HUMAN RESOURCES DEVELOPMENT FOR AN AFFORDABLE AND SUSTAINABLE RURAL WATER AND SANITATION PROGRAMME

by

Arif Hasan
Allah Javaya
Rashid Khatri

First Draft - 13 January 1994
(for discussion purposes only)

Arif Hasan and Associates, Architects and Planning Consultants
37-D, Mohd. Ali Society, Karachi-75350 Tel: 432361 Fax: 4553964

Abbreviations/Local Terms

Abbreviations:

BHU Basic Health Unit

IDA International Development Agency

LG&RDD Local Government and Rural Development Department

MNA Member National Assembly

MPA Member Provincial Assembly

OPP Orangi Pilot Project

O & M Operation and Maintenance

RTI Research and Training Institute

PHED Public Health Engineering Department

RWSS Rural Water and Sanitation System

UC Union Council

VWO Village Welfare Organisation

Local Terms:

baildar labourer

bazar market

chowkidar caretaker

hari peasant

katcha non permanent

mohalla neighbourhood

otaq guest house

swab blessings

talab pond

tapedar revenue collector

tarai rainfed pond

Contents

Appendices

HUMAN RESOURCE DEVELOPMENT FOR AN AFFORDABLE AND SUSTAINABLE RURAL WATER AND SANITATION PROGRAMME

A. THE EXISTING SITUATION

1. INTRODUCTION

This report is an assessment of existing Rural Water Supply and Sanitation Schemes (RWSS) in Sindh for use of community partici-pation in design, implementation, operation and maintenance (O & M); and preparation of pilot projects based on lessons learnt in the Orangi Pilot Project (OPP), Karachi. The terms of reference of the consultant are given in **Appendix - 1.**

The report is the result of discussions with PHED/LG&RDD officials and their consultants in Hyderabad, Sukkur, Shikarpur and Karachi; desk review of 19 completed or under completion RWSS; visits to 9 completed or under construction schemes and to 6 villages without RWSS; discussions with village communities; and review of existing literature and experiences on RWSS. Places visited and persons met are given in **Appendix - 2.** The team that carried out this work consisted of Mr. Allah Javaya National Country Officer, UNDP/World Bank and Sanitation Program, Islamabad; Mr. Rashid Khatri, Engineer to the OPP-RTI Karachi; and Arif Hasan, Consultant to the World Bank for this mission.

2. RURAL WATER SUPPLY AND THE SINDH SITUATION

2.1 Settlement Pattern

There are over 64,000 villages in Sindh. However, only 1,500 of these have populations of above 1,000. The vast majority consist of 25 households or below. The major problem is to serve these small village clusters with affordable and sustainable schemes.

2.2 Water Sources

Potable subsoil water in Sindh is rear. It is available only in parts of the Shikarpur district and small areas in the Larkana, Sukkur and Nawabshah districts. Elsewhere subsoil water is brackish. However, almost all of the densely populated areas of Sindh are served by canals. These canals are of two types; perennial canals that are closed for desilting for 21 days in a year, and seasonal canals that function for only 4 to 6 months per year. Over 80 percent of Sindh's rural population lives in areas served by perennial canals. Sindh also has extensive arid areas which are thinly populated. Most of these arid areas have almost no reliable source of water except a shallow rain-fed aquifer which often gets depleted in the dry season.
Based on the available sources of water the PHED/LG&RDD has developed 4 types of water supply schemes. These are:

a) Tubewell schemes for areas where potable water is available. Water in most cases is pumped to households through a distribution network.

b) Storage tanks and cholorination for areas where canal water is available. For a perennial source a storage capacity for 21 days is developed which serves the scheme during the canal desilting period. Where the canal is a seasonal one the storage tank has a storage capacity for 2 months and tubewells are sunk between the canal and the settlement tank. These tubewells serve the village during the dry season. Again, in almost all cases water is pumped to household connections through a distribution network. In some cases, water is supplied by gravity flow from overhead water tanks.

c) In arid areas wells are sunk to tap the rain water aquifer. In addition, tarais are developed to harvest and store rain water in depressions.

d) Hand pumps in sweet water zones.

2.3 Government Policy Regarding Rural Water Supply Schemes

Identification of schemes to be built is done by the MNAs and MPAs for their respective areas. The chief minister short-lists these schemes with the help of the politicians. The PHED examines these schemes and selects no more than 200 of them per year. First priority is given to schemes in areas where the subsoil water is brackish, the population is about 1,000 and the development cost per capita does not exceed Rs 2,500. Arid areas have the least priority.

Operation and management costs for 3 months are included in the cost of the schemes. After this 3 month period the schemes are to be handed over to the local bodies who are supposed to raise revenues for their operation and maintenance. However, this seldom happens and the government continues to bear the cost of operation and maintenance.

For political reasons the provincial government initiates the maximum number of schemes even if funds are not available. As a result, schemes that can be completed within a year take upto 4 years, or even more, to be built.

3. DESK REVIEW OF 19 SCHEMES

3.1 Schemes Reviewed

A list of schemes that have been reviewed is given in the matrix given in **Appendix - 3.** Nine of these are tubewell schemes; 3 have a perennial canal as their source; 6 have a seasonal canal as their source; and 1 consists of a shallow well. The findings of the review of these schemes is given in the sub-paragraphs below.

3.2 Design Criteria

There is a standard criteria developed by the PHED on which the schemes have been designed. This criteria is given in **Appendix - 4.** Certain modifications can be considered to enhance the performance of the schemes and reduce the capital and O & M costs. Some of these modifications/observations are given below.

a) As per design criteria, the base year for population projection is 1986, whereas year 1981 population census is considered for population projection. This assumption may lead to incorrect population projection. It is suggested that population projection should be based on actual population.

b) Minimum design population is taken as 1,000, although in certain schemes the design population is below the above figure.

c) Water demand per capita per day has been suggested as 20 gallons, however, it was observed that this figure has been lowered in certain schemes to meet with the source capacity.

d) Raw water storage calculations are proposed on 10 gallons per capita per day, whereas in most of the schemes 20 gallons per capita per day has been assumed. Generally two raw water storage tanks are provided, which are operated in parallel. The performance of these storage tanks may be improved by operating them in series.

e) The minimum size of electric motor installed is 10 HP, whereas the computed HP in most of the schemes is well below the above figure.

f) The pumps are installed on the assumption of 6,000 gallons/ hour and without field investigations. In certain schemes, the water table has gone down and centrifugal pumps have been lowered to draw the water. PHED is now proposing to replace these centrifugal pumps with turbine pumps.

g) Two tubewells per scheme are generally drilled at a distance of 200 feet or even less. Further investigations are required to assess minimum distance between tubewells to avoid interference or even the necessity of having 2 tube-wells of which one is a standby.

h) Water supply schemes where more than 2 tubewells havebeen installed (i.e. 2 working and 1 standby), standby tubewell may be avoided.

i) During field visit to one of the water supply schemes(Dodanko) it was noted that motor RPM was 2910 and pump RPM was 1450, is a mismatch.

j) The design of distribution network and transmission mains is not optimized. For distribution network, looped network is proposed. It is expected that the pipe length in the distribution network may be reduced by adopting looped/ branched network.

k) The distribution network is designed for 4 hours pumping. It appears that motor/pump and the distribution network are over designed.

