498,994,195
	(b) IRA to all cities	2,191,470,949	2,742,969,221	4,559,895,793	8,445,600,000	10,239,577,496
	(c) IRA to all municipalities *	3,054,601,475	4,046,837,742	7,127,522,550	12,484,800,000	16,325,288,074
Province and City	II IRA to Ilocos Norte Province					
	(1) Total: (2) + (3) + (4)	62,654,883	80,939,339	163,492,217	289,398,446	388,266,559
	(2) Provincial Government	16,210,979	22,490,350	46,066,295	83,411,499	124,187,082
	Percentage against (a)	(0.80)	(0.83)	(1.01)	(0.99)	(1.08)
	(3) Laoag City	16,893,665	20,595,743	40,939,802	75,659,313	89,766,916
	Percentage against (b)	(0.77)	(0.75)	(0.90)	(0.90)	(0.88)
	(4) Municipalities	29,550,239	37,853,246	76,486,120	130,327,634	174,312,561
	Percentage against (c)	(0.97)	(0.94)	(1.07)	(1.04)	(1.07)
	III Total Income of the Provincial Government	35,747,934	41,339,497	61,526,323	98,947,955	148,648,883
	Percentage of IRA	(45.35)	(54.40)	(74.87)	(84.30)	(83.54)
	IV Total Income of Laoag City	41,741,282	45,225,181	62,833,979	105,807,382	122,402,057
	Percentage of IRA	(40.47)	(45.54)	(65.16)	(71.51)	(73.34)
	V Total Income of Municipalities	55,670,211	69,559,817	99,724,246	160,002,056	n. a
	Percentage of IRA	(53.08)	(54.42)	(76.70)	(81.45)	
Municipality	VI IRA to Municipalities **					
	Total	29,550,239	37,853,246	76,486,120	130,327,634	174,312,561
		(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
	1. Adams	525,594	673,829	2,114,261	3,463,631	4,968,331
		(1.8)	(1.8)	(2.8)	(2.7)	(2.9)
	2. Bacarra	1,623,301	2,026,783	3,596,668	6,120,756	8,450,371
		(5.5)	(5.4)	(4.7)	(4.7)	(4.8)
	3. Badoc	1,605,422	1,998,164	3,597,730	6,114,325	8,148,105
		(5.4)	(5.3)	(4.7)	(4.7)	(4.7)
	4. Bangui	1,062,573	1,350,787	2,920,966	4,876,526	6,554,597
		(3.6)	(3.6)	(3.8)	(3.7)	(3.8)
	5. Batac	2,645,468	3,288,919	5,343,829	9,344,353	12,525,188
		(9.0)	(8.7)	(7.0)	(7.2)	(7.2)
	6. Burgos	939,280	1,268,128	3,110,566	5,240,148	5,857,299
		(3.2)	(3.4)	(4.1)	(4.0)	(3.4)
	7. Carasi	489,421	652,027	2,117,881	3,451,718	4,842,850
		(1.7)	(1.7)	(2.8)	(2.6)	(2.8)
	8. Currimao	689,233	892,658	2,176,147	3,493,149	5,024,995
		(2.3)	(2.4)	(2.8)	(2.7)	(2.9)
	9. Dingras	1,914,949	2,390,517	4,150,612	7,125,541	9,526,851
		(6.5)	(6.3)	(5.4)	(5.5)	(5.5)
	10. Dumalneg	368,689	490,466	1,753,866	2,804,408	4,004,335
		(1.2)	(1.3)	(2.3)	(2.2)	(2.3)
	11. Espiritu (Banna)	1,092,730	1,400,381	2,899,133	4,854,824	6,792,828
		(3.7)	(3.7)	(3.8)	(3.7)	(3.9)
	12. Marcos	943,290	1,254,777	2,764,152	6,222,680	7,957,262
		(3.2)	(3.3)	(3.6)	(4.8)	(4.6)
	13. Nueva Era	1,805,374	2,414,705	5,546,621	8,200,756	12,023,022
		(6.1)	(6.4)	(7.3)	(6.3)	(6.9)
	14. Pagudpud	1,424,784	1,859,911	3,811,666	6,553,052	8,207,737
		(4.8)	(4.9)	(5.0)	(5.0)	(4.7)
	15. Paoay	1,304,770	1,691,856	3,250,519	5,478,729	7,614,014
		(4.4)	(4.5)	(4.2)	(4.2)	(4.4)
	16. Pasuquin	1,532,512	1,981,767	3,805,270	6,505,442	9,150,563
		(5.2)	(5.2)	(5.0)	(5.0)	(5.2)
	17. Piddig	1,419,531	1,804,925	3,605,945	6,242,728	7,422,198
		(4.8)	(4.8)	(4.7)	(4.8)	(4.3)
	18. Pinili	1,192,078	1,451,203	2,902,786	4,820,046	6,215,821
		(4.0)	(3.8)	(3.8)	(3.7)	(3.6)
	19. San Nicolas	1,543,084	1,981,199	3,629,590	6,185,987	8,104,733
		(5.2)	(5.2)	(4.7)	(4.7)	(4.6)
	20. Sarrat	1,428,829	1,772,395	3,361,229	5,699,663	7,394,852
		(4.8)	(4.7)	(4.4)	(4.4)	(4.2)
	21. Solsona	1,376,137	1,845,866	3,690,897	6,300,340	7,951,812
		(4.7)	(4.9)	(4.8)	(4.8)	(4.6)
	22. Vintar	2,623,190	3,361,983	6,335,786	11,228,832	15,574,797
		(8.9)	(8.9)	(8.3)	(8.6)	(8.9)

Sources:
(1) Department of Budget and Management, (2) Bureau of Local Government Finance (DOF), (3) Provincial Annual Report and (4) Annual Report of the City of Laoag
Notes:
*IRA to barangays is not included. **Figures in bracket are shares (%) in the total of all municipalities in the province.

province was arranged with 0.9 - 1.1% to the national total IRA for nationwide municipalities (refer to Table 6.2.1, Supporting Report).

For the provincial government, the IRA has been the most important financial source of the total revenue as experienced, with 80 % of the total revenue of the provincial government between 1993 and 1994. The expenditures of the provincial government for the relevant sector in 1994 were reported at ₱ 796 thousand, about 0.6% of the IRA.

As for municipality, distribution share to each municipality in the province was within a certain range between 1990 and 1994. Municipalities, which had a share of more than 5% of the provincial total in 1994, were Batac, Dingras, Nueva Era, Pasuquin and Vintar.

6.3 Cost Recovery

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

For Level III system, WDs or RWSAs bear the entire capital cost financed by LWUA through loans with concessional terms of 8.5% - 12.5% interest rate and repayment period extending up to 30 years. Less capable WDs are granted soft loans that are interest free during the first 5 years' operation. In the occasion of the first assistance by the LWUA, the loan for the full investment required could be provided for the WDs. For the expansion/rehabilitation works of the WDs, 90 % of required investments may be granted by a loan and the remaining 10% shall be arranged by an equity of WDs. The cost of amortizing the loan and operation and maintenance of the system is recovered through monthly water bills. Details of financial performance with cost recovery are discussed in section 6.5.

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

6.4 Affordability

Table 6.4.1 indicates the affordability by level of sector service. At present the current water bills in the province seem to be within an affordable range based on the experiences, although actual income varies from municipality to municipality and barangay to barangay.

Table 6.4.1 Affordability in Water and Sanitation Services

Income/Level of Services	Amount (Pesos)	% to Monthly Income	Affordable Range (%) 5)
Median of Monthly Income 1)	4,069	100.0	-
Average Level III: Monthly Water Bill 2)	133	3.3	5.0 or less
Average Level II: Monthly Water Bill 3)	30 - 60	0.7 - 1.5	2.0 - 3.0
Mo. Level I Expenditures 3)	5 - 10	0.1 - 0.2	1.0 or less
Private Toilet Construction Cost - Flush Type Toilet 4)	34,900	-	-

Notes:
1) 1991 Family Income and Expenditures survey, NSO
(Median of the provincial figure is inflated to 1994 prices.)
2) Data from LWUA. It is assumed that 20 cum will be consumed per family.
3) Common figures in the province.
4) Current prices by JICA Study Team.
5) Based on the experiences mainly from LWUA, DPWH and DILG.

On the other hand, construction cost of household toilet seems to be expensive comparing with the family income. The estimated cost of flush type toilet facility is 8 times higher than the median monthly family income in the province. Therefore, subsidy from LGUs may be necessary.

6.5 Past Financial Performance of WDs and RWSAs/BWSAs

Five (5) WDs are currently managed in the province. Badoc Water District is not operational, although it is institutionally established. Table 6.5.1 shows the financial indicators of 5 WDs in 1995. Loan status of 6 WDs is shown in Table 6.5.2. The WDs, except Batac Water District, seem to be financially sound under the status that the revenue exceeded the total cost of operation and maintenance and monthly amortization, although some arrears are reported. As of now, the WDs had received loans of P 127,764 thousand from LWUA.

Most of the facilities managed by RWSAs and BWSAs were constructed under grant conditions by central government agencies (DPWH and LWUA) and LGUs with the recipient providing some equity contribution in the form of materials or labor. The associations are responsible for the operation and maintenance of the system, but the financial performance of the associations tends to face difficulties partly because the beneficiaries do not recognize the cost requirements. The information from LWUA on the registration of Level II systems revealed that there are 7 RWSAs in the province, to which a total of P 621 thousand was invested for the construction of facilities by different central government agencies.

Table 6.5.1 Financial Indicators of Water Districts

Water District	Descriptions						
	No. of Metered Connections	No. of Flat Rate Connections	Average of Monthly Rate	Average Consump. per Conn.	Average O&M Costs	Average Revenue	Collection Efficiency
	Nos.	Nos.	Pesos/cu.m.	cu.m./mo.	Pesos/mo.	Pesos/mo.	Percent (%)
Batac	809	-	8.95	21	152,222	163,909	91
Dingras	542	-	9.33	15	75,762	96,678	85
Ilocos Norte	7,370	-	6.93	20	892,469	1,181,058	94
San Nicolas	1,879	-	5.00	21	208,905	290,260	97
Sarrat	565	-	4.00	19	39,621	48,331	85

Source: IDS, LWUA
Note: Badoc water district is not included since it is not operational.

Table 6.5.2 Loan Status of Water Districts

Water District	Descriptions			
	Total Loan Availed	Remaining Payment Period 1)	Average Monthly Amortization	Current Arrears
	1000 Pesos	Months	Pesos	1000 Pesos
Badoc	50	114	538	101
Batac	7,734	282	42,623	-
Dingras	1,413	113	17,127	-
Ilocos Norte	109,682 2)	235	55,484	55
San Nicolas	8,430	278	80,393	-
Sarrat	455	256	4,356	52

Source: Loans Operation Div., LWUA (As of May, 1995)
Notes: 1) The longest remaining payment period among several loans is indicated.
2) On-going loan is included.

Chapter 7

WATER SOURCE DEVELOPMENT

7. WATER SOURCE DEVELOPMENT

7.1 General

The study on water source development covers the entire province to come up with a "Groundwater Availability Map" which identifies the areas with available potable water sources. The study gives an emphasis on groundwater sources rather than surface water considering the better quality and economy of utilizing groundwater for domestic water supply.

The study has two major components: (1) interpretation of existing geological and groundwater conditions, (2) preparation of Groundwater Availability Map to show groundwater potential areas under three categories. Standard well specifications by municipality were also established as reference for the future requirement of the water supply sub-sector.

