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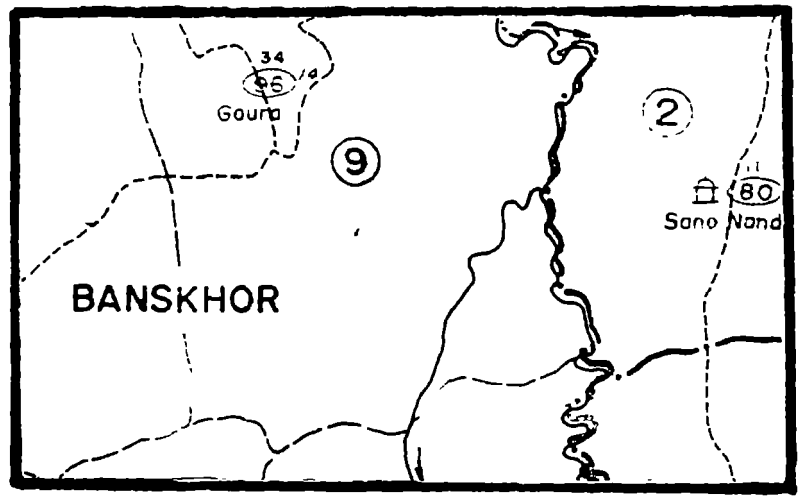
MINISTRY OF HOUSING AND PHYSICAL PLANNING

DEPARTMENT OF WATER SUPPLY AND SEWERAGE

KAPILBASTU DISTRICT

WATER SUPPLY AND SANITATION

DEVELOPMENT PLAN



Final Report
December 1993

HMG/FINNIDA

RURAL WATER SUPPLY AND SANITATION PROJECT

LUMBINI ZONE

KAPILBASTU DISTRICT
WATER SUPPLY AND SANITATION DEVELOPMENT PLAN

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LIST OF ACRONYMS AND ABBREVIATIONS

ADB	=	Agricultural Development Bank
CHV	=	Community Health Volunteer
CWSS	=	Community Water Supply and Sanitation (Project)
CDO	=	Chief District Officer
DDC	=	District Development Commitee
DDP	=	District Development Plan (here refers to water supply development plan)
DEO	=	District Educational Officer
DPHO	=	District Public Health Officer
DWE	=	District Water Engineer
DWSO	=	District Water Supply Office
DWSS	=	Department of Water Supply and Sewerage
FIM	=	Finnish Mark
FINNIDA	=	Finnish International Development Agency
HP	=	Health Post
LDO	=	Local Development Officer
MCH	=	Mother and Child Health (care programme)
MHPP	=	Ministry of Housing and Physical Planning
MLD	=	Ministry of Local Development
MOEC	=	Ministry of Education
MOH	=	Ministry of Health
NRs	=	Nepalese Rupee
NPC	=	National Planning Commission
O&M	=	Operation and Maintenance
PHC	=	Primary Health Care
RWSSP	=	Rural Water Supply and Sanitation Project (Lumbini Zone)
S.L.	=	Service Level
UC	=	Users' Committee
UNICEF	=	United Nations' Children's Fund
VDC	=	Village Development Committee
VHP	=	Village Hygiene Promotor
VHW	=	Village Health Worker
VIP	=	Ventilated Improved Pit-Latrine
WHO	=	World Health Organization
WSST	=	Water Supply and Sanitation Technician

EXECUTIVE SUMMARY

The District Water Supply and Sanitation Development Plan of Kapilbastu has been written to be used as the framework guideline when selecting projects for annual implementation programmes and setting priorities.

Kapilbastu District Present situation

The District is located in the Lumbini Zone and consists administratively of 15 Ilakas and 77 Village Development Committees and 1 Nagarpalika. The total area of the District is 1738 km2.

The altitude of the district varies from 90 m to 824 m above mean sea level. 42% of the District is classified as forest land. Despite the high percentage of forest land, considerable erosion problem exists in the District.

The total population of the District according to the village survey undertaken in 1992 during the preparation of this plan is 384586 consisting of 58986 households. Average household size in the District was calculated to be 6.52 persons and average population density in the District 206 people/km2. Major ethnic groups were Brahmin-Chhetris, Muslims, Tharu, Dhobi, Nepal, Lama, sherpa and Newars.

The economy of the District is entirely based on agriculture mostly subsistence farming.

The health statistics of the District show, that major groups of the disease are water and sanitation related, skin diseases, dysentery, diarrhoea and worms being most common reasons for seeking the medical help.

The District has a rural settlement pattern and infrastructure, most common settlement size being 10-40 houses only. Network of roads, paths is the main means of communication.

The development targets of the Eight Five Year Plan of the District are stating among other things the increasing of the population served by improved water supply to 72% by the year 1997.

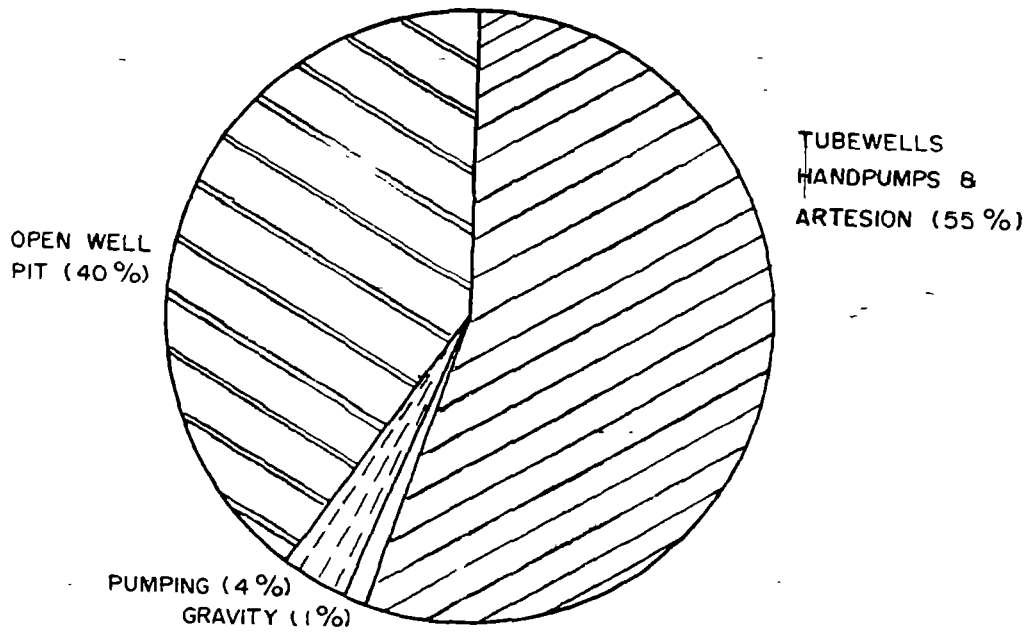
Present Water Supply and Sanitation Situation

In the field survey the primary source of water supply was surveyed clusterwise. The following results were obtained :

Improved water supply systems at present (1992) were found to be mostly private and common handpumps and few piped water supply systems. A large percentage of people gets the water from open wells.

Altogether 196,150 people have handpumps as their primary source of water. Around 30,000 people including Taulihawa and Krishnanagar towns are being served by the piped water supply. A large number of people ie, around 145,100 have open wells as their primary source.

The following pie-chart shows the distribution of all rural households using different water supplies as their primary source:



Distribution of households using hand pumps as primary source by implementing agency.

To compare the actual situation of the different users in terms of water quality, time needed to fetch water, quantity of water available from the supply, annual realiability of the source and daily service time of the water supply, the following service level criteria were used:

Category	Requirements to be met (the poorest characteristic decides the service level)				
	Quality	Quantity (l/c/day)	Acces-sability (min.)	Reliabi-lity (months/y)	Conti-nuity (hr/day)
Service Level 1. Good	Protected source	≥ 45	≤ 15	12	≥ 6
Service Level 2. Acceptable	Acceptable source	≥ 25	≤ 30	≥ 11	≥ 5
Service Level 3. Poor	Any source	≥ 15	≤ 60	≥ 10	≥ 4
Service Level 4. Very Poor	All other water supplies				

Protected source:

(a) protected spring with clear water quality
(b) borehole or well with clear water quality and good platform, > 10 m deep, equipped with pump or handpump
(c) artesian well with clear water quality and proper platform

Acceptable source:

(a) borehole or well with clear water quality, < 10 m deep
(b) borehole, well or artesian well with clear water quality but without proper platform
(c) spring with clear water quality

Population of Kapilbastu District falls into the above Service Level as follows:

- Level 1. Good 15 %
- Level 2. Acceptable 33 %
- Level 3. Poor 10 %
- Level 4. Very Poor 42 %

2% of the households in Kapilbastu were found to have a latrine, total of 1057 private latrines.

Sector Agencies

The field survey of the RWSSP shows, that the private households are very active in water supply development in the District. In fact 87 % of all hand pumps in the rural areas, serving 63 % of all rural handpump usier households, are installed byu private households. This differnce between the installation (87%) and user households (63 %) is explained by the better service level of the private hand pumps (one hand pump per 1.7 households) compared to the communal ones (1 hand pump per 6.5 households). However, the rate of installation of handpumps by the private households by far exceeds the rate of any governmental or non-governmental agencies.

The overall sector responsibility lies with the MHPP. The lead government agency within the sector is the DWSS. The Social Welfare Council coordinates the activities of the NGO's. Ministry of Health is managing the health activities through it's district and field (Ilaka and sub-Ilaka health post) level organization. The DDC programmes are managed through the district level organization of the Ministry of Local Development, i.e. LDO.

Donor agencies active in the District at present is only FINNIDA through Rural Water Supply and Sanitation Project.

Sector Financing

Total annual expenditure in the sector in Kapilbastu District has been NRs. 12.79 million in 90/91, 20.58 million in 91/92 and the budgeted amount for the fiscal year 1992/93 is 19.28 million. The estimated share of HMG of the total financing in 1992/93 is 30%, the donor share 35% and the rest will be covered by the beneficiaries and NGOs and DDC.

Sector Policies and Plans

HMG has stipulated the water supply implementation with the communities' full participation in planning, construction and management. This is to ensure the sustainability and facilitate the communities' to take full responsibility over the completed schemes. These policies have been formalized in the MHPP "Directives for construction and Management of Water Supply

Projects of 2047" and in the "Eight Five Year Plan" covering the planning period of 1992 - 1997.

The water supply coverage targets set in the Eight Five Year Plan are the following:

- 72 % coverage by the year 1997
- 100 % coverage by the year 2002

Beacause of the major input from the private households and excellent groundwater resources, it is realistic to assume that the water supply coverage targets set in the Eight Plan will be achieved in the Kapilbastu District.

The coverage targets of the Eight Plan have been taken as the planning basis for this plan.

Water Demand

The consumption rates used for water demand calculations in this plan are as follows :

- domestic consumption, 45 l/c/d
- schools, 6 l/c/d
- health institutions, outpatients 1000 l/d and inpatients 3000 l/d
- cattle, 20% of 45 l/head/d (or 9 l/head/day)

The water demand calculations in this plan are briefly presented in the table below :

Water Demand, m3/day	1992	1997	2002
Domestic			
- rural	16146	18855	22005
- bazaars and towns	1548	1950	2460
Domestic animals	1975	2120	2335
Schools	304	327	352
Health posts	115	132	154
Commercial and workshops	35	45	55
Total Water Demand, m3/day	20123	23429	27361
Total Water Demand, mill.m3/year	7.35	8.55	9.99

Socio-Economic, Cultural and Health Factors Related to Water Supply

The community should feel, that the water supply improvement is their priority and they want to invest their time and effort in the project. A request for starting the work should always come from the community.

Different groups of the community should be represented in the Users' Committee and served by the system on an equal basis.

The design guidelines recommended in this plan have certain inbuilt health impacts. These are the design consumption rate 45 l/c/day, continuous water supply all year round and large platform around the tubewells and tapstands. If these recommendations are followed, the individual users will be able to increase their consumption, wash more regularly on the water point and go to the tapstand in any hour without queuing. The users will also switch to using the improved water supply, because they are reliable and abandon the open wells, rivers etc. as sources of drinking water. Together with health education and sanitation program this will lead to a better health status of the village.

Water Supply Development Plan

The sufficiency of water resources ie ground water is found potentially very high in the district. A study made on the ground water resources by Cemat Consultants Ltd. in the district shows the annual average groundwater recharge as 450 mill. m3.

The quality of groundwater is generally good though the iron and manganese in some shallow aquifers exceeds the recommended value.

Except in very few cases of gravity water supply systems, the ground water resources are exceptionally good and provide the best source for domestic water supply practically in all parts of the district.

The costs of water supply implementation programme for the rural areas and for the period 1993-1997 and up to 2002 are presented below :

Item	1993-1997 Population Served	1993-1997 Cost Mill. NRs.	1998-2002 Population Served	1998-2002 Cost Mill. NRs.
1. Completion of Ongoing piped w/s projects	6 486	6.49	0	0
2. Rehabilitation of existing hand pump wells	180 027	8.87	0	0
3. Construction of point source w/s (handpump wells)	56 553	17.53	128 547	39.98
4. Construction of drilled well handpumps	3 562	5.34	3 562	5.34
5. Renewal of facilities 5%/year		38.23		45.32
Total	246 628	76.46	132 109	90.64

The capital and recurrent costs are presented in the table below.

Costs, NRs mill.	1993-1997	1998-2002
Water Supply Development		
WaterRSupply Development	76.46	90.64
- Urban	1.0	1.0
DWSS Institutions Costs		
- Facilities	5.0	5.0
- Equipment	5.0	5.0
O&M of Water Supplies		
- Rural	7.7	20.0
- Urban	1.29	2.0
DWSS staff and operations	8.0	10.0
Total	104.45	133.64

The total cost are presented in the table below.

Costs, NRs mill.	1993-1997		1998-2002	
	Total	Annual	Total	Annual
Rural Water Supply				
- Capital Costs	86.46	21.62	100.64	20.13
- Recurrent Costs	12.70	3.17	26.00	5.20
Urban Water Supplies				
- Capital Costs	1.00	0.25	1.25	0.20
- Recurrent Costs	4.29	1.07	6.00	1.20
Total	104.45	26.11	133.64	26.73

The financing of the above presented program is envisaged as follows:

	1993-1997 mill. NRs			1998-2002 mill. NRs		
	Total	Annual	%	Total	Annual	%
Capital Costs						
- Government	16.18	4.05	18.50	22.36	4.47	22.0
- Donors	22.25	5.56	25.44	20.34	4.07	20.0
- NGO's	2.50	0.62	2.86	4.06	0.81	4.0
- Beneficiaries	46.53	11.63	53.20	54.88	10.98	54.0
Total	87.46	21.86	100.00	101.64	20.33	100.0
Recurrent Costs						
- Government	3.40	0.85	20.0	6.40	1.28	20.0
- Beneficiaries	13.59	3.40	80.0	25.60	5.12	80.0
Total	16.99	4.25	100.0	32.00	6.40	100.0

The emphasis of the pregramme is on the continued input from the beneficiaries towards the water supply investment - mainly in the form of private hand pump installation. Outsider intervention is needed only in the Bhabar Zone and maybe in the areas showing high hardship and low shallow tubewell density in the South-Western part of the Disrict.

Sanitation Development

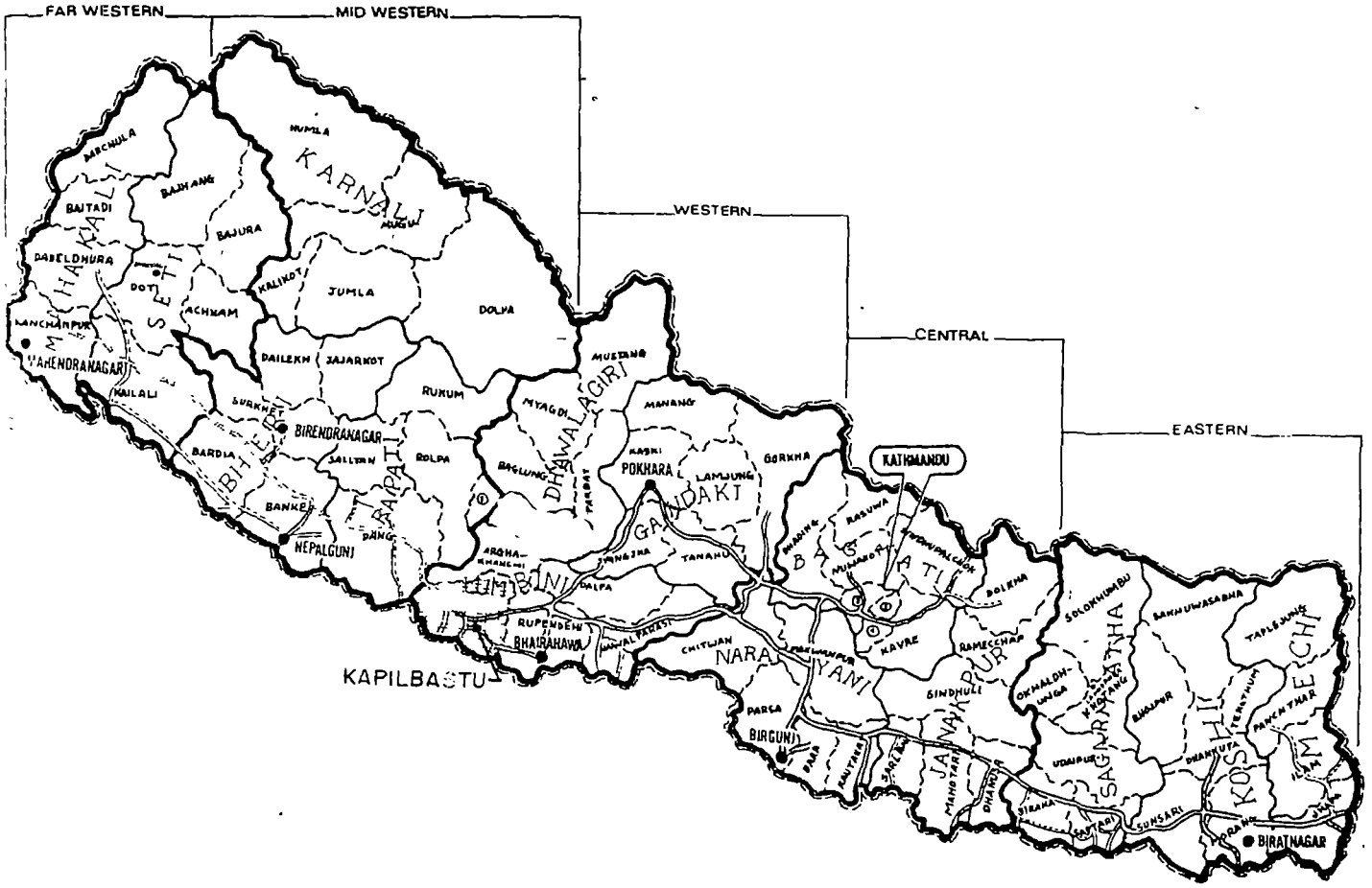
The general approach of the sanitation program recommended in this plan is to promote household latrine construction without subsidy as a part of the general hygiene education program. The basic

program would be implemented by training health post staff, school teachers and community health volunteers. Specialized sanitation promoters (Village Hygiene Promoters) would be working on the VDC level. Permanent latrines would only be constructed in schools and health posts by the District Water Supply Office.

The development target is to cover 50% of all households by the year 2002. An estimated rate of 40 household latrines per year per VDC has been used for planning purposes.

Total cost for the sanitation development for the year 1993-2002 would be about 22.82 million NRs, including the training costs in the community level and investment cost of the school latrines.

Figure 1. Nepal. Location of Kapilbastu District.



1. INTRODUCTION

The implementation of the water supply and sanitation activities in Nepal is presently suffering from lack of long term plans and comprehensive descriptions of the existing situation of the water supply and sanitation in the districts.

This has been noted in the recently prepared Water and Sanitation Sector Review and Development Plan which proposes that a water and sanitation sector plan is prepared for each district and then updated annually. The Project Document of the FINNIDA assisted Rural Water and Sanitation Project in Lumbini Zone also emphasizes the need for long term planning and has therefore included in its programme the preparation of District Water Supply and Sanitation Development Plans for all six districts within the project area.

The Kapilbastu District Water Supply and Sanitation Development Plan will form basis for planning, coordination and implementation of the water supply and sanitation development in the district. It will be a source of information on the existing situation and inventory of resources available for sector development in the district. *The Plan is to be used as a framework guideline when selecting projects for annual implementation programmes and setting priorities.*

The Plan should be updated annually based on additional data to be collected on water resources, water supply situation and the actual development.

2. KAPILBASTU DISTRICT

2.1 Administration

Nepal is divided into 5 Regions, 14 Zones and 75 Districts. A district is further divided into 15 Ilakas (Sectors) and one Ilaka consists of a number Village Development Committees (VDC) which are again divided into 9 Wards. A Ward is the smallest political and administrative unit.

Kapilbastu District is located in Lumbini Zone, Western Region. Its 15 Ilakas consist a total of 77 VDC's and 1 Nagarpalika. The location of the district is shown in Figure 1, and the administrative areas in Figure 2. More detailed District Maps 1:25,000 are available in Volume II.

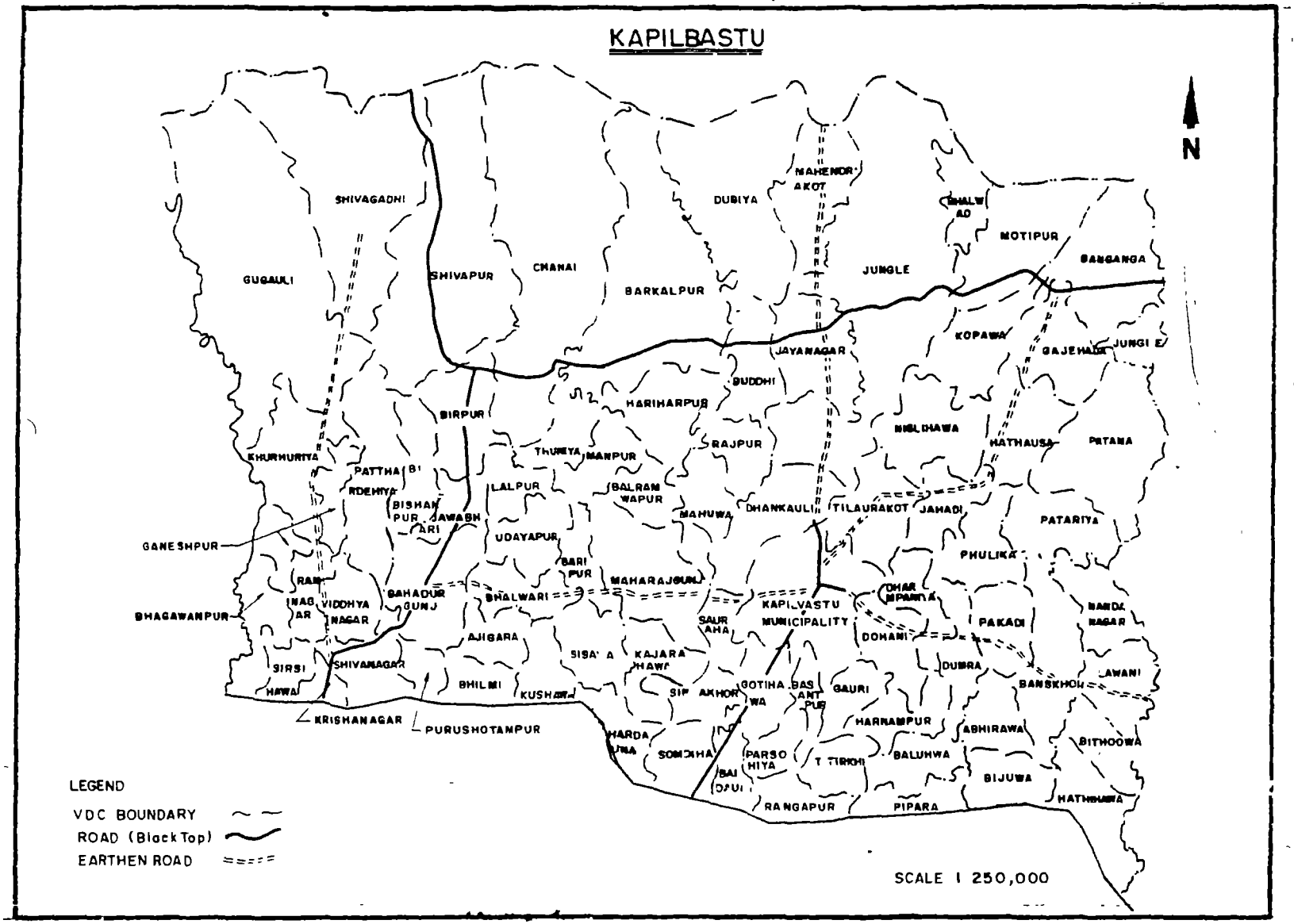


FIGURE 2. Kapilbastu District, Administrative Boundaries.

The district administration is headed by the Chief District Officer (CDO) and the Local Development Officer (LDO) is in charge of the general development activities of the district. The administration personnel is stationed in Taulihawa, except for the VDC secretaries who work at the VDC headquarters.

Local elections were held in May 1992 and councils were formed at ward, VDC and district levels. These councils will play important role in initiating, planning and monitoring development activities, including water supply and sanitation development. LDO as the member secretary of the District Development Council will plan, coordinate and monitor the development activities and report to the council. He will also has the supervisory responsibility over the line ministries engaged in development activities.

2.2 Physical Features of the District

The total area of the district is 1738 km2. It is nearly entirely located in terai plains with only a narrow belt along the Northern boundary belonging to the lower hill reaches. The altitude varies from 90 m to 824 m above sea level. A simplified topographic map is given in Figure 3.

The area is part of the Gangetic alluvial plain characterized be gently sloping cultivated land interspersed by large tracts of subtropical or dry jungle. About 42 % (733 km2) of the district is classified as forest land, 52 % (904 km2) is cultivated land and the remaining 6 % (101 km2) grass land, barren land and water bodies. Due to the population pressure considerable parts of the forest land has been taken for agricultural use during the last ten years.

2.3 Environment

In Kapilbastu District, erosion is the most common environmental problem, caused by overgrazing and deforestation. Erosion is more intense during the monsoon season when also the torrential rivers add to the effect by changing their courses and washing away large portions of land and soil.

Although there are no major cities in the district and therefore no large sewerage systems, the two main towns and the industrial plants, together with the fairly dense population cause considerable but localized pollution in the rivers, particularly during the period of low flow.