3.3 Implementation

The implementation of the schemes is done by government approved contractors through a process of

tendering. Progress of work depends on the availability of funds. Since a far greater number of schemes is approved than for which finances are available, schemes take a considerably longer time to complete than is necessary. This results in escalation of costs, problems of quality and difficulty in supervision.

3.4 Operation and Maintenance (O & M) Issues

The PC-1 of most schemes show that the schemes can be operated and maintained by payments of around Rs 20 per household per month. However, in almost all of the schemes reviewed this payment was not collected and no mechanism for its collection had been devised. In addition, the actual costs of operation and maintenance were considerably higher than those stipulated in the PC-1's. Recently, 87 schemes which the PHED was operating were handed over to the Union Councils (UCs). As a result, they stopped functioning and the PHED has had to take them back and run them at government expense.

Normally 4 persons are employed for the operation and maintenance of the scheme. These consist of a caretaker, an operator, a recovery clerk and a baildar. Their collective salaries work out to Rs 4,000 per month. Rs 500 per month is sanctioned for minor repairs. Average electricity costs work out to Rs 3,000 per month per scheme. Thus, the monthly average cost of running a scheme works out to Rs 7,500. This does not include major repairs. A village of 100 households would need to pay Rs 75 per month if the scheme is to function without any government subsidy.

O & M costs can be reduced by employing less persons at the site, reducing number of pumping hours and modifying design criteria and service standards.

3.5 Development Costs

The average development costs per capita, for different type of schemes are given below.

Type of Scheme	Per Capita Cost (Rs)
- Shallow tubewells in the barrage area	403
- Surface water, 21 day storage	1,578
- Surface water, 2 months storage	906
- Shallow well	894
- Deep tubewell	618

The capital costs of different components of the schemes have been worked out in **Appendix - 3** and are summarized below:

Component	Percentage of Total Cost
- Source development	18.34 to 29.08
- Distribution/mains	32.06 to 46.01
- Land	01.87 to 08.55
- Electrification	03.59 to 06.25
- Staff quarters/compound wall	07.58 to 20.73
- Contingencies	10.82 to 15.25

The average capital cost of the schemes can be reduced by well over 60 percent if the village community supplies land free of cost and takes over the development of the distribution system, which can be done incrementally over time; compound wall and elaborate staff quarters are not built; and if contingencies are cut down by making full funds available for the schemes which are sanctioned, even if this means the commencement of a fewer number of schemes.

3.6 Community Participation

There is no element of community participation in the design, implementation, financing and O & M of the schemes. Such parti-cipation is not even envisaged. However, households that connect to the system do so at their own cost and in addition make a lump sum payment of about Rs 130 for the connection. This is the only payment that is collected from the community.

However, in the IDA financed RWSS attempts at forming Village Welfare Organisations (VWO) for financing and managing the O & M of new and existing schemes, are being made. At Khandu village, near Hyderabad, the IDA-RWSS community participation team has initiated a dialogue with the community and a part of the community supports the concept proposed by the Programme. The Programme envisages 7 steps spread over a period of about 5 months that have to be taken with the community. In addition, the Programme components consist of water supply, sanitation and hygiene education. In the OPP's experience communities cannot follow long procedures and there should be no more than 3 steps. In addition, OPP's experience has taught it that communities can only receive and react effectively to one message at a time. Therefore, water supply has to be followed by sanitation, and sanitation by a health programme.

4. VISIT TO 9 COMPLETED SCHEMES

4.1 Choice of Schemes

The team visited 9 completed schemes. An attempt was made to visit schemes that were as different from each other as possible. Thus, 2 tubewell schemes, 4 surface water schemes, 1 hand pump scheme, 1 sullage works scheme, and 1 cluster of schemes serving arid areas were visited. These schemes were in the Hyderabad, Sukkur, Rohri, Shikarpur and Karachi divisions of the PHED. Unfortunately, no surface water scheme on a seasonal canal could be visited as the PHED office in Shikarpur said that the areas where such schemes were located were unsafe for traveling in. Again, an attempt was made that the villages served by the schemes should also be demographically different from each other and at different distances from the main roads. A brief description of important aspects of the schemes and villages is given in the sub-paragraphs below.

4.2 Khandu Village

Khandu village is in the sweet water zone on the main National Highway, a few kilometers from Hyderabad. It is a tubewell scheme. It was completed in 1990 and has been operated and maintained by the PHED till March 1993. During this period, it has been inoperative for 2 periods of 7 to 10 days each. No payments for O & M have been recovered from the users. The scheme is now with the UC and they intend to charge Rs 15 per household per month for residential connections and Rs 30 for commercial connections. The monthly O & M costs, not including major repairs, work out to about Rs 7,000. The villagers claim that there are about 400 households in Khandu. However, there are only 179 connections. Thus, the scheme is sustainable, if government covers the costs of major repairs and an average charge of Rs 40 per connection per month is levied. The villagers spoken to consider this charge as excessive and are unwilling to pay more than Rs 20 per month. The current unpaid electricity bill is Rs 104,947 and electricity is to be disconnected in the next few days. The UC does not have funds for paying this charge and is unable to collect it from the users.

Before the scheme, water was drawn from 8 hand dug wells and later by hand pumps. A large number of households still use hand pumps and the costs of installing one is Rs 2,500. O & M of hand pumps works out to about Rs 125 for a 6 to 8 months period, or about Rs 15 to Rs 20 per month.

The village is semi-urban in character. It has 11 clans living in it. Each clan has its own neighbourhood or mohallah. A number of residents would have preferred to have decentralized neighbourhood schemes that their clans organisations could maintain. Many residents said that if the scheme became inoperative they would go back to using hand pumps rather than pay exhorbitant charges.

The community participation unit of the IDA financed RWSS has visited the village and attempted to form a VWO consisting of 1 member from every mohallah. The VWO would manage and operate the scheme and each member would have the responsibility of collecting payments from his clan members. The village seems to be evenly divided for and against this proposal. The people more actively concerned with village level issues seem to be shopkeepers and traders.

4.3 Kara Khoh Village

Kara Khoh village is about 5 kilometers from Kotri near the River Indus. The scheme is a surface water one. Water is pumped from the Kalri Bagar Canal to storage tanks and then pumped into a distribution system. The scheme was set up in 1987 and until a year and a half ago it was with the PHED. During this period the government paid all O & M costs. The UC now operates the scheme at its own cost. Recently it has imposed a charge of Rs 10 per household per month for O & M purposes. However, there are only about 100 houses in the village and about 70 of these have connections. The average cost of running the scheme is about Rs 7,000 per month. To be sustainable, the users would have to pay Rs 100 per month if the government bears the costs of major repairs. The villagers are unwilling to bear this cost and would very much prefer to have a lower level of service and pay no more than Rs 15 per month. The village lies in the Bolari UC. This is a rich UC and has a revenue of Rs 29,000,000. The villagers feel that the UC can afford to give them water at subsidized rates if not free of cost.
Before the water scheme became operative people collected water from a katcha tank which was fed by gravity from a water channel. In the opinion of the team, this tank could have been improved and a water scheme around it could have been developed.