The major data used in the study were obtained from concerned agencies (NAMRIA, BMGS, NWRB, LWUA, DPWH and PPDO) and supplemented by the information gathered through questionnaires. Among the information, the Geologic Map published by then BMGS, the Water Resource Investigation Report and the Well Inventory Database of NWRB were essential for the analysis of geological characteristics, projection of high yielding area and possible area with salt water intrusion, and classification of groundwater potential areas, respectively.

The Groundwater Availability Map may be used for provincial level master plan at present. However, updating the map is a requisite to gain more information on prevailing groundwater conditions using the questionnaires prepared for the study. An annual review and updating of the database will enable the LGUs to implement water source development on a project site basis.

The database on existing groundwater sources and their conditions is summarized in Table 7.1.1 (Well data from each municipality are presented in Table 7.1.1, Water Source Information, Data Report). It shows that there are 16,183 shallow wells, 574 deep wells and 189 developed springs existing in the province. About 16% of these water sources are government-owned facilities. Of the total wells, 98% remains functional at present. In addition to the above sources, 17 undeveloped springs, which are considered as unsafe sources, are reported.

Table 7.1.1 Existing Groundwater Sources in the Province

Description	Shallow Well	Deep Well	Spring	Total
1. Number of water sources	16,183	574	189	16,946
2. Profile of different sources	96%	3%	1%	100%
3. Owned by Government Agency	2,136	473	189	2,798
4. Privately owned	14,047	101	0	14,148
5. Sources with quality problem	70	68	0	138
6. Non-functional wells	178	64	[illegible]	242
7. Undeveloped springs	[illegible]	[illegible]	16	16
8. Untapped springs	[illegible]	[illegible]	3	3

7.2 Geology

The rock units in the province are classified into three (3) main groups based on the ages of rock formations. These are, from the oldest to youngest, the Pliocene and Older Rocks, the Pliocene to Pleistocene Rocks and the Recent Deposits. The grouping of the rocks is related to their potential as groundwater sources. The younger rocks are considered the most important to groundwater because of their high porosity and permeability relative to the older rocks. The distribution of these rock groups is shown in Figure 7.2.1, Geological Map of the Province.

(1) Pliocene and Older rocks

These rocks, covering about 70% of the province, are largely distributed in the Ilocos Mountains and foothills of Luzon Central Cordillera. Part of these rocks are the Eocene andesite lava and pyroclastics and Miocene diorite intrusive extensively occupying the eastern and southern most parts of Ilocos Norte. The Early to Late Miocene conglomerate, sandstone, shale, limestone with minor basalt flows and pyroclastics are widespread in the central and northwestern sections. These rocks are cut apart from the younger rocks by a north-northeast trending fault that traverses from Badoc to Pagudpud.

(2) Pliocene to Pleistocene rocks

The rocks comprised approximately 15% of the total provincial land area. These are largely found in the gently sloping and hilly parts of Pagudpud, Bangui, Pasuquin, Bacarra, Laoag, San Nicolas, Paoay, Batac, Currimao, Piddig, Espiritu, Pinili and Badoc. They are mainly sandstone, interbedded siltstone and claystone and limestone. The total thickness of these rocks is more than 1,000m as correlated with similar deposits in adjoining provinces.

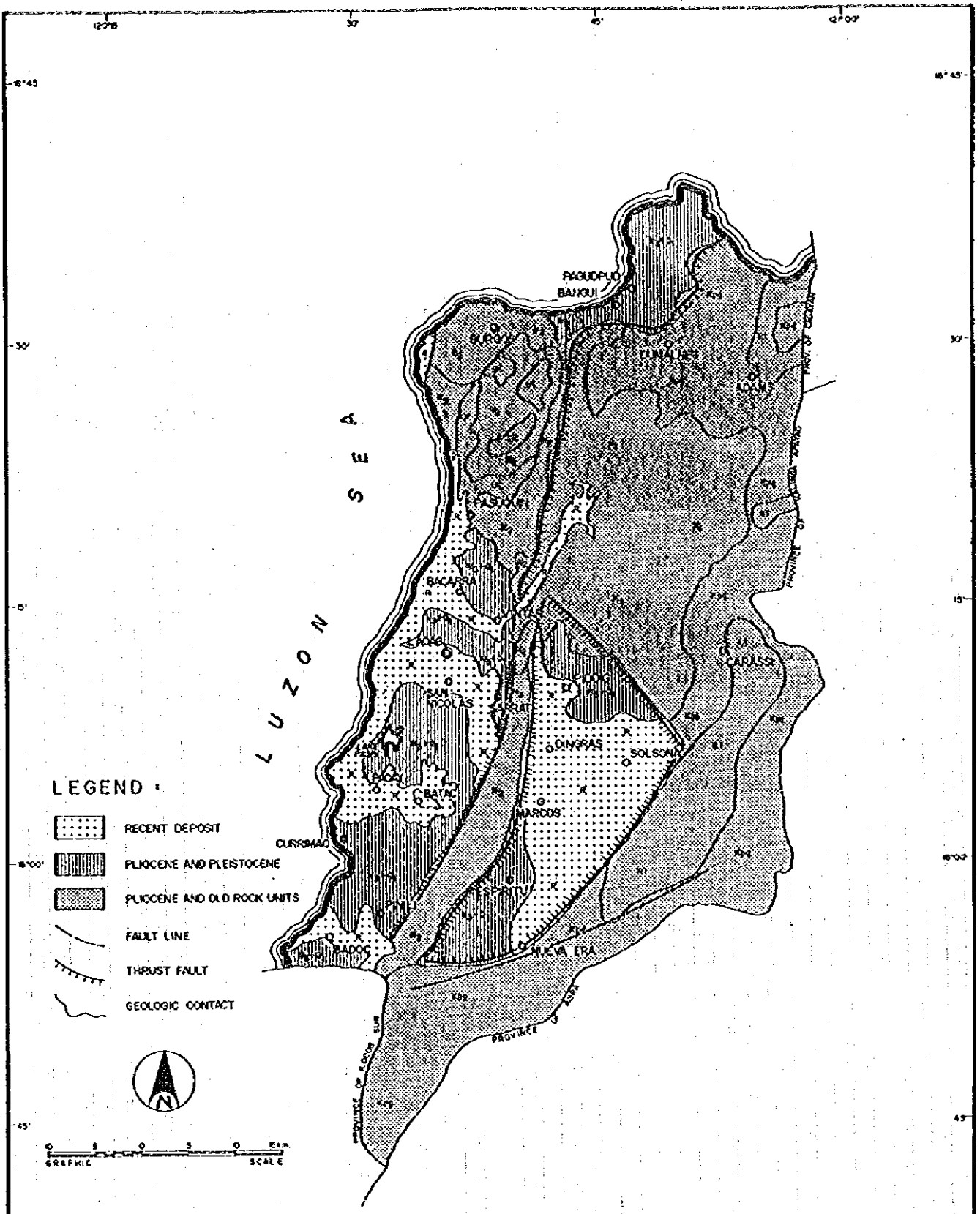


FIGURE 7.2.1

GEOLOGICAL MAP

(3) Recent deposits

The deposits are widespread in the western half of the province from Pasuquin to Badoc. These are also found in the gently sloping portions of Dingras, Piddig, Solsona, Marcos, Espiritu and Nueva Era. The deposits make up about 15% of the total land area of Ilocos Norte. They are made up of unconsolidated layers of clay, silt, sand and gravel with thickness extending up to 120m and in parts overlie the Pliocene to Pleistocene rocks as reported in Badoc and Laoag area.

The major faults observed influence the distribution of rock formations in the province. A north-northeast trending fault, traversing from Badoc to Pagudpud divides the province in two geologically distinct areas. The northwestern side of the fault is characteristically depressed with thick cover of Pliocene to Pleistocene rocks and Recent sediments. On the other hand, the southeastern side has high relief, with limited occurrence of Plio-Pleistocene rocks and relatively thin cover of alluvium. This is with the exception of the Solsona area, where three intersecting faults resulted in an enclosed valley landscape that serve as basin for thick Pliocene to Pleistocene sediments and Recent alluvial accumulations.

7.3 Groundwater Sources

7.3.1 Classification of Groundwater Sources

For planning purposes, the province is divided into the following groundwater categories:

(1) Shallow well areas

These are areas having water bearing rock formations extending not more than 20m in depth from the ground surface. Shallow well areas are usually located in alluvial and coastal plains where Recent unconsolidated materials overlie impervious rocks at shallow depth. The extent of completely shallow well area is limited, because most of the Recent formations are thick or deposited on the Late Pliocene to Pleistocene rocks that usually have mutiple aquifers located at greater depths.

(2) Deep well area

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

(3) Difficult area

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

In addition to the above classification, areas potential to have high yielding aquifers and with saline water intrusion problem are also presented based on NWRB's geo-resistivity survey and results of water quality examination of some wells.

7.3.2 Groundwater Availability in the Province

The Groundwater Availability Map presented in Figure 7.3.1 shows the distribution of the three groundwater categories in the province. It also depicts areas potential for high yielding wells and with saline water intrusion. The well information, such as depth, static water level, and specific capacity given in the figure are averages of limited data available in each municipality that were taken as reference. The major databases used in the preparation of the map were obtained from BMGS and NWRB. The methodology and procedure with respective outputs are discussed in Section 7.3, Supporting Report. Technical well information in each municipality is also presented in Table 7.6.1 of the same report.

As mentioned above, the interpretation of existing groundwater condition is based on limited data. The well parameters (depth, static water level and specific capacity) indicated in the map are anticipated to vary within a specific municipality, since the ground characteristics change with depth and direction. Particularly, the specific capacities of wells are very variable, which depend on aquifer characteristics, well type and design, and method of construction. Most of the wells in the inventory of NWRB are driven wells, which have limited intake sections that are usually not properly set in the most permeable layers. Thus, majority of these wells have low specific capacities. Bored and gravel packed wells are expected to have higher specific capacities than wells constructed using conventional methods.