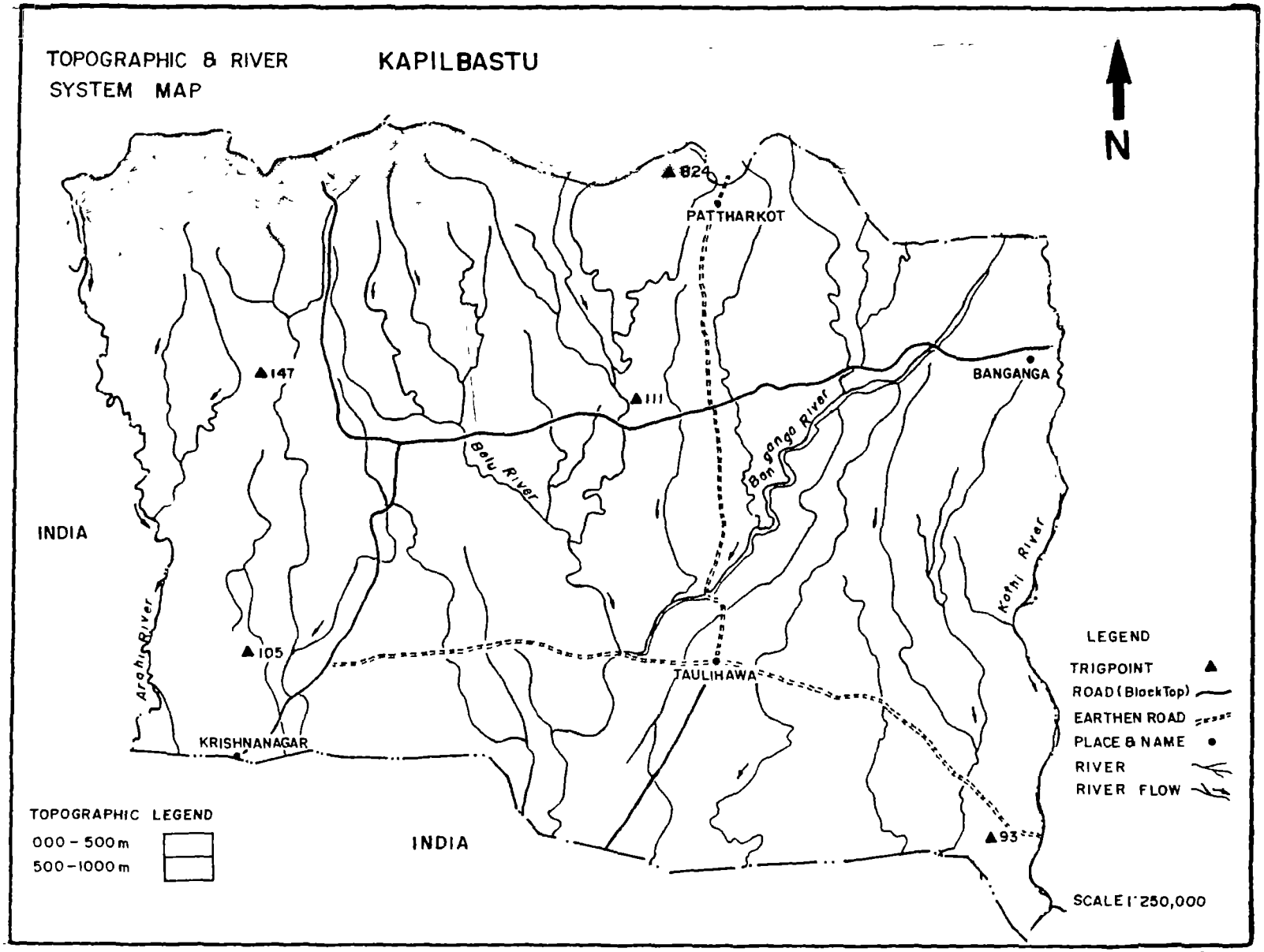


Figure 3. Topographic Map and River System of Kapilbastu District.

2.4 People

According to the field survey, undertaken by the RWSSP during the preparation of this plan in November 1992 (see Annex 1), the total population of the district was 384,586 at that time, consisting of 58,986 households which gives the average household size as 6.52 persons. The national census was undertaken in Nepal during 1991. The census figure for the population of Kapilbastu is 372,205 consisting of 60,990 households. The two population figures tally wery well, considering the time difference and population growth within that time.

93 % of the population was found to be rural and 7 % urban. The field survey of the RWSSP (see chapter 3.6.1) was undertaken only in rural areas.

The average density was thus 206 persons/km2, varying from 55 people/km2 in Gugauli VDC to 532 people/km2 in Phulika VDC. The variation in the population density is demonstrated in Figure 4.

The major ethnic and caste groups in the district and their proportions are presented in Table 1.

Table 1. Ethnic Groups in Kapilbastu

Ethnic group	% of population in Kapilbastu
Brahmin, Chettri, Thakuri	18.61%
Tharu	12.29%
Gurung, Magar, Rai, Limbu, Lama, Sherpa	2.64%
Sarki, Kami, Damai, Badi, Dhobi, Nepal	9.45%
Newars	0.27%
Muslims	14.49%
Others	42.24%

People of different ethnic groups are often settled in same village, so clear areas of one particular ethnic group can not usually be defined.

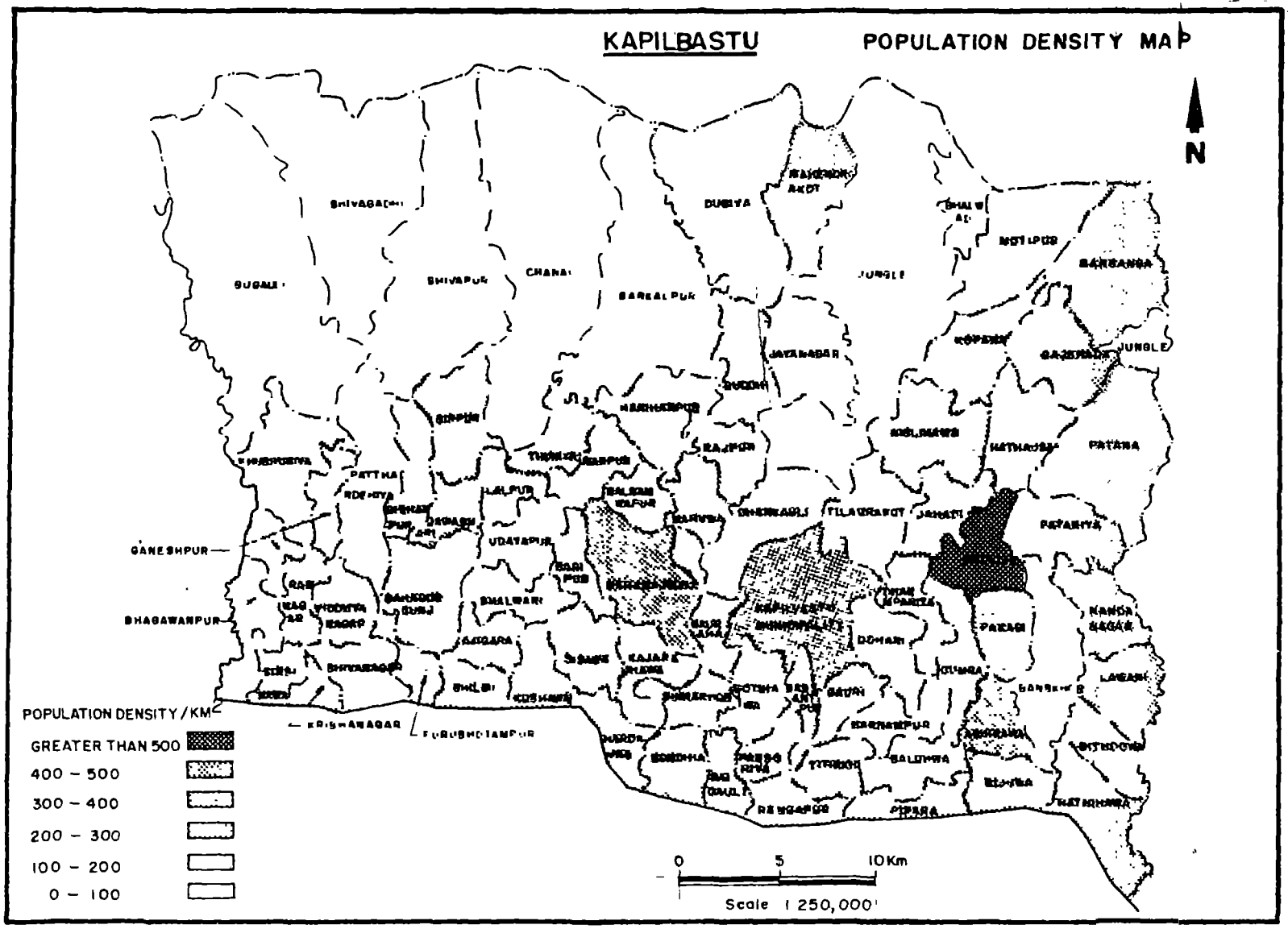


Figure 4. Population Density of Kapilbastu District

2.5 Social and Cultural Features

Kapilbastu is, apart from a narrow belt in the north of the District, a Terai District. The population can be roughly divided into three major groups.

Tharu settlements

Tharus are the original inhabitants of the Terai. This group of people were living in the area, when it still was covered with dense forest. Nowadays the Tharu settlements are in the open, deforested land, and their lifestyle has somewhat changed due to the destruction of the jungle, which was a source of many products for the Tharu people. The Tharu farmers are often sharecropping and the plot holding sizes are small. The villagers are densely populated, houses being very close to each other. The are lot of cattle within the village and the people's and cattle's housing is very close to each other. Houses are very close to each other and houses are mostly mud plastered.

The household size in the Tharu settlements has often been found high, varying from 10 up to 50 people. The system of extended family is still very common among the Tharus.

The social cohesion of the Tharu communities is strong and their traditional leaders powerful.

Tharu people have developed skillful wood carving, pottery and basket weaving crafts. They have especially appropriate and well made grain storage containers, made of mud, to store paddy, dhal and other foodstuffs.

Immigrant settlers from the hills

These communities are formed by the migrated population from the mid-hills, mostly from Arghakhanchi and Gulmi. These people are mostly very recent settlers, migrated during the last 30 years.

These communities are formed by different caste and ethnic groups also found in the hills - brahmin-chhetris, magars, kamis etc.

These communities have a different settlement pattern from that of the Tharus. The villages look well planned, allowing enough land for each household and tracks are often spacious, leaving room for proper drainage.

Many of the pahari communities have a lot of experience in running different development projects in their Village Development Committees. Work is often done in irrigation, drinking water supply, forestry etc. Small Farmers Development Fund, Red Cross and other agencies have been active in these villages.

Muslim villages in the southern part of the District

In the southern part of the District, the communities are mostly formed by old settlers, who have inhabited this area for hundreds of years. Majority of these people are muslims. These settlements are dense, the plan resembling that of the Tharu villages. The architecture is, however, different, having characteristic brick buildings and tile roofs.

2.6 Economy

The economy of the district is based mainly on agriculture - mostly subsistence farming. In the industrial sector there are few small sugar factories, one pesticides factory, two distilleries and a number of small workshops, flowermills serving the local consumption. The commercial activities are limited to serving the local population only. In general, Kapilbastu District can be considered as a deficit area where consumption exceeds production. The balance is made up by government subsidies and remittances from people working outside the district. However, with regards to food supplies the district is self-sufficient and even exports a small surplus to the neighboring districts.

The main crops are rice, wheat, oilseeds, maize, beans and sugarcane. Keeping livestock is a part of agriculture. Based on the results of the field survey 1992 the number of domestic animals can be estimated as follows:

-	cows	147 773
-	buffaloes	60 447
-	horses	743
-	sheep/goats	88 084
-	pigs	2 503

The agricultural products exported from the district are rice and wheat and sugarcane. The quantities of these exports are, however, small.

Reliable statistics on the income level in the district do not exist but it can be assumed to be near the average of the terai districts, which was estimated at NRs 1287 per household per month in 1988 (NRs 504 cash and NRs 783 kind). (Source: Multipurpose Household Budget Survey, Nepal Rastra Bank, 1988). Although the main occupation of the people in the district is related to agriculture there is some wage employment through the local industries and commercial enterprises. An important source of cash income are the remittances of the family members, normally male, working outside the district, many of them in India and particularly in the Indian Army.

2.7 General Health Status of the District

As the health statistics from the year 1991 (see Table 2) show the majority (56 %) of the diseases recorded in the hospitals and health posts is Kapilbastu are related to poor water supply and sanitation.

Table 2. Health Statistics of the Health Posts, 1991

infective parasite diseases	20 646	28 %
skin diseases and equivalent	12 845	17 %
Acure Respiratory Infections (ARI)	7 714	11 %
digestive system diseases	6 009	8 %
diseases of nervous system and sense organs	5 879	8 %
diseases of blood and blood organs	2 921	4 %
accident, poisoning and violence	2 808	4 %
endocrine, nutritional and metabolic diseases	2 534	3 %
skeleton and muscular system diseases	1 765	2 %
other diseases	10 725	15 %

The health facilities of the district consist of one district hospital in Taulihawa with 15 beds and another one in Bahadurganj (outpatients only), 9 Ilaka health posts and ayruvedic health post. The hospitals and the health posts treat 30-200 out-patients per day each, on average. There are 5 medical doctors at the moment in the district attached to the two hospitals.

The ayruvedic and herbal treatment have in the villages in many cases preference over the modern medicine. Patients who visit doctor, expect immediate relief, therefore diseases which require treatment over an extended period (e.g. tuberculosis and leprosy) are difficult to treat. Lot of the medicines are dispensed by small local pharmacies, often without proper supervision or prescription.

As sanitation is almost non-existent in the villages, the fecal-oral transmission route for the diseases is the main source of infection. The congested settlement pattern of some communities resulting in bad drainage and environmental sanitation can definitely be seen contributing towards spreading of the infections.

Some of the low-lying villages are regularly flooded during the rains, which makes the environmental conditions very bad.

2.8 Infrastructure

The district is mainly rural, but there are 2 towns, namely Taulihawa (popul. 17,146), and Krishnanagar (popul. 8,732). The rest of the district consists of village-like settlements -

clusters. The district has altogether 1174 clusters, according to the field survey 1992.

The distribution of the settlements by size is presented in Table 3. This information has been obtained from the field survey 1992.

Table 3. Distribution of the Settlement Sizes

Settlement size, households/settlement	% of all settlements
0 - 20	19%
21 - 40	28%
41 - 60	27%
61 - 80	15%
81 - 100	5%
Over 100	6%

The road system of the district consists of about 95 km of tarmac roads and 45 km all-weather gravel roads passable for heavy traffic throughout the year. In addition there is a number of secondary roads suitable only for light vehicles. These roads become impassable for 3-5 months as a result of the monsoon rains. The rest of the area is covered by a network of tracks and paths, some of them improved and maintained by the villagers.

The main centers of Kapilbastu have telephone systems which are linked to the national telephone network.

Kapilbastu has a electricity networks connected to the national grid but practically only the towns, Taulihawa and Krishnanagar, are electrified. There is, at the moment, construction of 33 kV line going on to provide connection between Chandrauta sub-station and Taulihawa and Pipara.

2.9 Development

The main national planning tools are the Five Year Plans. The Eight Plan has been recently announced, covering the years 1993-97. The Plan gives the framework for development, sets the levels of public financing, and identifies emphasis sectors and priority projects. The Plan forms basis for the annual budgets.

The Five Year Plans are also used at the district level and no separate district development plans exist. However, during the preparation of a Five Year Plan, districts and the district level offices of the line agencies submit priority project proposals to be included in the Plan. The recommendations for the District level

development have not yet been published during the preparation of this plan.

3. PRESENT WATER SUPPLY AND SANITATION SITUATION

3.1 Sector Policies and Plans

The government policies for water and sanitation sector are described by the Decentralization Act and the Directive No. 2047 "Directives for Construction and Management of Water Supply Projects", which emphasize decentralization and community involvement and management in both water supply development and operation and maintenance.

The National Planning Commission has also prepared the Eight Five Year Plan 1992 - 97 and in it set the national targets for the drinking water and sanitation as follows:

"The basic objective will be to:

1. provide drinking water facilities to 72 % of the population by the end of the Eight Plan period, consistent with the long term objective of providing drinking water facilities to the entire population within the next 10 years.

2. extend knowledge and services related to personal and domestic hygiene and environmental sanitation to the maximum number of people."

An abstract of the detailed sector strategy proposals of the Eight Five Year Plan in Annex 2.

The government has prepared a "Drinking Water Supply and Sanitation Sector Review and Development Plan (1991-2000) which, sets the goals and strategies for the sector development:

> "The development goal for the water and sanitation sector during the 1990's will be a sustained improvement in health status and productivity for Nepal's population as a whole, with particular emphasis on lower income groups. The goal will be achieved through the provision of adequate, locally sustainable water supplies and sanitation facilities in association with improved personal, household and community hygiene behaviors."

The target of the Sector Plan is to increase the national water supply coverage from 37 % in 1990 to 77 % in 2000 (rural from 34 % to 75 % respectively) and the sanitation coverage from 6 % in 1990 to 31 % in 2000 (rural from 3 % to 25 % respectively).

The Sector Plan estimates that the total investment requirement in the sector is NRs 2.200 mill. annually, 47 % coming from the government, 47 % from the donors and 6 % from the beneficiaries.

The Sector Plan and the Eight Plan have somewhat different target setting. In the case of the Kapilbastu District, it seems, that the more ambitious targets (of water supply coverage) set in the Eight plan, can be achieved, as the private effort of the water supply development can well be utilized.

3.2 Sector Agencies

3.2.1 Institutional Arrangements in the Sector

The overall responsibility for the formulation and steering the implementation of policies and strategies in the water supply and sanitation sector lies with the Ministry of Housing and Physical Planning (MHPP). The lead Government Agency in the sector is the Department of Water and Sewerage of the MHPP. The other main Government Agencies directly involved in the sector are Nepal Water Supply Corporation (urban water supply and sewerage), Ministry of Local Development through the District Development Committees and Ministry of Health (health education and environmental sanitation). All of these agencies, except the Nepal Water Supply Corporation, are represented in Kapilbastu District.

In addition to the governmental offices, national and foreign NGO's are participating in the water and sanitation development. Their functions are coordinated by the Social Welfare Council (SWC).

As the present Government policy directs, the communities are increasingly assuming responsibility over their water supply and the role of the other agencies is being changed from direct implementation and operation towards guidance, support and supervision.

3.2.2 Department of Water Supply and Sewerage (DWSS)

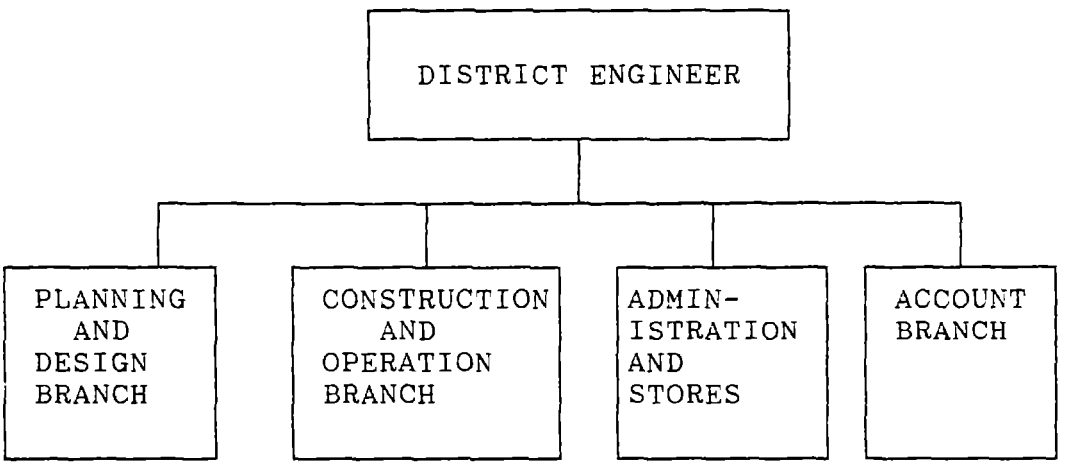
Department of Water Supply and Sewerage (DWSS) is the lead government agency in water supply and sanitation sector responsible for rural and small urban water supplies. It has also undertaken few projects for household latrine construction. In addition to the direct implementation and operation of the schemes, its role extends to coordinate the sector activities of the other agencies, including NGO's, providing technical assistance to agencies and to communities when required, disseminating information on the sectoral plans and policies of HMG/N in order to achieve some level of uniformity in implementation and to avoid duplication of effort.

DWSS is functioning at central, regional and district levels.

In Kapilbastu the DWSS is mainly involved in planning, designing and construction of pumping systems for towns, small market centers and rural villages in the areas where shallow ground water is not available. It also operates 4 piped schemes (2 urban and 2 rural) at the moment and gives assistance to community managed water supply systems in case of major break-down or damage. The District Water Supply Office (DWSO) is also at the moment implementing 9 projects, covering 9 VDCs through the FINNIDA aided Rural Water Supply and Sanitation Project.

The District Water Supply Office is headed by the District Engineer and is divided into 4 different Branches. The organization chart is presented in Figure 5.

Figure 5. DWSO organization in Kapilbast District



The total number of permanent staff posts is 26 of which 22 are filled at present. In addition, there are 39 temporary staff working in the project or operating the completed water supply systems. The total number of staff at present is 61. The personnel can be considered to be adequate.

The staff in various categories is presented below:

PERMANENT STAFF

Technical staff	Posts	Filled
District Engineer, gazetted II	1	1
Assistant Engineer, gazetted III	2	1
Overseer, non-gazetted I	6	6*
Draftsman, non-gazetted I	1	-
Plumber	2	2
Tracer	1	-
Kaligad	2	2
W/S ass. technician	2	2
Administrative staff		
Clerk	1	-
Accountant, non-gazetted I	1	1
Ass. accountant	1	1
Ass. clerk	1	1
Typist clerk	1	1
Peon	4	4
Total permanent staff	26	22

* One in Rupandehi DWSO on deputation at the moment.

TEMPORARY STAFF (attached to rural schemes)

Supervisor	3
Plumber	2
Ass. plumber	2
Kaligad	1
Store keeper	2
Peon	6
Total, rural implementation and operation	16

STAFF ASSIGNED TO TAULIHAWA AND KRISHNANAGAR WATER SUPPLIES

Pump operator	2
Assistant pump operator	2
Supervisor	1
Plumber	3
Meter reader	2
Kaligad	2
Peon	6
Total, town operation	18

In addition, there are a staff of 5 attached to the implementation activities of the FINNIDA's RWSS project at the moment.

The DWSO has been recently shifted from Krishnanagar to Taulihawa where there is an existing office building with 3 offices and a storage yard located on plot of Taulihawa water supply. There is also a new office building with 4 offices under construction and it is expected to be completed during 1993. There is, however, no store or workshop in the premises. The Krishnanagar office will remain as a branch office and will mainly accommodate the staff operating the Krishnanagar town water supply. For transport the DWSO has no vehicles, only few bicycles. Private contractors are used for major transport requirements. RWSS Project has two trucks and four tractors assisting the 6 districts of the Lumbini Zone in their material transportation needs.

There are some basic tools and equipment for cutting pipes and threads available at DWSO, either used in yard in open or at various sites or kept in the store. In general, the equipment and facilities for maintenance and repairs are inadequate.

The main problems faced by the DWSS office in Kapilbastu are the following:

- No stores facilities
- Poor communication systems, particularly roads, in some parts of the district;
- lack of transport;
- Present organization and staffing which is not suitable for community based approach in water supply development;
- Undeveloped practices at the district level for coordinating water supply development activities. This problem is expected to be solved by the new functions of DDC and District Assembly;

- Lack of medium and long terms plans, both in the overall district development as well as in the water and sanitation sector.

3.2.3 Other Sector Agencies

The following are the government line agencies and other agents involved in water supply and sanitation sector in Kapilbastu District:

Ministry of Health:

The District Public Health Office (DPHO) manages the preventative health and sanitation activities in the district, particularly at the village level. Health education activities also fall under the management of the DPHO.

Hygiene and health education are part of the preventive health programmes and is carried out mainly through the health posts. The Village Health Workers play and important role in this work.

The DPHO has 88 technical staff stationed in the district office and in the health posts. Although subjects related to water supply and sanitation are included in the work of the most of the staff, none of them is engaged full-time in the sanitation activities. There are 2 health education officers who in their work are dealing with hygiene and sanitation.

Ministry of Local Development:

The District Development Committee (DDC) distributes Grant-In-Aid (a project of Ministry of Local Development) funds to the VDCs (formerly the village panchayat) for constructing water supply systems. The funds are normally channeled through DWSO. These are mainly used for installing community hand pumps.

Communities and private households:

The communities and the individual households have already, through installing about 12 800 handpumps in the area, provided a major input in the water supply development in the district. These are installed by individual households, with no financial or other support form outside. The private households are the major group also for the future water supply development. This also in line with the Government policy of giving more emphasis to the private sector.

Commercial Private Sector:

Private households employ local well construction craftsmen for the tube well sludging. This is the most important method of water supply development in the district.

Drilling work of deep tube wells is implemented by private drilling contractors.

Private contractors are also used the implementation of the DWSS construction works. Smaller contracts can be granted to the contractors from the district and larger to contractors from all over Nepal.

Industries serving the water supply sector are not readily available in the district, but there are suppliers in the main town where materials and tools necessary to construct or maintain water supplies are available. Sand, gravel, timber bricks and stones, are produced throughout the district. The closest manufacturers and suppliers of materials and equipment are either in Butwal, Bhairahawa or across the border in India.

NGO's:

The NGO's active in the water sector in Kapilbastu is the Red Cross which started its village water supply and sanitation programme in 1989. Women's Development Organization is also working in this field but in a very small scale.

Donors:

The only donor active in the water sector in Kapilbastu District at the moment is FINNIDA through the Rural Water Supply and Sanitation Project which started in 1990.

3.3 Sector Financing

During the Seventh Plan (1985-90) the nationwide budget allocations to investments in the water supply and sanitation sector have been 4.3 % of the total budget amounting to NRs 2,302 mill., out of which NRs 1,655 mill. were for rural water supplies and 3.8 mill.NRs for rural sanitation. The operation and maintenance funds, which also provides for employment of staff for completed schemes, come through the regular budget and the Renewal and Extensions budget and were NRs 48.5 mill. during the Seventh Plan.

According to the preliminary information on the Eight Plan (1992-97) the total investment in the water supply and sanitation sector will be NRs 6,273 mill. and the share from the total

development expenditure will be 5.53 %, which is considerably bigger than during the Seventh Plan.

The DWSS expenditures in Kapilbastu in 1991/92 were NRs 4.096 mill. and the budget for 1992/93 is NRs 5.8 mill. A more detailed break-down of the expenditures and their sources is presented in Table 4.