The village consists entirely of the Mohana community and is fairly affluent by rural Sindh standards.

4.4 Nur Khan Chand Village

Nur Khan Chand village is 3 kilometers from Hyderabad on the National Highway. The scheme is under construction and is part of the IDA financed RWSS. It is a surface water scheme. Water is pumped from a nearby canal into 2 settlement tanks and then pumped into a distribution system. A VWO has been formed. The organisation consists of 11 members, each representing a mohallah of the village. The 11 members have chosen a chairman by consensus. The organisation is not yet fully operative and attempts at collecting money have not been as successful as was envisaged. The activists and the most aware persons in the village seem to be primary school teachers.

At present water is acquired by most houses by donkey carts from the nearby canal. However, the people at their own cost have also erected a water tank into which water is pumped from the canal and then distributed to individual underground water tanks in a number of houses through gravity flow. These houses are satisfied with this arrangement. Again, a number of villagers seemed to prefer the creation of decentralize mohallah level water supply systems of this sort.

4.5 Dadanko Village

Dadanko village is in the Arore UC. It has a population of 965. The villagers claim that there are about 150 households in the village. It has a surface water scheme which was completed in 1990. Water is pumped from a canal to 2 storage tanks in the village and then pumped into a distribution system. The canal source is about 2.25 kilometers away from the village. A closer source was available from a water channel near the village. However, land for setting up a pumping station could not be acquired and the landlords who used the water channel were unwilling to give water for the water scheme.

So far the scheme has been with the PHED and the government has paid O & M costs. However, when the scheme becomes inoperative and requires minor repairs people collect money and arrange to get the scheme functioning again. This work is organised by a voluntary organisation established by primary school teachers.

Actual costs of O & M per month are not available. However, there are 6 employees for the water works and 2 pumping stations. As such the O & M costs should be in the neighbourhood of Rs 10,000 per month. If 100 household connect to the system, they would have to pay Rs 100 per household per month as O & M

charges, provided government bears the cost of major repairs. The villagers are not willing to pay more than Rs 20 per month. They say that if the scheme becomes inoperative they will go back to digging wells and collecting water from water channels.

Many villagers said that they would prefer a lower level of service at Rs 20 per month than the present level at Rs 50.

4.6 Bux Khatpar Village

Bux Khatpar village is 19 kilometers from Rohri. The situation here is identical to that of Dadanko except that the water source is a kilometer away. Before scheme was established people collected water from water channels.

4.7 Abad Village

Abad is a large village, semi-urban in character. It is a 15 minute drive from Rohri. It is in the sweet water zone. Villagers claim that over 65 percent of the population has pumps in their homes. Of these half are reciprocating pumps and the rest hand pumps. Households that do not have pumps get water from their neighbours. Abad has a large bazar, workshops and a sizable number of traders.

The team visited the sullage works at Abad. The O & M costs of the works is about Rs 10,500 per month. The effluent from the works is used extensively by farmers for growing vegetables. The team feels that the sullage works could be auctioned out to an entrepreneur who could operate and maintain them and recover revenues with profit by selling the effluent to the farmers. In addition, the works could be operated by the private sector at less than half the current cost.

4.8 Miandad Khoso Village

Miandad Khoso village is 7 kilometers from Sukkur in the PHED Sukkur Sub-Division I. It has a population of 3,325. Its water scheme is based on two tubewells. The tubewells are over one and a half kilometers from the village. This is because the PHED could not acquire 1.25 acres of land for the water scheme nearer to the village. However, 1.25 acres for the scheme is excessive.

Initially PHED installed centrifugal pumps on the two borewells and todate these pumps have been lowered by about 10 feet to tap the underground water.

Water is pumped into a distribution system and from there to house connections and community tanks. Due to lowering of centrifugal pumps, the total head on the distribution system has been reduced. The community has installed suction pumps on the main distribution lines, so the water is not reaching the remote points and hence all the community tanks are in disuse.

The water scheme often fails. The PHED carries out repairs but not promptly. When long delays take place the wadera collects money from the people and gets the repairs done. The technical know-how for minor repairs is available locally. During the period that the scheme is inoperative, people go back to collecting water from water channels and hand pumps, which many households still retain. However, over the years the subsoil water has become progressively brackish due to waterlogging and salinity.

The Miandad Khoso scheme is a part of the rehabilitation programme of the IDA financed RWSS Programme. PHED is planning to replace the centrifugal pumps by turbine pumps. However, so far the villagers do not seem to be aware of the Programme. Again, the school teachers in the village are more open to new ideas and concepts than the other villagers.

4.9 Ali Khan Khoso Village

Ali Khan Khoso village is a 15 minutes drive from Rohri. A hand pump and sanitation scheme by the RDD has been initiated here through the IDA funded RWSS project. The village consists of about 600 households. 60 percent of these have installed their own hand pumps. The cost of installing a hand pump, according to the villagers, is Rs 1,200. Those villagers who do not have hand pumps collect water from their neighbours. This does not seem to be a major problem. Villagers say that they spend upto Rs 120 - Rs 150 per year on maintaining the hand pump.

The RDD has installed a hand pump near a mosque in the village. The cost of installing this hand pump is supposed to be Rs 12,000. The houses near the hand pump, which do not have their own pumps, use this facility. However, the houses away from it continue to collect water from their neighbours. The community members spoken to do not see any reason why they should install community hand pumps at Rs 12,000 per pump at their own cost.

A demonstration latrine has also been built in the village. The villagers have been told that its cost is Rs 15,000. It is well maintained and is constantly used. However, villagers so far see no reason to build community latrines at their own cost. They would prefer to build latrines in their homes and spend no more than Rs 700 on them. Experience tells us that this is possible.

The village has a VWO. However, the villagers claim that it is inactive and its shape and form was decided in a meeting attended by no more than 20 persons.

4.10 Water Schemes in Gadap UC, Karachi

The Gadap area is about 40 kilometers from Karachi. It is an arid area where the subsoil water is constantly falling due to mechanical extraction for agricultural purposes. In many areas sweet water has been depleted and the tubewells have become saline. Two water schemes were visited by the team in the Gadap UC.

A PHED scheme, which has not yet become operative, has been built for Gadap town. Gadap has 400 houses. The scheme consists of a tubewell which will pump water to individual house connection through a distribution network. At present people get water from an existing tubewell which is owned by a farmer. Donkey carts carry water to the people's homes and charge Rs 10 per trip. There was a possibility here of getting the farmer who owns the tubewell to operate it commercially.