(1) Shallow well areas

No shallow well area is defined in the province. The Recent deposits, where shallow aquifers usually occur, extend up to 120m. There are apparently two discrete aquifers occurring within the deposits, from near surface to 60 mbgl and from 80 to about 12 mbgl. In some of the wells in Laoag and Badoc, the Recent formation covers the Pliocene to Pleistocene rocks. Shallow wells in Ilocos Norte have average depth of

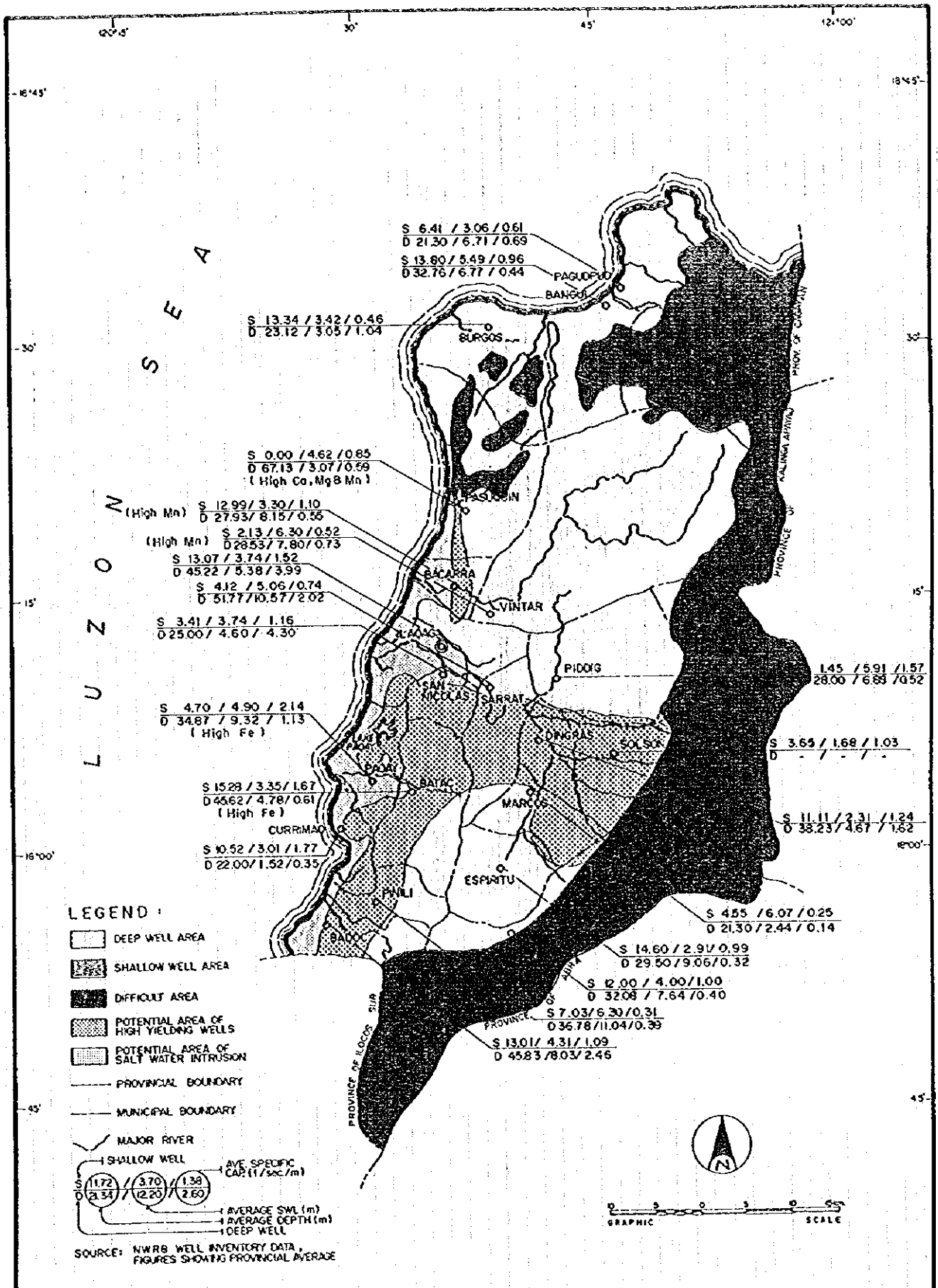
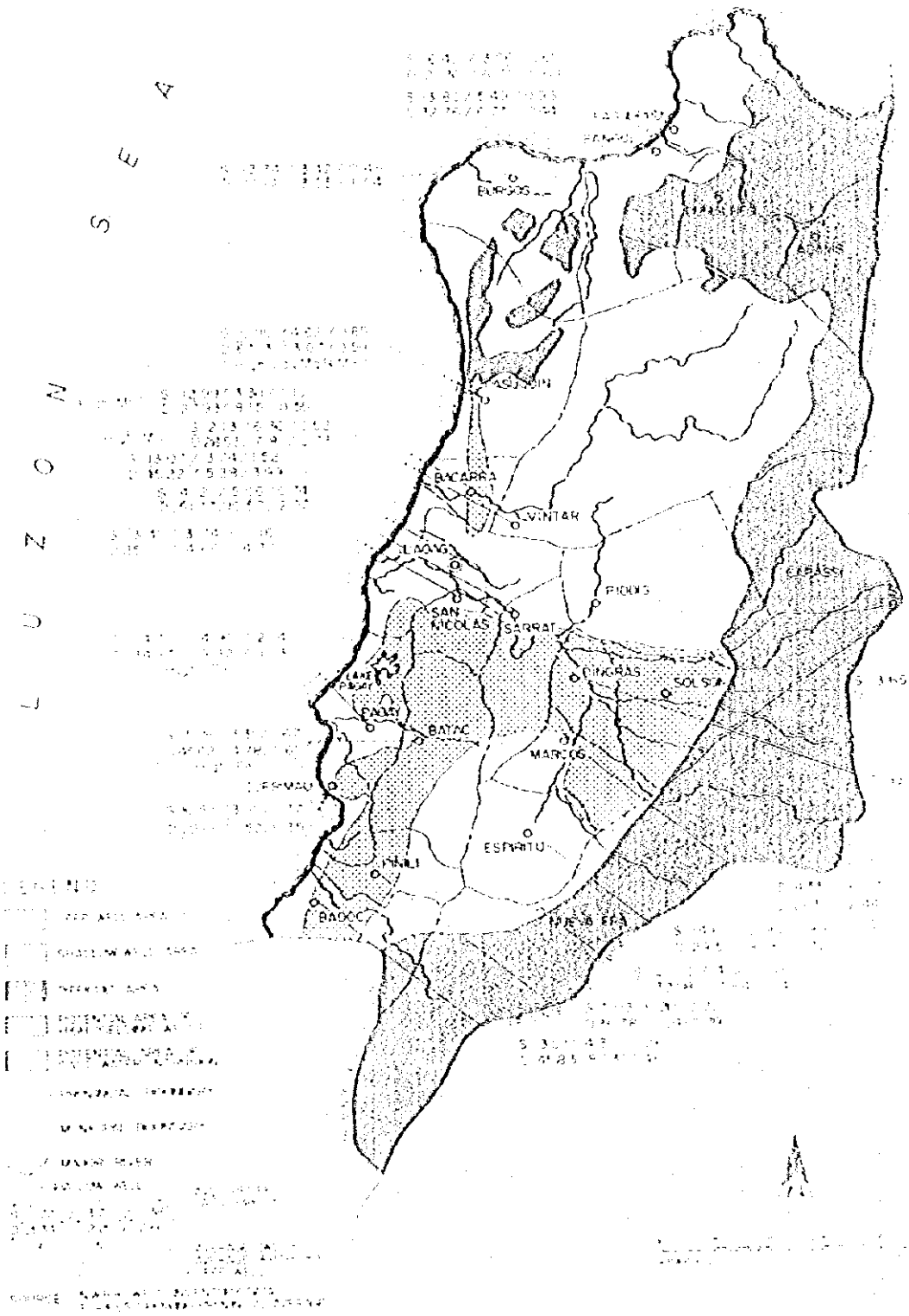


FIGURE 7.3.1

GROUNDWATER AVAILABILITY MAP



GROUNDWATER AVAILABILITY MAP

8.40m (5.79 to 19.82 m.). These wells have average static water level of 4.15 mbgl (0.61 to 16.77 mbgl) and average specific capacity of 1.17 l/sec/m of drawdown (0.01 to 9.13 l/sec/m).

(2) Deep well areas

The deep well areas cover approximately 70% of the total land area of the province. Parts of the municipalities of Burgos, Pasuquin, Bacarra, Laoag, Vintar, Sarrat, Piddig, Espiritu, Nueva Era, Batac, Paoay, Currimao, Pinili, Badoc, Bangui, and Pagudpud are potential for deep well development. Moreover, the existing deep wells in the province have an average depth of 38.03m (20.70 to 219.53m) with average static water level of 7.12 mbgl (0.08 to 30.66mbgl) and average specific capacity of 1.31 l/sec/m of drawdown (0.01 to 41.38 l/sec/m).

(3) Difficult areas

About 30% of the provincial area is classified as difficult areas. These are mainly situated in the hilly and mountainous eastern portion of the province, particularly in the municipalities of Adams, Dumalneg, Carassi and Nueva Era.

(4) Water quality of groundwater

The groundwater in the province is generally potable except in some areas with high iron, manganese and chloride concentrations. The water resources investigation of NWRB and water supply improvement studies for the water districts in Ilocos Norte identified the areas with water quality problem as follows:

1) Possible area with salt water intrusion

The geo-electric survey of NWRB delineated the western coast of the province as possible area affected with saline water intrusion. This conformed with the results of water quality analyses of some wells in the area. Portions with high salinity are reported in Bacarra, Laoag, San Nicolas, Sarrat, Batac and Paoay.

2) Area with high iron and manganese concentrations

According to the water supply improvement study of Ilocos Norte Water District, some of the wells in Paoay and Batac have high iron concentration. This high iron content may be attributed to the weathering of the iron-rich sand in these localities. In the adjoining municipalities of Pasuquin, Bacarra and Vintar, high manganese is likewise reported.

3) Areas affected by other chemicals

Hydrogen sulfide gas and yellowish color water were reported in Laoag City, however, these are localized. The gas is possibly derived from the decomposition of organic matters buried in the alluvium. Furthermore, hard water in some parts of the province is caused by high calcium and magnesium dissolved from the limestone members of the different rock formations underlying Ilocos Norte.

The areas mentioned above are indicated in the Groundwater Availability Map.

7.4 Spring Sources

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

For this study, springs are categorized into developed, undeveloped and untapped springs. A developed spring is utilized and must have sanitary protection, otherwise, it is classified as undeveloped spring, which is considered as unsafe water source. An untapped spring, as the name implies, is unutilized and flowing in its natural state.

The province is dissected by several faults and has undergone series of folding that resulted in intense fracturing, practically in older rock formations. In addition, it has fairly extensive limestone formations with numerous sinkholes that capture surface runoff. Based on the inventory of water sources made through the study, there are 189 developed springs serving the province. These springs have discharges ranging from 0.15 to 3.47 l/sec. A total of 17 untapped springs is reported in Laoag City, Badoc, Batac, Burgos, Currimao, Marcos, Nueva Era, Pasuquin and Sarrat. Three (3) untapped springs have been identified in Dingras, Pagudpud and Piddig with potential yield ranging from 1.25 to 1.90 l/sec. The technical information of springs in each municipality is presented in Table 7.4.1, Supporting Report.

7.5 Surface Water Source

The province has several rivers, namely, Laoag, Vintar, Bulu, Quiaoit, Badoc, Banuyen, Pasuquin and Pagudpud. These rivers are generally flowing westward to discharge into the Luzon Sea. They have drainage areas ranging from 25 to 1,355sq.km. At present, they are

are used for irrigation. Among these streams, Laoag and Vintar rivers are the most potential source of future water supply for the province considering their discharge of approximately 10 m^3/sec at the time of sampling and proximity to the densely populated areas.

Water quality analysis of Laoag and Vintar rivers was conducted to determine the surface water quality in the province. The results of the analysis showed that both river waters were turbid with high Biochemical Oxygen Demand (BOD). These levels exceeded the maximum limit for Class "A" fresh surface water (refer to 7.5 Water Quality Analysis Results, Supporting Report). Also, Vintar river has high iron content. Both river waters will require complete treatment for domestic water use.

7.6 Future Development Potential of Water Sources

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

Shallow wells are the most practical source for Level I facilities. Considering the existing shallow wells in the province, the potential aquifers are expected between 6 to 20 mbgl in the Recent alluviums. One disadvantage of shallow wells is the lowering of water level during dry spell that consequently reduces the discharge of the wells. Another disadvantage is the usual high susceptibility of shallow aquifers to direct infiltration of surface pollutants.