Table 4. Capital and Recurrent Expenditure for Water Supplies in Kapilbastu District

Source	1990/91 NRs mill. (actual)	1991/92 NRs mill. (actual)	1992/93 NRs mill. (budget)
HMG through DWSS:			
-Water supply development	2.409	4.1	4.0
-Staff salaries + administ.	1.068	1.4	1.8
-Operation and Maintenance	-	-	-
DDC programme			
-Water supply development	-	0.40	0.20
FINNIDA RWSS Programme			
-Water supply development	2.0	7.0	5.56
-Staff salaries + administ	0.3	0.4	0.54
-Sanitation	0.1	0.15	0.68
Red Cross water supply and sanitation programme	0.42	0.63	-
*Communities (estimated)			
-Water supply development	5.2	5.2	5.2
-Operation and maintenance	2.0	2.5	3.0
Total			
-Water supply development	10.03	17.30	14.96
-Staff salaries	1.37	1.80	2.34
-Operation and maintenance	2.00	2.50	3.00
-Sanitation	0.10	0.15	0.68
Total annual investment in the sector	13.50	21.78	20.98

* *Estimated rate of handpump installation by private households is about 2 600 hand pumps per annum. Estimated cost of a family handpump is about 2000 NRs (local No 4 pump, 6 m of GI, slotted in the bottom and sludging fee 500 Rs,.*

* *Estimated maintenance cost is calculated as follows:*

- *4 bucket washers required per annum*
- *pump head and all parts changed once in 10 years*
- *6 m GI pipe replaced once in 10 years*
- *relocating or resluoging the well once in 5 years*

Total annual maintenance cost per annum hence 250 NRs/household.

3.4 Ongoing Programmes

3.4.1 Implementation Programmes

The water supply development in Kapilbastu District is implemented through various government channels and other programmes:

- DWSS own programme financed fully through the government budget. The DWSS has been concentrating on pumped water supply systems with overhead tanks (altogether 5 pumped systems). DWSS has constructed 110 shallow tubewells;

- DDC programme financed by DDC from an government budget allocation through Ministry of Local Development. The funds are generally used for purchasing pipes and handpumps for villages to construct handpump wells, cement and paying the skilled labour, all other material and labour costs being covered by the communities. These wells are usually constructed with little or no technical supervision and designs. The DDC programme is presently concentrating in 2 VDC's. The DDC has so far supported construction of 306 wells.

- The FINNIDA supported Rural Water Supply and Sanitation Project started in Lumbini Zone in 1990. The project has a programme to cover about 49,400 people in the district during the first phase 1990-1994. The funds are channelled partly through DWSS (government contribution) and partly through the Project Implementation Unit (FINNIDA contribution). The implementation is carried out by DWSS in cooperation with the benefitting communities. It has been preliminarily indicated that FINNIDA may be willing to support the second phase of the project covering the years 1994-1997. The project has by now supported construction of 187 handpumps in 9 VDC's and one gravity water supply (Mahendrakot) and supports also latrine construction in the schools and health education for the teachers.

- Red Cross water rural water supply and sanitation programme started in 1989 in the South-Eastern part of the district and has so far constructed 501 handpumps in 7 VDC's and is at the moment active in 3 VDC's. The programme has also supported the construction on private latrines in the villages.

The government has no specific programme for the private sanitation (latrine) promotion. It falls under the general health education tasks of the 79 Village Health Workers who are stationed in the various VDC's in the district. The time spared for hygiene

education and sanitation promotion activities is limited due to the work load of their regular programmes.

3.4.2 Water Supplies under Construction

The water supply development in the district is based mainly on handpumps which are implemented by various programmes (see Chapter 3.4.1), by communities and by individual households. The estimated production of handpump wells during the ongoing financial year 1992/93 is as follows:

DDC programme	56 handpumps in 1991/92
DWSO	0 handpumps in 1991/92
RWSSP (FINNIDA)	250 handpumps in 1991/92
Red Cross	84 handpumps in 1991/92
Communities and households	2500-3000 handpumps in 1991/92

The list of the piped water supply schemes under construction is presented in Table 5 below.

Table 5. Piped Water Supply Schemes under Construction

Implementing Agency/scheme	Type of scheme	Total population (Agency's information)	Average implementation time until present
DWSS			
- Chandrauta W/S	pumping	12,875	7 yr.
DWSS/FINNIDA			
- Mahendrakot W/S	gravity	2,650	3 yr.
Total		15,525	

3.5 Existing Water Supply Systems

3.5.1 Present Status

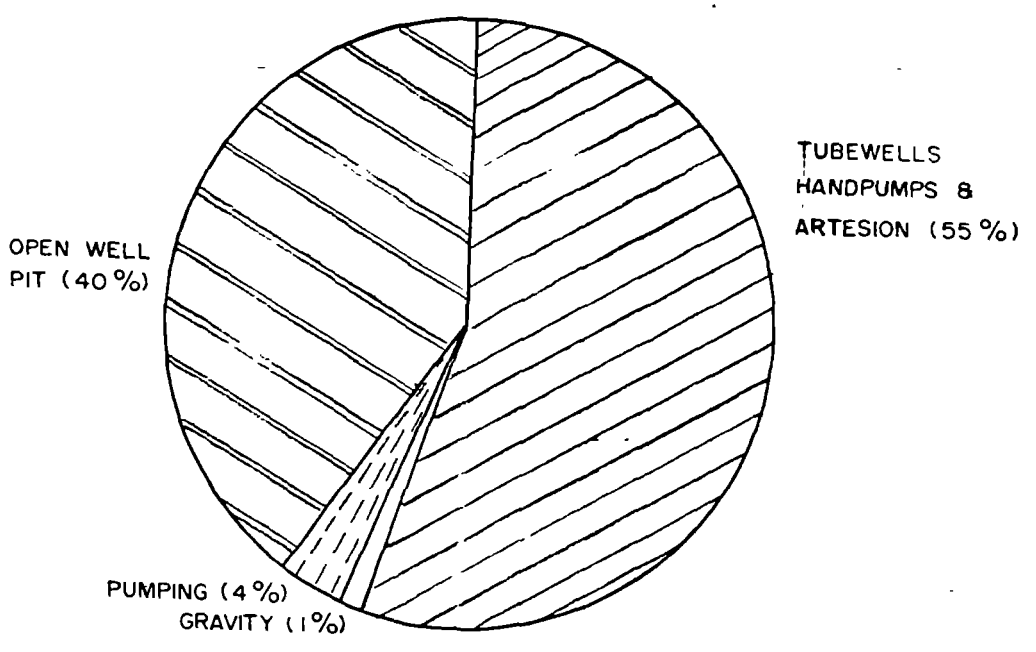
The situation presented in this chapter refers to the rural households only, as the RWSSP field survey was not extended to the semi-urban areas (Taulihawa and Krishna Nagar) due to practical difficulties. Water supply situation of theses two areas is briefly described in chapter 3.7. and annexes 5 and 6.

The people in the district are getting their water for domestic use through improved water supplies: handpump wells, pumping systems and piped gravity schemes or through unprotected sources: open wells and pits. Some of the handpump wells, particularly those installed by the consumers or communities themselves, fall into the category "unprotected source" because of poor installation and protection.

The biggest group of people in rural Kapilbastu (55 %) are using handpump wells as their primary source.

The distribution of people as per their primary source is presented in the Figure 6 (based on the field survey 1992).

Figure 6.
Present Water Use, December 1992; Rural Population's Primary Source of Water according to the field survey



A large percentage of population (40%) are using traditional open wells as their primary source. These wells are vulnerable for pollution, as they are unprotected and all users dip their own vessels into the well. These wells may also provide sources for epidemics of water borne diseases.

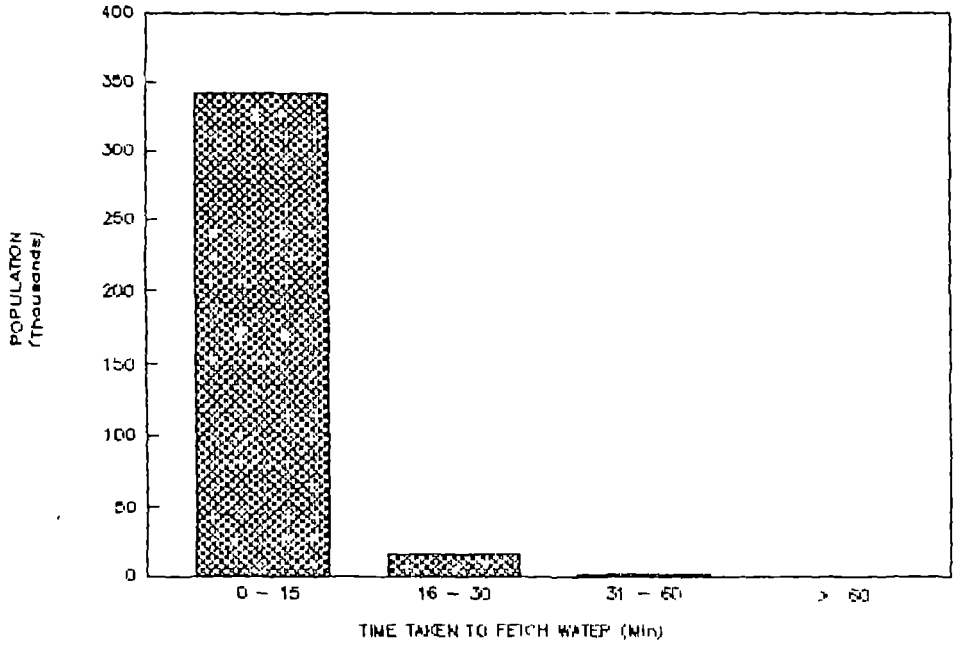
Most people in Kapilbastu District have a perennial water source as their primary source of drinking water. Only 6 % of the (total) population have to find another source for the dry months.

Majority of people (95 %) can collect their water (go and come back) within 15 minutes.

Distribution of people in the district by the time needed to fetch water (go to the collection point and return) is presented in the Figure 7 (based on the field survey 1992).

Figure 7.

Distribution of Population by the Time Needed to Fetch Water



Improved water supplies - piped water supply schemes or tubewells equipped with handpumps - have been constructed by various public or non-government organizations, by communities or by private individuals. The different implementing/donor agencies are described under the chapter 3.2 "Sector Agencies". Tables 6 and

7 below present summary of the data of the handpump wells and the piped water supply schemes in the district. This data is based on the results of the RWSSP field survey.

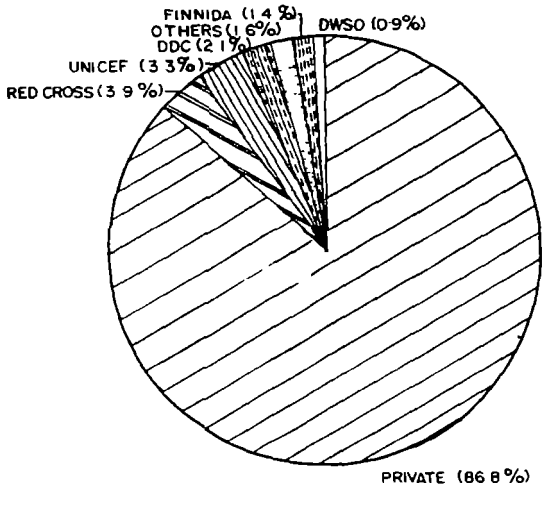
Table 6. Hand pump wells and artesians in Kapilbastu District

Type	No.	Population using the well as primary source	Total pop. including secondary users
Shallow tube well	12,943	190,560	
Drilled tube well	48	825	3,306*
Artesian wells	118	4,770	
Total	13,109	196,155	

* *Secondary users are those people, who most of the year use one primary source e.g. household pump, and then during the dry season fall back to secondary source. So the number of users per well is actually varying according to the season.*

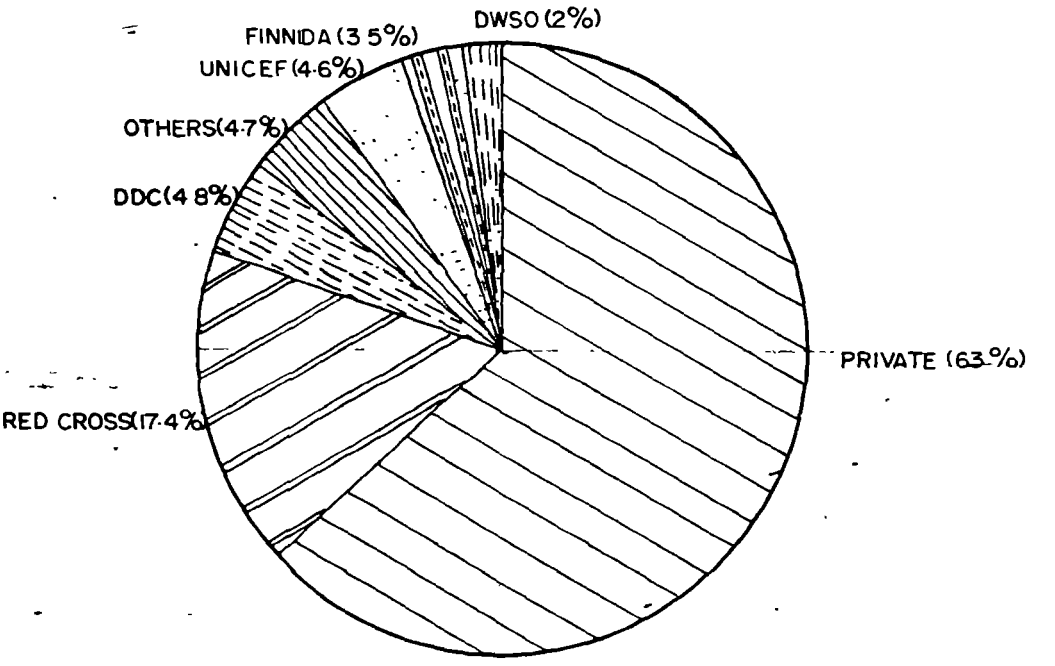
Majority of all the handpumps is installed by the private households. Figure 8. shows the distribution of handpump well construction by the implementing agency. The government, donor or NGO intervention into the handpump installation seems almost insignificant and therefore the future development programme should heavily rely on private households.

Figure 8. Installation of hand pumps by private people and different agencies, distribution based on the number of hand pumps, (rural areas only).



The pie-chart in Figure 8 does not, however, show the user distribution between the provate/common hand pumps. Figure 9. shows the this distribution of (hand pump) service by different agencies.

Figure 9. Distribution of households using hand pumps as primary source by implementing agency.



The differnce between the installation (87%) and user households (63 %), seen in the two previous pie-charts is explained by the better service level of the private hand pumps (one hand pump per 1.7 households) compared to the communal ones (1 hand pump per 6.5 households). However, the rate of installation of handpumps by the private households by far exceeds the rate of any governmental or non-governmental agencies.

Table 7. Existing Improved, Piped Water Supply Systems

Implementor or donor agency	Type of the scheme	Population served	No of taps
		Agency's information	
DWSS			
- Maharajganj W/S	pumping	4,711	2 0
- Bahadurganj W/S	pumping	11,623	33
Red Cross			
- Bhalwad W/S	gravity	1,200	10
- Motipur W/S (out of order)	pumping	1,000	12
Total		18,534	75

It can be seen from the above figures and tables that handpumps are by far the most common water supply system in Kapilbastu. It can also be noted that, on average, the piped schemes are relatively large serving a population of 4,600 on average. The individual existing pipelines are shown in the 1:25,000 Water Supply Maps enclosed with this reports.

Table 8. below gives some indicators of the present status and construction quality of point source water supplies (handpump wells and dug wells).

Table 8. Construction Quality and the Present Status of the Point Source Water Supplies

Type	Average depth (m)	% of water points with good yield*	% of wells which dry up
Shallow tube wells	10.2	91%	8%
Drilled tube wells	20.1	76%	19%
Artesian wells	39.2	91%	4%

* *Yields were not measured during the field survey, but users' perception of the yield was asked.*

The field survey shows, that the operational status of the tube wells is relatively good. The problem is that some of the wells dry during the dry months. Drying may also mean that the water level in the tube well drops below the reach (suction level) of the pump. Seasonality of many tube wells drops the service level delivered by them.

3.5.2 Operation, Maintenance and Management of the Water Supplies

Handpump wells and other points source water supplies are operated and maintained by the households or communities without external assistance. There is seldom a User Committee or other formal organization to manage the wells and the necessary activities are carried out and funds collected on ad-hoc basis.

During the field survey the operational status of the handpumps was evaluated. Persentage of operational handpumps by ownership is presented in the Table 9.

Table 9. Operational status of the handpumps by ownership.

Pump type	Total	Community owned	Privately owned
	% operational	% operational	% operational
Nepal No 2	94%	46%	96%
Nepal No 4	96%	79%	97%
Nepal No 6	92%	92%	95%
Rower	92%	91%	92%
Improved No 6	96%	96%	N.A
India MK II	91%	91%	N.A.
Nissaku	92%	92%	N.A.

The operational status of the hand pumps is according to the field survey very good. The operation (broken/operational) was also verified by the enumerators during the field survey, so it is not a question of "users' perception" in this case. The best operational record is with the privately owned handpumps. It must also be noticed that high operational record of privately owned No 2,4 and 6 pumps refer to a very large number of pumps (total of some 11 000), as all commonly owned pumps are much fewer (total of some 2 000).

The 3 rural piped water supply systems are operated, maintained and managed by DWSO with a total staff of 13 who are on temporary assignment with year to year extension. The consumers do not take part in the maintenance and are also not contributing

anything towards the O&M costs. It the intention of the government to hand over these schemes to the communities to be managed and operated by the Users Committees.

The operational status of the pumping schemes is poor, mostly due to the low average of the daily operational hours. Due this reason, most of the systems deliver poor service.

3.6 Water Supply Situation

3.6.1 Field Survey of the Water Supply Situation

Undertaking the field survey in the Terai Districts is of uttermost importance, as no central organization is in detail following up the water supply development done by the private households. As this amounts to for example 87 % of all tube well installation, it was necessary to undertake a detailed field survey to find out the actual water supply situation.

In order to get a comprehensive picture of the real present water supply situation and service levels, a survey has been carried out covering all villages, wards and clusters in the rural areas district. In addition to the water supply data, information were also collected on water resources, population, livestock, general economy and sanitation. A detailed description on the field survey 1993 is presented in Annex 1.

Semi-urban areas of Taulihawa and Krishna Nagar were not included in the field survey due to the practical difficulties. high number of houses and many different overlapping water supply systems would have required different survey approach. As in the rural areas the situation was surveyed clusterwise, a householdwise survey is required in semi-urban areas.

Information on the schemes is available for those schemes which are implemented by DWSS, District Development Committees, NGOs and the donors, thus covering only a small part of the water supplies. Even that information is limited and based on the design documents and often different from the actual situation in the field.

The coverage of the various public piped water supplies and other improved systems does not give a true and whole picture of the actual water supply situation and the service levels, (often future , design populations are quoted). In the survey the present water supply situation was analyzed from the users point of view. The following factors affecting the service of the users' were determined:

- reliability of the water source, is the primary source perennial?
- accessibility; how much time is needed to fetch water (to go and return)?
- water quality in the source (protected or not protected?)
- continuity of the supply (how many hours a day can the source give water?)

3.6.2 Service Level Criteria

When analyzing the field survey data the consumers were categorized into 4 service levels as shown in Table 10.

The purpose of the service level classification is to be able to compare the situation of groups of people using different water sources.

Table 10. Water Supply Service Levels

Category	Requirements to be met (the poorest characteristic decides the service level)				
	Quality	Quantity (l/c/day)	Accessability (min)	Reliability (months/y)	Continuity (hr/day)
Service Level 1. Good	Protected source	≥ 45	≤ 15	12	≥ 6
Service Level 2. Acceptable	Acceptable source	≥ 25	≤ 30	≥ 11	≥ 5
Service Level 3. Poor	Any source	≥ 15	≤ 60	≥ 10	≥ 4
Service Level 4. Very Poor	All/other water supplies				

Protected source:

(a) protected spring with clear water quality
(b) borehole or well with clear water quality and good platform, > 10 m deep, equipped with pump or handpump
(c) artesian well with clear water quality and proper platform

Acceptable source:

(a) borehole or well with clear water quality, < 10 m deep
(b) borehole, well or artesian well with clear water quality but without proper platform
(c) spring with clear water quality

3.6.3 Service Levels and Coverage Indicators in Kapilbastu District

The population of the Kapilbastu District falls into various service categories as follows:

- Level 1. Good 15 %
- Level 2. Acceptable 33 %
- Level 3. Poor 10 %
- Level 4. Very Poor 42 %

It is remarkable that, although only about 12 % of the population is served by the public piped water supply schemes, as much as 48 % of the population has a good or acceptable water supply service. This is resulted in by the high number of handpumps, owned by private households or by communities.

The service level variations between the VDC's is further described by a simplified hardship classification, based on number of people falling into each service level in each VDC.

The overall hardship ranking of the individual VDC is calculated as follows:

H = (0xL1 + 1xL2 + 2xL3 + 3xL4) where

L1 = % of people falling into service level 1
L2 = % of people falling into service level 2
L3 = % of people falling into service level 3
L4 = % of people falling into service level 4

The VDC's have been classified into 3 hardship classes as follows:

HARDSHIP CLASS	H	Water supply situation on average in the VDC
I	0 - 100	Best
II	101 - 150	Average
III	151 - 200	Poor
IV	201 - 300	Very Poor

Figure 10 provides a rough guideline for comparing the water supply situation and service levels in each VDC. Annex 3 has a list of VDCs in hardship order.

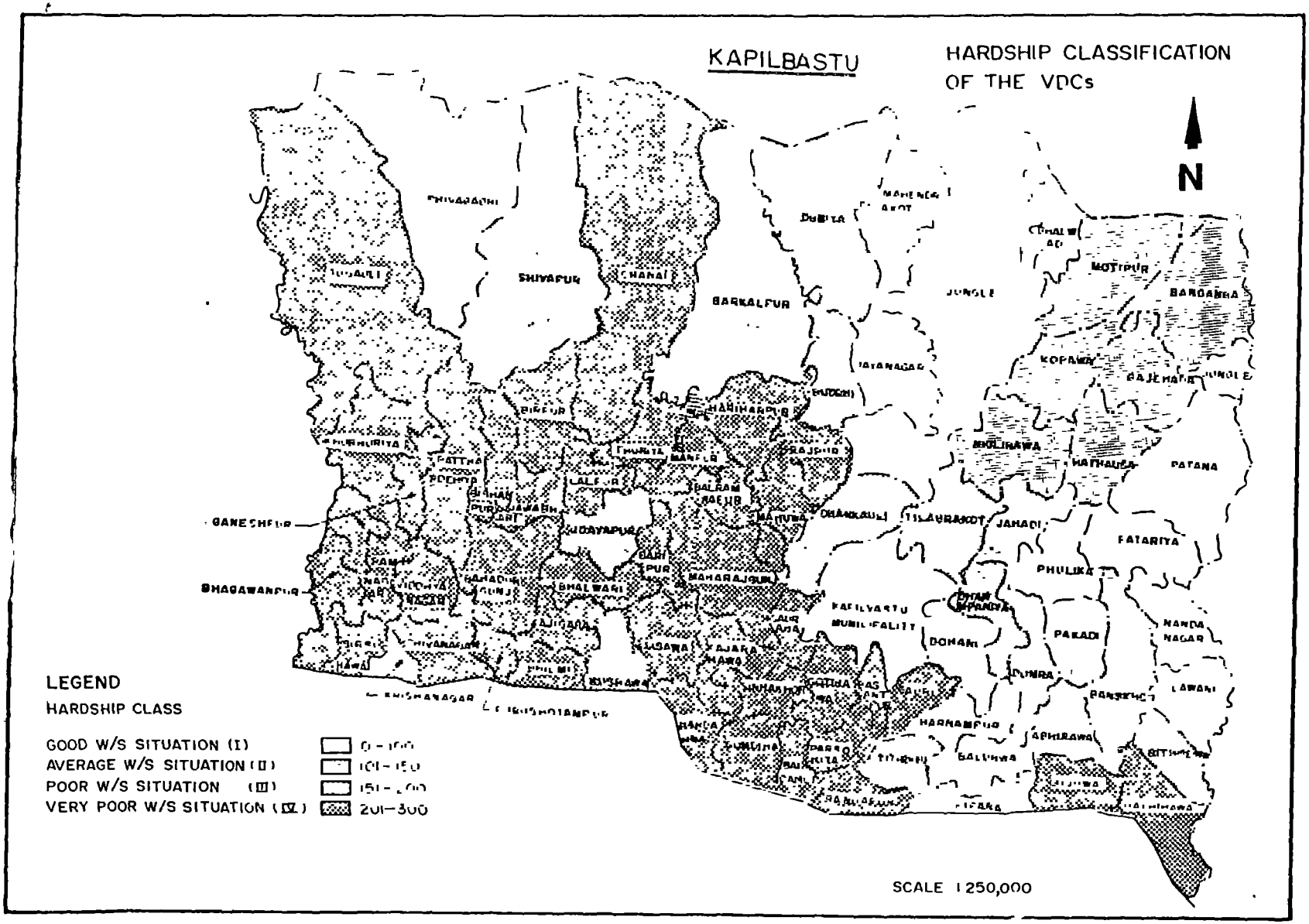


Figure 10. Hardship classification of the VDCs.

3.7 Urban Water Supply

There are two urban water supply schemes in Kapilbastu District, namely Taulihawa Water Supply and Krishnanagar Water Supply, both managed and operated by DWSS.

Taulihawa Water Supply serves the urban area of the Taulihawa municipality, (population 17 146 according to 1991 census), commercial area, a hospital, schools and the administrative offices. The water supply system is based on ground water and consist of 2 boreholes with submersible pumps, an overhead reservoir and a water reticulation network. Water is distributed through 432 house connections and 52 public taps. The average daily consumption is about 800 m3 restricted by the poor condition of the distribution system. The system is operated by DWSO with a staff of 10.

Krishnanagar Water Supply serves the Krishnanagar VDC which is expected to become a municipality in near future. It has a population of 8 732 (1991), commercial area, local small industries, schools and the administrative offices. The water supply system is based on ground water and consist of 2 boreholes with submersible pumps, an overhead reservoir and a water reticulation network. Water is distributed through 520 house connections and 32 public taps. The average daily consumption is about 1200 m3. The water supply is operated by DWSO with a staff of 8.

More detailed descriptions on both urban water supplies are presented in Annexes 5 and 6.

3.8 Sanitation Situation

The sanitation situation in Kapilbastu is poor. No sewerage systems exist and latrines and septic tanks can be found mainly in the two towns. Outside the urban areas latrines are rare even in health posts, schools and other public places.

During the field survey 1057 private household latrines were recorded, which means that about 2 % of the population have sanitation facilities. However, since most of the latrines are of a very poor standard, the coverage of improved sanitation in Kapilbastu District is considerably lower.