The other water scheme was established in 1987 under the Prime Minister's Five Point Programme of the Junajo government. It serves 2 villages; Ghulam Mohammad Jokhio village which has 200 houses in it, and Haji Sain Rakhio village which has 300 houses. The scheme consist of a hand dug well which pumps water to surface distribution tanks in the villages. The villagers claim that the scheme has never worked at all. However, since 1987 a caretaker of the PHED is employed at the scheme.

At Haji Sain Rakhio village an individual has established a bore from where the families collect water and those who can pay to hire donkey cart to supply them with water. Again, there is a possibility of getting an entrepreneur to develop a water scheme for the village and operate it commercially.

At Ghulam Mohammad Jokhio village, 25 families have got together and dug a well 120 feet deep. They have installed a reciprocating pump and intend to build a storage tank eventually. However, they need technical advice and guidance.

In Konkar Village there is also a government scheme which operates erratically. In addition, there is a private bore which was installed by Dr. Shamsuddin, the village doctor. In 1980 Dr. Shamsuddin spent Rs 100,000on this bore and its necessary mechanical components. Donkey carts buy water from this bore and sell it to individual households. The payment from the donkey cart owners pays for the electricity charges. Individuals collecting water and carrying it manually to their homes do not pay a charge. Dr. Shamsuddin replaces the pump to the bore almost annually. He purchases old machinery from scrap dealers and needs technical advice on pump and motor specifications and pipe sizing.

5. VISIT TO 6 VILLAGES WITHOUT WATER SCHEMES

5.1 Choice of Villages

The team visited 6 villages that have no water schemes so as to choose 3 of these for pilot project sites. The choice of the 6 was made on the basis of size of the village, distance from main road, water source and sociology. An attempt was made that these factors should be as representative of the Sindh situation as

possible. The sites visited are near Hyderabad, Sukkur, Shikarpur and Karachi. The Orangi Pilot Project (OPP) is working in all these towns and so it would be easier for it to operate pilot projects at these locations.

5.2 Kirar Solangi Village

The village is located 5.5 kilometers from Hyderabad off the National Highway. It has a population of about 1,100 living in 125 - 150 houses. People collect water from a water course that operates once every 8 days. On other days water is collected from depressions that the communities fill from the water channel when it is operative. Subsoil water is at 20 - 25 feet and is brackish. The village had established a system of water supply which is now out of order. Water was pumped from a bore near a canal about 1.5 kilometers from the village. This bore is 40 feet deep but the water is hard and the villagers prefer to use the water of the water course. The electricity bill for pumping is paid by a local tapedar so that he can get sawab. The village has no BHU but does have a primary school.

The villagers are willing to accept separate underground water tanks in each mohallah from where they can draw water by hand pumps installed on the tanks. They understand fully well that this system can be improved on a self-help basis by installing pumping facilities on the tanks and a pipe distribution system from them.

5.3 Darya Beg Mughal Village

The village is 7.5 kilometers from Hyderabad in Deh Hatri. It has a population of 2,000 and a number of small clusters around it. The subsoil water is brackish except for near the canal and is at a depth of 50 feet. People collect water from a water course about 500 meters from the village. The water course is below the ground level and water has to be pumped from the water course for agricultural purposes. Two pumps are operated individually by landlords who recover their O & M costs from other agriculturalists who use this water. So the system of selling water for agricultural purposes exists and is understood.

Most of the population is involved in agriculture. There are no big landlords. A number of residents are employed in government service. There is a primary boys and girls school, a middle school and a BHU. A number of girls and boys study at a high school in a neighbourhood village. The village is electrified.

There is a major man-made depression in the village which has now become a cesspool. Originally, it was the village talab or pond where water was stored before the canals became perennial. Water can be channelized from the water course to this talab by gravity flow.

The village population consists almost entirely of Syed and Mughals. There is a social welfare organisation managed by school teachers and clerks. Qurban Ali Shah is a possible contact. Darya Beg Mughal is a typical semi-developed Sindhi village. An increasing number of villages will become like it in the not to distant future.

5.4 Saleh Dal Village

The village is 17 kilometers from Hyderabad and 5.5 kilometers off the National Highway. The population of the village is about 1,500 and the number of households is around 200. Water is acquired by hand pumps but the villagers complain that it is hard and has a taste of oil. In certain areas it has become brackish due to waterlogging and salinity. At less than half a kilometer distance there are 2 canals and many families prefer to get water from them. The water level in both the canals are higher than ground level and can be carried to settlement tanks in the village by gravity flow.

70 percent of the village population work as haris and agricultural labour. 20 percent of the population owns land. The rest are government servants, traders and shopkeepers. There are 6 clans in the village each having their own mohallas.

The villagers are not averse to having separate underground water tanks for each mohallah with hand pumps on them. They understand that this system can be upgraded through self-help as and when the community has the resources.

There is no BHU in the village but a primary boys and girls school does exist. There is no community or social welfare organisation either. Possible contact are Jan Mohammad, shop-keeper; Mir Mohammad Dal, land owner; and Abdul Haq, owner of a hotel in the main bazar.

5.5 Garo Goth

Garo Goth is 30 kilometers from Rohri. According to the villagers it consist of just over 200 households. The canal source is about 2 kilometers from the village. The village acquires water from a large pond that is fed by a water channel that operates once in 8 days. The villagers have constructed this pond and the landlord has provided land for it free of cost. An electric motor has been installed on the pond to feed the mosque and the wadera's house and otaq or guest house.

Almost all the residents are agriculturalists. There is a primary school for boys in which some girls also study. There is no BHU. The village has a carpenter and a blacksmith but no other skilled artisans. There is a social welfare organisation called "The Young Junejo Welfare Association" of which the active members are primary school teachers.

Garo Goth is a typical backward Sindhi village and the villagers seem willing to accept a water scheme developed around improve-ments in the pond and a distribution system from it.

5.6 Darwaish Kakaputa Village

The village is in the Shikarpur Sub-Division I of the PHED. The population of the village is about 2,400 living in over 300 houses. The nearest canal source is 2.5 kilometersfrom the village. Half the village has a sweet subsoil aquifer and in the other half the water is brackish. The residents living in the brackish zone collect water from a water course that operates once in every 10 days. When the water course is not in operation, they collect water from depressions near the water course.

The village has a primary boys school which functions at the otaq. There is no girls school. A BHU has been constructed but does not function. All village residents belong the same clan.

5.7 The Gadap Sites

58 kilometers from Karachi there is a small cluster of villages in the arid zone. These villages are: Rozi Ghundar with 25 - 30 houses; Nausherwan with 10 - 12 houses; Parpia Ghundar with 15 - 20 houses; and Hayat Ghundar with 15 - 20 houses. This adds upto 65 to 80 houses. All these villages are in the Gadap UC. The terrain is hilly and is typical of much of the arid areas of Sindh. The settlement pattern is also typical.

Water is acquired by this cluster from a hand dug well in a dry river bed. This well is about half to one kilometer from the different villages and the water in it becomes insufficient during the dry season. A sub surface dam at an appropriate place in the dry stream with a hand pump next to it, could be a possibility of improving water supply. A provision of a donkey cart to be used commercially by an enterprising villager would ease the supply situation considerably.