In general, deep wells have better water quality and invariable yields when developed with appropriate technology. This is because of aquifers' relatively deeper location that makes them less susceptible to surface contaminants. The usual confinement of deep aquifers resulted in rise of water level above the aquifers. Lowering of water level does not affect the saturated thickness, therefore, deep well discharge remains constant. In the Recent deposits and Pliocene to Pleistocene rocks, deep aquifers occur from 21 to 60 mbgl and from 80 to 120 mbgl. In the Miocene limestone and sediments, potential aquifers are expected in the upper 60 m.

Additional wells can still be developed to meet the future water supply demand of the province. Prior to any well development, a detailed groundwater resource study must be considered for its optimum utilization. For planning purpose, standard well specifications for each of the municipality were prepared as presented in Table 7.6.3, Supporting Report. The

parameters, such as well depth, static water level and specific capacity provided in the specifications were estimated from the available data gathered for the study.

The identified untapped springs can be developed as alternative sources for wells. Springs are the most reliable water sources in areas considered difficult for well development, particularly in Adams, Dumalneg, Carassi and Nueva Era. Prior to spring development, supplementary study must also be conducted to determine the effect of seasonal fluctuation of discharge and water quality.

Chapter 8

FUTURE REQUIREMENTS IN WATER SUPPLY AND SANITATION IMPROVEMENT

8. FUTURE REQUIREMENTS IN WATER SUPPLY AND SANITATION IMPROVEMENT

8.1 General

Phased investments for provincial sector development are planned in the same manner as adopted in the National Sector Master Plan (NSMP); Medium-Term Investment covering the years 1996 to 2000 and Long-Term Development covering the period 2001 to 2010.

Targets of provincial service coverage for the two phases are established as percentages of beneficiaries or utilities to be served by sub-sector. Service coverage in the base year (1995) and national sector targets indicated in the NSMP and the Medium-Term Philippine Development Plan (MTPDP) are the bases of the study. Sector targets which are not prescribed in the national plan; school and public toilets as well as sewerage are assumed based on the current conditions. In addition, preliminary discussions on solid waste management are included as a vital component of sanitation sector.

Projection of frame values by municipality is undertaken for respective sub-sectors; future population by urban and rural area, the number of student enrollment to public schools and the number of public utilities. Reference base figures for the study of framework are the 1990 Census of Population and Housing and the statistical data of the province and information from relevant agencies. Provincial population by target year is projected referring to the manner of declining growth rates of regional population projected by NSO, while the base year population (1995) is estimated in application of the 1980-1990 growth rate by municipality (broken down to urban and rural areas). The population distribution to urban and rural areas prepared by NSO in 1990 is modified to meet actual conditions in the classification of the areas.

Types of required facilities and their implementation criteria according to service level standards are referred to the said Master Plan. Some planning conditions and assumptions not prescribed in the national plan are conferred to the relevant standards of sector agencies and provincial government. For sewerage requirements, the deficit in sanitation must first be addressed. Partial upgrading of on-site disposal to a sewerage system (off-site disposal) is envisaged in the final target year.

In estimating future requirements by municipality, additional population (or number of students/public utilities) to be served by sub-sector is first calculated as a shortfall at target years

in comparison between target and base year service coverage. In this regard, planned/on-going projects to be completed by 1995 are considered as part of base year service coverage. Required number of facilities by sector component is then estimated corresponding to the said additional population (or number of students/public utilities) to be served. Rehabilitation work for Level I facilities limited to new deep wells to be constructed under PW4SP is taken into account. Generally, rehabilitation of deep wells and shallow wells constructed by means of conventional method is difficult.

Logistic support is considered as a mininum requirement of LGUs for community development and training, and other relevant activities along with the implementation of PW4SP. The types and number of well drilling/rehabilitation equipment and supporting vehicle for Level I facilities are also suggested as reference information.

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

8.2 Targets of Provincial Sector Plan

Provincial sector targets for the year 2000 and 2010 are determined as the provincial average of the desirable minimum level for each sub-sector. Table 8.2.1 summarizes the target percentages to be served by sub-sector. Details by sub-sector are discussed in this sub-section.

(1) Water supply

The base year service coverage was calculated as a total of those in 1995 and expected by planned/on-going projects scheduled to be completed by the end of 1995 as shown in Table 8.2.2 (details are referred to Supporting Report).

The base year service coverage in urban area (83%) is already exceeding MTPDP sector target (71%) for the year 2000, while rural area (65%) is far behind the sector target of 85%. As identified in Chapter 4, the lower service coverage in rural area is caused by the presence of a large number of unsafe sources/facilities and/or no provision of water supply facilities.

Table 8.2.1 Provincial Sector Targets

Sub-Sectors		Phase I (1996-2000)		Phase II (2001-2010)	
Water Supply		Population Coverage (%)	Additional Population to be Served	Population Coverage (%)	Additional Population to be Served
Urban Water Supply		85	13,191	95	66,028
Rural Water Supply		80	73,178	95	95,005
Sanitation		Households Coverage (%)	Additional Households to be Served	Households Coverage (%)	Additional Households to be Served
Household Toilets		96	13,246	98	44,432
Urban	Flush	25	2,067	50	13,312
	Pour Flush	75	1,089	50	91
	VIP	0	0	0	0
Rural	Flush	10	1,042	20	1,641
	Pour Flush	90	9,048	80	29,388
	VIP	0	0	0	0
School Toilet		Coverage (%)	Additional Public School Students to be Served	Coverage (%)	Additional Public School Students to be Served
		90	11,370	95	12,604
Public Toilet		Coverage (%)	Additional Public Utilities with Sanitary Toilets	Coverage (%)	Additional Public Utilities with Sanitary Toilets
		100	23	100	36
Sewerage		Not Applicable		Coverage (%)	Population to be Served
				50	49,848
Solid Waste		Coverage (%)	Additional Households to be Served	Not Applicable	
		50	7,325		

Table 8.2.2 Base Year Service Coverage of Water Supply

Municipalities	Type	Population 1995	Population Served by 1995 Facilities				
			Level III	Level II	Level I	Total	% Coverage
Adams	Urban	0	0	0	0	0	0
	Rural	1,165	644	0	0	644	55
	Total	1,165	644	0	0	644	55
Bacarra	Urban	8,649	5,970	0	1,099	7,069	82
	Rural	20,318	4,667	1,080	5,503	11,250	55
	Total	28,967	10,637	1,080	6,602	18,319	63
Badoc	Urban	1,744	0	0	584	584	33
	Rural	25,793	0	1,952	8,621	10,573	41
	Total	27,537	0	1,952	9,205	11,157	41
Bangui	Urban	3,964	1,525	0	1,599	3,124	79
	Rural	9,973	600	4,376	2,605	7,581	76
	Total	13,937	2,125	4,376	4,204	10,705	77
Batac	Urban	13,989	4,389	0	7,501	11,890	85
	Rural	32,163	0	0	23,691	23,691	74
	Total	46,152	4,389	0	31,192	35,581	77
Burgos	Urban	1,459	505	0	634	1,139	78
	Rural	7,265	936	0	3,102	4,038	56
	Total	8,724	1,441	0	3,736	5,177	59
Carassi	Urban	0	0	0	0	0	0
	Rural	774	0	602	110	712	92
	Total	774	0	602	110	712	92
Currimao	Urban	1,068	926	0	81	1,007	94
	Rural	9,367	996	0	3,793	4,789	51
	Total	10,435	1,922	0	3,874	5,796	56
Dingras	Urban	6,003	5,805	0	85	5,890	98
	Rural	26,758	1,408	1,239	16,695	19,342	72
	Total	32,761	7,213	1,239	16,780	25,232	77
Dumalneg	Urban	0	0	0	0	0	0
	Rural	971	828	0	0	828	85
	Total	971	828	0	0	828	85
Espiritu	Urban	3,253	3,035	0	126	3,161	97
	Rural	13,489	0	0	10,457	10,457	78
	Total	16,742	3,035	0	10,583	13,618	81
Laoag City (Capital)	Urban	42,262	21,235	0	11,048	32,283	76
	Rural	49,595	3,960	0	30,164	34,124	69
	Total	91,857	25,195	0	41,212	66,407	72

Table 8.2.2 Base Year Service Coverage of Water Supply (Cont'd.)

Municipalities	Type	Population 1995	Population Served by 1995 Facilities				
			Level III	Level II	Level I	Total	% Coverage
Marcos	Urban	1,497	0	0	972	972	65
	Rural	13,087	0	540	8,965	9,505	73
	Total	14,584	0	540	9,937	10,477	72
Nueva Era	Urban	1,416	0	870	104	974	69
	Rural	4,644	0	1,670	664	2,334	50
	Total	6,060	0	2,540	768	3,308	55
Pagudpud	Urban	4,158	3,390	0	254	3,644	88
	Rural	14,065	2,195	6,627	1,655	10,477	74
	Total	18,223	5,585	6,627	1,909	14,121	77
Paoay	Urban	7,230	1,210	0	3,185	4,395	61
	Rural	15,578	1,256	0	8,317	9,573	61
	Total	22,808	2,466	0	11,502	13,968	61
Pasuquin	Urban	5,663	5,175	0	293	5,468	97
	Rural	17,828	0	2,150	9,306	11,456	64
	Total	23,491	5,175	2,150	9,599	16,924	72
Piddig	Urban	3,238	0	0	2,460	2,460	76
	Rural	15,125	0	650	10,010	10,660	70
	Total	18,363	0	650	12,470	13,120	71
Pinili	Urban	2,032	2,010	0	0	2,010	99
	Rural	13,697	0	0	6,290	6,290	46
	Total	15,729	2,010	0	6,290	8,300	53
San Nicolas	Urban	20,168	17,356	558	1,762	19,676	98
	Rural	9,884	0	0	5,512	5,512	56
	Total	30,052	17,356	558	7,274	25,188	84
Sarrat	Urban	7,400	5,385	150	884	6,419	87
	Rural	15,229	0	475	8,002	8,477	56
	Total	22,629	5,385	625	8,886	14,896	66
Solsona	Urban	3,361	0	0	2,930	2,930	87
	Rural	18,019	0	4,422	5,650	10,072	56
	Total	21,380	0	4,422	8,580	13,002	61
Vintar	Urban	4,662	2,310	0	1,330	3,640	78
	Rural	24,518	75	16,890	2,493	19,458	79
	Total	29,180	2,385	16,890	3,823	23,098	79
Provincial Total	Urban	143,216	80,226	1,578	36,931	118,735	83
	Rural	359,305	17,565	42,673	171,605	231,843	65
	Total	502,521	97,791	44,251	208,536	350,578	70

Considering the existing conditions, water supply sector targets were determined by urban and rural area. Phase I development shall be focused on the bottom up of rural water supply to a moderate target of 80% slightly lower than MTPDP sector target, while in urban area, 85% is adopted for furtherance of service coverage. Phase II targets are planned to increase both urban and rural water supply coverage to 95%, as envisaged in the NSMP or slightly higher level.

(2) Sanitation

1) Household toilets

As with water supply, the base year service coverage is calculated as shown in Table 8.2.3 reflecting any planned or on-going projects scheduled to be completed by 1995 (details are referred to Supporting Report).

The province has a base year service coverage of 91% which is well above the current national average coverage of 77%. Urban area registers a high level of 96% that is beyond the national target of 93% set by the MTPDP. Rural area however, has 90% considering some "shared users". By type of sanitary toilet facility, the existing percentage composition to total households is as follows:

Type	Urban (%)	Rural (%)
Flush	19	4
Pour-flush	80	94
VIP latrine	1	2

To lessen the gap of the service coverage between the urban and rural area and to attain an equitable distribution of this basic facility, the same target is applied to both areas. Provincial target of Phase I for household toilets is planned to be 96% which is the current service coverage in urban area and three (3) percent higher than the set target by the MTPDP. For Phase II, 98% that is again a bit higher than the set target of 94% in the NSMP is adopted.