4. WATER RESOURCES

4.1 Meteorology

Long term rainfall, temperature, relative humidity and wind speed data are available from 3 stations in Kapilbastu District (see Table 11):

Table 11. Meteorological Stations in Kapilbastu District

Station	Elevation	Established
Taulihawa	94 m	1970
Pattharkot (West)	200 m	1973
Bhagwanpur	80 m	1975

The nearest station with evaporation and sunshine data is in Bhairahawa.

The location of the rainfall stations is shown in Figure 10.

The mean annual rainfall for the Lumbini Zone is presented in Figure 11. The average annual rainfall in Kapilbastu District is around 2000 mm. During the recording period of 1981-90 the highest recorded annual rainfall was 2717 mm in 1981 in Pattharkott and the lowest 1265 mm in 1982 in Bhagwanpur. About 80 % of the rainfall comes during the monsoon season (June to September). The annual rainfall pattern, i.e. the monthly average rainfall distribution in Taulihawa is presented in Figure 12.

Figure 11. Mean annual rainfall in Lumbini Zone

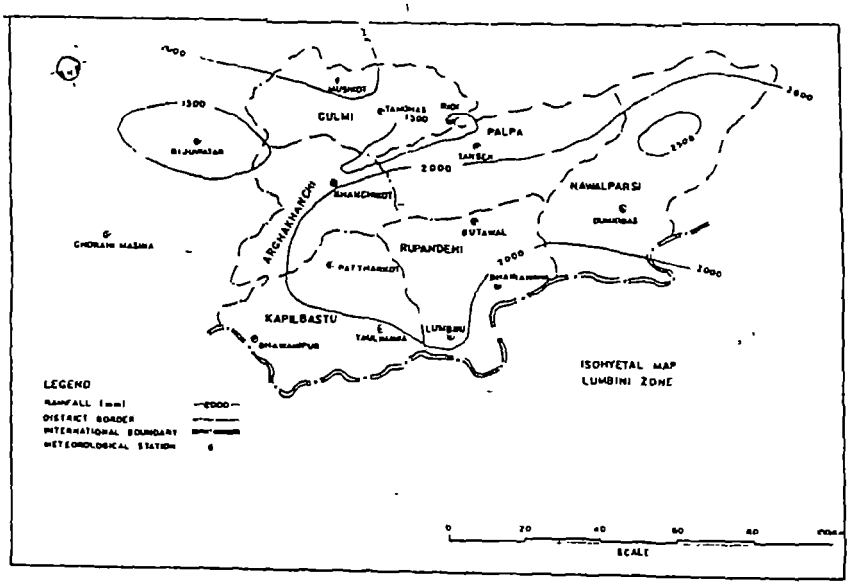
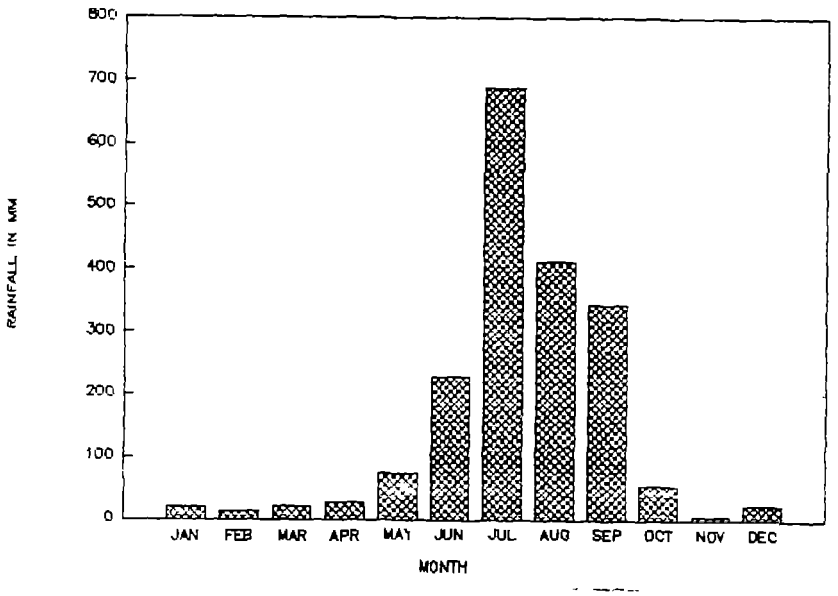


Figure 12. Annual Rainfall Pattern in Taulihawa Station.



Average annual evaporation comes to 1690 mm measured from the Bhairahawa station which belongs to the same climatical zone as Kapilbastu.

4.2 Ground Water Resources

The groundwater resources in the district were studied by Cemat Consultants Ltd in 1990-91 and the results are presented in their report "Final Report on Ground Water Resources Study in Rupandehi, Kapilbastu & Nawalparasi Districts", April 1991. What follows is mainly based on the findings of the study.

Terai plain is composed of unconsolidated alluvial sediment of Pleistocene to recent age. Most sediments within the district are deposited by the rivers originated from the Churia Hill and higher Himalaya. The granulometry of the alluvium becomes gradually finer towards South. At the foot of Churia Hills there is a 5 - 8 km wide zone, called Bhawar zone, where gravel, boulder and cobble deposits are accumulated in series of extensive alluvial fans. As a result of continuous shifting of river courses, the lateral continuity of the deposits is low.

The thickness of the Terai alluvium is in the order of 1000 to 2000 m.

The groundwater level in Terai is generally less than 7 m b.g.l., except in the Bhawar zone where it is deeper, usually between 7 and 25 m. Groundwater level fluctuates with the seasons and is highest in the Bhawar zone - from 5 to 9 m - but decreases towards south where it ranges from 2 to 3 m. Some aquifers, particularly the deeper ones, are artesian.

It is notable that aquifers in the area do not form a uniform groundwater basin but are confined and thus separate from each other having their own piezometric surface. Below the shallow aquifers there are several deeper, usually high yielding aquifers.

According to the study report the average annual groundwater recharge is 450 mill.m3.

The area of Kapilbastu District can be divided into four zones having different hydrogeological characteristics. This division is based on the features of shallow aquifers, namely the sediment composition of the aquifers, water level fluctuations and confined and unconfined nature of the aquifers. The zones, which are presented in Figure 13, are:

Zone I Boulder Region, deep water level (ranges 10 -15 m b.g.l.), high fluctuation;

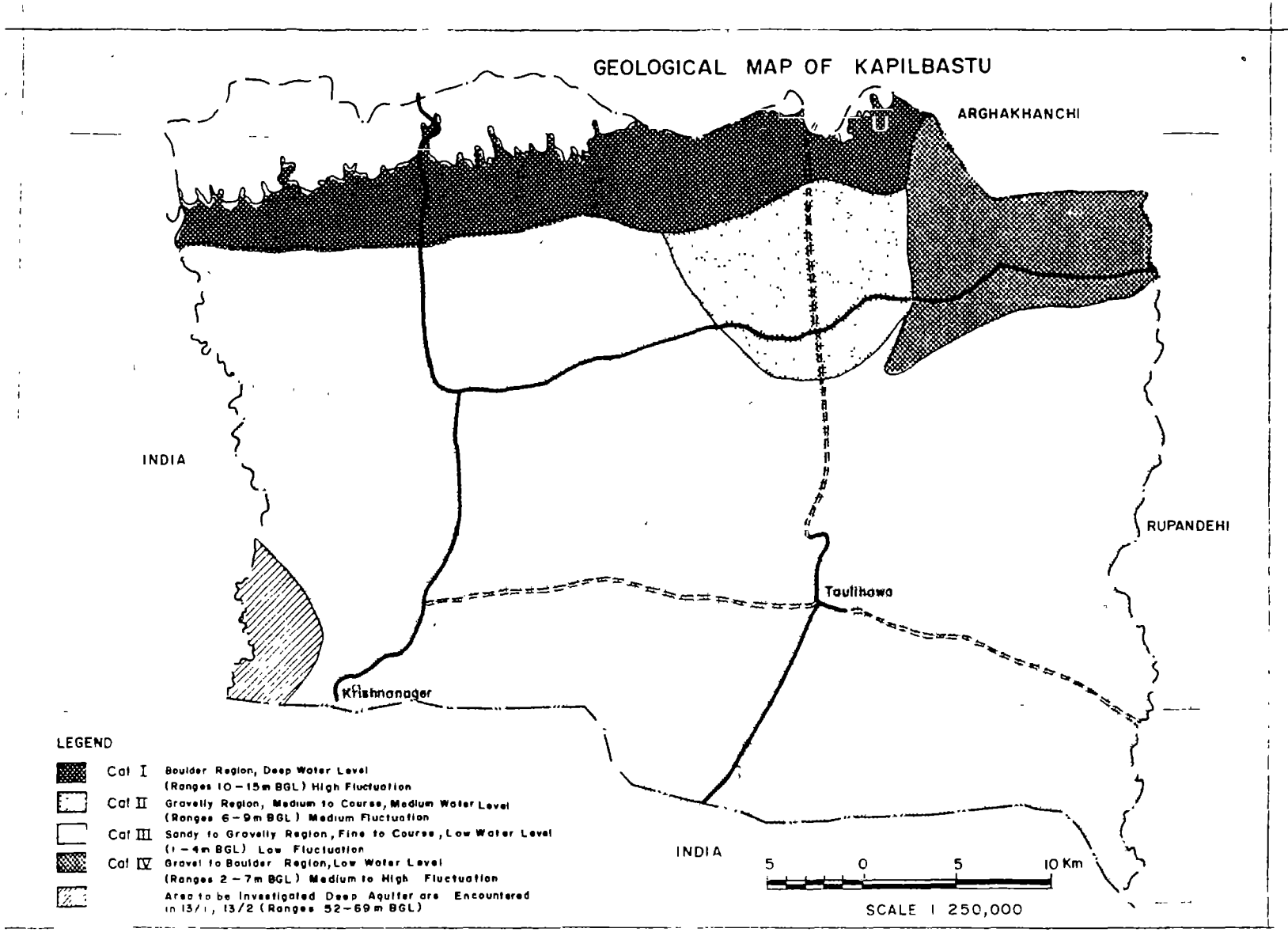


Figure 13. Hydrogeological Map of Kapilbastu District.

Zone II Gravelly Region, medium to coarse material, medium water level (6 - 9 m b.g.l.) medium fluctuation;

Zone III Sandy to Gravelly Region, fine of coarse material, low water level (1 - 4 m b.g.l), low fluctuation;

Zone IV Gravel to Boulder Region, low water level (2 -7 m), medium to high fluctuation.

The quality of the groundwater is generally good, though in some cases, particularly in shallow aquifers, the iron and manganese contents exceed the permissible levels. The hygienic quality is also normally good, but in very shallow aquifers (<10 m) the leaching of organic and other materials from the surface reach the groundwater and can cause contamination. Annex 6 describes the hygienic water quality of the shallow tubewells, based on the sampling programme of the RWSSP in its scheme areas. Sampling has been done both in private and RWSS constructed tubewells. It show, that the number of polluted wells is altogether very low in the group of sampled wells. Water quality in very shallow tubewells (below 10 m) without platform deteriorates somewhat during the rainy season. All of the open wells were found contaminated during the rainy season. As the number of samples is still quite low, the research programme should be continued.

It can be concluded that groundwater resources in Kapilbastu are exceptionally good and provide the best source for domestic water supply practically in all parts of the district.

4.3 Surface Water Resources

Kapilbastu District belongs to Ganges river basin. The main river is Banganga and other larger perennial rivers are Belu Khola, Arahi Khola and Kothi Nadi. The river system of Kapilbastu is presented in Figure 3.

The flow in the rivers fluctuates greatly depending on the rains. The minimum flow originate entirely from the springs in the catchments. The water quality in the rivers changes with the flow and is fairly good during the dry season and very turbid during the rainy season. In general, the hygienic quality of the river waters is not satisfactory for drinking purposes without treatment.

5. WATER DEMAND

5.1 Population

The population of the Kapilbastu District was, according to the field survey by RWSSP, 384,586 in 1992. This is slightly higher than the figure of the 1991 national census which is 372,205, but this is due to the later date of survey. Since the higher figure is more recent, it has been used as a basis of this Plan. The annual growth between 1981 and 1991 was, as calculated from the national census figures for Kapilbastu, 3.2 % which is above the national average of 2.07 % for rural areas.

The future projections are presented in Table 12 below:

Table 12. Population Forecast

	1992	growth p.a.	1997	growth p.a.	2002
rural	358,800	3.15 %	419,000	3.15 %	489,000
towns	25,800	4.7 %	32,500	4.7 %	41,000
Total rural	384,600	3.2 %	451,500	3.2 %	530,000

The population projections in each of the 79 VDC's, except for the Taulihawa N.P. and Krishnanagar VDC, are presented in Annex 4.

5.2 Other Users

Most of the households in the district have domestic animals, cows, buffaloes, sheep, coats, poultry, etc.(see Chapter 2.5), and they use water, either from a water supply system or a natural water courses. The number of animals can be estimated to grow at the same rate as the population.

In addition to the domestic use of water other users which need to considered are schools, health posts, other institutions, commercial premises and workshops other small scale industries. The possible future major industrial plants will have their own water supply systems and are not included in the water demand estimates of this study.

The estimated projections of the school enrolment and the number of outpatients are as follows:

	1992 (actual)	1997 (projection)	2002 (projection)
Primary schools, pupils	31,400	33,600	36,000
Secondary schools, pupils	6,600	7,000	7,500
High schools, pupils	12,600	13,500	14,500
Health posts,outpatients	72,200	77,400	82,900
Hospitals, inpatients	1,600	1,700	1,800

The school enrolment figures have been obtained through the field survey 1992.

5.3 Water Demand

The water demand forecasts have been made on the basis of the DWSS design criteria.

5.3.1 Domestic Water Demand

The domestic water demand for water supplies in the rural areas is estimated at 45 liters/capita/day (lcd). This consumption includes losses and wastage of 20 %.

As the main water supply option in the rural areas on kapilbastu is and will be the hand pump well, this daily per capita requirement will easily be met.

In bazaars and town areas the unit water demand is estimated as 60 lcd.

The water demand estimates of the urban water supplies are indicative only and are based on the consumption figure of 100 lcd.

5.3.2 Other Water Demand

The per capita consumption of the domestic animals are estimated at following rates.

-	cow	45 l/day
-	buffalo	45 l/day
-	horse	45 l/day
-	sheep, goat	5 l/day
-	pig	5 l/day

In many cases the animals can be watered from natural sources but often, particularly during the dry season and when the natural water sources are far away, they have to be watered at the household using normally the same water as used for human consumption. Considering that a major part of the animal consumption can be satisfied from the natural sources, their average requirement is here estimated to be 20 % of the their calculated daily consumption.

The water demand of the schools is estimated at 6 l/pupil/day. Health post are assumed to use water 1000 l/day when not equipped with latrines and 3000 l/d when latrine is available. In the hospitals the consumption is estimated at 3000 l/inpatient/day.

Other institutional water consumptions are included in the domestic consumption, except for the district headquarters where a separate provision is made for the administrative staff. The number of this staff has been estimated during the RWSSP field survey.

Commercial water demand is estimated at 10 % of the domestic consumption in bazaars and town areas.

5.4 Total Water Demand

The water demand forecasts have been made assuming that the specific consumption rates will stay the same throughout the planning period. The forecast includes the indicative water demands of the piped water supply schemes of Taulihawa and Krishnanaga, but does not include the water demand of the main industrial plants.

The total water demand projections for the district are presented in Table 13 below:

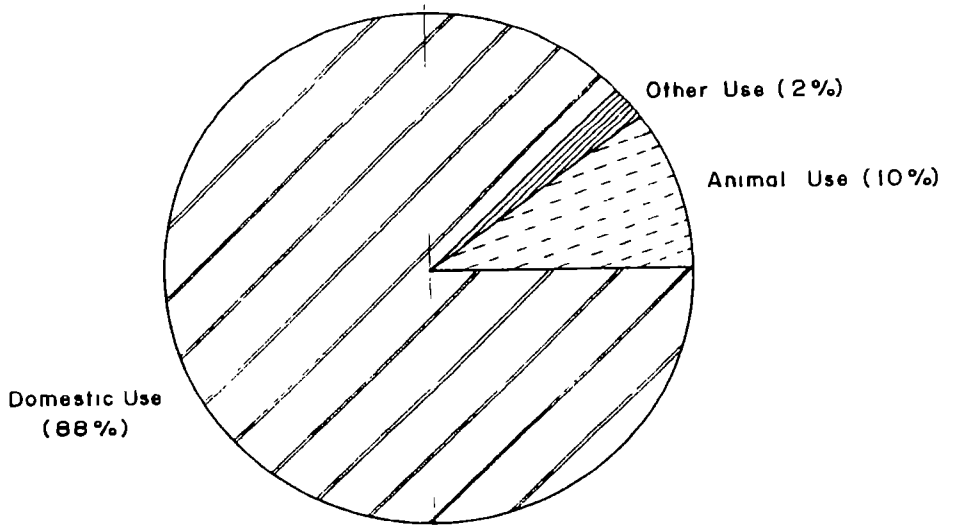
Table 13. Water Demand Forecast

Water Demand, m3/day	1992	1997	2002
Domestic			
- rural	16146	18855	22005
- bazaars and towns (Taulihawa & Krishna Nagar)	1548	1950	2460
Domestic animals	1975	2120	2335
Schools	304	327	352
Health posts	115	132	154
Commercial and workshops	35	45	55
Total Water Demand, m3/day	20123	23429	27361
" , mill.m3/year	7.35	8.55	9.99

The distribution of the demand between the different users is illustrated in Figure 14.

Figure 14.

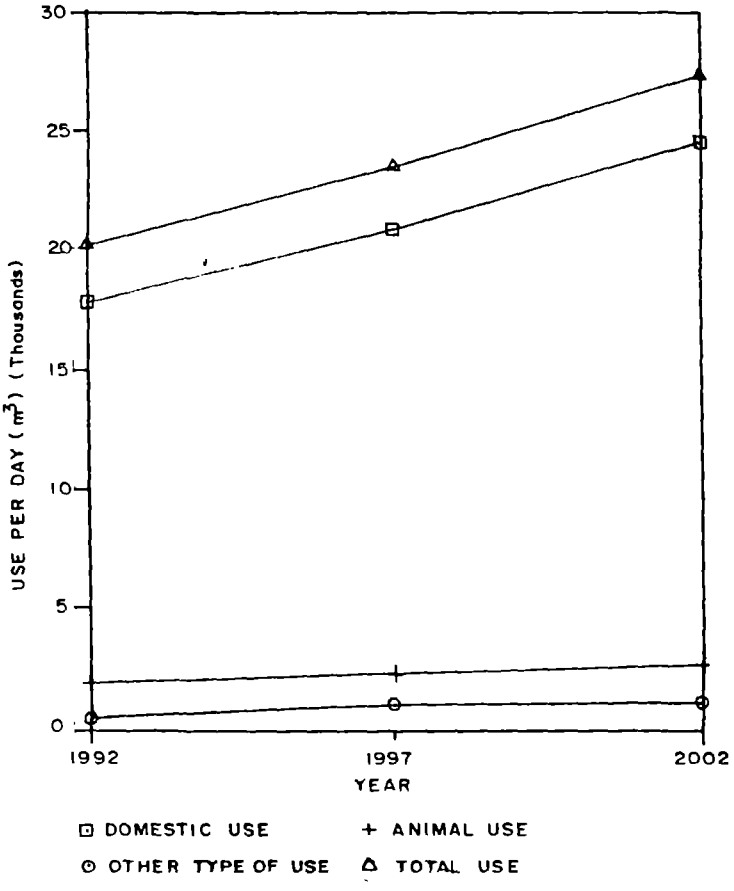
Distribution of Water Consumption between Users.



The forecasted growth of the demand is graphically illustrated in Figure 15.

Figure 15.

Water Demand Forecast



6. SOCIO-ECONOMIC, CULTURAL AND HEALTH ASPECTS RELATED TO WATER SUPPLY AND SANITATION

6.1 Social Aspects

The private household have traditionally been supplying themselves with hand pumps. Also in the villages the hand pumps, even if privately owned, are actually shared by neighbours. So one private handpump is in most cases serving more than one household.

The operation and maintenance is also good in privately owned hand pumps, as owners are naturally interested in maintaining their property. Problems like "lacking in feeling of ownership" do not arise.

The cooperation of the villagers in installing community hand pumps is also good. Large numbers have been constructed as community effort and the maintenance of these pumps is also relatively good. This may originate from the tradition of open wells, constructed and maintained by the community.

With regard to sanitation the felt need by the people for improvement is important, because the responsibility for improvement lies entirely with the household. Traditionally, there are no sanitation facilities in the houses and latrines are a new concept which requires proper introduction and a change in the personal hygiene behavior of the people in the villages. If latrines or other sanitary facilities are introduced without the full acceptance of the people, if the technology is not well suited in the local conditions or, if sufficient care has not been taken for training in their proper use and maintenance, major and long lasting set-backs can be expected in the development of improved sanitation.

6.2 Cultural Aspects

Different ethnic and caste groups do have different practices as regard to the water supply and sanitation. The groups using less water in their households should be provided more (within the design guidelines and technical possibilities) and encouraged by health education to use more water. Health behavior studies, using the rapid assessment methods, provide quick, cheap but reliable information about the basic hygiene and water use practices. These should then be used as the basis for all health education and sanitation programmes.

6.3 Home Economy and Affordability

It is important to make available appropriate and low cost maintenance hand pumps for the households. If the annual repair cost and also a one time investment needed is low enough, problems of affordability do not arise.

The results of the field survey indicate that the local suction pumps do not cause affordability problems for the households.

The operation and maintenance costs of the scheme must be estimated before construction and the community given clear understanding about the financial burden the scheme will represent to the community members. This should be calculated on a household basis e.g. 100 NRs/hh/a and clearly informed to all the community members. This applies especially to pumping schemes.

Some indication of the affordability of the scheme for the community can be obtained, if the Users' Committee is asked to raise e.g. two years maintenance costs before the construction starts. This also gives an indication of the community's ability of fee collection, accounting, trust between the community and the leaders to handle the community money.

6.4 Health Aspects

The health improvement of a particular community can not be achieved with an improved water supply system only. Hygiene and sanitation habits must be improved, only then the improved drinking water has some impact.

The government has, through its primary health programme and educational system, all the channels and infrastructure necessary for health education in the village level. These systems, are however, somewhat hampered by lack of motivated and trained manpower, teaching aids. Health and hygiene education is also difficult if the water supply situation is poor. The schools and health posts with no water supply and no latrines can not act as an example of a hygienic environment, and hence as a habit creating surroundings for the children.

The water supplies should be carefully designed not to create any drainage or water logging problems in the villagers. Spill and overflow water should be carefully drained away to the fields. Watering facilities for domestic animals should be arranged so that they can be drained and cleaned so as not to form breeding places of mosquitoes.

7. WATER SUPPLY DEVELOPMENT PLAN

7.1 Water Supply Options

7.1.1 The Sufficiency of the Water Resources

The estimated annual water demand in 1997 is 8.55 million m3. The annual groundwater recharge rate has been estimated to be 450 million m3. Although all the groundwater can not be abstracted, it is safe to assume, that groundwater resources can supply the future demand. Water requirements for the two urban areas, Taulihawa and Krishnanagar will be in order of 1.0 mill. m3 per annum. There may be water requirements for larger industrial plants of the same magnitude. In addition, there is the water requirement for irrigation which by far exceeds the other uses of water in Terai. Practically all this water is groundwater and, considering the rapid expansion of irrigation, localized shortages and dropping groundwater levels may be possible in future. In such cases, domestic water supply should always have preference over other uses of the same water resources and the industrial or irrigation use of water should not be allowed to affect to domestic water supplies in any way.

7.1.2 Source Options

Shallow (5 - 25 m) groundwater abstracted through tube wells and ring wells is the most feasible source of water supply in most of the Kapilbastu District. Where this is not possible, due to the geological formations or the quality of the groundwater, deeper aquifers may be tapped by boreholes. In some cases in the Northern, hilly parts of the district, spring sources can be used. Only in exceptional cases surface water, i.e. rivers should be used as a source of water supply.

7.1.3 Technology Options

The suitable technologies for water supplies in Kapilbastu District depend mainly on the groundwater situation and the number of users of the system:

1. Shallow tube well

Depth normally 5 - 10, but wells up to 60 m exist. Constructed by using sludging method. Dia 38 or 50 mm GI of plastic casing, PVC screen is recommended. Equipped with suction-type handpump. Raised platform constructed and drainage provided. Suitable in soft soil conditions when the static ground water level is above 5 m b.g.l. (normally Zones IV and III). Suitable for one household or a group of few households with less than 100 people. Typical drawing in Figure 16.

4. Drilled tube well

These wells are best drilled with simple percussion rigs. In future, more sophisticated drilling rigs (down-the-hole hammer, odex drilling) may be introduced. These wells are to be constructed only in those areas, where sludging is not possible, mostly in bhawar zone. In the hydrogeological maps, these wells are suitable option in the Zones I, II, IV. These wells are equipped with a lift pump.

Recommended pump types are:

- India MK II & III, for water levels deeper than 20m.
- TARA pumps for water levels from 6m - 20m.

5. Piped gravity water supply

Small garvity water supply systems, as recommended in the design guidelines, published by the Department of Water Supply and Sewerage in 1993, are recommended to be constructed, where feasible. This type of water supplies are prefered in the Bhawar zone, if suitable spring sources can be identified.

6. Ring wells

Ring wells are a technology option in limited cases, if qualified craftsmen are available in the area. The problem with the ring well construction is the short construction season and problems of dewatering. It is difficult to achieve necessary water thickness in the wells, to guarantee the perenniality.