In the Gadap area there are a number of villages which acquire water for domestic purposes from agricultural tubewells and are most unhappy about it as they become the dependents of landlords as a result. The possibility of giving credit to an entrepreneur for making a bore and operating it commercially is already being looked into by the OPP.

6. CONCLUSIONS FROM DESK REVIEW AND FIELD VISITS

6.1 Small Villages

The vast majority of rural residents live in clusters of small villages. If RWSS has to be effective some sustainable manner of serving these small clusters has to be developed. At present their requirements are almost totally ignored.

6.2 Policy Issues

a) There is no need to provide water schemes in the sweet water zones. Individual households in most cases are capable of installing and maintaining a hand pump. Many can also afford to tap the aquifer mechanically. It is necessary, however, to assist in developing the skills for installing and maintaining hand pumps and improvements in their design and manufacture.

b) In the arid zones, wherever possible, water harvesting as opposed to the tapping of the subsoil aquifer should be resorted to. If that is not possible, arrangements should be developed so that only a limited amount of water can be extracted mechanically so as to preserve the aquifer from depletion.

c) The existing water supply systems in the village should be studied before designing a scheme. The priority, as far as possible, should be to improve these systems or develop schemes around them.

d) A lower level of service than what is provided today through the PHED schemes, should be developed initially, with the possibility of improving the system incrementally over time through self-help.

e) Full financing for the schemes that are initiated should be provided, even if it means commencing fewer schemes. This will save on contingence costs.

6.3 Design Criteria

The design criteria for new schemes needs to be reviewed as suggested in paragraph 3.2 of the report. If the policy modifi-cations suggested in paragraph 6.2 above are accepted, a new criteria will have to be evolved.

6.4 O & M Issues

a) Communities seem unwilling to pay more than Rs 20 - Rs 25 per month for the O & M of the schemes. However, there are a number of households in every village that are willing to pay substantially more.

b) Many villagers seem to prefer a decentralized system where O & M can be managed by their neighbourhoods rather than by the whole village.

c) The necessary technical skills for O & M of water schemes need to be developed at the village level. This will lower maintenance costs and increase the efficiency of the scheme.

d) The financial and technical sustainability of O & M of the scheme should govern its design and the level of service that is to be provided.

e) Community involvement in financing, designing and managing the construction of a scheme, or part of it, will guarantee its O & M by the community. This has been seen in the water schemes visited by the team, which people have constructed themselves.

f) O & M staff at the scheme can be lowered considerably. There is no need for a recovery clerk, a chowkidar or a baildar if the community is involved in looking after the scheme. The operator can also be employed on a part time basis if he is already earning his livelihood in the village doing something else.

6.5 Land for Water Schemes

1.25 acres of land is purchased for the water schemes by the PHED. 1.25 acres is excessive and in most cases less than 0.33 acres would be sufficient. Land should not be acquired but should be donated by the village for the scheme. If an individual donates the land, the only compensation he should get is that a member of his family should be trained and employed as the operator of the scheme. A similar procedure has been followed for school buildings in many parts of Pakistan, where a member of the family that donates the land becomes the chowkidar of the school. The system seems to work.

6.6 Pump House, Compound Wall and Staff Quarters

The design of the pump house and the staff quarters in the PHED schemes can be simplified considerably and hence made much cheaper to construct and to maintain. This can be done without compromising on durability and quality. Similarly, the team feels that if the village community owns the scheme, there is no need for a compound wall around it. A low wall/fencing on the retaining walls of the storage tanks can be constructed to prevent animals from getting to them.

6.7 Canals and Storage Tanks

Instead of constructing storage tanks for the 21 days desilting period, part of the canals can be converted into temporary storage ponds for this period by constructing gates at the intake point. This will lower costs further. However, the implication of this suggestion needs to be discussed with the Irrigation Department and their acceptance acquired.

6.8 Community Responses

From conservations with the communities it is obvious that they will accept a lower level of service if they have no other option. They would also prefer to operate and maintain water schemes themselves provided O & M is affordable to them. However, they, or at least some of the households, would like to have the possibility of upgrading the system over time. There seems to be a general feeling in the villages which have been visited that the government schemes will not function without government funding and that such funding is not going to be available in the near future. In addition, in most of the villages visited, people prefer to have decentralize system for their individual neighbourhoods rather than a village level system.

6.9 Community Activists and Organisations

In the larger villages visited by the team, the community activists seem to be shopkeepers and traders. In the smaller villages they are school teachers and government employees. In half of the villages visited there were social welfare organisa-tions, most of them based on clan relations. These organisations concern themselves with births, marriages and death rituals and in supporting widows and orphans.

B. THREE PILOT PROJECTS

7. PROJECT SITES

Three proposed project sites are:

a) Mirza Beg Mughal village in Deh Hatri, Hyderabad. The village has a population of about 2,000 and a number of small clusters around it. The water source is a water channel about 150 meters from the village. A detailed description of the village is given in paragraph 5.3.

b) Garo Goth, about 30 kilometers from Rohri. The village consists of about 200 households. The water source is a pond that is fed by a water channel that operates once in 10 days. A detailed description of the village is given in paragraph 5.5.

c) A cluster of 4 small villages in Gadap, 58 kilometers from Karachi. Number of household is between 65 and 82. The source of water is a well in a dry river bed about half to one kilometer from the villages. The cluster has no elect-ricity. A detailed description is given in paragraph 5.7.

8. STRATEGIES

8.1 Actors Involved

The actors involved in the pilot projects will be the government of Sindh (LG&RDD/PHED), the village communities and the OPP-RTI. They will work as partners in development.

8.2 Institutional Arrangements

A project coordinator will be appointed for the three pilot projects. He should be a PHED official. His role will be to facilitate the project and liaison with actors involved assisted by OPP. In addition, the PHED will depute the engineer of the sub-division in which the project is located to design and supervise the implementation of the water and sanitation schemes. Whenever necessary he will be assisted by a senior design engineer of the PHED.

The OPP will depute one engineer cum social organiser for the project. He will work with the PHED staff and the village community. He will be assisted as and when necessary by the technical staff and social organisers of the OPP.

The UNDP/World Bank, Regional Water & Sanitation Group for South Asia will facilitate the government sector agencies, external support agencies, the government of Sindh and the OPP in the implementation of these pilot projects. For this purpose it will assign an engineer whose advice and support can be sorted by the pilot projects as and when necessary.

A site office will be established at each pilot project. This will be staffed by two social organisers recruited from the community and a surveyor (trained by the OPP) who will also be recruited from the village residents. Project office costs will be allocated to and disburse through the OPP-RTI.

8.3 Process of Development

The OPP will assist site office to motivate and help village communities and coordinate the PHED staff and/or local councils to work together to develop sustainable water supply schemes. To this end it will train government officials and community members in its concept of development through community participation at the OPP-RTI in Karachi and at the pilot project sites. Once the water supply schemes are implemented the LG&RDD/PHED, OPP and the community will work together to develop a peoples financed and managed sanitation and drainage system in which developing the disposal arrangements alone, will be the financial responsibility of the government agencies. At the same time as the sanitation programme commences, the health department staff will receive training at the OPP-RTI to carry out a health education programme at the pilot projects. These pilot projects will then become demonstration and training areas for similar programmes for other villages. The necessary training for scaling of the programmes will continue to be given at the OPP-RTI in Karachi. If further OPP involvement is required at the new sites, a new agreement for that can be negotiated.