The existing composition of the 3 facility types serves as an indicator in the distribution for Phase I, while for Phase II, VIP latrine is phased-out.

2) School toilets

The base year service coverage of public school students is shown in Table 8.2.4 counting expected coverage of any planned or on-going projects scheduled to be completed by 1995 (details are referred to Supporting Report).

Table 8.2.3 Base Year Service Coverage of Household Toilets

Municipality	Area	1995		Households and Population Using Sanitary Toilets								
		Population	No. of HHs	Number of Households				Served Population	Coverage (%)			
				Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total
Adams	Urban	0	0	0	0	0	0	0	0	0	0	0
	Rural	1,165	213	0	184	0	184	1,002	0	86	0	86
	Total	1,165	213	0	184	0	184	1,002	0	86	0	86
Bacarra	Urban	8,649	1,798	482	1,177	42	1,701	8,130	27	65	2	94
	Rural	20,318	4,149	252	3,475	83	3,810	18,693	6	84	2	92
	Total	28,967	5,947	734	4,652	125	5,511	26,823	12	78	2	92
Badoc	Urban	1,744	358	50	283	0	333	1,622	14	79	0	93
	Rural	25,793	5,098	120	4,740	0	4,860	24,503	2	93	0	95
	Total	27,537	5,456	170	5,023	0	5,193	26,125	3	92	0	95
Bangui	Urban	3,964	794	80	692	0	772	3,845	10	87	0	97
	Rural	9,973	2,049	130	1,691	0	1,821	8,876	6	83	0	89
	Total	13,937	2,843	210	2,383	0	2,593	12,721	7	84	0	91
Batac	Urban	13,989	2,700	280	2,315	0	2,595	13,429	10	86	0	96
	Rural	32,163	6,351	437	4,837	0	5,274	26,695	7	76	0	83
	Total	46,152	9,051	717	7,152	0	7,869	40,124	8	79	0	87
Burgos	Urban	1,459	285	15	235	0	250	1,269	5	82	0	87
	Rural	7,265	1,390	27	953	0	980	5,158	2	69	0	71
	Total	8,724	1,675	42	1,188	0	1,230	6,427	3	71	0	74
Carrassi	Urban	0	0	0	0	0	0	0	0	0	0	0
	Rural	774	159	0	50	44	94	457	0	31	28	59
	Total	774	159	0	50	44	94	457	0	31	28	59
Currimao	Urban	1,068	219	61	63	0	124	609	28	29	0	57
	Rural	9,367	1,844	59	1,386	0	1,445	7,306	3	75	0	78
	Total	10,435	2,063	120	1,449	0	1,569	7,915	6	70	0	76

Table 8.2.3 Base Year Service Coverage of Household Toilets (Cont'd.)

Municipality	Area	1995		Households and Population Using Sanitary Toilets								
		Population	No. of HHs	Number of Households				Served Population	Coverage (%)			
				Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total
Dingras	Urban	6,003	1,179	114	1,046	0	1,160	5,943	10	89	0	99
	Rural	26,758	5,199	81	5,088	0	5,169	26,758	2	98	0	100
	Total	32,761	6,378	195	6,134	0	6,329	32,701	3	96	0	99
Dumalneg	Urban	0	0	0	0	0	0	0	0	0	0	0
	Rural	971	183	0	183	0	183	971	0	100	0	100
	Total	971	183	0	183	0	183	971	0	100	0	100
Espiritu	Urban	3,253	649	161	339	149	649	3,253	25	52	23	100
	Rural	13,489	2,566	305	1,636	598	2,539	13,354	12	64	23	99
	Total	16,742	3,215	466	1,975	747	3,188	16,607	14	61	23	98
Laoag City (Capital)	Urban	42,262	8,540	2,100	6,302	0	8,402	41,839	25	74	0	99
	Rural	49,595	9,956	663	8,404	0	9,067	45,131	7	84	0	91
	Total	91,857	18,496	2,763	14,706	0	17,469	86,970	15	80	0	95
Marcos	Urban	1,497	291	9	282	0	291	1,497	3	97	0	100
	Rural	13,087	2,552	0	2,355	0	2,355	12,040	0	92	0	92
	Total	14,584	2,843	9	2,637	0	2,646	13,537	0	93	0	93
Nueva Era	Urban	1,416	266	4	184	0	188	1,005	2	69	0	71
	Rural	4,644	934	0	613	0	613	3,065	0	66	0	66
	Total	6,060	1,200	4	797	0	801	4,070	0	66	0	66
Pagudpud	Urban	4,158	806	27	702	0	729	3,742	3	87	0	90
	Rural	14,065	2,575	9	2,323	0	2,332	12,659	0	90	0	90
	Total	18,223	3,381	36	3,025	0	3,061	16,401	1	89	0	90
Paoay	Urban	7,230	1,419	356	1,048	15	1,419	7,230	25	74	1	100
	Rural	15,578	2,933	224	2,260	395	2,879	15,266	8	77	13	98
	Total	22,808	4,352	580	3,308	410	4,298	22,496	13	76	9	98

Table 8.2.3 Base Year Service Coverage of Household Toilets (Cont'd.)

Municipality	Area	1995		Households and Population Using Sanitary Toilets								
		Population	No. of HHs	Number of Households				Served Population	Coverage (%)			
				Flush	Pour Flush	VIP Latrine	Total		Flush	Pour Flush	VIP Latrine	Total
Pasuquin	Urban	5,663	1,184	270	724	0	994	4,757	23	61	0	84
	Rural	17,828	3,556	56	2,396	0	2,452	12,301	2	67	0	69
	Total	23,491	4,740	326	3,120	0	3,446	17,058	7	66	0	73
Piddig	Urban	3,238	646	30	613	0	643	3,238	5	95	0	100
	Rural	15,125	3,081	0	2,993	23	3,016	14,823	0	97	1	98
	Total	18,363	3,727	30	3,606	23	3,659	18,061	1	97	1	99
Pinili	Urban	2,032	387	14	371	0	385	2,032	4	96	0	100
	Rural	13,697	2,626	24	2,390	0	2,414	12,601	1	91	0	92
	Total	15,729	3,013	38	2,761	0	2,799	14,633	1	92	0	93
San Nicolas	Urban	20,168	4,089	583	3,500	0	4,083	20,168	14	86	0	100
	Rural	9,884	1,915	154	1,684	0	1,838	9,489	8	88	0	96
	Total	30,052	6,004	737	5,184	0	5,921	29,657	12	86	0	98
Sarrat	Urban	7,400	1,487	251	1,236	0	1,487	7,400	17	83	0	100
	Rural	15,229	3,160	0	3,126	0	3,126	15,077	0	99	0	99
	Total	22,629	4,647	251	4,362	0	4,613	22,477	5	94	0	99
Solsona	Urban	3,361	673	135	510	0	645	3,227	20	76	0	96
	Rural	18,019	3,539	160	3,226	0	3,386	17,298	5	91	0	96
	Total	21,380	4,212	295	3,736	0	4,031	20,525	7	89	0	96
Vintar	Urban	4,662	968	160	557	0	717	3,497	17	58	0	75
	Rural	24,518	4,929	85	3,306	0	3,391	16,917	2	67	0	69
	Total	29,180	5,897	245	3,863	0	4,108	20,414	4	66	0	70
Provincial Total	Urban	143,216	28,738	5,182	22,179	206	27,567	137,732	18	77	1	96
	Rural	359,305	70,957	2,786	59,299	1,143	63,228	320,440	4	84	2	90
	Total	502,521	99,695	7,968	81,478	1,349	90,795	458,172	8	82	1	91

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

Municipality	Public Schools Toilets			Public Toilets		
	1995 Total No. of Public Schools Students	Std. No. of Public School Students that can be Served by Base Year (1995) Sanitary Toilets	Coverage (%)	Number of PU in 1995	Number of PU with Sanitary Toilets in Base Year (1995)	Coverage (%)
Adams	379	379	100	1	1	100
Bacarra	6,199	5,700	92	2	2	100
Badoc	3,906	4,056	104	1	1	100
Bangui	3,157	3,307	105	2	2	100
Batac	7,340	7,640	104	1	1	100
Burgos	2,136	2,286	107	2	2	100
Carassi	105	255	243	1	1	100
Currimao	2,267	2,417	107	1	1	100
Dingras	4,724	4,874	103	1	1	100
Dumalneg	236	236	100	1	1	100
Espiritu	4,487	4,350	97	1	1	100
Laoag City (Capital)	15,404	7,700	50	11	11	100
Marcos	2,335	2,100	90	1	1	100
Nueva Era	1,390	1,150	83	1	1	100
Pagudpud	3,661	3,811	104	1	1	100
Paoay	2,436	2,586	106	1	1	100
Pasuquin	4,894	3,700	76	1	1	100
Piddig	2,992	3,142	105	1	1	100
Pinili	2,723	2,550	94	2	2	100
San Nicolas	5,616	5,766	103	2	2	100
Sarrat	3,035	3,185	105	1	1	100
Solsona	3,917	3,000	77	1	1	100
Vintar	3,805	2,600	68	1	1	100
Provincial Total	87,144	76,790	88	38	38	100

Note: PU - Public Utilities

Present service coverage is 88% applying the standard number of public school students to be served by one (1) unit of toilet facility. The high level is due to a large number of newly constructed schoolbuildings with sanitary toilets and the fact that the province was a recipient of the recently concluded JICA - assisted Rural Environmental Sanitation Project II.

In the absence of national targets for school toilets, the existing level of service coverage is the base in setting up the targets. It is expected that all new construction of schoolbuildings will entail sanitary toilets enabling the coverage to increase on a high level. For Phase I and II, 90% and 95% are set, respectively.

3) Public toilets

The base year service coverage considering expected additional coverage by 1995 is shown in Table 8.2.4 (details are referred to Supporting Report).

All existing public utilities (limited to public markets and bus/jeepney terminals) have at least one sanitary toilet or a 100% service coverage. In setting up the targets without national target as of now, the indicator would be the existing level of coverage. Accordingly, a 100% coverage for Phase I and Phase II is assumed.

(3) Sewerage

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

(4) Solid waste

The municipal level data in 1995 on the number of households served by the municipal refuse collection revealed that the current practice is concentrated to urban areas. The base year service coverage for urban area by municipality is shown in Table 8.2.5.

About 13% of the total households in the province relied on municipal refuse collection using trucks or a 46% urban household coverage. These municipalities have a total of 13 units of collection truck.

No national targets have yet been set. However, considering the present level of coverage, a 50% urban household coverage is applied for the medium-term period (2000).