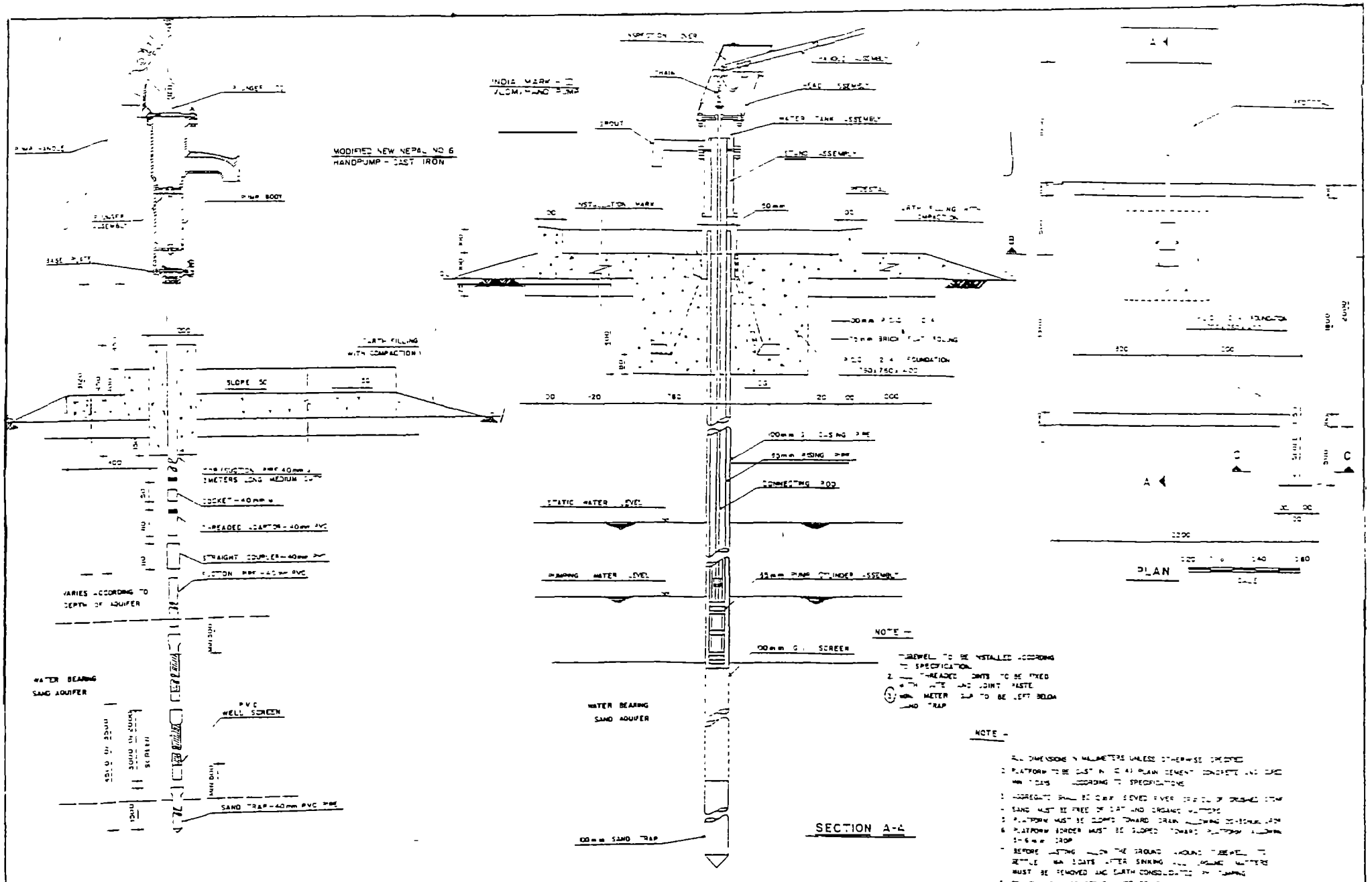


Figure 16. Typical Drawings of Shallow Tube Well, Drilled Tube Well

7.1.4 Costs

For the planning purposes the following unit costs for construction and O&M and economic life times are used:

	Capital cost NRs/capita	O&M cost NRs/capita/yr	lifetime years
Shallow tube well	310	10*	10
Drilled tube well	1500	10	10
Gravity piped W/S	1600	20	20
Rehabilitations of handpump wells	50	10	10
Completion of schemes under construction	1000	20	20

* *Operation and maintenance cost of the shallow tubewells are estimated to be sligtly more expensive than the O & M costs of present installations. This is due to the fact that the standard of the new installations is expected to be sligthly higher than the old installations.*

Completion of an ongoing water supply scheme is estimated to cost on average 60 % of the cost of a corresponding new scheme.

7.2 Planning Criteria

7.2.1 Planning Horizon

The Plan covers the period 1993 - 1997 and gives an outline up to the year 2002.

7.2.2 Consumers to be Served

The Plan focuses on the human consumption, thus covering domestic, institutional, commercial and small scale industries' demand in rural areas and commercial centres. A moderate provision (20 %) of the water demand for domestic animals is made but major industries and irrigation are excluded.

The Plan does not cover the two main towns, Taulihawa and Krishnanagar, which have their own water supply systems and plans. Major industrial plants are also not covered by the Plan. However, since DWSS is operating and maintaining the water supplies in Taulihawa and Krishnanagar, appropriate separate provisions for these schemes are made in the cost estimates and in the future manpower requirements of DWSO, Kapilbastu.

7.2.3 Service Levels

The Plan aims at improved water supply service for increased number of people. People receiving a good service level (see Chapter 3.6.3) are expected to increase from the present (1992) 15 % to 72 % in 1997 and 100 % in 2002. The service target is to provide good quality water at 45 lcd within a walking distance of not more than 15 minutes (150-200 meters) and supplied round the year for more than 6 hrs a day.

Water will be distributed mainly through handpump wells. In case of a piped scheme water is distributed through public taps and individual connections are planned only for rural health posts, for institutions and administrative premises and for a limited number of commercial and private consumers in the urban areas. One shallow tube well or dug well should not serve more that 50 - 75 people (base population) and one deep tube well not more than 120 (base population) people. One public tap should not serve more that 75 (base population) people.

7.2.4 Water Quality

Water supplied to the consumers should in principle meet the guideline standards set by WHO. However, since treatment of water is practically unfeasible in most of the schemes, the Plan emphasizes the selection of a good quality source and its protection in order to secure good quality water even without treatment. This means that all handpumps must have a sufficiently large platform and proper drainage. It also means that a tube well or ring well should have sufficient depth, i.e. it should be tapping the second ground water layer. As a source for piped schemes, boreholes or protected springs are preferred over other types of water sources e.g. streams, open wells and alike.

7.2.5 Technology

For the reason of sustained operation and maintenance, shallow tubewells equipped with locally made handpumps are preferred. Where shallow groundwater is not available, gravity piped schemes have preference over pumping schemes.

The technology used must take into account the socio-cultural aspects as described in chapter 6. Based on them and on the poor operational records of the large piped schemes the Plan recommends small systems of maximum 10 taps outside urban areas. Larger systems should be broken into smaller sub-systems with independent tanks and distribution networks.

The locations of wells and, in case of piped water supplies, the boundaries of the distribution network, tap locations, location

and number of the tanks should be decided in cooperation with the consumers.

Health aspects have been included in the planning criteria by introducing enough water (45 l/c/d) to increase the present water use. The Plan also recommends collection points with platforms large enough for washing, proper drainage systems and properly protected sources.

7.2.6 Institutional Aspects

The development of the water supply sector requires better coordination, standardization and exchange of information than at present. Different implementing/financing agencies - the government, donors, NGOs - must agree over policies, division of responsibilities and annual implementation programmes. Better mutual coordination and planning would result in economical use of scarce resources and less overlapping.

Water supply planning should become an integral part of the overall district planning and should, therefore, be guided by the District Development Council and coordinated by the LDO. The annual development programmes in water supply sector will be approved by the DDC.

The DWSO will remain as the lead agency in the water supply sector in the district but will shift its emphasis from the direct implementation and operation more towards planning, coordination, supervision and technical assistance.

The communities already have the main role in planning, implementing and operating and maintaining handpumps. This role will be strengthened and will be extended to piped water supplies also. For this purpose Users' Committees will be formed in all water supply schemes serving more than one or few households.

7.2.7 Financial Aspects

The Plan is based on a water supply development which can be realistically financed and its operation, maintenance and renewal is affordable. Thus, it is assumed that:

- The Government development funding will continue at present (92/93) level, on average 5 million NRs annually;
- The donor funding will continue at present (92/93) level, maximum 8.5 million annually;
- The input of communities and private households will retain its present high level when it comes to

construction of handpump wells. In case of piped schemes the communities will meet all direct operation and maintenance costs of the water supplies, and will provide the necessary local materials unskilled manpower during the construction (about 20 % of the total cost).

7.2.8 Priority Criteria

As the community participation and management of water supplies is the general approach of the Plan, no water supply development should be started or implemented without the initiative or request of the benefitting community and its full consent and participation.

When such a request and commitment exist, the Plan gives priority to the following types of water supply development:

- Low service level areas (hardship areas);
- Areas or schemes having low per capita investment and O&M costs;
- Improvement of the standard of the existing shallow tube wells;
- rehabilitation of existing piped schemes if otherwise feasibly;
- completion of schemes under construction;
- small schemes serving one or few communities (clusters) only;
- schemes which provide for the needs of the poorer fraction of the community, which does not have their own means to improve their water supply situation.

It is emphasized that the Plan does not in any way intend to prevent private households or communities from developing their water supply situation even if that development does not meet any of the priority criteria. In those cases, however, no support other than technical advise can not be expected from the government or the donors.

7.3 Development Scenarios

During the preparation of this Plan different water supply development scenarios were considered representing different service coverage level and different technologies.

A higher service coverage than 72 % by the year 1997 would require considerable increase in financing, manpower and other resources. The technology based on large schemes, river intakes, or pumping systems would be more expensive to construct and uneconomical to operate.

Lower targets in the service coverage are possible and would be easier to achieve, but are not in line with the national targets and would not serve the interests of the consumers.

7.4 Water Supply Development Plan 1993-2002

7.4.1 General Approach

The water supply development in the Kapilbastu District will be based on the community involvement and community management, thus the emphasis will on handpump wells, particularly in the improvement of the standard of the existing wells. The target is to provide good service level of water supply for 72 % of the population (303 738 people) by year 1997.

The development of water supplies will be primarily carried out be the communities and individual households themselves with no or minimal assistance from outside. The government, donor and NGO support should be directed to the areas where present service levels are the lowest (i.e areas of high hardship rating). For practical reasons one VDC should be considered as a unit where water supply development should be completed (to the extent possible taking into account the water resources).

In the Plan the communities' own need and priorities are emphasized: water supply development should not be forced on the people, instead, the implementation of improved water supplies should only take place when the benefitting communities request it and are ready to assume their part in the implementation and operation and maintenance. Since it is not possible to predict communities' attitude at this stage, it also not possible to precisely define which clusters, wards and VDCs are covered in any given year. Therefore, the Plan can only give indications of priorities and possible options and set financial and capacity frames for the development.

The following procedure is suggested for the use of the Plan in the preparation of annual plans for government/donor implementation or support:

1) The requests from the communities are filed/collected in the DWSO.

2) Preliminary costings of the requests up to the coverage suggested in the Plan is made using the Plan data (Annex 4).

3) The DWSO puts the requests into the priority order using the hardship rating presented in the Plan and the preliminary costings.

4) This list is then discussed in the District Water Supply and Sanitation Coordination Committee (see Chapter "7.4.3 Institutional Development" and preliminary financing plan is drawn up, including HMG, donors and NGOs.

5) These costed, prioritized lists of requested VDC programmes with possible financing options are then forwarded to the DDC for their consideration and approval.

The approved annual water supply development programme is binding for all implementing agencies - the DWSO, the donors and the NGO's.

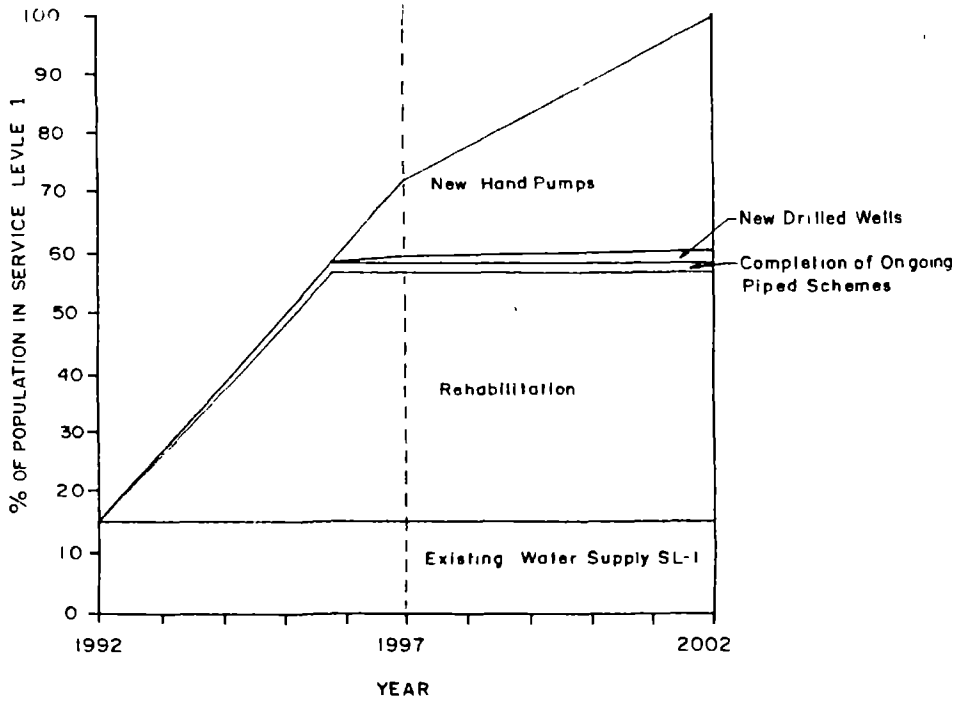
7.4.2 Water Supply Coverage

People receiving a good service level is expected to increase from the present (1992) 15 % to 72 % in 1997 and 100 % in 2002. The estimated development of the water supply coverage in VDC's is presented in Figure 17.

The coverage target of 72 % in the year 1997 is an average figure for the district and the individual VDCs have variable coverage figures, some are higher some lower than 72 %. This somehow reflects the availability of water sources and hence the costs of implementation. The VDCs with abundant potential groundwater resources would be covered quicker and with less cost, than those having scarce resources and difficult ground conditions (e.g. Bhawar Zone).

Figure 17.

Water Supply Coverage 1992-2002



7.4.2 Water Supply Development

The water supply development in Kapilbastu District during 1993-1997 takes place in three categories:

1. Completing the present water supply construction projects;
2. Rehabilitation of existing water supplies, private and public;
3. Construction of new water supplies.

Table 14. below shows the summary to the implementation programme for rural areas. A more detailed description (VDC wise) of the water supply development is presented in Annex 4. Municipalities are not included in Annex 4.

Table 14. Rural Water Supply Implementation Programme

	1993-1997		1998-2002	
Item	Population Served	Cost Mill. NRs.	Population Served	Cost Mill. NRs.
1. Completion of Ongoing piped w/s projects	6 486	6.49	0	0
2. Rehabilitation of existing hand pump wells	180 027	8.87	0	0
3. Construction of point source w/s (handpump wells)	56 553	17.53	128 547	39.98
4. Construction of drilled well handpumps	3 562	5.34	3 562	5.34
5. Renewal of facilities 5%/year		38.23		45.32
Total	246 628	76.46	132 109	90.64

It is noticeable that the rehabilitation requirement is very high. Large portion of the rural population (60%, about 213,700 people) are already covered with improved water supplies. There is, however, a possibility to increase the hygienic quality of the shallow tubewells with only a small investment (50 Rs/cap) and therefore rehabiliation here is recommended.

The piped water supply projects to be completed and rehabilitated are shown in the set of District Maps, 1:25,000 in Volume 2. The VDC's which have the lowest service levels have the highest priority for implementation of new water supplies are shown in the hardship classification map (see Figure 9).

7.4.3 Institutional Development

Sector Coordination in the District Level

The district office of the Department of Water Supply and Sewerage will remain a lead agency in the water supply sector in Kapilbastu District. Its role will change from the present implementation oriented more towards planning, coordination, promotion and technical assistance.

The coordination of the water supply and sanitation activities in the district needs to be improved considerably. To facilitate this a District Water and Sanitation Coordination Committee shall be established under the chairmanship of the LDO and meeting regularly 3-4 times a year to discuss and review the progress of ongoing programmes and projects and the future plans. The District Engineer, who will be the secretary of the Committee, will prepare the necessary progress reports, plans and other documents for the Committee's consideration.

The Committee will recommend the annual implementation programme as outlined in the chapter "7.4.1 General approach" to the DDC. It should also prepare annual financing plans, recommending which VDC/water supply scheme should be taken by which implementing agency. This would minimize parallel planning and implementation activities. It is economical for one implementing agency to work in a limited area and take new areas in the proximity of old ones.

The Committee should facilitate for coordination between water supply, health education and sanitation programmes. An attitude change towards good health, hygiene and sanitation practices can be achieved among the population when the community is already working for improvement of their water supply. Sanitation campaigns are also better received by the communities simultaneously with the water supply improvement.

Common operation and maintenance policies and division of responsibilities should be agreed upon in the Committee. The questions like "Will the DWSO give pipes and fittings to the broken Red Cross systems?" must be discussed. The revitalization of the O & M systems of the old existing schemes (formation of the Users' Committees, training of the village maintenance workers etc.) should be discussed and actions agreed upon.

The Committee should comprise at least the following members:

- LDO, Chairman
- District Engineer, DWSS, Secretary
- District Public Health Officer
- Representative of each Donor Programme having a water supply and/or sanitation component
- Representative of each NGO Programme with water supply and/or sanitation component

Manpower Development of the DWSO

The changing responsibilities of DWSS will be reflected in the organization structure and personnel development - more inputs are required in planning and design, coordination and community promotion.

The overall schenario of serving the settlements in the District with privately constructed and owned handpumps, calls for support and strenghtening of the private sector. The District already has a large number of small scale tube well contractors actively serving the households.

The technical manpower of the DWSO is mainly needed in drilling programmes and completion of the ongoing piped systems.

A staffing pattern, capable of implementation rate of some 46,750 population annually, is presented in Table 15.

Table 15. DWSS Staff Profile

Staff Group	1992 (present) DWSO	1993 - 2002 (proposal) DWSO	1993 - 2002 (proposal) Other agencies and private sector
District Engineer	1	1	0
Senior technical staff (Engineers)	2	2	0
Overseers	6	6	2
Draftsman	1	1	0
Senior Technicians (WSST)	2	5	17
Junior technicians	4	2	6
Shallow tubewell mistris	0	0	40
Peons and other staff	4	4	0
Community promotion officer	0	1	1
Administrative staff	5	5	0
Staff of Taulihawa town W/S	9	0	9*
Staff of Krishnanagar town W/S	8	0	9*
Total	42	27	84

* *Town water supplies staff from municipalities or NWS Coorporation, depending on the government decisions*

The Logistics

The facilities of DWSS need to be improve which means that the present plot reserved for DWSS use have to be expanded. The priorities are:

- Stores building
- One vehicle, 4-wheel drive

- One tractor with trailer
- Workshop, office and survey equipment

Urban Water Supplies

As it is the policy of the government, the urban water supplies should be as soon as possible taken over by the municipalities. An alternative for this would be that the National Water Supply Corporation would step in and take over the Taulihawa and Krishnanagar urban water supplies.

7.4.4 Operation and Maintenance of Water Supplies

The main responsibility of the operation and maintenance of the tube wells will remain with the private households. The government should support the households by encouraging the industry and bussiness to provide good quality inexpensive spare parts for hand pumps.

The operation and maintenance of gravity piped schemes and point source water supplies should be the responsibility of the communities through the Users Committees and the Village Maintenance Workers employed by the UC's.

A specific unit or section - Village Water Supply Maintenance Section - should be established in the District Water Supply Office for supporting the Users Committees. Every gravity scheme and every cluster with community managed point sources should be visited at least once a year and a maintenance report should be prepared on it. A more detailed description of the maintenance system is presented in Annex 8.

As undertaken elsewhere in the country by the Asian Development Bank funded Project, a study about the future management of the urban water supply systems, should be conducted also in Kapilbastu District. Policies adapted elsewhere in the country can be adapted also in the Western Region.

7.4.5 Costs

The total capital costs of the water supply sector in Kapilbastu District are presented in Table 16 below. These costs relate to the development plan presented in Table 14 and VDC wise in Annex 4.

All costs are presented in the 1993 level and no price escalation has been estimated.

Table 16. Water Supply Capital Costs

Costs, NRs mill.	1993-1997	1998-2002
Water Supply Development		
- Rural	76.46	90.64
- Urban	1.00	1.00
DWSS Institutions Costs		
- Facilities	5.0	5.0
- Equipment	5.0	5.0
Total	86.46	100.64

The total recurrent costs of the water supply sector, excluding the maintenance costs of private facilities, are in Table 17. below:

Table 17. Water Supply Recurrent Costs

Costs, NRs mill.	1993-1997	1998-2002
O&M of Water Supplies		
- Rural	7.7	20.0
- Urban	1.29	2.0
DWSS staff and operations	8.0	10.0
Total	16.99	32.00

The total cost are presented in Table 18.

Table 18. Total Water Supply Costs (urban and rural)

Costs, NRs mill.	1993-1997		1998-2002	
	Total	Annual	Total	Annual
Rural Water Supply				
- Capital Costs	86.46	21.62	100.64	20.13
- Recurrent Costs	12.70	3.17	26.00	5.20
Urban Water Supplies				
- Capital Costs*	1.00	0.25	1.00	0.20
- Recurrent Costs	4.29	1.07	6.00	1.20
Total	104.45	26.11	133.64	26.73

* *The capital costs of urban water supplies is only tentative and more detailed surveys on the overall situation of the urban water supplies in the District need to be undertaken.*

7.4.6 Financing

The financing of the capital and recurrent cost of the rural water supplies will be shared between the government, donors, NGO's and the beneficiaries. The private households will, however, form the main investing party, as is the situation nowadays. The beneficiaries contribution will consist of, as presently, installing the household tube wells and providing community contribution for the DDC, DWSO, NGO or donor assisted projects. The household wells form, however, the major part of their contribution. The direct O&M cost of water supplies are expected to be fully met by the beneficiaries, although some provision for government contribution is made to meet the cost of the schemes which are still operated by DWSS.

The pattern of financing, % contributed by different parties, planned in Table 19, follows the present investment patters, presented previously in Table 4.

Table 19. Financing of Water Supply Costs

	1993-1997 mill. NRs			1998-2002 mill. NRs		
	Total	Annual	%	Total	Annual	%
Capital Costs						
- Government	16.18	4.05	18.50	22.36	4.47	22.0
- Donors	22.25	5.56	25.44	20.34	4.07	20.0
- NGO's	2.50	0.62	2.86	4.06	0.81	4.0
- Beneficiaries	46.53	11.63	53.20	54.88	10.98	54.0
Total	87.46	21.86	100.00	101.64	20.33	100.0
Recurrent Costs						
- Government	3.40	0.85	20.0	6.40	1.28	20.0
- Beneficiaries	13.59	3.40	80.0	25.60	5.12	80.0
Total	16.99	4.25	100.0	32.00	6.40	100.0

When compared with last few years expenditure and the present - 1992/93 - budget, the above financing plan for 1993 - 2000 means the remaining (on average) on the present level in the government annual capital expenditure. The beneficiaries share will obviously increase due to the increased implementation volume.

There is a big increase to be expected in the operation and maintenance costs, most of which is, however to be financed by the beneficiaries. The present operation and maintenance budget of the government represents only 5 % of the estimated operation and maintenance costs. As the operation and maintenance policies of the government are yet to be detailed and implemented at the national level, it is difficult to say, what is the government's share of the operation and maintenance costs. It is however obvious, that the beneficiaries at present invest large sums annually into operation and maintenance of the tubewells. This is clearly seen from the good operational status of the existing privately owned shallow tube wells.

In urban water supplies, the capital costs are expected to be mainly financed be the government. The operation and maintenance costs are expected to be met fully by the user charges.

7.4.7 Risks

There are several factors which may hinder achieving the targets set out in the Plan:

1. Sufficient funds are not made available, either from the government side of from the donors. The most crucial is the donor contribution, which is 25 % of the capital costs. Since FINNIDA's commitment is secured up till the end of 1993 and a preliminary understanding exists on the extension of that commitment till the end of 1997 the risk financing are not very grave;

2. The operation and maintenance does not function properly, therefore, the completed water supplies do not provide the expected service. This can be avoided through strong O&M support system and careful planning, design and construction of the schemes. This is a risk of piped systems.

All the above risks are real but mostly manageable. If they can not be avoided the result will be a slower pace in implementation or a poorer than expected service level due to the inadequate operation, maintenance and renewal of the water supply systems.

8. SANITATION DEVELOPMENT PLAN

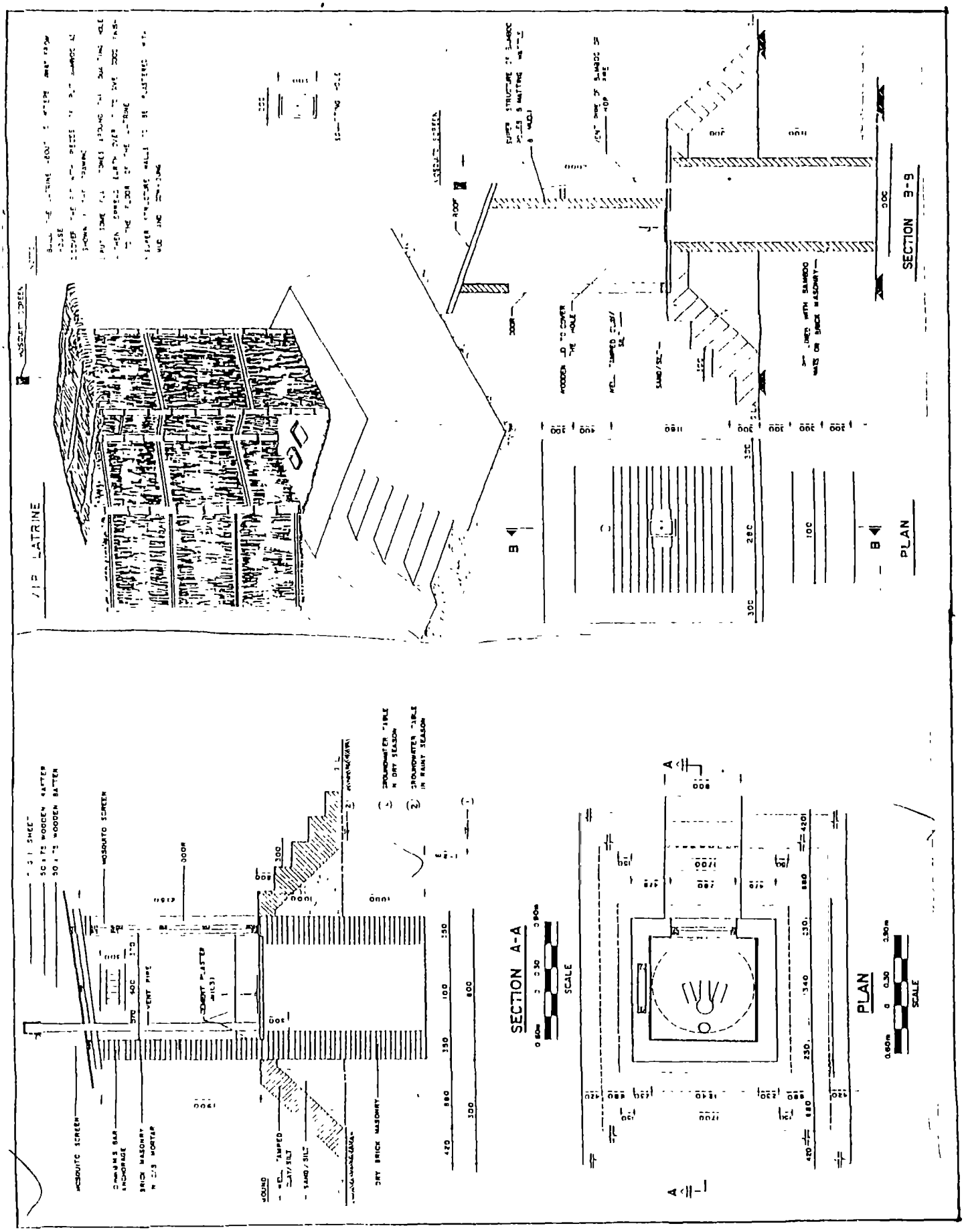
8.1 General Approach

As shown in Chapter 3.8 the sanitation situation in Kapilbastu District is poor and very little is being done for its improvement.