9. ASSUMPTIONS

The proposal for the pilot projects is based on the following assumptions.

- No other community participation programme which are "softer" than the strategies develop for the pilot projects will be in operation when the pilot projects are being implemented. If that has not happened the village communities will not collaborate.

- The LG&RDD/PHED engineers and staff will accept the OPP concept of community participation as developed in Orangi and other sites where the OPP is working.

- The LG&RDD/PHED and OPP will be able to get expert technical advice (engineering and hydro-geology) in new and innovative technologies from the RWSG-SA.

- The problem of logistics will not be a constraint in the development and implementation of the pilot projects. The OPP staff will hire its own vehicles as and when necessary.

- The government of Sindh will give full political support to the pilot projects and will not initiate any policies that jeopardize the projects.

10. ACTIVITIES

- Orientation of LG&RDD/PHED officials and local councillors (who will be involved with the projects) in the OPP concept of community participation. This orientation will be arranged at the OPP-RTI in Karachi.

- Visit to the sites by the LG&RDD/PHED and OPP staff and holding of meetings with the village communities leading to the selection of social organisers and surveyors. These will be trained at the OPP-RTI in Karachi.

- Holding of discussions between the community, LG&RDD/PHED and OPPto decide on the concept of the projects.

- Based on the concept the LG&RDD/PHED and the OPP-RTI will develop the technology and procedure for implementing the project. Detailed design and estimates for the water supply system will be developed by LG&RDD/PHED in coordination with OPP-RTI.

- A site office will be set up and the staff will be appointed for social organisation and coordination.

- The role of the community in the project will be decided through dialogues and discussions and they will be trained and given advice for part financing, managing, operating and maintaining the system.

- A system of monitoring the pilot projects will be established through the dialogue between the government agencies, OPP and the community. Each actor in the programme will monitor its own work.

- The government agencies assisted by OPP will supervise the work being done for the development of the source, which is the responsibility of the government. Site office, with the help of the government agencies and the OPP will supervise and help implement the distribution network or whatever is decided in its place.

- The same procedure as the above will be followed for the sanitation programme after the water supply schemes have been built. No extra staff or additional site office will be required for the sanitation programme.

- A health education programme will be developed for the pilot project with the help of the district health department and the site office in the village.

- OPP staff, consisting of three persons will visit the pilot projects for 2 days in a month for the first 6

months and after that for 1 day in a month.

11. TIME FRAME

It is difficult to spell out a definite time frame for the pilot projects as their development depend very much on the acceptability of the government agencies and the communities of the OPP's development through community participation concept. However, it should not take more than 2 years to complete the water supply and part of the sanitation component and to initiate the health education programme. An approximate timetable is given below.

- Orientation of LG&RDD/PHED officials and local councillors and appointment and training of social organisers and surveyors.	4 months
- Holding of discussions between community, government agencies and OPP leading to a decision on the concept of the projects. Establishment of site offices.	3 months
- Design of the schemes and cost estimates and identification of the role of the community.	3 months
- Implementation of water supply scheme	8 months
- Initiation of sanitation programme	2 months
- Initiation of health programme	2 months
- Conversion of projects into training centres	2 months
	Total : 24 months

12. OUTPUTS

The pilot project outputs will be as under.

- A water supply scheme which will be operated and maintained by the community provided the development and maintenance of the water source is done by the government at the expense of the community or partially at its expense. An attempt will be made to develop the necessary technical, financial and managerial capacity within the community to take over the complete O & M of the system.

- The development of a sanitation programme that can be financed, managed and implemented by the villagers provided the disposal and related works are developed and maintained by the government at the expense of the community or partially at its expense. An attempt will be made to develop the necessary technical, financial and managerial capacity within the community to take over the complete O & M of the system.

- The development of trained persons in the village who can motivate and organise communities and operate and maintain water supply and sanitation schemes.

- The transferring of OPPs concept of development through government-community partnership to relevant government departments.

- The creation of demonstration and training areas at the pilot projects to help in the scaling up of the concept and its implementation.

- The development of training material based on the documen-tation of the projects. This will be in the

form of manual, photographs and slides.

- The initiation of a health education programme with the health department which they can develop further and replicate.

13. MONITORING INDICATORS

There are no set monitoring indicators except that the project should be able to develop as has been set out in the paragraphs above. For monitoring purposes the OPP staff member who will be assigned full time to the project, will prepare detailed reports on his site visits and dialogues with the communities. The social organisers will be encouraged to maintain diaries of their activities, problems and community responses. In addition, the OPP staff member will photograph the progress of work and will teach the social organisers how to document their work photographically. The director of the OPP-RTI will prepare a quarterly report based on the above documentation. The major monitoring input will consist of regular meetings between the OPP staff member, government agencies representatives and social organisers and the documentation of these meetings. Often these meetings will be attended by the director and/or joint director of the OPP-RTI and senior OPP social organisers.

14. BUDGET FOR THREE PILOT PROJECTS - 2 YEAR PHASE

14.1 Abstract

Item	Year-1 (Rs)	Year-2 (Rs)	Total (Rs)
a) **OPP-RTI consultancy fee** at Rs 300,000 per year per pilot project	**900,000**	**900,000**	**1,800,000**
b) **OPP-RTI direct costs**	**1,353,300**	**958,235**	**2,311,535**
i) 3 site offices	(204,600)	(240,465)	(445,065)
ii) Training at OPP-RTI 3 groups/21 persons/ 105 persons per day	(200,000)	(200,000)	(400,000)
iii) On-site training	(215,400)	(247,710)	(463,110)
iv) Project office at OPP-RTI	(739,000)	(223,830)	(962,830)
c) **Development costs for water supply**			**3,108,750**
d) **Development costs for sanitation/drainage disposal**			**1,554,375**
Total:	**2,253,300**	**1,858,235**	**8,774,660**

14.2 Details

a) **OPP-RTI consultancy fee** at Rs 300,000 per year per project for 2 years **Rs 1,800,000**
per year per project for 2 years

b) **OPP direct costs**

i) **3 site offices**

Item	Year-1 (Rs)	Year-2 (Rs)	Total (Rs)
- Salaries of 2 social organisers at Rs 1500 per month	36,000	36,000	72,000
- Salary of 1 surveyor at Rs 1500 per month	18,000	18,000	36,000
- Office rent at Rs 600 per month	7,200	7,200	14,400
- Stationary, postage, photocopies etc. (overheads)	4,500	6,000	10,500
- Extension literature	2,500	2,500	5,000
- Inflation at 15 %	-	10,455	10,455
Total for 1 site office:	68,200	80,155	148,355
Total for 3 site offices:	**204,600**	**240,465**	**445,065**

ii) **Training at OPP-RTI** **200,000** **200,000** **400,000**

3 groups of 21 persons. Total of 105 persons per day inclusive of TA/DA of trainees at about Rs 1900 per person/day

iii) **On-site training visits**	Hyderabad (Rs)	Sukkur (Rs)	Karachi (Rs)
- Travel cost: 2 visits per month for first 6 months and then 1 visit per month of 1 day each	30,000	70,200	Included in project office transport costs
- Local transport at Rs 800 per day for 18 days	14,400	14,400	
- Accommodation at Rs 500 per day (54 days)	27,000	27,000	
- TA/DA at Rs 280 per day for overnight stay of Rs 100 per day for day stay	13,500	13,500	5,400
For Year 1:	84,900	125,100	5,400