Table 8.2.5 Base Year Service Coverage of Municipal Solid Waste System in 1995

Municipality	Total No. of Households	No. of Urban Households	No. of House-hold Served*	Coverage of Households (%)	Coverage of Urban HHs (%)
Adams	213	0	0	0	0
Bacarra	5,947	1,798	900	15	50
Badoc	5,456	358	889**	16	248
Bangui	2,843	794	0	0	0
Batac	9,051	2,700	112	1	4
Burgos	1,675	285	0	0	0
Carassi	159	0	0	0	0
Currimao	2,063	219	0	0	0
Dingras	6,378	1,179	1,149	18	97
Dumalneg	183	0	0	0	0
Espiritu	3,215	649	0	0	0
Laoag City (Capital)	18,496	8,540	6,763	37	79
Marcos	2,843	291	0	0	0
Nueva Era	1,200	266	0	0	0
Pagudpud	3,381	806	0	0	0
Paoay	4,352	1,419	0	0	0
Pasuquin	4,740	1,184	0	0	0
Piddig	3,727	646	35	1	5
Pinili	3,013	387	0	0	0
San Nicolas	6,004	4,089	662	11	16
Sarrat	4,647	1,487	0	0	0
Solsona	4,212	673	875**	21	130
Vintar	5,897	968	1800**	31	186
Provincial Total	99,695	28,738	13,185	13	46

* Equivalent to total number of urban households served
** Covers some rural barangays / households

8.3 Projection of Frame Values

8.3.1 Population Projection

Future population for all municipalities by urban and rural area was projected for the target years of 2000 and 2010 together with the present population in 1995 as a planning base year.

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

- Population census data of 1980 and 1990 on different administrative levels,
- Annual population growth rates for future regional population projected by NSO, and
- The 1992 Philippine Yearbook.

The past population development at different administrative levels was first reviewed to come up with the demographic characteristics of the region and province. Through review of NSO regional population projection and the 1992 Philippine Yearbook, the behavior of population development through the future was analyzed. Referring to these demographic study, population projection of the province by target year was carried out in assumption of declining annual growth rates employing a simple compounded formula $(1+r)^n$. Present population in 1995 was also estimated in the same manner. Major study results are presented as follows:

(1) Review of past population development in the province and population distribution in 1990 to urban and rural areas.

The past population development during the census period from 1980 to 1990 revealed that:

- The province recorded 1.7% of average annual growth rate, almost the same as the regional rate at 1.9%, as a conservative growth, and
- Percentage of provincial population to the regional population slightly decreased from 13.2% in 1980 to 13.0% in 1990.

(2) Review of the NSO regional population projection in view of annual growth rates (base year 1990) and the demographic conditions presented in the 1992 Philippine Yearbook.

Annual growth rates of regional population projected by NSO were analyzed using simplified formula. The conservative growth rates were calculated reflecting demographic characteristics of moderate decline of fertility and mortality described in the 1992 Philippine Yearbook. Future behaviors of provincial population are assumed to follow more or less the same as those of regional ones, unless specific development takes place in the province.

(3) Estimation of present provincial population (1995) applying 1980-1990 average annual growth rate of respective municipalities (further broken down to urban and rural areas) assuming that the behaviors of past population development prevailed up to the present.

(4) Projection of provincial population by target year:

- The manner of discount in annual growth rates of

- Population in 2000 was projected from the base year 1995 applying the annual growth rate of 1.19% (29.1% discount of the growth rate of the province observed during last census decade, 1980-1990).
- Population in 2010 with the base year of 2000 was projected applying the annual growth rate of 1.00%.
- Present profile of population distribution both in urban and rural areas is assumed to prevail through the future.

Population by target year and the year 1995 is presented in Table 8.3.1 covering all municipalities broken down to urban and rural areas. Number of households by target year was also studied and included in Table 8.3.5, Supporting Report.

8.3.2 School Enrollment Projection

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

School age population is extrapolated from the NSO age group classification of 5-9, 10-14 and 15-19 years old bracket by municipality. The age group for the elementary level is from 7 to 13 years, while that for the high school level is from 14 to 17 years. The percentages of school age population for the target years are based on the existing composition or structure of the 1990 population.

From the school age population, the number of children who would attend either private or public school, by target year is computed using the projected participation rate. The participation rate by target year varies depending on the socio-economic condition of the province. Generally, an improved economy will result to a higher participation rate. For the province, an increase in the participation rate in both private and public schools is foreseen in years 2000 and 2010.

The number of public school students by target year is then derived from the projected number of children who will attend school. A participation rate for public school enrollment is established based on the existing participation rate of public school students to the total school age population. A slight increase of 2% from the 1995 participation rate is foreseen in 2000 and only 1% from the 2000 rate in 2010 (details are referred to Table 8.3.6, Supporting Report). Table 8.3.2 shows the projected number of public school students by municipality and by target year.

Table 8.3.1 Future Population by Urban and Rural Area by Municipality

Municipality	1990			1995			2000			2010		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Adams	0	1,119	1,119	0	1,165	1,165	0	1,236	1,236	0	1,365	1,365
Bacarra	8,428	18,512	26,940	8,649	20,318	28,967	9,176	21,556	30,732	10,136	23,811	33,947
Badoc	1,738	23,889	25,627	1,744	25,793	27,537	1,850	27,365	29,215	2,044	30,228	32,272
Bangui	3,805	9,116	12,921	3,964	9,973	13,937	4,205	10,581	14,786	4,645	11,688	16,333
Batac	12,859	30,233	43,092	13,989	32,163	46,152	14,841	34,123	48,964	16,394	37,693	54,087
Burgos	1,234	6,409	7,643	1,459	7,265	8,724	1,548	7,708	9,256	1,710	8,514	10,224
Carassi	0	632	632	0	774	774	0	821	821	0	907	907
Currimao	1,047	8,420	9,467	1,068	9,367	10,435	1,133	9,938	11,071	1,252	10,977	12,229
Dingras	5,805	24,714	30,519	6,003	26,758	32,761	6,369	28,388	34,757	7,035	31,358	38,393
Dumalneg	0	828	828	0	971	971	0	1,030	1,030	0	1,138	1,138
Espiritu	3,038	12,304	15,342	3,253	13,489	16,742	3,451	14,311	17,762	3,812	15,808	19,620
Laoag City (Capital)	38,875	44,881	83,756	42,262	49,595	91,857	44,838	52,617	97,455	49,529	58,121	107,650
Marcos	1,347	11,643	12,990	1,497	13,087	14,584	1,588	13,885	15,473	1,754	15,338	17,092
Nueva Era	1,151	4,087	5,238	1,416	4,644	6,060	1,502	4,927	6,429	1,659	5,443	7,102
Pagudpud	3,857	12,701	16,558	4,158	14,065	18,223	4,411	14,922	19,333	4,873	16,483	21,356
Paoay	6,724	13,956	20,680	7,230	15,578	22,808	7,671	16,527	24,198	8,474	18,256	26,730
Pasuquin	5,373	16,037	21,410	5,663	17,828	23,491	6,008	18,914	24,922	6,636	20,893	27,529
Piddig	3,063	14,015	17,078	3,238	15,125	18,363	3,435	16,047	19,482	3,794	17,726	21,520
Pinili	2,024	12,926	14,950	2,032	13,697	15,729	2,156	14,531	16,687	2,382	16,051	18,433
San Nicolas	18,781	8,851	27,632	20,168	9,884	30,052	21,397	10,486	31,883	23,636	11,583	35,219
Sarrat	6,940	14,332	21,272	7,400	15,229	22,629	7,851	16,157	24,008	8,672	17,848	26,520
Solsona	3,008	15,875	18,883	3,361	18,019	21,380	3,566	19,117	22,683	3,939	21,117	25,056
Vintar	4,509	22,575	27,084	4,662	24,518	29,180	4,946	26,012	30,958	5,463	28,734	34,197
Provincial Total	133,606	328,055	461,661	143,216	359,305	502,521	151,942	381,199	533,141	167,839	421,080	588,919

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

Municipality	Number of Public School Students			No. of Public Utilities		
	1995	2000	2010	1995	2000	2010
Adams	379	383	379	1	2	3
Bacarra	6,199	6,715	7,287	2	2	3
Badoc	3,906	4,318	4,739	1	2	4
Bangui	3,157	3,406	3,693	2	3	4
Batac	7,340	8,064	8,797	1	3	5
Burgos	2,136	2,312	2,505	2	4	6
Carassi	105	116	127	1	2	3
Currimao	2,267	2,460	2,664	1	2	4
Dingras	4,724	5,167	5,671	1	3	5
Dumalneg	236	255	275	1	2	3
Espiritu	4,487	4,880	4,974	1	1	3
Laoag City (Capital)	15,404	16,714	18,232	11	13	15
Marcos	2,335	2,548	2,790	1	2	4
Nueva Era	1,390	1,503	1,631	1	2	3
Pagudpud	3,661	4,016	4,377	1	3	5
Paoay	2,436	2,682	2,969	1	1	3
Pasuquin	4,894	5,318	5,774	1	2	4
Piddig	2,992	3,248	3,548	1	2	3
Pinili	2,723	2,982	3,249	2	2	3
San Nicolas	5,616	6,149	6,690	2	3	4
Sarrat	3,035	3,356	3,683	1	2	3
Solsona	3,917	4,274	4,659	1	1	3
Vintar	3,805	4,198	4,615	1	2	4
Provincial Total	87,144	95,064	103,328	38	61	97

8.3.3 Projection of the Number of Public Utilities

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

Twenty three (23) public markets/bus terminals are planned to be constructed by year 2000, and another 36 by the year 2010. Refer to Table 8.3.2 for the total number of public utilities by municipality by target year (details are referred to Supporting Report).

8.3.4 Planning Area and its Projected Population for Sewerage

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

Only 4 municipalities/city with a total urban population of 99,695 are considered (refer to Table 8.5.5).

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

The number of urban households in 2000 is the potential households for the planning (refer to Table 8.3.5, Supporting Report).

8.4 Types of Facilities and Implementation Criteria

In principle, types of facilities and their implementation criteria as prescribed in the NSMP are adopted to this PW4SP.

8.4.1 Water Supply

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

(1) Urban water supply

1) Service level

It shall be noted that a national policy for urban water supply is a Level III system in general as the most suitable measure. Therefore, for the investment needs of the sector development, it is assumed in this PW4SP that underserved and/or unserved urban population at present and in the future will be provided with individual house connections. However, it does not intend to exclude Level I and II facilities from being implemented in urban area in the future as individual cases.

2) Utilization of existing facilities

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

3) Water source

Majority of existing Level III systems are utilizing deep wells in view of economy and easy O&M. In this context, priority is given to deep wells wherever applicable.

The groundwater productivity was assumed based on the study results of water sources in Chapter 7 and presented in Table 8.4.1.

Table 8.4.1 Groundwater Productivity

Municipality	Specific Capacity (liter/sec/m)	Well Depth (meter)	Groundwater Productivity per Deep Well (cu. m/16 hr)
Adams	0.00	0	0
Bacarra	2.50	50	1,440
Badoc	2.50	50	1,440
Bangui	2.00	30	1,152
Batac	2.50	30	1,440
Burgos	1.50	30	864
Carassi	0.00	0	0
Currimao	2.50	50	1,440
Dingras	2.50	50	1,440
Dumalneg	0.00	0	0
Espiritu	2.50	50	1,440
Laoag City (Capital)	2.50	50	1,440
Marcos	2.50	50	1,440
Nueva Era	2.50	50	1,440
Pagudpud	2.00	30	1,152
Paoay	2.50	50	1,440
Pasuquin	2.50	50	1,440
Piddig	2.50	50	1,440
Pinili	2.50	50	1,440
San Nicolas	2.50	50	1,440
Sarrat	2.50	50	1,440
Solsona	2.50	50	1,440
Vintar	2.50	50	1,440

4) Number of systems

In principle, one Level III system is considered for urban area of every municipality. When any Level III system exists, the future requirements are considered as an expansion of the existing system, otherwise a new system was considered.