In this plan it is recommended, that the **hygiene education and sanitation promotion programmes** are incorporated as essential components into the existing health education programmes. At the same time, there should be good coordination and co-operation with water supply development programmes.

This plan recommends simple pit latrines and VIP (Ventilated Improved Pit) latrines to be promoted in the District. Many of the past programmes of promoting pour-flush latrines, often with a considerable subsidy, now face serious maintenance problems. The pour-flush latrine requires a considerable amount of water for proper operation and is not feasible in households with no house or yard water connection. In schools, health posts and semi-urban areas, pucca type VIP latrines, including an emptiable alternative, are recommended. Typical drawings of latrines are presented in Figure 18.

Figure 18. Typical Drawings of Latrines.



The main objective of the sanitation programme is not latrine construction, but a formation of hygienic sanitary habits. The plan therefore recommends hygiene education programmes and sanitation promotion **without subsidy**. Best results are achieved, when people are motivated to build their own latrines, after they have understood the necessity of the latrines for improved health.

Subsidy is only needed for school latrine and health post latrine programme, which concentrates on providing a sanitary environment for these institutions, as an addition to the hygiene education work. The subsidy rate for these latrines is same as for the water supply systems.

Apart from sanitation promotion, the work in the villages would include improvement of the environment by introducing waste disposal and drainage.

In the sanitation promotion programmes, the qualified motivational manpower is the key issue. If each VDC would have a sanitation promotion person, a village health worker and in each cluster, a community health volunteer , a viable hygiene education and sanitation promotion programme could be implemented. This requires an additional manpower (compared to the present government set up) input of village hygiene promoters (village based), one per VDC.

8.2 Sanitation Development

The sanitation development in Kapilbastu District emphasizes health and hygiene education and sanitation promotion and comprises the following components:

1. Manpower development and training
2. School and health post latrine programme
3. Hygiene education and latrine promotion programme in the VDC's
4. Hygiene education programme in the schools

Manpower development and training

The magnitude of the sanitation development can be directly estimated by the manpower input into the programme. The following inputs are proposed:

- CHV programme to cover all the VDCs in the District by the year 2002. Training programme to produce 2 CHV per ward of each VDC which means that about 1404 CHV's should

be trained in the district. Number of trained CHV's, VHW & school teachers is estimated to be 883, which means about 665 CHV's should be trained in the plan period.

- Training programme for all VHWs and health post personnel to manage the hygiene education and sanitation programme, the supervision and follow-up of the CHVs' work.

- Training programme for school teachers to implement hygiene education in schools.

- Employment of village hygiene promoters, one per VDC.

- Appointment of one hygiene and sanitation training officer in DPHO's office.

Kapilbastu District has 9 Ilaka health posts. These will provide a viable infrastructure for a community sanitation and hygiene education programme, implemented through village health workers, community health volunteers, and where and when additional donor funds are available, through village hygiene promoters.

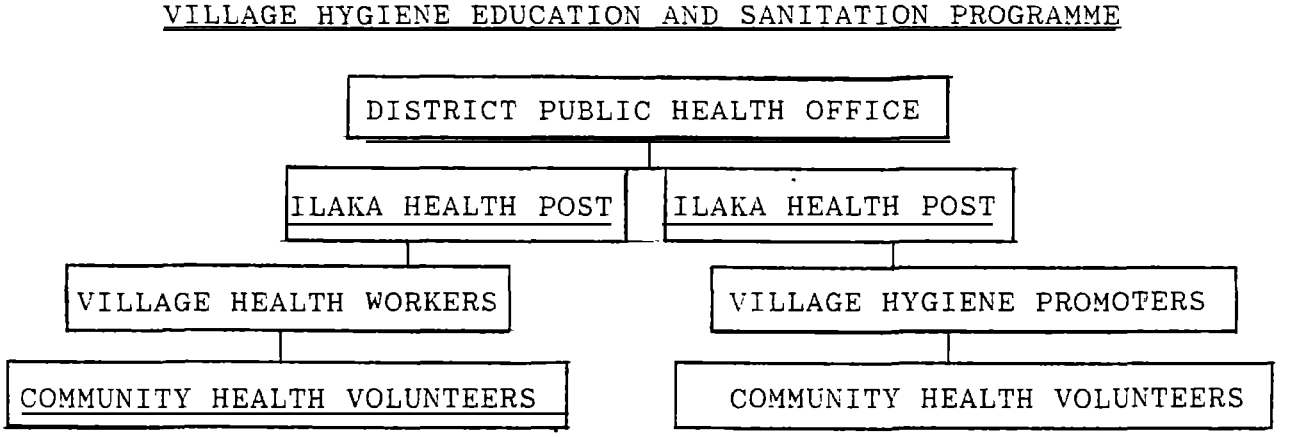
Starting sanitation and hygiene education programme needs a lot of institutional support, especially in terms of training and motivation of the existing staff. As the infrastructure (buildings etc.) is however already there, this will not require major investments. The main task will be manpower development by retraining, motivating and when necessary, screening the existing manpower.

Follow-up systems of the personnel working at the field level must be created. Personnel posted in the villages, must be regularly visited by the supervisory staff. Community health volunteers must be visited in their villages and invited for mutual gatherings to discuss their progress and programmes.

Extensive training programmes are required to create the hygiene education and sanitation promotion skills for the existing manpower. Training programmes for community health volunteers must be initiated. These training costs will also form the main part of the costs required for starting the hygiene education and sanitation programme.

A proposed organizational structure of the hygiene education and sanitation programme within the MOH is shown in Fig 19.

Figure 19. Institutional arrangement of Hygiene Education and Sanitation Promotion.



School and health post latrine programme

There are 11 health posts & sub health posts, 397 primary schools, 23 secondary schools and 21 high schools in the district and practically none of them have any sanitation facilities.

The programme will aim at constructing sufficient number of VIP latrines in all health posts and schools by the year 2002. This means that about 452 latrine units will be constructed. Construction of the latrines will be done by the DWSO with the financing coming from HMG or from a donor programme.

The latrine construction programme will include a training and follow-up component to ensure that the facilities are well maintained after completion.

The programme will be closely coordinated with the water supply development to ensure that no latrines are built in the schools or health posts where there is no water supply.

Hygiene education and latrine promotion programme in the VDC's

The programme will be part of the MOH's health education programme and will contain the following components:

1. General health education campaigns by the DPHO's staff;

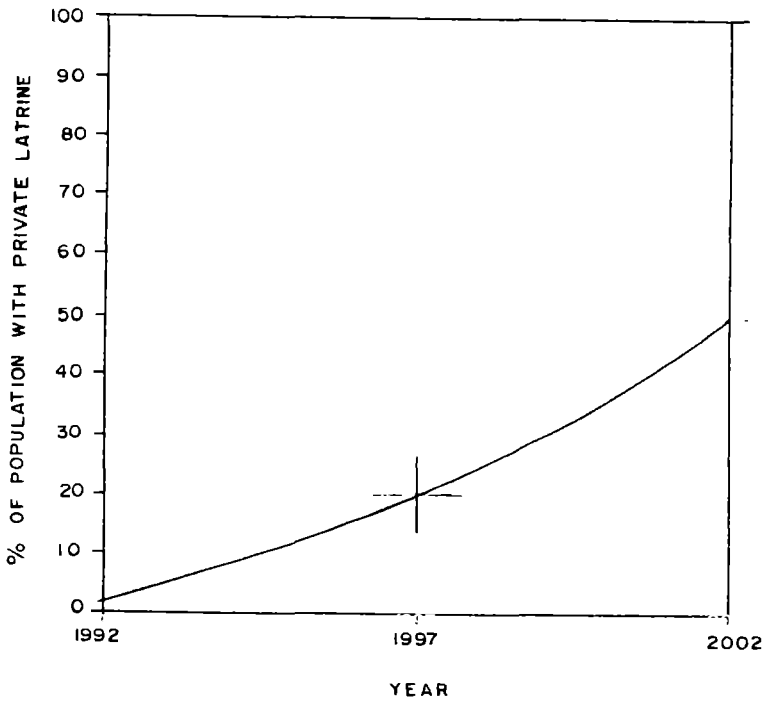
2. Intensified hygiene education and latrine construction promotion by the CHV's in their respective clusters

Hygiene education programme in the schools

This programme will linked with the school latrine construction programme and the teacher's training programme. It will include general hygiene education in the schools and practical training in the proper use and maintenance of latrines.

The construction of the latrines in the households depends on the promoters' ability to change the prevailing attitudes towards improved hygiene and to create a need for improved sanitation. Therefore, it is difficult to project the development of the coverage of the improved sanitation. It is obvious that at the beginning the progress will be slow but will eventually speed up when the campaigns gain momentum. This Plan has set a target of 20 % household coverage by the year 1997 and 50 % household coverage by the year 2002 with private latrines. This is based on the assumption that each CHV, VHW and trained school teacher will be given responsibility to motivate people for construction of at least two private latrines per year.

Figure 19. Sanitation Coverage Projection



8.3 Institutional Development

The lead agency in sanitation promotion should be the Ministry of Health. Ministry of Education and Culture would be responsible for sanitation and hygiene education in schools.

The Department of Water Supply and Sanitation is responsible for all the technical support needed for the sanitation programmes. This mainly means, that the DWSS would produce the necessary designs and cost estimates for different type of latrines. The DWSO would also organize the sanitation in schools and health posts, connected with the water supply programmes.

The above organizations are already in place and functioning in Kapilbastu.

The RWSSP experience of the health education and sanitation programmes show, that the communities are often ready to give strong support to the health posts. Funds are collected and manpower provided for construction and maintenance work. A strong link between the community and the health post can be created and the programme made sustainable.

8.4 Costs and Financing

The total cost of the sanitation programme include the following costs:

- training and follow-up cost of the community health volunteers (unit cost of one persons training 1600 Rs)
- training and follow-up cost of the village health workers (unit cost of one persons training 1600 Rs)
- training and follow-up cost of the school teachers (unit cost of one persons training 1600 Rs)
- salaries of the village hygiene promoters (unit cost of one persons training 1600 Rs)
- investment cost of the school latrines (unit cost of one school latrine 40 000 Rs)

Table 20. Sanitation Development costs

	Mill. NRs		
	1993	1997	2002
CHV, VHW, VHW and school teachers' programme	0.38	1.14	1.52
School latrine investment	0.50	8.79	8.79
Hygiene education and latrine promotion (follow up costs)	0.20	0.80	1.00
Total	1.08	10.43	11.31

Total cost for the sanitation development in 1993-2002 would be 22.82 mill. NRs, in the 1993 cost level.

9. FOLLOW-UP OF THE PLAN

9.1 Use of the Plan

The Kapilbastu District Water Supply and Sanitation Plan should be used as guideline when selecting priorities for and implementing water supply and sanitation development, making institutional arrangements, setting annual development targets and preparing budget estimates and when considering the use of a specific water supply source. The Plan can be used as a source of base information when commencing feasibility studies of individual schemes. The Plan also gives other development agencies information about present water supply and sanitation situation in the district and the future sector development. The Plan is the main tool in coordinating the water and sanitation sector activities in the district.

9.2 Updating of the Plan

The actual development hardly ever follows precisely any plan and the same will be the case with this Plan also. Regular updating should therefore be an inseparable part of the planning process.

The key information - the water supply and sanitation situation and the service levels and coverage - should be updated annually as well as the targets and estimates. This should be carried out by the District Engineer and his regular staff. A major updating and revision should take place at least every 5 years when the Plan report and the attached maps are revised. This should be carried out by the District Engineer and his staff with some assistance from the Regional or Central offices of the DWSS.

9.3 Collection of Planning Data

Accurate and comprehensive data is essential in both preparation and updating of the Plan. In order to improve the quality of data and to avoid the major data and information collection exercises included in the preparation of this report, it is essential that regular data collection, processing and storing is arranged in the District. A proposal for a data collection system is presented in Annex 7.

FIELD SURVEY FOR THE DISTRICT WATER SUPPLY DEVELOPMENT PLAN

General

The main objective of the Field Survey of the District Water Supply Development Plan (DDP) is to find out the existing water supply situation in district with respect to hardship, reliability, quantity and quality. This goal could be achieved only by extensive field work, visiting all the clusters in the district.

Private households and many agencies have implemented the water supply schemes in the district but records were not readily available. For example nobody has recorded the number of shallow tube wells installed in the district.

As this was the first time to embark on this kind of work, a seminar was organized to discuss planning and strategies. Hence 2 days seminar was took place in fourth week of September in 1991 and was participated by Deputy Director General (DDG), Regional Director (RD), Project Manager of RWSSP, 6 District Engineer (DE) and all responsible Consultant staff.

Working procedure

Field questionnaires were developed in 5 sets, 2 for technical evaluation and 3 for general data collection.

Considering the existing manpower situation of HMG, it was agreed to hire temporary high school level enumerators and overseers to supervise them. Overseer's task was to supervise the enumerators' work and technically evaluate all the gravity schemes in the district.

In total 9 overseers and 45 enumerators were hired for the Kapilbastu field survey.

Questionnaires were field tested and modified after testing. Computer specialist then modified the questionnaire to facilitate the computer entry and developed the data base programmes. One computer person was hired to enter the data.

Field survey in Kapilbastu started in September 1992 and was completed in December 1992, hence the total time of the field survey was 11 weeks.

Data collection for maps

Readymade maps showing VDC and ward boundaries were not available, and areal phorographs prepared by the survey department were taken as reference to mark the VDC and ward boundaries. This job was done in consultation with the VDC chairman, VDC secretary and local elders.

This job took considerable time but gave reliable VDC and ward boundaries.

The overseers plotted relevant information on to these maps and draftsmen transferred these information on to the final maps.

Procedures in the field level

Each group consisted of 1 overseer and 5 enumerators surveying one VDC. Total 9 groups were working in adjoining VDCs to enabel easy communication and sharing of information. The whole District was covered in the same manner.

After completing the data collection work in entire district, sample rechecking was conducted in 26 wards of 27 VDC in different location by exchanging the enumerator who were completely unknown to the new VDC.

The out put was compared with previous work and was found satisfactory. The difference in total number house holds & total population was 2 % in both, which can considered to be reasonable. This difference is due to isolated dwellings in remote areas. Over all result of rechecking was satisfactory.

Time and manpower requirement

The field survey was undertaken by 9 overseers and 45 enumerators in 11 weeks, 2 1/2 months.

Two types of manpower were involved in the Kapilbastu District Development Plan as follows:

a) Field staff (9 overseers & 45 enumerators)

b) Office staff; Apart from logistic support from office following manpower was involved in the preparation of the DDP:

1. Full time Senior Engineer	1 No.
2. Full time Draft-persons	2 Nos.
3. Full time computer person	1 No.
4. Part time computer specialist	1 No.
5. Part time expatriate	2 Nos.

Total man months used is given below :

1. Senior Engineer	3 mm
2. Overseer (9 x 2.5)	22.5 mm
3. Draftpersons (2 x 9)	18 mm
4. Computer person (1 x 5)	5 mm
5. Computer specialist (1 x 4)	4 mm
6. Expatriate (2 x 1)	6 mm

Mapping Exercise

This is most sophisticated and time consuming task in the preparation of the DDP.

Old (1961) Survey of India topographic maps (1:50,000) are available, but were outdated in terms of settlements, place names and roads. Those maps do not have any administrative boundaries presented on them. It was decided to update and amend these maps. These maps together with the aerial photographs (1:25 000) were used for preparation of the water supply maps. To cover the whole Kapilbastu district 18 numbers of A1 size sheets are required. As each finished map consists of 2 different "layers", total of 36 sheets need to be drafted. The "layers" of one sheet of the map are the following:

I	1st layer	This layer contains contours at 100 ft interval, rivers and roads.
II	2nd layer	This contains administrative boundaries, clusters and water supply information.

Annex 2

Drinking Water and Sanitation

Ref :Eight Plan (1992-1997)
Summary
(Unofficial translation)

His Majesty's Government
National Planning Commission
Nepal, July 1992.

Objectives

The basic objectives will be to:

1. provide drinking water facilities to 72 percent of the population by the end of the Eighth Plan period, consistent with the long term objective of providing drinking water facilities to the entire population within the next 10 years.

2. extend knowledge and services related to personal and domestic hygiene and environmental sanitation to the maximum number of people.

Policies

1. Priority will be given to small scale and cost effective projects.

2. Drinking water facilities will be extended in the Terai region through shallow tubewells, deepset tubewells and maintenance and repair of the existing water sources.

3. Rural drinking water and sanitation programmes will be integrated and implemented with women's involvement.

4. Existing irrigation systems will be improved and arrangements will be made to utilize them for the supply of drinking water as well.

5. The involvement of local communities will be made mandatory in all phases of the project, i.e., identification, formulation, implementation and operation and maintenance.

6. NGOs, local bodies and the private sector will be involved in the rural areas of the Terai for the installation of shallow and deep tubewells, the construction of wells, operation and maintenance. Piped water supply projects with the maximum coverage of 500 people will also be carried out in similar manner without the involvement of the government. His Majesty's Government will make matching grants available for the execution of such projects, the rest being borne by the consumers.

7. Sewer lines will be constructed and extended in major towns.

8. Public awareness on sanitation will be raised through training programmes, health education and promotional campaigns.

9. The support of users will be mobilized to reduce leakage in water supply.

10. The formation of companies to execute water supply projects will be encouraged. Loans will be made available through banks and His Majesty's Government will provide certain grants.

11. Municipalities and District Development Committees will be involved in urban area drinking water programmes. Repair and maintenance works will be carried out on existing systems to increase water supply. Improvements will be made in the supply of water even during dry seasons, by developing alternative sources of water in feasible areas.

Targets and Programmes

During the Eighth Plan period, drinking water facilities will be extended to and additional 7,199,000 people, including 6,756,000 people in rural areas and 443,000 people in urban areas. By the end of the Eighth Plan period, 15 million people or 72 percent of the total population, including 13,455,000 people (72 percent) in rural areas and 1,615,000 people (77 percent) in urban areas, will benefit from drinking water facilities.

During the Eighth Plan period, sanitation facilities will be extended to an additional 1,573,000 people, including 1,159,000 in rural areas and 414,000 in urban areas. By the end of Eighth Plan period, 2,685,000 or 13 percent of the total population, including 1,672,000 (9 percent) in rural areas and 1,013,000 (48 percent) in urban areas will benefit from sanitation facilities.

The following programmes will be carried out in order to meet the targets:

1. Drinking Water Supply Programme

Tubewell Programme

About 60,559 new shallow tubewells (including artesian), deep set tubewells and wells will be installed in rural areas of the Terai. This will benefit 4,057,000 people.

Spring Protection

An additional 268,000 people will benefit from the protection and improvement of some 8,000 sources.

On Going Projects

An additional 1,404,000 people will benefit from the completion of about 500 on-going piped water supply schemes.

New Projects

New piped system projects will be initiated and completed during this plan period which will benefit an additional 1,027,000 people.

Kathmandu Drinking Water Supply

An additional 83,000 people in Kathmandu Valley will be provided drinking water facilities during the plan period. The leakage of water supply will be reduced from the present 40 percent to 30 percent by the end of the plan period.

Urban Area Drinking Water Supply Projects

During the Eighth Plan period, 28 urban area drinking water supply projects will be renovated and extended for the benefit of an additional 360,000 people.

2. Sanitation Programme

During the Plan period 2,000 model latrines will be constructed at various schools, health posts and drinking water projects, for the benefit of 20,000 people. Another 50,000 private latrines will be constructed by motivating people which will benefit an additional 300,000 people. About 100,000 people will benefit from the construction of sewer lines in urban areas outside the Valley. The construction of new sewer lines within the valley will benefit

about 245,000 people. 9,000 latrines will be constructed outside the valley to benefit 54,000 people. Programmes implemented by national and international nongovernment organizations will benefit and additional 695,000 people. Some 15,000 latrines will be constructed, combined with bio-gas plants. An additional 90,000 people will benefit from this scheme, to be undertaken by Bio-gas Company. Another 69,000 people will benefit from the construction of private latrines in urban areas.

Implementation Arrangement

Of the total physical targets in the drinking water and sanitation sector during the Eighth Plan period, about 60 percent of the target in the drinking water sector and 54 percent of the target in the sanitation sector will be achieved through the execution of programmes by NGOs, private sector entrepreneurs, companies and local bodies.

Financial Provisions

A total of Rs.6,273 million has been allocated for drinking water and sanitation programmes during the Eighth Plan period.

ANNEX 3

HARDSHIP RANKING OF THE VDCs

	VILLAGE DEVELOPMENT COMMETTE	HS
50	MAHUWA	277
51	MANPUR	274
70	SINHAKHOR	272
29	GAURI	267
71	SIRSIHAWA	266
72	SISAWA	266
66	SAURAHA	264
5	BALRAMAWAPUR	263
74	THUNHIYA	262
12	BHAGAWANPUR	261
18	BISHNUPUR	260
9	BARIPUR	258
2	AJIGARA	256
73	SOMADIHA	253
40	KAJARAJAWA	250
28	GANESHPUR	248
78	VIDDHYA NAGAR	248
4	BAIDAULI	247
30	GOTIHAWA	242
46	LALPUR	242
67	SHIVA NAGAR	241
16	BIJUWA	240
33	HARIHARPUR	239
64	RAM NAGAR	239
14	BHALWARI	237
59	PATHARDEIYA	237
31	GUGAULI	236
48	MAHARAJGANJA	234
32	GARDAUNA	233
15	BHILMI	231
38	JAWAMARI	228
62	PURUSHOTTAMPUR	228
11	BASANTAPUR	225
63	RAJPUR	225
17	BIRPUR	215
42	KHURUHURIYA	213

ANNEX 3

HARDSHIP RANKING OF THE VDCs

	VILLAGE DEVELOPMENT COMMETTE	HS
36	HATHIHAWA	205
56	PARSOHIYA	203
21	CHANAI	202
65	RANGAPUR	202
3	BAHADURGANJA	201
10	BARKALPUR	200
45	KUSHAHAWA	200
22	DHANKAULI	191
20	BUDDHI	183
44	KRISHNA NAGAR	181
76	TITIRKHI	179
77	UDAYAPUR	175
75	TILAURAKOT	169
23	DHARMPANIYA	168
25	DUBIYA	168
19	BITHOOWA	167
68	SHIVA GADHI	161
52	MOTIPUR	147
69	SHIVAPUR	147
54	NIGLIHAWA	146
61	PIPARA	145
7	BANGANGA	135
6	BALUHAWA	132
1	ABHIRAWA	128
35	HATHAUSA	123
27	GAJEHADA	122
34	HARNAMPUR	122
43	KOPAWA	114
26	DUMRA	105
8	BANSKHOR	101
60	PHULIKA	90
24	DOHANI	88
13	BHALWAD	87
55	PAKADI	75
47	LAWANI	73
53	NANDA NAGAR	72

ANNEX 3

HARDSHIP RANKING OF THE VDCs

	VILLAGE DEVELOPMENT COMMETTE	HS
49	MAHENDRAKOT	70
39	JAYA NAGAR	69
57	PATANA	57
58	PATARIYA	54
37	JAHADI	47

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
1	ABHIRAWA	1	83
		2	169
		3	179
		4	126
		5	114
		6	110
		7	76
		8	44
		9	175
2	AJIGARA	1	279
		2	298
		3	259
		4	244
		5	259
		6	263
		7	186
		8	237
		9	233
3	BAHADURGANJA	1	300
		2	153
		3	247
		4	153
		5	142
		6	253
		7	233
		8	237
		9	223
4	BAIDAULI	1	273
		2	245
		3	200
		4	259
		5	276
		6	289
		7	245
		8	197
		9	272
5	BALRAMAWAPUR	1	224
		2	242
		3	271
		4	247
		5	280
		6	239
		7	300
		8	300
		9	300

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
6	BALUHAWA	1	119
		2	139
		3	209
		4	165
		5	189
		6	57
		7	49
		8	110
		9	156
7	BANGANGA	1	128
		2	143
		3	125
		4	200
		5	82
		6	162
		7	145
		8	107
		9	110
8	BANSKHOR	1	43
		2	142
		3	99
		4	78
		5	282
		6	122
		7	38
		8	42
		9	79
9	BARIPUR	1	294
		2	300
		3	243
		4	276
		5	263
		6	300
		7	281
		8	224
		9	175
10	BARKALPUR	1	295
		2	132
		3	168
		4	291
		5	116
		6	271
		7	174
		8	192
		9	225

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
11	BASANTAPUR	1	247
		2	180
		3	121
		4	175
		5	260
		6	180
		7	284
		8	253
		9	280
12	BHAGAWANPUR	1	246
		2	241
		3	291
		4	178
		5	253
		6	280
		7	286
		8	254
		9	271
13	BHALWAD	1	81
		2	79
		3	33
		4	59
		5	56
		6	115
		7	59
		8	72
		9	10
14	BHALWARI	1	253
		2	189
		3	250
		4	256
		5	244
		6	249
		7	210
		8	216
		9	253
15	BHILMI	1	257
		2	200
		3	258
		4	264
		5	278
		6	231
		7	141
		8	189
		9	228

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
16	BIJUWA	1	267
		2	0
		3	191
		4	253
		5	239
		6	0
		7	0
		8	281
		9	147
17	BIRPUR	1	292
		2	193
		3	278
		4	277
		5	240
		6	189
		7	199
		8	235
		9	164
18	BISHNUPUR	1	293
		2	118
		3	263
		4	242
		5	176
		6	269
		7	289
		8	276
		9	291
19	BITHOOWA	1	204
		2	0
		3	211
		4	254
		5	116
		6	268
		7	285
		8	84
		9	115
20	BUDDHI	1	185
		2	81
		3	113
		4	245
		5	190
		6	154
		7	184
		8	230
		9	174

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
21	CHANAI	1	280
		2	0
		3	0
		4	0
		5	0
		6	0
		7	0
		8	172
		9	0
22	DHANKAULI	1	186
		2	265
		3	212
		4	153
		5	100
		6	94
		7	183
		8	176
		9	194
23	DHARMPANIYA	1	85
		2	79
		3	182
		4	190
		5	221
		6	107
		7	219
		8	246
		9	131
24	DOHANI	1	136
		2	100
		3	96
		4	89
		5	122
		6	55
		7	73
		8	52
		9	70
25	DUBIYA	1	186
		2	124
		3	228
		4	181
		5	141
		6	103
		7	102
		8	98
		9	103