Total for Year 1 : Rs 215,400

Total for Year 2 (Year-1 + 15 % inflation) : Rs 247,710

Total for 2 Years : Rs 463,110

iv) **Project office at OPP-RTI**	Year-1 (Rs)	Year-2 (Rs)	Total (Rs)
- Project coordinator (engineer cum social organiser will also document and monitor the project) at Rs 5,000 per month.	60,000	60,000	120,000
- Technical back up	50,000	50,000	100,000
- Transport vehicle for Karachi/Hyderabad sites	450,000	-	450,000
- POL/maintenance at Rs 2,000 per month	24,000	24,000	48,000
- Driver at Rs 2,000 per month	24,000	24,000	48,000
- Stationary	2,000	2,000	4,000
- Photography/printing	2,000	2,000	4,000
- Audio visual	2,000	2,000	4,000
- Survey instruments, tools, shuttering	100,000	-	100,000
- Misc./contingencies	25,000	25,000	50,000
- 15 % inflation on total	-	34,830	34,830
Total:	**739,000**	**223,830**	**962,830**

c) **Government share of development cost of water schemes:**

	Population	Cost per Capita (Rs)	Development Cost (Rs)
- Darya Beg Mughal	2,000	750	1,500,000
- Garo Goth	1,500	750	1,125,000
- The Gadap cluster	645	750	483,750
		Total:	**3,108,750**

The cost of development has been taken as 50 percent of average PHED costs for water schemes. This works out to Rs 750 per capita.

d) **Development cost of development of sewage/drainage disposal:**

	Population	Cost per Capita (Rs)	Development Cost (Rs)
- Darya Beg Mughal	2,000	375	750,000
- Garo Goth	1,500	375	562,500
- The Gadap cluster	645	375	241,875
		Total:	**1,554,375**

The cost of development has been taken as 50 percent of average of PHED costs for drainage and sullage works. This works out to Rs 375 per capita.

e) LG&RDD/PHED will bear the costs of their inputs into the pilot projects.

15. SCALING UP OF THE PILOT PROJECTS

The scaling up process can begin as soon as one of the water schemes is completed. Activists from other villages along with local councillors and engineers or other sub-divisions can visit the sites and be explained the process of development and implementation. The OPP-RTI can continue to play the role of an orientation and training agency through its office in Karachi. It is estimated that on the completion of the three water schemes, 30 to 40 new schemes of a similar nature can be commenced.

APPENDIX - 2

PLACES VISITED - PERSONS MET DURING FIELD VISITS

Date	Time	Place	Persons met
21-12-93	1000	Arif Hasan Office, Karachi	1. Perween Rahman OPP-RTI Director 2. Rashid Khatri OPP-RTI Engineer
22-12-93	0800-1030	Karachi-Hyderabad by car PHED Office	1. Habibullah Memon Director Design 2. Shamsheer Khan Engineer RWSSP 3. R.E. Bermingham Chief Advisor, RWSSP 4. Dr. C.M. Cotton Participation Advisor, RWSSP
	1500-1730	Hyderabad-Karachi	
23-12-93	1000	Arif Hasans office, Karachi	1. Meeting with Perween Rahman, Rashid Khatri 2. Talk to Mr. Minnatullah in Bangladesh regarding future course of action
26-12-93	1000	Arif Hasans office (review of proposals and technical options, outline of report)	1. Perween Rahman 2. Rashid Khatri
27-12-93	0800-1030	Karachi-Hyderabad	
	1030-1130	PHED Office, Hyderabad	1. Mohd. Siddique Jallalani XEN, Division I 2. Ashfaq Rajpar Assistant Engineer 3. Amir Memon Assistant Engineer
	1215-1415	Khandu (tube-well Scheme)	1. Mohd. Rahim Secretary UC 2. PHED staff at the scheme 3. Headmaster Rab

			de Nasha
			4. Village residents
	1545-1730	Karakhoh (Surface water scheme)	1. PHED staff at the site
			2. Village residents
			3. Imam Bux, Ex-Councillor
	Night stay at Hyderabad		
28-12-93	1000-1200	PHED Office, Hyderabad	1. Mohd. Siddique Jallalani XEN, Division I
			2. Mr. Javaid, Sub Engineer
	1515-1300	Nur Khan Chand (Scheme under construction)	1. PHED staff at site
			2. Village residents
			3. Abdul Razzak, Member, VWO
			4. Mohd. Rahim, Member, VWO
	1310-1340	Kirar Solangi (village without water scheme)	1. Village residents
	1350-1440	Darya Beg Moghul (village with out water scheme)	1. Village residents
			2. Abdullah Shah, School teacher
			3. Qurban Ali Shah, Landlord
	1500-1615	Saleh Dal	1. Village residents 2. Murid Dal, School teacher 3. Jan Mohammad, Shopkeeper 4. Wali Mohd. Dal, Ex-chairman UC 5. Abdul Haq Dal, Hotel owner
	Evening	Hyderabad	Mr. Javaya works on preparation of matrix of desk review of schemes
	Night stay at Hyderabad		
29-12-93	1030-1245	PHED Office, Hyderabad	1. Habibullah Memon, Director Design 2. Mohd. Nazar
	1430-1700	Hyderabad-Karachi	
02.01.94	Morning	Arif Hasans office, Karachi (Work on report outline)	

	1545-1700	Karachi-Sukkur by air	
	Night stay at Sukkur		
03-01-94	1000-1200	PHED Office, Sukkur	1. Ahmed Khan Abro, Asstt. Engineer Rohri 2. Nabi Bux Sheikh, Head Clerk 3. Niaz Ahmed Sheikh, Sub-Engineer, Rohri
	1250-1400	Dodanko (Surface water scheme)	1. Village residents 2. Amman Ullah, School teacher 3. PHED staff at the scheme
	1415-1440	Bux Khatpar (Surface water scheme)	1. Village residents 2. PHED staff at the scheme
	1455-1600	Garo Goth (Village without water scheme)	1. Village residents 2. Tharo Khan, School teacher
	1630-1730	Roshanabad, Munshi Nizamuddin, Long Bhatti villages	1. Village residents at Roshanabad
	Night stay at Sukkur		
04-01-94	1000-1030	PHED Office, Sukkur	1. Ayaz Ahmed Ansari Sub Divisional Engineer
	1045-1110	Abad (Sullage works and hand pumps)	1. Village residents 2. Abdul Malik, Kiryana shop owner
	1120-1220	Miandad Khoro (tube well water scheme)	1. Village residents 2. Mujahid Ali, School teacher 3. Abdus Sattar Khoso, Vadera of the village
	1315-1400	PHED Office, Shikarpur	1. Mohd. Khan Kalhoro XEN, Shikarpur 2. Bashir Ahmed Sheikh Asstt. Engineer
	1420-1515	Darwaish Kakaputa (village without water scheme)	
	1700	Arrived Sukkur	
	Night stay at Sukkur		
05-01-94	1100-1145	RDD Office, Sukkur	1. Ayaz Ali Noorani, Asstt. Director 2. Asim Iqbal Faruqi, Senior Engineer of Indus Associates
	1215-1300	Ali Khan Khoso	1. Village residents