In addition to the above, any rural barangay/s being served by the existing urban Level III system are considered to be continued throughout the future. A merged Level III system covering more than two municipalities is also considered, if technical and economic conditions are being met.

5) Rehabilitation

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

(2) Rural water supply

1) Service level

The Level I systems are generally planned for rural areas where houses are scattered (deep and/or shallow wells). Spring development is excluded from the Level I plan

ning in view of cost effectiveness. Level II systems are considered where houses are clustered and suitable untapped spring is available.

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

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

2) Utilization of existing facilities

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

3) Water source

For Level I facilities, deep well construction is given priority wherever applicable in view of safety against possible contamination and stable water supply. Standard specifications of shallow and deep wells are summarized in Table 8.4.2 based on the water source evaluation results presented in Chapter 7. Conventional construction method (driven well) may be employed under the favorable substrata or hydro-geological conditions. The standard structure of wells in application of "open-hole drilling and gravel pack" is presented in Figure 8.4.1, Supporting Report.

Table 8.4.2 Standard Specifications of Level I Wells

Specification	Shallow Well	Deep Well
Construction Method	Open-hole drilling and gravel pack	
Casing Diameter	50 mm	100 mm
Borehole Diameter	150 mm	200 mm
Ranges of Well Depth	Standard Depth	
0 - 20 m	20 m	N.A.
21 - 40 m	N.A.	30 m
41 - 60 m	N.A.	50 m
61 - 80 m	N.A.	70 m

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

4) Number of systems/facilities

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

5) Rehabilitation

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

8.4.2 Sanitation

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

(1) Household toilets

Only two (2) types of sanitary toilet facilities for individual houses are considered for Phase I and II; flush and pour-flush considering the very low coverage of VIP toilets at present.

The type of toilet facilities is dependent on the existing or planned service level of water supply in the community. In urban and rural areas with Level I or II water supply facilities, only pour-flush is considered, while in urban areas with Level III water supply systems, flush type toilets requiring a piped water connection are included.

(2) School toilets

Standard service level currently used by DECS (50 students per unit facility) is employed for both phases.

The standard toilet facility (1 building) with 5 units of toilet bowl to serve for 250 students is adopted for the planning purpose, which is modified from FW4SP design to provide a shallow well as a water source.

(3) Public toilets

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

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

8.4.3 Urban Sewerage

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

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

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

8.4.4 Solid Waste

In terms of facility requirements, this PW4SP only studied the number of refuse collection trucks required for the year 2000. A rated capacity of 5 cu.m truck/vehicle is considered for calculation of required units of truck. Disposal of solid waste shall be studied in detail through investigations, F/S and D/D. Unit solid waste generation for urban area is assumed to be 0.418kg per capita per day.

8.5 Service Coverage by Target Year

8.5.1 Water Supply

The service coverage in terms of population to be served by target year was estimated by urban and rural area by municipality. The service coverage in rural area was further subdivided by service level (Level I & Level II) to finally come up with physical requirements.

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

- provincial sector targets,

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

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

(1) Phase I requirements

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

The utilization of untapped springs for Level II systems was given priority during Phase I period for rural water supply. At the time of this plan preparation, three (3) untapped springs in three (3) municipalities were identified.

(2) Phase II requirements

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

Table 8.5.1 exhibits the population to be served by target year, while Figures 8.5.1 and 8.5.2 present maps showing service coverage by 2000 and 2010, respectively (details are referred to Supporting Report).

Through the Phase I development, approximately 86,400 persons in the province will be served by additional water supply services, of which 13,200 persons or 15% of the total will be urban population and 73,200 persons or 85% will be rural population.

In the Phase II period, a total of 161,000 persons, of which 66,000 persons or 41% in urban area and 95,000 persons or 59% in rural area, will be further benefited by water supply services. This additional service coverage in urban area includes upgrade of service level for 38,500 persons served by Level I and II facilities in 1995.

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

Municipalities	Type	Phase I (2000)									Phase II (2010)								
		Total Population	Service Coverage				Additional Population to be Served				Total Population	Service Coverage				Additional Population to be Served			
			Level III	Level II	Level I	Total	Level III	Level II	Level I	Total		Level III	Level II	Level I	Total	Level III	Level II	Level I	Total
Adams	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	1,236	644	0	345	989	0	0	345	345	1,365	644	0	653	1,297	0	0	308	308
	Total	1,236	644	0	345	989	0	0	345	345	1,365	644	0	653	1,297	0	0	308	308
Bacarra	Urban	9,176	6,701	0	1,099	7,800	731	0	0	731	10,136	9,629	0	0	9,629	2,928	0	0	2,928
	Rural	21,556	4,667	1,080	11,498	17,245	0	0	5,995	5,995	23,811	4,667	1,080	16,873	22,620	0	0	5,375	5,375
	Total	30,732	11,368	1,080	12,597	25,045	731	0	5,995	6,726	33,947	14,296	1,080	16,873	32,249	2,928	0	5,375	8,303
Badoc	Urban	1,850	989	0	584	1,573	989	0	0	989	2,044	1,942	0	0	1,942	953	0	0	953
	Rural	27,365	0	1,952	19,940	21,892	0	0	11,319	11,319	30,228	0	1,952	26,765	28,717	0	0	6,825	6,825
	Total	29,215	989	1,952	20,524	23,465	989	0	11,319	12,308	32,272	1,942	1,952	26,765	30,659	953	0	6,825	7,778
Bangui	Urban	4,205	1,975	0	1,599	3,574	450	0	0	450	4,645	4,413	0	0	4,413	2,438	0	0	2,438
	Rural	10,581	600	4,376	3,489	8,465	0	0	884	884	11,688	600	4,376	6,128	11,104	0	0	2,639	2,639
	Total	14,786	2,575	4,376	5,088	12,039	450	0	884	1,334	16,333	5,013	4,376	6,128	15,517	2,438	0	2,639	5,077
Batac	Urban	14,841	5,114	0	7,501	12,615	725	0	0	725	16,394	15,574	0	0	15,574	10,460	0	0	10,460
	Rural	34,123	0	0	27,298	27,298	0	0	3,607	3,607	37,693	0	0	35,808	35,808	0	0	8,510	8,510
	Total	48,964	5,114	0	34,799	39,913	725	0	3,607	4,332	54,087	15,574	0	35,808	51,382	10,460	0	8,510	18,970
Burgos	Urban	1,548	682	0	634	1,316	177	0	0	177	1,710	1,625	0	0	1,625	943	0	0	943
	Rural	7,708	936	0	5,230	6,166	0	0	2,128	2,128	8,514	936	0	7,152	8,088	0	0	1,922	1,922
	Total	9,256	1,618	0	5,864	7,482	177	0	2,128	2,305	10,224	2,561	0	7,152	9,713	943	0	1,922	2,865
Carassi	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	821	0	602	110	712	0	0	0	0	907	0	602	260	862	0	0	150	150
	Total	821	0	602	110	712	0	0	0	0	907	0	602	260	862	0	0	150	150
Currimao	Urban	1,133	926	0	81	1,007	0	0	0	0	1,252	1,189	0	0	1,189	263	0	0	263
	Rural	9,938	996	0	6,954	7,950	0	0	3,161	3,161	10,977	996	0	9,432	10,428	0	0	2,478	2,478
	Total	11,071	1,922	0	7,035	8,957	0	0	3,161	3,161	12,229	2,185	0	9,432	11,617	263	0	2,478	2,741
Dingras	Urban	6,369	5,805	0	85	5,890	0	0	0	0	7,035	6,683	0	0	6,683	878	0	0	878
	Rural	28,388	1,408	1,749	19,553	22,710	0	510	2,858	3,368	31,358	1,408	1,749	26,633	29,790	0	0	7,080	7,080
	Total	34,757	7,213	1,749	19,638	28,600	0	510	2,858	3,368	38,393	8,091	1,749	26,633	36,473	878	0	7,080	7,958
Dumalneg	Urban	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rural	1,030	828	0	0	828	0	0	0	0	1,138	828	0	253	1,081	0	0	253	253
	Total	1,030	828	0	0	828	0	0	0	0	1,138	828	0	253	1,081	0	0	253	253
Espiritu	Urban	3,451	3,035	0	126	3,161	0	0	0	0	3,812	3,621	0	0	3,621	586	0	0	586
	Rural	14,311	0	0	11,449	11,449	0	0	992	992	15,808	0	0	15,018	15,018	0	0	3,569	3,569
	Total	17,762	3,035	0	11,575	14,610	0	0	992	992	19,620	3,621	0	15,018	18,639	586	0	3,569	4,155
Laoag City (Capital)	Urban	44,838	27,064	0	11,048	38,112	5,829	0	0	5,829	49,529	47,053	0	0	47,053	19,989	0	0	19,989
	Rural	52,617	3,960	0	38,134	42,094	0	0	7,970	7,970	58,121	3,960	0	51,255	55,215	0	0	13,121	13,121
	Total	97,455	31,024	0	49,182	80,206	5,829	0	7,970	13,799	107,650	51,013	0	51,255	102,268	19,989	0	13,121	33,110

Table 8.5.1 Population to be Served by Target Year (Water Supply) (Con't.)