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
26	DUMRA	1	55
		2	25
		3	126
		4	287
		5	112
		6	46
		7	94
		8	129
		9	108
27	GAJEHADA	1	113
		2	108
		3	76
		4	124
		5	116
		6	135
		7	129
		8	103
		9	103
28	GANESHPUR	1	200
		2	268
		3	281
		4	220
		5	264
		6	274
		7	276
		8	210
		9	265
29	GAURI	1	229
		2	196
		3	284
		4	262
		5	294
		6	270
		7	281
		8	280
		9	283
30	GOTIHAWA	1	243
		2	266
		3	231
		4	212
		5	143
		6	197
		7	299
		8	231
		9	271

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
31	GUGAULI	1	195
		2	232
		3	196
		4	294
		5	197
		6	192
		7	216
		8	214
		9	224
32	GARDAUNA	1	197
		2	210
		3	239
		4	233
		5	270
		6	256
		7	211
		8	240
		9	264
33	HARIHARPUR	1	206
		2	283
		3	219
		4	287
		5	223
		6	277
		7	173
		8	171
		9	207
34	HARNAMPUR	1	67
		2	143
		3	209
		4	140
		5	59
		6	86
		7	169
		8	177
		9	63
35	HATHAUSA	1	107
		2	116
		3	190
		4	157
		5	133
		6	122
		7	101
		8	170
		9	98

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
36	HATHIHAWA	1	264
		2	219
		3	157
		4	181
		5	197
		6	143
		7	174
		8	269
		9	259
37	JAHADI	1	102
		2	42
		3	74
		4	43
		5	50
		6	86
		7	53
		8	28
		9	2
38	JAWAMARI	1	239
		2	211
		3	233
		4	253
		5	250
		6	200
		7	196
		8	300
		9	257
39	JAYA NAGAR	1	22
		2	0
		3	253
		4	0
		5	35
		6	19
		7	79
		8	56
		9	96
40	KAJARAJAWA	1	268
		2	209
		3	230
		4	218
		5	280
		6	254
		7	273
		8	267
		9	255

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
42	KHURUHURIYA	1	271
		2	244
		3	230
		4	234
		5	149
		6	149
		7	190
		8	219
		9	151
43	KOPAWA	1	117
		2	104
		3	99
		4	110
		5	87
		6	89
		7	120
		8	103
		9	103
44	KRISHNA NAGAR	1	O/H
		2	O/H
		3	O/H
		4	O/H
		5	O/H
		6	O/H
		7	O/H
		8	207
		9	160
45	KUSHAHAWA	1	282
		2	263
		3	183
		4	104
		5	224
		6	213
		7	151
		8	108
		9	110
46	LALPUR	1	239
		2	253
		3	251
		4	236
		5	248
		6	268
		7	251
		8	235
		9	228

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
47	LAWANI	1	113
		2	30
		3	98
		4	119
		5	50
		6	139
		7	104
		8	5
		9	77
48	MAHARAJGANJA	1	222
		2	213
		3	239
		4	186
		5	167
		6	291
		7	231
		8	299
		9	296
49	MAHENDRAKOT	1	200
		2	0
		3	176
		4	0
		5	0
		6	23
		7	27
		8	0
		9	105
50	MAHUWA	1	240
		2	266
		3	293
		4	297
		5	293
		6	288
		7	277
		8	290
		9	218
51	MANPUR	1	244
		2	300
		3	300
		4	295
		5	264
		6	258
		7	264
		8	300
		9	267

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
52	MOTIPUR	1	77
		2	108
		3	90
		4	93
		5	83
		6	118
		7	98
		8	100
		9	65
53	NANDA NAGAR	1	1
		2	6
		3	45
		4	91
		5	40
		6	67
		7	153
		8	189
		9	40
54	NIGLIHAWA	1	120
		2	97
		3	75
		4	170
		5	224
		6	201
		7	107
		8	193
		9	169
55	PAKADI	1	29
		2	71
		3	60
		4	142
		5	47
		6	88
		7	69
		8	88
		9	52
56	PARSOHIYA	1	140
		2	273
		3	224
		4	105
		5	125
		6	203
		7	249
		8	179
		9	284

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
57	PATANA	1	83
		2	58
		3	93
		4	44
		5	55
		6	29
		7	16
		8	74
		9	59
58	PATARIYA	1	33
		2	50
		3	26
		4	45
		5	30
		6	44
		7	80
		8	114
		9	61
59	PATHARDEIYA	1	271
		2	277
		3	294
		4	241
		5	163
		6	235
		7	228
		8	225
		9	189
60	PHULIKA	1	24
		2	73
		3	115
		4	83
		5	105
		6	117
		7	60
		8	51
		9	131
61	PIPARA	1	122
		2	226
		3	102
		4	100
		5	96
		6	152
		7	176
		8	143
		9	168

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
62	PURUSHOTTAMPUR	1	284
		2	269
		3	232
		4	191
		5	190
		6	158
		7	242
		8	238
		9	200
63	RAJPUR	1	205
		2	133
		3	221
		4	295
		5	297
		6	293
		7	100
		8	279
		9	144
64	RAM NAGAR	1	236
		2	266
		3	275
		4	241
		5	216
		6	226
		7	251
		8	219
		9	222
65	RANGAPUR	1	182
		2	148
		3	171
		4	289
		5	209
		6	183
		7	252
		8	177
		9	208
66	SAURAHA	1	276
		2	250
		3	300
		4	287
		5	293
		6	272
		7	278
		8	267
		9	157

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
67	SHIVA NAGAR	1	124
		2	289
		3	282
		4	248
		5	219
		6	254
		7	194
		8	251
		9	278
68	SHIVA GADHI	1	276
		2	189
		3	176
		4	98
		5	184
		6	137
		7	190
		8	99
		9	126
69	SHIVAPUR	1	127
		2	129
		3	109
		4	104
		5	170
		6	172
		7	134
		8	273
		9	153
70	SINHAKHOR	1	254
		2	284
		3	279
		4	209
		5	258
		6	294
		7	300
		8	250
		9	285
71	SIRSIHAWA	1	288
		2	248
		3	288
		4	233
		5	300
		6	231
		7	231
		8	298
		9	259

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
72	SISAWA	1	294
		2	290
		3	300
		4	293
		5	283
		6	273
		7	277
		8	240
		9	188
73	SOMADIHA	1	223
		2	168
		3	228
		4	281
		5	268
		6	263
		7	258
		8	266
		9	298
74	THUNHIYA	1	279
		2	200
		3	291
		4	264
		5	272
		6	273
		7	242
		8	222
		9	268
75	TILAURAKOT	1	226
		2	264
		3	128
		4	91
		5	152
		6	97
		7	182
		8	248
		9	70
76	TITIRKHI	1	111
		2	219
		3	45
		4	114
		5	248
		6	167
		7	244
		8	204
		9	185

WARD WISE HARDSHIP FOR KAPILBASTU DISTRICT

VDC	VDC NAME	WARD NO.	HARDSHIP
77	UDAYAPUR	1	205
		2	158
		3	224
		4	196
		5	156
		6	216
		7	162
		8	130
		9	141
78	VIDDHYA NAGAR	1	235
		2	223
		3	225
		4	276
		5	273
		6	259
		7	247
		8	281
		9	216

Annex 4

Assumptions made when calculating the Water Supply Development Plan for the years 1993 - 1997 :

1. 100% of the population using handpumps as their primary source, and in service level 2, 3 and 4 have been considered for rehabilitation.

2. New Investments :

   I. 100% of population presently served by Kuwa (Pit) and Kulo and in service level 4.

   II. 60% of the population presently served by open well and in service level 4.

   III. 30% of the population presently served by open wells and in service level 3.

   IV. 35% population of the bhawar zone area are in need of drilled wells for water supply

   - 50% of this population is considered to be served in this plan

ANNEX 4 KAPILBASTU DISTRICT

Coverage target for the year 1997 - 72 %

VILLAGE DEVELOPMENT COMMETTE	EXISTING SITUATION IN 1992 Popula-tion in 1992	Hardship figure	Popul.in Service Level 1	% of Popul.in S.L. I	Popul. in the 1997	WATER SYPPLY DEVELOPMENT PLAN 1993-1997 People in Serv. Lev.I in 1997	Completing schemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Popul. covered in 1997	% of tot popul. of 1997	CAPITAL COSTS 1993-1997, NRs Completing schemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Total Capital Cost, NRs 1993-1997
1 ABHIRAWA	4,598	128	1,552	33.76%	5,382	1,817		1,431	627		3,875	72%	0	71,550	194,370	0	265,920
2 AJIGARA	3,863	256	90	2.32%	4,522	105		903	1,255		2,263	50%	0	45,150	389,050	0	434,200
3 BAHADURGANJA	8,562	201	951	11.11%	10,022	1,114		3,282	1,420		5,816	58%	0	164,100	440,200	0	604,300
4 BAIDAULI	3,796	247	103	2.72%	4,443	121		1,038	1,833		2,992	67%	0	51,900	568,230	0	620,130
5 BALRAMAWAPUR	3,241	263	6	0.19%	3,794	7		695	1,689		2,391	63%	0	34,750	523,590	0	558,340
6 BALUHAWA	3,895	132	752	19.30%	4,559	880		2,727			3,607	79%	0	136,350	0	0	136,350
7 BANGANGA	8,476	135	190	2.24%	9,922	222		9,081			9,303	94%	0	454,050	0	0	454,050
8 BANSKHOR	6,489	101	3,500	53.94%	7,596	4,097		1,782			5,879	77%	0	89,100	0	0	89,100
9 BARIPUR	2,404	258	25	1.04%	2,814	29		593	1,268		1,890	67%	0	29,650	393,080	0	422,730
10 BARKALPUR	5,668	200	0	0.00%	6,635	0		3,976		801	4,777	72%	0	198,800	0	1,201,500	1,400,300
11 BASANTAPUR	2,312	225	68	2.96%	2,706	80		1,113	255		1,448	54%	0	55,650	79,050	0	134,700
12 BHAGAWANPUR	3,696	261	66	1.79%	4,326	77		588	1,845		2,510	58%	0	29,400	571,950	0	601,350
13 BHALWAD	4,444	87	1,091	24.54%	5,202	1,277		3,809			5,086	98%	0	190,450	0	0	190,450
14 BHALWARI	3,556	237	132	3.72%	4,163	155		1,167	877		2,199	53%	0	58,350	271,870	0	330,220
15 BHILMI	3,656	231	507	13.87%	4,280	594		709	1,541		2,844	66%	0	35,450	477,710	0	513,160
16 BIJUWA	4,066	240	18	0.43%	4,760	21		1,805	701		2,527	53%	0	90,250	217,310	0	307,560
17 BIRPUR	6,754	215	45	0.67%	7,906	53	6,486	3,445			9,984	126%	6,486,000	172,250	0	0	6,658,250
18 BISHNUPUR	3,020	260	0	0.00%	3,535	0		697			697	20%	0	34,850	0	0	34,850
19 BITHOOWA	3,122	167	948	30.37%	3,655	1,110		860	362		2,332	64%	0	43,000	112,220	0	155,220
20 BUDDHI	4,560	183	369	8.08%	5,338	431		3,164	249		3,844	72%	0	158,200	77,190	0	235,390
21 CHANAI	6,476	202	484	7.48%	7,581	567		3,329	342	911	5,149	68%	0	166,450	106,020	1,366,500	1,638,970
22 DHANKAULI	6,643	191	500	7.53%	7,776	586		4,570	453		5,609	72%	0	228,500	140,430	0	368,930
23 DHARMPANIYA	3,431	168	829	24.16%	4,016	970		1,535	387		2,892	72%	0	76,750	119,970	0	196,720
24 DOHANI	4,406	88	2,236	50.75%	5,158	2,618		1,700			4,318	84%	0	85,000	0	0	85,000
25 DUBIYA	3,646	168	8	0.22%	4,268	9		3,008		456	3,473	81%	0	150,400	0	684,000	834,400
26 DUMRA	4,063	105	1,744	42.93%	4,756	2,042		1,755	200		3,997	84%	0	87,750	62,000	0	149,750
27 GAJEHADA	8,252	122	197	2.39%	9,660	231		8,794			9,025	93%	0	439,700	0	0	439,700

ANNEX 4 KAPILBASTU DISTRICT

Coverage target for the year 1997 - 72 %

VILLAGE DEVELOPMENT COMMETTE	EXISTING SITUATION IN 1992 Popula-tion in 1992	Hardship figure	Popul.in Service Level I	% of Popul.in S.L. I	Popul. in the 1997	WATER SYPPLY DEVELOPMENT PLAN 1993-1997 People in Serv. Lev.I in 1997	Completing schemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Popul. covered in 1997	% of tot popul. of 1997	CAPITAL COSTS 1993-1997, NRs Completing schemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Total Capital Cost, NRs 1993-1997
28 GANESHPUR	4,154	248	6	0.15%	4,863	7		1,234	1,061		2,302	47%	0	61,700	328,910	0	390,610
29 GAURI	3,083	267	7	0.24%	3,609	9		749	1,141		1,899	53%	0	37,450	353,710	0	391,160
30 GOTIHAWA	3,321	242	187	5.64%	3,887	219		932	748		1,899	49%	0	46,600	231,880	0	278,480
31 GUGAULI	6,960	236	402	5.77%	8,147	470		2,192	1,804		4,466	55%	0	109,600	559,240	0	668,840
32 GARDAUNA	3,211	233	17	0.53%	3,759	20		1,380	407		1,807	48%	0	69,000	126,170	0	195,170
33 HARIHARPUR	4,671	239	489	10.47%	5,468	572		1,031	1,134		2,737	50%	0	51,550	351,540	0	403,090
34 HARNAMPUR	3,466	122	1,323	38.16%	4,057	1,548		1,572			3,120	77%	0	78,600	0	0	78,600
35 HATHAUSA	5,850	123	240	4.11%	6,848	281		5,809			6,090	89%	0	290,450	0	0	290,450
36 HATHIHAWA	5,446	205	6	0.12%	6,375	7		4,233	350		4,590	72%	0	211,650	108,500	0	320,150
37 JAHADI	4,693	47	2,988	63.67%	5,493	3,498		1,757			5,255	96%	0	87,850	0	0	87,850
38 JAWAMARI	2,163	228	20	0.93%	2,532	23		789			812	32%	0	39,450	0	0	39,450
39 JAYA NAGAR	4,034	69	2,261	56.05%	4,722	2,647		1,759			4,406	93%	0	87,950	0	0	87,950
40 KAJARAJAWA	3,471	250	0	0.00%	4,063	0		1,194	832		2,026	50%	0	59,700	257,920	0	317,620
41 KAPILBASTU N.P.	0	0	0	ERR	0	0		0			0	0%	0	0	0	0	0
42 KHURUHURIYA	7,220	213	55	0.76%	8,452	64		3,788	1,531		5,383	64%	0	189,400	474,610	0	664,010
43 KOPAWA	8,336	114	77	0.93%	9,758	91		9,076			9,167	94%	0	453,800	0	0	453,800
44 KRISHNA NAGAR	1,554	181	163	10.47%	1,819	190		838	282		1,310	72%	0	41,900	87,420	0	129,320
45 KUSHAHAWA	3,813	200	277	7.25%	4,463	324		1,812	895		3,031	68%	0	90,600	277,450	0	368,050
46 LALPUR	2,727	242	43	1.58%	3,192	50		891			941	29%	0	44,550	0	0	44,550
47 LAWANI	4,938	73	3,090	62.58%	5,780	3,617		1,475			5,092	88%	0	73,750	0	0	73,750
48 MAHARAJGANJA	11,982	234	592	4.94%	14,026	692		4,073	4,234		8,999	64%	0	203,650	1,312,540	0	1,516,190
49 MAHENDRAKOT	5,724	70	3,572	62.41%	6,700	4,182		1,303			5,485	82%	0	65,150	0	0	65,150
50 MAHUWA	3,901	277	6	0.16%	4,566	7		598	1,683		2,288	50%	0	29,900	521,730	0	551,630
51 MANPUR	2,730	274	25	0.93%	3,196	30		386	1,285		1,701	53%	0	19,300	398,350	0	417,650
52 MOTIPUR	9,076	147	130	1.43%	10,624	152		8,705			8,857	83%	0	435,250	0	0	435,250
53 NANDA NAGAR	4,842	72	2,988	61.70%	5,668	3,497		1,787			5,284	93%	0	89,350	0	0	89,350
54 NIGLIHAWA	8,869	146	593	6.69%	10,382	694		8,263			8,957	86%	0	413,150	0	0	413,150

ANNEX 4 KAPILBASTU DISTRICT

Coverage target for the year 1997 - 72 %

VILLAGE DEVELOPMENT COMMETTE	EXISTING SITUATION IN 1992				WATER SYPPLY DEVELOPMENT PLAN 1993-1997						CAPITAL COSTS 1993-1997, NRs					Total
	Popula-tion in 1992	Hardship figure	Popul.in Service Level I	% of Popul.in S.L. I	Popul. in the 1997	People in Serv. Lev.I in 1997	Completing schemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Popul. covered in 1997	% of tot popul. of 1997	Completing schemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Capital Cost, NRs 1993-1997
55 PAKADI	4,312	75	2,387	55.35%	5,048	2,794		1,900			4,694	93%	0	95,000	0	0	95,000
56 PARSOHIYA	2,898	203	6	0.21%	3,392	7		1,754	681		2,442	72%	0	87,700	211,110	0	298,810
57 PATANA	5,656	57	3,069	54.26%	6,621	3,592		2,819			6,411	97%	0	140,950	0	0	140,950
58 PATARIYA	5,151	54	3,039	59.00%	6,030	3,558		2,361			5,919	98%	0	118,050	0	0	118,050
59 PATHARDEIYA	7,759	237	69	0.89%	9,082	81		2,878	2,185		5,144	57%	0	143,900	677,350	0	821,250
60 PHULIKA	5,021	90	2,571	51.20%	5,877	3,009		1,881			4,890	83%	0	94,050	0	0	94,050
61 PIPARA	3,922	145	631	16.08%	4,591	738		2,799	350		3,887	85%	0	139,950	108,500	0	248,450
62 PURUSHOTTAMPUR	2,456	228	23	0.96%	2,875	27		1,181	862		2,070	72%	0	59,050	267,220	0	326,270
63 RAJPUR	3,324	225	101	3.04%	3,891	118		1,531	753		2,402	62%	0	76,550	233,430	0	309,980
64 RAM NAGAR	3,127	239	28	0.89%	3,660	33		1,102	1,000		2,135	58%	0	55,100	310,000	0	365,100
65 RANGAPUR	3,619	202	435	12.02%	4,236	509		1,815	726		3,050	72%	0	90,750	225,060	0	315,810
66 SAURAHA	2,730	264	0	0.00%	3,196	0		869	714		1,583	50%	0	43,450	221,340	0	264,790
67 SHIVA NAGAR	3,654	241	7	0.18%	4,277	8		1,306	1,165		2,479	58%	0	65,300	361,150	0	426,450
68 SHIVA GADHI	4,778	161	59	1.24%	5,593	69		4,269		458	4,796	86%	0	213,450	0	687,000	900,450
69 SHIVAPUR	7,498	147	779	10.39%	8,777	912		5,287		936	7,135	81%	0	264,350	0	1,404,000	1,668,350
70 SINHAKHOR	3,750	272	0	0.00%	4,390	0		675	1,875		2,550	58%	0	33,750	581,250	0	615,000
71 SIRSIHAWA	2,962	266	130	4.39%	3,467	152		407	1,637		2,196	63%	0	20,350	507,470	0	527,820
72 SISAWA	4,847	266	100	2.07%	5,674	117		766	2,275		3,158	56%	0	38,300	705,250	0	743,550
73 SOMADIHA	4,078	253	21	0.51%	4,774	24		1,331	1,587		2,942	62%	0	66,550	491,970	0	558,520
74 THUNHIYA	4,301	262	118	2.74%	5,035	138		778	1,745		2,661	53%	0	38,900	540,950	0	579,850
75 TILAURAKOT	5,969	169	1,523	25.51%	6,987	1,782		2,449	800		5,031	72%	0	122,450	248,000	0	370,450
76 TITIRKHI	3,451	179	625	18.11%	4,040	732		1,548	629		2,909	72%	0	77,400	194,990	0	272,390
77 UDAYAPUR	2,784	175	13	0.46%	3,259	15		2,064	268		2,347	72%	0	103,200	83,080	0	186,280
78 VIDDHYA NAGAR	3,409	248	28	0.81%	3,990	32		1,075	1,166		2,273	57%	0	53,750	361,460	0	415,210
	358,786		51,731	14.42%	419,985	60,554	6,486	180,027	53,109	3,562	303,738	72%	6,486,000	9,001,350	16,463,790	5,343,000	37,294,140

Annex 4

Assumptions made when calculating the Water Supply Development Plan for years 1998 - 2002

1. Population receiving service level 1 in the beginning of the planning period will stay covered with annual renewal investment of 5%.

2. Distribution of new investment is as follows

   - 88% new handpumps
   - 12% new drilled wells

3. All VDCs are brought upto 100% coverage

ANNEX 4 KAPILBASTU DISTRICT

Coverage target for the year 2002 - 100%

VILLAGE DEVELOPMENT COMMETTE	EXISTING SITUATION IN 1997 Popula- tion in 1997	Popul.in Service Level I	% of Popul.in S.L. I	Popul. in the 2002	WATER SYPPLY DEVELOPMENT PLAN 1997-2002 People in Serv. Lev.I in 2002	Completing Ischemes under const.	Rehabi- litation	New Hand Pumps	New drilled wells	Popul. covered in 2002	% of tot popul. of 2002	CAPITAL COSTS 1997-2002, NRs New Hand Pumps	New drilled wells	Total Capital Cost, NRs 1997-2002
1 ABHIRAWA	5,382	3,875	72%	6,300	4,536		1,764			6,300	100%	546,840	0	546,840
2 AJIGARA	4,522	2,263	50%	5,293	2,649		2,644			5,293	100%	819,713	0	819,713
3 BAHADURGANJA	10,022	5,816	58%	11,732	6,808		4,924			11,732	100%	1,526,440	0	1,526,440
4 BAIDAULI	4,443	2,992	67%	5,201	3,502		1,699			5,201	100%	526,690	0	526,690
5 BALRAMAWAPUR	3,794	2,391	63%	4,441	2,799		1,642			4,441	100%	509,020	0	509,020
6 BALUHAWA	4,559	3,607	79%	5,337	4,222		1,115			5,337	100%	345,650	0	345,650
7 BANGANGA	9,922	9,303	94%	11,614	10,890		724			11,614	100%	224,440	0	224,440
8 BANSKHOR	7,596	5,879	77%	8,891	6,882		2,009			8,891	100%	622,790	0	622,790
9 BARIPUR	2,814	1,890	67%	3,294	2,213		1,081			3,294	100%	335,110	0	335,110
10 BARKALPUR	6,635	4,777	72%	7,767	5,592		1,374	801		7,767	100%	425,940	1,201,500	1,627,440
11 BASANTAPUR	2,706	1,448	54%	3,168	1,695		1,473			3,168	100%	456,630	0	456,630
12 BHAGAWANPUR	4,326	2,510	58%	5,064	2,938		2,126			5,064	100%	659,145	0	659,145
13 BHALWAD	5,202	5,086	98%	6,089	5,953		136			6,089	100%	42,160	0	42,160
14 BHALWARI	4,163	2,199	53%	4,873	2,574		2,299			4,873	100%	712,690	0	712,690
15 BHILMI	4,280	2,844	66%	5,010	3,329		1,681			5,010	100%	521,110	0	521,110
16 BIJUWA	4,760	2,527	53%	5,571	2,957		2,614			5,571	100%	810,340	0	810,340
17 BIRPUR	7,906	5,745	73%	9,255	6,725		2,530			9,255	100%	784,300	0	784,300
18 BISHNUPUR	3,535	2,545	72%	4,138	2,979		1,159			4,138	100%	359,290	0	359,290
19 BITHOOWA	3,655	2,332	64%	4,278	2,730		1,548			4,278	100%	479,880	0	479,880
20 BUDDHI	5,338	3,844	72%	6,248	4,500		1,748			6,248	100%	541,880	0	541,880
21 CHANAI	7,581	5,149	68%	8,874	6,027		1,936	911		8,874	100%	600,160	1,366,500	1,966,660
22 DHANKAULI	7,776	5,609	72%	9,103	6,565		2,538			9,103	100%	786,780	0	786,780
23 DHARMPANIYA	4,016	2,892	72%	4,701	3,386		1,315			4,701	100%	407,650	0	407,650
24 DOHANI	5,158	4,318	84%	6,037	5,054		983			6,037	100%	304,730	0	304,730
25 DUBIYA	4,268	3,473	81%	4,996	4,066		474	456		4,996	100%	146,940	684,000	830,940
26 DUMRA	4,756	3,997	84%	5,567	4,679		888			5,567	100%	275,280	0	275,280
27 GAJEHADA	9,660	9,025	93%	11,307	10,564		743			11,307	100%	230,330	0	230,330