	1815-2000	Sukkur-Karachi by air	
06-01-94	1100-	PHED Office, Karachi	
	1215-1315	Khamiso Goth, Mangio Goth, Gadap	1. Dr. Shams-uddin (supply water to villagers) 2. Village residents
	1340-1430	Rozi Ghundar, Nausherwan, Papia Ghundar, (villages without water schemes)	1. Village residents 2. Agedino, School teacher
	1500-1530	Ghulam Mohammad Jokio Goth, Haji Sain Rakio Goth (Water schemes exist but do not function)	1. Village residents
	1530-1600	Gadap-Karachi	
08-01-94 to 13-01-94	Karachi	Report writing	

APPENDIX - 4

BASIS FOR PREPARATION OF NEW WATER SUPPLY
AND SEWERAGE SCHEMES FOR A.D.P. 1986-87

	Urban	Rural
Water Supply & Sewerage Schemes		
1. Annual growth rate of population (average)	4 %	3 %
2. Design period	10 years	10 years
3. Base year (for population projection)	1986	1986
(Where population is less than 1,000 persons, minimum design population is taken as 1,000 persons.)		
Water Supply Schemes		
4. Water demand per capita: for population upto 5,000	-	20 gln/day
more than 5,000	30 gln/day	-
5. Distribution coverage	Entire constructed/ developed area	
6. Raw water storage tank's capacity at 10/R to 20/U gln/capita per day		
a) On perennial source Lined tanks	21 days + 50 % tube wells	21 days + 50 % tube wells
b) On non-perennial source:		
i) Katcha tank : 75 %	2 months	2 months
ii) Lined tank : 25 %	+ tube wells	+ tube wells
7. Ground water storage capacity	8-12 hours of daily supply	-
8. Overhead reservoir's capacity	4-6 hours of daily supply	-
9. Shallow tubewell capacity for average conditions	6,000 gln/hr	6,000 gln/ hour
10. Slow sand filters	30-50 gln/sft/ day	-
11. Chlorination		
- Gas chlorinator/ hypo chlorinator	Wherever practicable	

Sewerage/Drainage Schemes

12. Design flow	80 % of water supply	80 % of water supply
13. Population coverage	Entire constructed/developed area	
14. Type of sewage collection system	Surface drains & underground sewers + brick pavement in streets upto Town Committee level	Surface drains & brick pavement in streets
15. Disposal works:-		
a) Screening chambers (minimum 1 No.)	12' - 15' dia (circular)	5' x 8' (rectangular)
b) Sewage collection tank (minimum 1 No.)	15' - 25' dia (circular)	15' dia (circular)
16. Sewage treatment:		
Oxidation ponds	Anaerobic pond 1 day retention followed by 7 days retention facultative pond then disposal on fields/canal	3 days anaerobic pond then disposed on field/ canal

General

17. Provision for cartage of materials	10 %	10 %
18. Provision for contingencies	5 %	5 %
19. Provision for test operation of the scheme	3 months cost of annual maintenance	3 months cost of annual maintenance
20. Phasing of schemes		
a) Scheme costing Rs 1 million	Ist year = 20 % 2nd year = 80 %	
b) Scheme costing between Rs 1 to Rs 5 million	Ist year = 10 % 2nd year = 50 % 3rd year = 40 %	

c) Scheme costing Rs 5 million or above	Ist year = 10 % 2nd year = 25 % 3rd year = 35 % 4th year = 30 %
21. Provision for price contingencies (P&D basis adopted)	Ist year = Nil 2nd year = 6.5 % 3rd year = 13 % 4th year = 20 %

Notes:

1. In rural schemes, underground sewers may be provided if absolutely necessary.

2. For drainage schemes pumping, disposal for rain water/ sewage from khads wherever necessary may be provided.

/Israr Rana

Jan. 1994

Rural Water Supply Issues in Gadap

Note on a Site Visit, 23 August 1993

1. An increasing number of tubewells are becoming brackish in the Gadap region. In addition, water levels have fallen from 70 feet to over 200 feet. This is because the rain-water acquifer has been depleted by mechanical extraction and the subsoil acquifer is also in the process of being depleted for the same reason.

2. The sweet water subsoil acquifer cannot sustain the agricultural activity that is currently taking place in Gadap. As in the case of Malir and Kathore this region will become a desert once the sweet water subsoil acquifer, which takes centuries to develop, is finished. There seems no way in which this process can now be reversed as the people using water for agriculture will not agree to limit its use or agree not to install new tubewells.

3. The solution lies in

3.1 making the people understand that the subsoil acquifer cannot be tapped for agricultural purposes. The boring that is done with the help of OCT credit should be used exclusively for drinking purposes. A motor of not more than 1-1/2 HP should be installed with a 1" pipeline. A raised surface tank should be built for storing water and people should collect from it. The entrepreneur who takes the loan for the boring and the tank should sell the water. Hopefully with limited use the bore will not become saline but there is no guarantee of that as there are other wells in the region pumping out water.

The choice of the location for the boring and the water tank is important. It should be located at a place from where the maximum number of people can be served and from where gravity flow pipeline can be installed if people wish to develop them themselves;

3.2 letting the water become brackish and utilizing the brackish water for cultivating plants and trees that can grow in it. Research into the subject could be carried out and the relevant species identified and introduced to the farmers;

for drinking purposes an alternative source of water supply should be developed. This could be developed by damming the small streams near the villages and creating rainfed reservoirs. These could be used for watering animals and hand pumps should be installed on their edges. This process would also recharge, to a limited extent, the rainwater acquifer over a long period of time. The villagers could help in the construction of the dams and take over the responsibi-lity of operating and maintaining the system. If electricity is available a piston pump could be used. Instead of a hand pump and over time a piped distribution system could be developed;

examining the feasibility of installing reverse osmosis plants for making brackish water potable. This is a fairly sophisticated process. However, there is no harm in looking into this possibility.

4. I will ask Rashid Khatri to assist in identifying possible sites for small check dams and/or sub-surface dams. Proper structural engineers would be required to design these low cost dams and check and collect water run off. The cost of a small dam would be less than that of a tubewell.