Municipalities	Type	Phase I (2000)								Phase II (2010)								
		Total Population	Service Coverage				Additional Population to be Served				Total Population	Service Coverage				Additional Population to be Served			
			Level III	Level II	Level I	Total	Level III	Level II	Level I	Total		Level III	Level II	Level I	Total	Level III	Level II	Level I	Total
Marcos	Urban	1,588	378	0	972	1,350	378	0	0	378	1,754	1,666	0	0	1,666	1,288	0	0	1,288
	Rural	13,885	0	540	10,568	11,108	0	0	1,603	1,603	15,338	0	540	14,031	14,571	0	0	3,463	3,463
	Total	15,473	378	540	11,540	12,458	378	0	1,603	1,981	17,092	1,666	540	14,031	16,237	1,288	0	3,463	4,751
Nueva Era	Urban	1,502	303	870	104	1,277	303	0	0	303	1,659	1,576	0	0	1,576	1,273	0	0	1,273
	Rural	4,927	0	1,670	2,272	3,942	0	0	1,608	1,608	5,443	0	1,670	3,501	5,171	0	0	1,229	1,229
	Total	6,429	303	2,540	2,376	5,219	303	0	1,608	1,911	7,102	1,576	1,670	3,501	6,747	1,273	0	1,229	2,502
Pagudpud	Urban	4,411	3,495	0	254	3,749	105	0	0	105	4,873	4,629	0	0	4,629	1,134	0	0	1,134
	Rural	14,922	2,195	7,177	2,566	11,938	0	550	911	1,461	16,483	2,195	7,177	6,287	15,659	0	0	3,721	3,721
	Total	19,333	5,690	7,177	2,820	15,687	105	550	911	1,566	21,356	6,824	7,177	6,287	20,288	1,134	0	3,721	4,855
Paoay	Urban	7,671	3,335	0	3,185	6,520	2,125	0	0	2,125	8,474	8,050	0	0	8,050	4,715	0	0	4,715
	Rural	16,527	1,256	0	11,966	13,222	0	0	3,649	3,649	18,256	1,256	0	16,087	17,343	0	0	4,121	4,121
	Total	24,198	4,591	0	15,151	19,742	2,125	0	3,649	5,774	26,730	9,306	0	16,087	25,393	4,715	0	4,121	8,836
Pasuquin	Urban	6,008	5,175	0	293	5,468	0	0	0	0	6,636	6,304	0	0	6,304	1,129	0	0	1,129
	Rural	18,914	0	2,150	12,981	15,131	0	0	3,675	3,675	20,893	0	2,150	17,698	19,848	0	0	4,717	4,717
	Total	24,922	5,175	2,150	13,274	20,599	0	0	3,675	3,675	27,529	6,304	2,150	17,698	26,152	1,129	0	4,717	5,846
Piddig	Urban	3,435	460	0	2,460	2,920	460	0	0	460	3,794	3,604	0	0	3,604	3,144	0	0	3,144
	Rural	16,047	0	1,140	11,698	12,838	0	490	1,688	2,178	17,726	0	1,140	15,700	16,840	0	0	4,002	4,002
	Total	19,482	460	1,140	14,158	15,758	460	490	1,688	2,638	21,520	3,604	1,140	15,700	20,444	3,144	0	4,002	7,146
Pinili	Urban	2,156	2,010	0	0	2,010	0	0	0	0	2,382	2,263	0	0	2,263	253	0	0	253
	Rural	14,531	0	0	11,625	11,625	0	0	5,335	5,335	16,051	0	0	15,248	15,248	0	0	3,623	3,623
	Total	16,687	2,010	0	11,625	13,635	0	0	5,335	5,335	18,433	2,263	0	15,248	17,511	253	0	3,623	3,876
San Nicolas	Urban	21,397	17,356	558	1,762	19,676	0	0	0	0	23,636	22,454	0	0	22,454	5,098	0	0	5,098
	Rural	10,486	0	0	8,389	8,389	0	0	2,877	2,877	11,583	0	0	11,004	11,004	0	0	2,615	2,615
	Total	31,883	17,356	558	10,151	28,065	0	0	2,877	2,877	35,219	22,454	0	11,004	33,458	5,098	0	2,615	7,713
Sarrat	Urban	7,851	5,639	150	884	6,673	254	0	0	254	8,672	8,238	0	0	8,238	2,599	0	0	2,599
	Rural	16,157	0	475	12,451	12,926	0	0	4,449	4,449	17,848	0	475	16,481	16,956	0	0	4,030	4,030
	Total	24,008	5,639	625	13,335	19,599	254	0	4,449	4,703	26,520	8,238	475	16,481	25,194	2,599	0	4,030	6,629
Solsona	Urban	3,566	101	0	2,930	3,031	101	0	0	101	3,939	3,742	0	0	3,742	3,641	0	0	3,641
	Rural	19,117	0	4,422	10,872	15,294	0	0	5,222	5,222	21,117	0	4,422	15,639	20,061	0	0	4,767	4,767
	Total	22,683	101	4,422	13,802	18,325	101	0	5,222	5,323	25,056	3,742	4,422	15,639	23,803	3,641	0	4,767	8,408
Vintar	Urban	4,946	2,874	0	1,330	4,204	564	0	0	564	5,463	5,190	0	0	5,190	2,316	0	0	2,316
	Rural	26,012	75	16,890	3,845	20,810	0	0	1,352	1,352	28,734	75	16,890	10,332	27,297	0	0	6,487	6,487
	Total	30,958	2,949	16,890	5,175	25,014	564	0	1,352	1,916	34,197	5,265	16,890	10,332	32,487	2,316	0	6,487	8,803
Provincial Total	Urban	151,942	93,417	1,578	36,931	131,926	13,191	0	0	13,191	167,839	159,445	0	0	159,445	66,028	0	0	66,028
	Rural	381,199	17,565	44,223	243,233	305,021	0	1,550	71,628	73,178	421,080	17,565	44,223	338,238	400,026	0	0	95,005	95,005
	Total	533,141	110,982	45,801	280,164	436,947	13,191	1,550	71,628	86,369	588,919	177,010	44,223	338,238	559,471	66,028	0	95,005	161,033

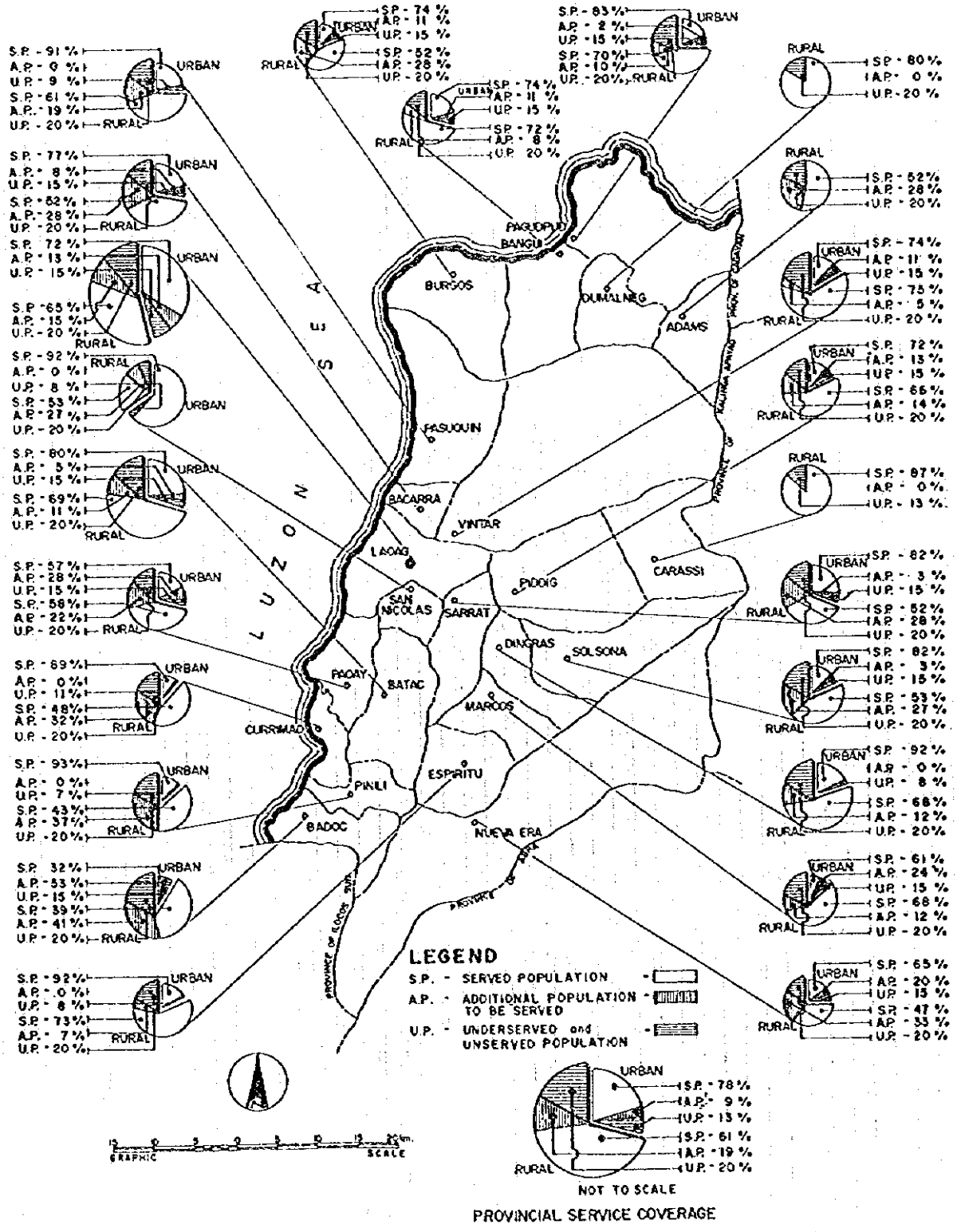


FIGURE 8.5.1

MAP SHOWING FUTURE WATER SUPPLY SERVICE COVERAGE BY 2000

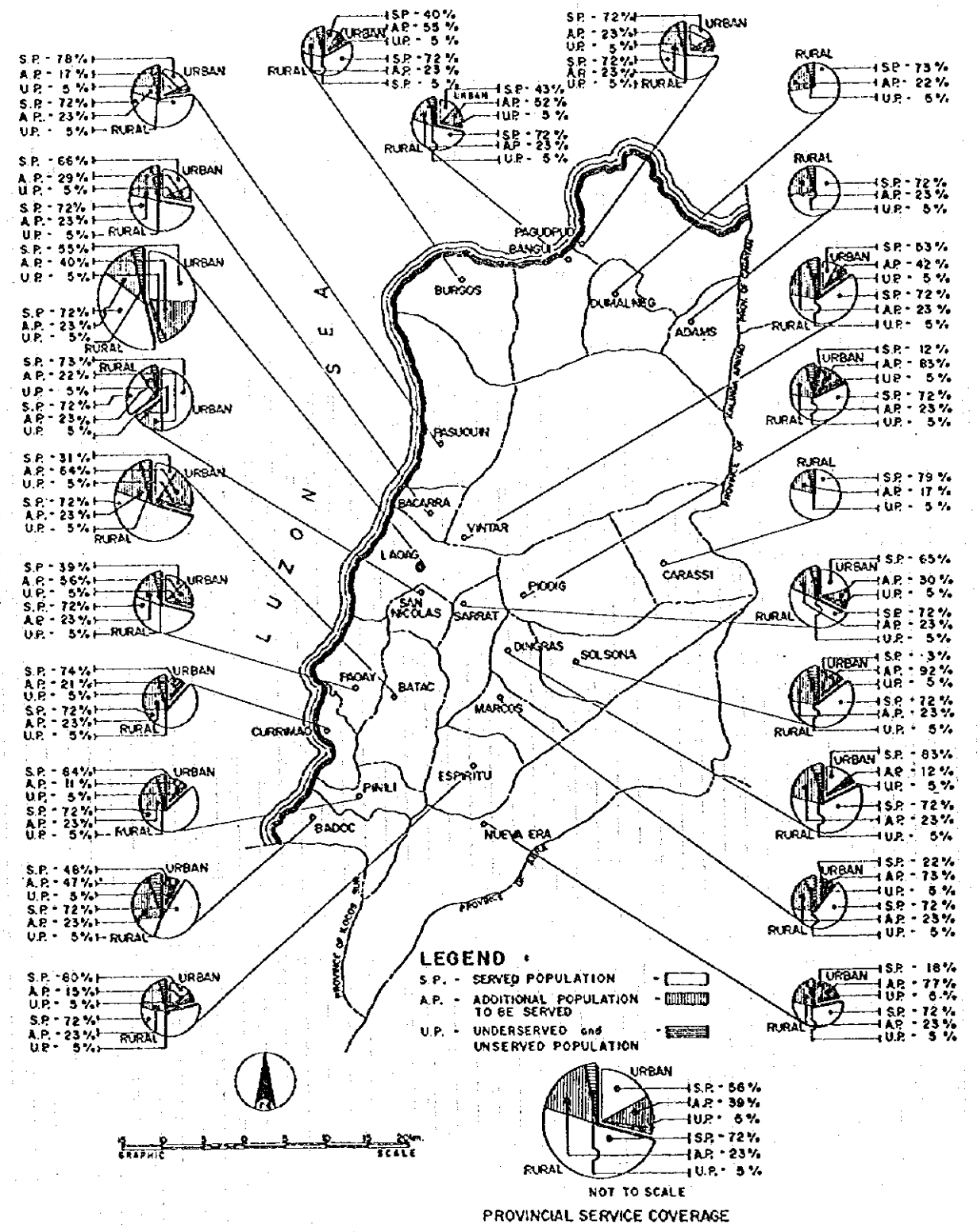


FIGURE 8.5.2

MAP SHOWING FUTURE WATER SUPPLY SERVICE COVERAGE BY 2010