ANNEX 4 KAPILBASTU DISTRICT

Coverage target for the year 2002 - 100%

VILLAGE DEVELOPMENT COMMETTE	EXISTING SITUATION IN 1997 Popula-tion in 1997	Popul.in Service Level I	% of Popul.in S.L. I	Popul. in the 2002	WATER SYPPLY DEVELOPMENT PLAN 1997-2002 People in Serv. Lev.I in 2002	Completing schemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Popul. covered in 2002	% of tot popul. of 2002	CAPITAL COSTS 1997-2002, NRs New Hand Pumps	New drilled wells	Total Capital Cost, NRs 1997-2002
28 GANESHPUR	4,863	2,302	47%	5,692	2,695			2,997		5,692	100%	929,070	0	929,070
29 GAURI	3,609	1,899	53%	4,224	2,222			2,002		4,224	100%	620,620	0	620,620
30 GOTIHAWA	3,887	1,899	49%	4,551	2,223			2,328		4,551	100%	721,680	0	721,680
31 GUGAULI	8,147	4,466	55%	9,537	5,228			4,309		9,537	100%	1,335,790	0	1,335,790
32 GARDAUNA	3,759	1,807	48%	4,400	2,115			2,285		4,400	100%	708,350	0	708,350
33 HARIHARPUR	5,468	2,737	50%	6,400	3,204			3,196		6,400	100%	990,760	0	990,760
34 HARNAMPUR	4,057	3,120	77%	4,749	3,652			1,097		4,749	100%	340,070	0	340,070
35 HATHAUSA	6,848	6,090	89%	8,016	7,129			887		8,016	100%	274,970	0	274,970
36 HATHIHAWA	6,375	4,590	72%	7,462	5,373			2,089		7,462	100%	647,590	0	647,590
37 JAHADI	5,493	5,255	96%	6,431	6,151			280		6,431	100%	86,800	0	86,800
38 JAWAHARI	2,532	1,846	73%	2,964	2,161			803		2,964	100%	248,930	0	248,930
39 JAYA NAGAR	4,722	4,406	93%	5,528	5,157			371		5,528	100%	115,010	0	115,010
40 KAJARAJAWA	4,063	2,026	50%	4,756	2,372			2,384		4,756	100%	739,040	0	739,040
41 KAPILBASTU N.P.	0	0	ERR	0	0					0	0%	0	0	0
42 KHURUHURIYA	8,452	5,383	64%	9,893	6,301			3,592		9,893	100%	1,113,503	0	1,113,503
43 KOPAWA	9,758	9,167	94%	11,422	10,730			692		11,422	100%	214,520	0	214,520
44 KRISHNA NAGAR	1,819	1,310	72%	2,129	1,534			595		2,129	100%	184,450	0	184,450
45 KUSHAHAWA	4,463	3,031	68%	5,225	3,548			1,677		5,225	100%	519,784	0	519,784
46 LALPUR	3,192	2,298	72%	3,737	2,690			1,047		3,737	100%	324,570	0	324,570
47 LAWANI	5,780	5,092	88%	6,766	5,961			805		6,766	100%	249,550	0	249,550
48 MAHARAJGANJA	14,026	8,999	64%	16,418	10,534			5,884		16,418	100%	1,824,040	0	1,824,040
49 MAHENDRAKOT	6,700	5,485	82%	7,843	6,420			1,423		7,843	100%	441,130	0	441,130
50 MAHUWA	4,566	2,288	50%	5,345	2,678			2,667		5,345	100%	826,770	0	826,770
51 MANPUR	3,196	1,701	53%	3,741	1,991			1,750		3,741	100%	542,500	0	542,500
52 MOTIPUR	10,624	8,857	83%	12,436	10,368			2,068		12,436	100%	641,080	0	641,080
53 NANDA NAGAR	5,668	5,284	93%	6,635	6,186			449		6,635	100%	139,190	0	139,190
54 NIGLIHAWA	10,382	8,957	86%	12,153	10,485			1,668		12,153	100%	517,080	0	517,080

ANNEX 4 KAPILBASTU DISTRICT

Coverage target for the year 2002 - 100%

VILLAGE DEVELOPMENT COMMETTE	EXISTING SITUATION IN 1997 Popula-tion in 1997	Popul.in Service Level I	% of Popul.in S.L. I	Popul. in the 2002	WATER SYPPLY DEVELOPMENT PLAN 1997-2002 People in Serv. Lev.I in 2002	Completing Ischemes under const.	Rehabi-litation	New Hand Pumps	New drilled wells	Popul. covered in 2002	% of tot popul. of 2002	CAPITAL COSTS 1997-2002, NRs New Hand Pumps	New drilled wells	Total Capital Cost, NRs 1997-2002
55 PAKADI	5,048	4,694	93%	5,908	5,494			414		5,908	100%	128,340	0	128,340
56 PARSOHIYA	3,392	2,442	72%	3,971	2,859			1,112		3,971	100%	344,720	0	344,720
57 PATANA	6,621	6,411	97%	7,750	7,505			245		7,750	100%	75,950	0	75,950
58 PATARIYA	6,030	5,919	98%	7,058	6,928			130		7,058	100%	40,300	0	40,300
59 PATHARDEIYA	9,082	5,144	57%	10,632	6,021			4,610		10,632	100%	1,429,185	0	1,429,185
60 PHULIKA	5,877	4,890	83%	6,880	5,724			1,156		6,880	100%	358,360	0	358,360
61 PIPARA	4,591	3,887	85%	5,374	4,550			824		5,374	100%	255,440	0	255,440
62 PURUSHOTTAMPUR	2,875	2,070	72%	3,365	2,424			941		3,365	100%	291,710	0	291,710
63 RAJPUR	3,891	2,402	62%	4,555	2,812			1,743		4,555	100%	540,330	0	540,330
64 RAM NAGAR	3,660	2,135	58%	4,285	2,499			1,786		4,285	100%	553,660	0	553,660
65 RANGAPUR	4,236	3,050	72%	4,959	3,571			1,388		4,959	100%	430,280	0	430,280
66 SAURAHA	3,196	1,583	50%	3,741	1,853			1,888		3,741	100%	585,280	0	585,280
67 SHIVA NAGAR	4,277	2,479	58%	5,007	2,901			2,106		5,007	100%	652,860	0	652,860
68 SHIVA GADHI	5,593	4,796	86%	6,547	5,614			475	458	6,547	100%	147,250	687,000	834,250
69 SHIVAPUR	8,777	7,135	81%	10,274	8,352			986	936	10,274	100%	305,660	1,404,000	1,709,660
70 SINHAKHOR	4,390	2,550	58%	5,138	2,985			2,153		5,138	100%	667,567	0	667,567
71 SIRSIHAWA	3,467	2,196	63%	4,059	2,571			1,488		4,059	100%	461,280	0	461,280
72 SISAWA	5,674	3,158	56%	6,642	3,697			2,945		6,642	100%	912,916	0	912,916
73 SOMADIHA	4,774	2,942	62%	5,588	3,444			2,144		5,588	100%	664,645	0	664,645
74 THUNHIYA	5,035	2,661	53%	5,893	3,115			2,779		5,893	100%	861,339	0	861,339
75 TILAURAKOT	6,987	5,031	72%	8,179	5,890			2,289		8,179	100%	709,590	0	709,590
76 TITIRKHI	4,040	2,909	72%	4,729	3,405			1,324		4,729	100%	410,440	0	410,440
77 UDAYAPUR	3,259	2,347	72%	3,815	2,747			1,068		3,815	100%	331,080	0	331,080
78 VIDDHYA NAGAR	3,990	2,273	57%	4,671	2,661			2,010		4,671	100%	623,100	0	623,100
	419,985	303,738	72%	491,625	355,547	0	0	132,516	3,562	491,625	100%	41,080,056	5,343,000	46,423,056

TAULIHAWA TOWN WATER SUPPLY

1. General

Taulihawa Water Supply serves the urban area of the Taulihawa municipality, i.e. 17 146 people in 1992, commercial area, a hospital, schools and the administrative offices. The water supply system is based on ground water and consist of 2 boreholes with submersible pumps, an overhead reservoir and a water reticulation network. Water is distributed through 432 house connections and 52 public taps. The average daily consumpition is about 800 m3 restricted by the poor condition of the distribution system. The water supply system was constructed in 1981.

2. Source

The water supply is based on groundwater, i.e. 2 boreholes drilled on the DWSO compaund about 1 km from the town centre. The boreholes are 220 m and 150 m deep respectively, both dia 150 mm with steel casing and screens. The yields of the boreholes are 27 l/s and 14 l/s respectively, which is sufficient for the present supply.

3. Pumping

Both two boreholes are equipped with electrically driven submersible pums with a rated pumping capacity of 27 l/s and 14 l/s. Both pums are operating and in a reasonable condition. The average daily production is 800 m3.

4. Storage

There is only one storage tank in the system: 450 m3 overhead reservoir located at the DWSO compound. The reservoir is made of concrete and has a 30 stand. It is in a good condition. The reservoir capacity can be considered sufficient for the present water consumption.

5. Distribution System

The distribution system covers the center of the Taulihawa town. The total lenght of the network is about 12 500 m with pipe sizes varying from 15 mm to 200 mm. The main material is GI but also HDPE pipes are used in trunk main. The condition of the network is poor and water losses through leakakes are substantial. Also the capacity of the network is not sufficient, therefore the demand is not fully met.

6. Consumers

There are approximately 13 000 peole living in the service area of the system and for most the piped water supply is the main source of water. Particularly in the outskirts of the town, handpump wells are used as alternative source.

Water is delivered to the consumers through 300 house connections, most of which are metered, and through 50 public taps. The condition of most of the taps and their surroundings is poor.

7. Operation and Maintenance

The pumps are operated 18 hrs per day on average which provides sufficient water for the system. The supply of water is intgermittent, normally about 18 hrs/day.

8. Organization and Staff

Taulihawa Water Supply is managed and operated by DWSO which has a staff of 10 for this purpose. The staff is as follows:

Supervisor	1
Pump operator	1
Plumber	2
Meter reader	1
Assistant pump operator	1
Kaligad	1
Peon	3

9. Cost and Revenue

The annual operation and maintenance cost of the water supply system is about NRs 255 172. The main cost items are the salaries, 185 172 NRs and energy, NRs 30 000.

The consumers having house connections are charged monthly for their water consumption: NRs 7 per month minimum charge which covers the consumption up to 10 m3 and NRs 1.20/m3 thereafter. The total revenue collection is about NRs 116 000 per year.

10. Future Plans

As a part of ADB 2nd water supply project a Feasibility Study was prepared in 1991 for augmentation of Taulihawa water supply. According to the study the cost of the augmentation which would meet the estimated water demand of 2010 is NRs 17.614 mill. However, the project implementation is not included in the ADB programme.

The aim of the government is to hand over the management and operation of small urban schmes to local councils. There have been discussions between DWSS and the municipal council of Taulihawa to that effect but no firm plans have been made so far.

KRISHNANAGER TOWN WATER SUPPLY

1. General

Krishnanagar Water Supply serves the Krishnanagar VDC, i.e. 8,732 people in 1992, commercial area, local small industries, schools and the administrative offices. The water supply system is based on ground water and consist of 2 boreholes with submersible pumps, an overhead reservoir and a water reticulation network. Water is distributed through 520 house connections and 32 public taps. The average daily consumpition is about 1200 m3. The water supply system was constructed in 1983.

2. Source

The water supply is based on groundwater, i.e. 2 boreholes drilled on the DWSO compaund about 1 km from the town centre. The boreholes are 150 m and 150 m deep respectively, both dia 200 mm with steel casing and screens. The yields of the boreholes are 55 l/s and the other is out of order, which is sufficient for the present supply.

3. Pumping

Both two boreholes are equipped with electrically driven submersible pums with a rated pumping capacity of 55 l/s each. One of the pumps is out of order but the oher one in in a reasonable condition. The average daily production is 1200 m3.

4. Storage

There is only one storage tank in the system: 450 m3 overhead reservoir located at the DWSO compound. The reservoir is made of concrete and has a 30 stand. It is in a good condition. The reservoir capacity can be considered sufficient for the present water consumption.

5. Distribution System

The distribution system covers the center of the Krishnanager town. The total lenght of the network is about 10 000 m with pipe sizes varying from 15 mm to 200 mm. The main material is GI but also HDPE pipes are used in trunk main. The condition of the network is reasonable. Also the capacity of the network is sufficient to meet the demand.

6. Consumers

There are approximately 8 600 peole living in the service area of the system and for most the piped water supply is the main

source of water. Particularly in the outskirts of the town, handpump wells are used as alternative source.

Water is delivered to the consumers through 520 house connections, most of which are metered, and through 32 public taps. The condition of most of the taps and the hygienic standard of their surroundings is poor.

7. Operation and Maintenance

The pumps are operated 9 hrs per day on average which provides sufficient water for the system. The availability of water in the distribution system is continuous troughout the day.

8. Organization and Staff

Krishnanagar Water Supply is managed and operated by DWSO which has a staff of 8 for this purpose. The staff is as follows:

Pump operator	1
Plumber	1
Meter reader	1
Assistant pump operator	1
Kaligad	1
Peon	3

9. Cost and Revenue

The annual operation and maintenance cost of the water supply system is about NRs 216 582. The main cost items are the salaries, 161 252 NRs and energy, NRs 105 600.

The consumers having house connections are charged monthly for their water consumption: NRs 7 per month minimum charge which covers the consumption up to 10 m3 and NRs 1.20/m3 thereafter. The total revenue collection is about NRs 170 000 per year.

10. Future Plans

Aparet from normal maintenance and reneval, there are no immediate plans to augment or expand the water supply system.

The aim of the government is to hand over the management and operation of small urban schmes to local councils. There have been discussions between DWSS and the municipal council of Krishnanagar to that effect but no firm plans have been made so far.

Water Quality Data Analysis

From Lumbini Zone:

Hygienic Quality of Different Water Supplies

December 1993

1. GENERAL

The Rural Water Supply and Sanitation Project runs a zonal water laboratory using the multiple tube method for bacteriological water testing. Chemical testing of water is done in laboratories in Kathmandu.

2. SAMPLING ROUTINE OF THE LABORATORY

The laboratory collects samples on regular basis at the rate of 7 samples a week. Number of samples is limited by the method, as one set of samples takes one week to analyze and one set can accommodate 7 samples.

Samples are collected from different types of water supplies to get the overall picture of the factors affecting the water quality. It has been difficult to accumulate enough rainy season samples, as the rainy season is shorter than the dry season, and also the electricity supply has failed several times during the rainy season, spoiling several sets of samples.

3. WATER QUALITY CRITERIA

WHO standards for the water quality have been used to describe the water quality.

<u>WHO standards for bacteriological quality of the rural water supplies:</u>

a) Untreated water entering a distribution system (spring and stream sources of the gravity water supplies)

faecal coliform 0 number/100 ml
total coliform 3 number/100 ml

b) Unpiled water supplies (hand pumps and other wells)

faecal coliform 0 number/100 ml
total coliform 10 number/100 ml

These standards, are however, very strict, as especially the Terai tube wells mostly serve only a few households.

4. SOME CONCLUSIONS OF THE TABULATION OF DATA

Some conclusions can be made looking at the tabulation of the data:

- water quality in tube wells is generally good, better than any other group of sources. Overall percentage of polluted samples only 7 %.

- very shallow tube wells (below 10 m) show some pollution during the rainy season, but hardly any polluted samples were found during the dry season.

- wells with platform seemed to have overall better water qualtity during the rainy season also.

- water quality deteriorates considerably in rivers during the rainy season and is also not good during the dry season. They seem to represent the worst water supply quality of all tested groups.

- water qualtity in open wells also deteriorates considerably during the rainy season, and is also not good during the dry season. Of all Terai sources, this seems to be worst type of water supply.

- spring sources seem to have a big difference between the dry season and rainy season quality, but samples from protected springs are still too few to establish the effect of the protection on the water quality.

Tabulation of the original data is presented below.

OBS! DEFINITION OF POLLUTED HERE IS 1 OR MORE E.COLI IN 100 ml

OTHER SOURCES

Open wells	Dry season		Rainy season		TOTALS	
m	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)
0 - 10	4	23	5	8	12	31
% polluted	17%		100%		39%	

OBS! DEFINITION OF POLLUTED HERE IS 1 OR MORE E.COLI IN 100 ml

	Dry season		Rainy season		TOTALS	
	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)
Rivers	16	44	7	9	23	53
% polluted	36%		75%		43%	

OBS! DEFINITION OF POLLUTED HERE IS 1 OR MORE E.COLI IN 100 ml

All springs	Dry season		Rainy season		TOTALS	
	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)
Springs	3	48	12	31	15	79
% polluted	6%		38%		19%	

(no knowledge about the protection)

FOLLOW-UP OF THE BACTERIOLGICAL WATER QUALITY IN THE TUBE WELLS

Updated on 1.12.1993

Depth of the tube well	Dry season				Rainy season				TOTALS		
	Platform		No platform		Platform		No platform				
m	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	No of polluted samples, 1 or more E.Coli in 100 ml	(Total number of samples)	
0 - 10	2	14	1	42	1	5	4	14	8	75	11%
11 - 20	0	11	0	8	0	3	1	1	1	23	4%
21 - 30	0	22	0	7	4	22	1	6	5	57	9%
31 - 40	0	19	0	10	0	20	1	2	1	51	2%
41 - 50	0	14	0	0	0	16	1	2	1	32	3%
51 - 60	0	2	0	2	0	8	0	0	0	12	0%
61 or more	0	13	1	2	1	7	0	1	2	23	9%
TOTALS	2	95	2	71	6	81	8	26	18	273	7%
% polluted	2%		3%		7%		31%		7%		

MAINTENANCE AND OPERATION POLICIES AND PROCEDURES

1. General

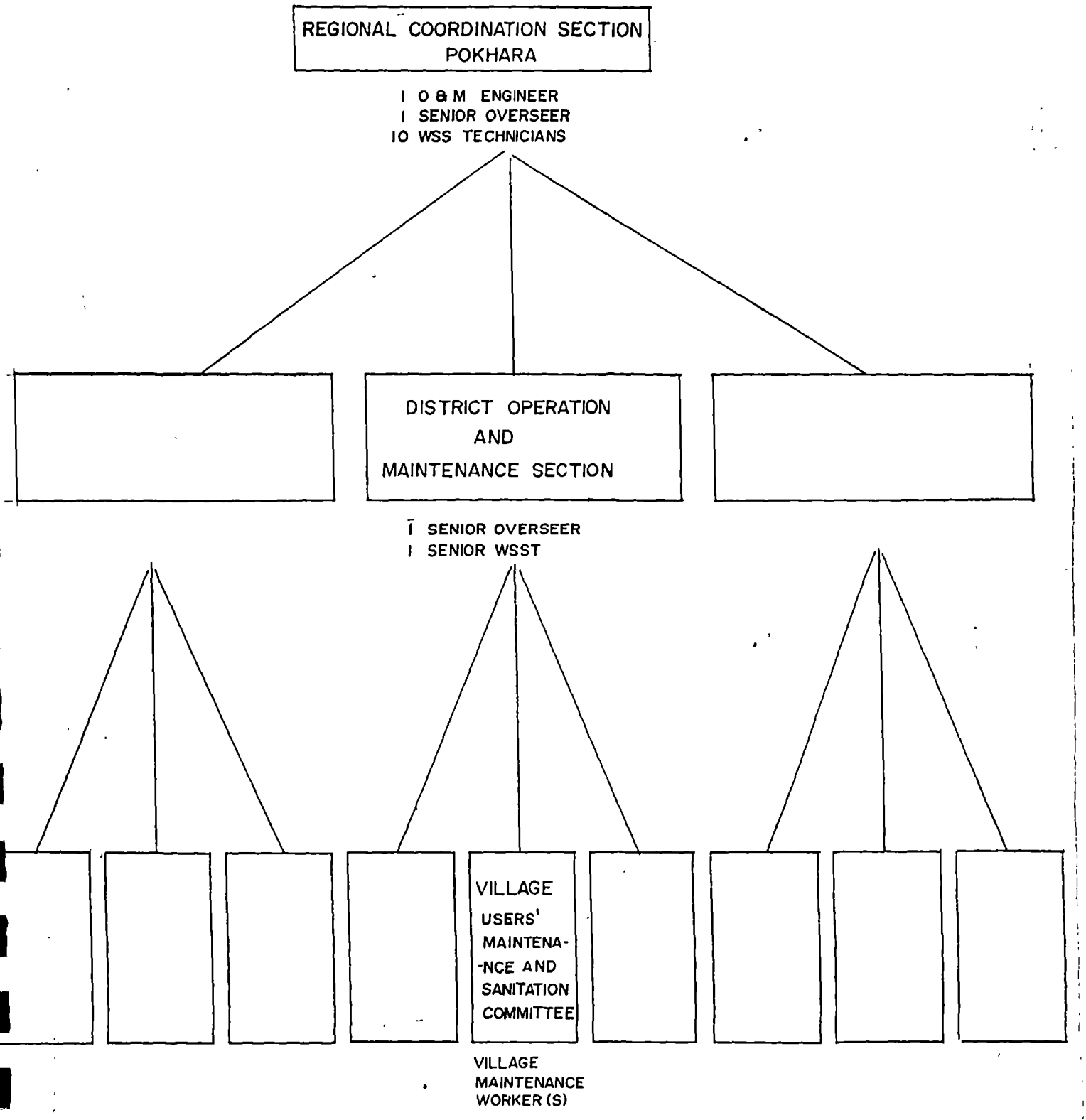
According to the RWSSP field survey, the most common opeation and maintenance problems of the hand pumps were:

- leaking foot valves
- unhygienic surroundigs of the hand pumps due to lack of platform and drainage
- turbid water when pumping due lack of screen in the well casing

Maintenance problems of the shallow tube wells equipped with suction pumps can be easily taken care of by the individual households. The support of the government agencies is mainly needed in the maintenance of pumping, gravity and deep tube well systems.

ORGANIZATIONAL STRUCTURE OF OPERATION AND MAINTENANCE

(HELVETAS 1991, WEST. REGION)



3. Division of responsibilities between the different tiers of the operation and maintenance structure.

1. Regional Operation and Maintenance Coordination Section

- Institutional support to the users' committee (agreements, explaining the responsibilities, public meetings, etc.)
- Regular inspection of the schemes (minimum twice a year). On site training of the village maintenance worker.
- Major maintenance activities (beyond the village's capabilities) whent the district office does not undertake them.
- Training of the village maintenance workers
- Aquisition, storage and transportation to the roadhead of fittings, pipes and other materials not available locally

2. District Operation and Maintenance Section

- Institutional support to the users' committee (agreements, explaining the responsibilities, public meetings, etc.)
- Regular inspection of the schemes (minimum twice a year). On site training of the village maintenance worker.
- Major maintenance activities (beyond the village's capabilities).

3. Village Maintenance and Sanitation Committee

- Day-to-day operation and management of the scheme, including the selection and employment of the village maintenance worker, collection of fees, bookkeeping, organizing the unskilled labour for maintenance work and collection of local materials
- Provision of locally available materials
- Provision of unskilled and skilled labour available in the village
- Organize the preventative maintenance by the users
- Transportation of materials and equipment provided by HMG from roadhead.

3. STORING, PROCESSING AND UTILIZING THE DATA

The collected data should be kept at District Engineer's office and summarized copies should be sent automatically to DWSS Regional office and headquarters and to the LDO as a part of the annual report of the District DWSS. The data and the summary reports should be made available at request to anybody at the DE's office.

4. RESPONSIBILITIES

The overall responsibility for collecting the data should lie with the DE, except for the rainfall data which will be collected and processed by the Meteorological Department as earlier. The other institutions involved in the sector development, such as other government departments and NGO's should submit the relevant required data to DWSS.

5. WATER SUPPLY DATA COLLECTION PLAN

River and Spring Flow Measurements:

V-notches will be installed in the springs and rivers which are planned as potential sources for water supply systems.

The readings will be done in one months intervals by appointed readers or, if the V-notch is at of near a DWSS scheme, by the operator. The recordings are marked on a specific form (Attachment 1) and submitted to DE each trimester. DE keeps a file for each reading and prepares an annual summary with flow calculations on a specific form (Attachment 2) and submits a copy of that to DWSS Regional office, DWSS headquarters and to the Ministry of Water Resources by the end of July, each year.

Operational Data

As a part of the Operation and Maintenance Programme a Operational Status Report will be completed annually at the end the financial year. The report form is in Attachment 3.

For the DWSS schemes, the operator fills the form monthly and submits a copy the O&M Section of DWSS which prepares a status report for each scheme and submits copies to the DWSS Regional office and the headquarters and to the LDO.

For other schemes, mainly managed by the Users Committees, the O&M Section of DWSS office carries out an annual inspection and fill in the Operational Status Report (Attachment 3). A summary of these reports (Attachment 4) is prepared at the end of July each year and submitted to the DWSS Regional office and the headquarters and to the LDO

WATER SUPPLY DATA COLLECTION AND REPORTING PLAN (ONLY GRAVITY SYSTEMS)

1. PURPOSE OF DATA COLLECTION

In order to be able to plan the future water supply development - to identify the needs for improvements and the water resources to be used and to set the priorities - data on the water supply situation and water resources has to be available. The collection and reporting of the data will form part of the process of updating the District Water Supply and Sanitation Plan. Water supply data will also help in planning and organizing operation and maintenance and management of the water supply systems.

Water supply data reporting would be logical to link with the annual reporting procedure of the District Engineer.

2. DATA TO BE COLLECTED

The following data would be necessary:

Water Resources:
- rainfall data
- river flow/spring flow data
- water quality data (selected sources)

Water Supply Operations:
- operational status and operation records of schemes
- operational status and operation records of schemes managed by Users Committees

Water Supply Development:
- completed schemes: system description, implementing agency, financing agency, date of completion, no of users, cost, management arrangement;
- Schemes under construction: system description, implementing agency, financing agency, starting date, estimated time for construction and cost, no of users, management arrangement, status;
- Schemes under design: system description, implementing agency, financing agency, estimated time of construction and cost, no of users, management arrangement, status.

Water Supply Service Level Data:
- number and percentages of the people served by different types of water supplies and their service levels

Development Data

For each scheme completed or under different stages of implementation a Project Status Report will be completed annually or immediately after the completion of the scheme. This is done by the implementing agency or, in case of implementation being done by the community, by the supporting or funding agency. A copy of the report will be submitted to DE who prepares a summary and sends, before the end of July each year, copies of it to the DWSS Regional office and headquarters and to the LDO.

Water Supply Service Level Data

Based on the water supply development data indicating the number of new people being served by improved water supplies and on the Operational Status Report which indicate improvements or deteriorations in the service levels, the DE prepares annually before the end of July a water supply situation report by VDC's with a district summary. This is basically an update of the water supply situation data included in the DWSSP. Copies of the report will be submitted to the DWSS Regional office and headquarters and to the LDO.

Attachments

1. V-Notch measeurement sheet
2. Flow measurement summary sheet
3. Operational status report

ANNEX 9
Attachment 1

V-NOTCH MEASUREMENNT SHEET

Name of the Measuring Point: _____

Type of Water Course: Spring ___ River ___

Name of Measurer: _____

Date	Reading cm	Water: clear/ turbid/ muddy	Rain after previous reading	Leakage (yes/no)	Overflow (yes/no)

Note: Measurements to be taken once a month. Every four months to be filled in a separate sheet and submitted to the District Engineer before 15th of the following month.

ANNEX 9
Attachment 2

FLOW MEARUREMENT SUMMARY SHEET

Name of the Measuring Point: _____

Type of Water Course: Spring ___ River ___

Year: _____

Month	Measurements:										Mean Flow (l/s
	1.		2.		3.		4.		5		
	cm	flow (l/s)	cm	flow (l/s)	cm	flow (l/s)	cm	flow (l/s)	cm	low l/s)	
I											
II											
III											
IV											
V											
VI											
VII											
VIII											
IX											
X											
XI											
XII											

ANNEX 9
Attachment 3

OPERATIONAL STATUS REPORT

Date:
Filled by:

Name of the Scheme:
Type of the Scheme: Gravity piped system __ Point source __
Type of source: stream __ spring ___
Operating Institution: DWSS __ Community with Users Committee __
Community without UC ___ Other,which:

Design population _____ Present population using scheme _____
Design capacity _____ m3/day Present capacity _____ m3/day

No of taps _____ Total lenght of the pipelines _____ m

INTAKE: condition:

PIPELINES: condition:

TAPS: -general condition
-no of broken taps
-no of dry taps

GENERAL ASSESSMENT:

Annual Mean:_____ litres/second

Max. Flow:_____ litres/second

Min. Flow:_____ litres/second

Remarks: