CHAPTER 4

WATER MANAGEMENT SYSTEM IN GUJARAT: EMERGING ISSUES OF GOVERNANCE

As seen in the previous chapter, successful community models have emerged in different parts of India and among these the case of Gujarat is also significant. Gujarat has seen the active involvement of both the state government and several non governmental organizations in the sphere of water management. Gujarat has been chosen for intensive study in this Thesis and this Chapter looks into the specific situation of Gujarat in terms of availability of water, existing water sources and the issues related to them, particularly those that have contributed to the severe crisis of drinking water. The response of the government and some of the initiatives taken by it as well as by NGOs and communities in solving this crisis have also been discussed here.

Gujarat: The Emerging Crisis of Water Governance

Flood and drought cycles characterize some Indian states. Safe drinking water is becoming a scare commodity all over the world but more so in India. Gujarat is one of the states worst affected with drinking water problems. Gujarat enjoys a unique environment setting on account on its geological evolution, climatic variation and rich diversity of ecosystems, it shares only about 6% of the total geographical area of the country but account for over 30% of the nation's coastline and is a truly maritime state. It is considered one of the more prosperous Indian states of India. In 1996-97 it had a relatively high per capita income of Rs. 3,717, 35% higher than the national figure (At 1980-81 prices). The pre-dominantly industrial state has experienced the highest rate of growth of per capita income, among the major 16 states, in the post-liberalisation years. Yet, the state has paid a heavy environmental price for its economic growth. Industrial pollution and over-exploitation of natural resources has led to large parts of the state experiencing man-made disasters like desertification, droughts and flash floods. The state is also prone to natural disasters like cyclones and earthquakes, the latest massive earthquake having hit the state in January 2001. The availability of water resources is heavily skewed and large portions of Gujarat and arid of semi-arid, while some portions are moist sub-
tropical. South and Central Gujarat are relatively water-abundant while north Gujarat, Saurashtra and kachchh are water-scarce. Responses to scarcity have typically been technologically centered and supply dominated rather than addressing critical concerns, primarily equity across and between regions (spatial and temporal), within communities (class and caste) and at the level of the household (men and women users). Thus, apart from the factors that determine the physical availability of the resource, there are social, institutional and economic factors that determine access to fresh water supplies for drinking. The challenge therefore, is far more complex than physical dimensions related to mere water availability.

Drought is typical of Gujarat, coming regularly as it does. During the past 40 years since its inception, as a state Gujarat has faced 12 major droughts, the most severe being those being in the 1985-88 period. Droughts occur every three years on average. In 1999, a large part of Gujarat suffered from the worst drought since then. Except South Gujarat, the entire State is drought prone (Hirway 1999). The frequency and severity of droughts is high in the low rainfall areas of the State viz. districts of Kachchh, Banaskantha and Surendranagar. The rainfall is not evenly distributed over the entire year. In many parts of the State, the rainfall occurs over a few rainy days only during monsoon in a few erratic showers with wide variations across regions. It is therefore never a new, unexpected phenomenon. Yet the nature and impact of drought have changed from famine and starvation in the past of drinking water and fodder during recent times.

Lack of adequate and safe drinking water is perhaps the biggest challenge that the state of Gujarat faces in the new millennium. Over 75% of its villages have been declared as 'no source' villages (Hirway, 2000) because these do not have dependable or sustainable sources of water. It is estimated that during the drought of 2000, 25 million people in 9,500 villages, 4 metros and 79 towns were hit by drinking water scarcity. An estimated loss of agricultural production worth Rs. 4,000 crore has been reported. About 2,400 villages had to be supplied drinking water by tankers.

The water board's policy of lifting water from borewells and transporting this through extensive pipelines to distant villages, many of them between 100-300 km away from the water source,
has been economically expensive, administratively cumbersome and environmentally exploitative. Many of the pipeline schemes are dysfunctional or defunct. Worse, excessive levels of nitrates, fluoride or salinity affect drinking water in all the districts. For instance, groundwater in almost 30% of the state's area is affected by salinity while 14% of the 18,000 villages have high levels of fluoride. In the alluvial areas of North Gujarat, thousands of open wells have dried up; and in coastal areas, overdraft has led to saline intrusion, causing irreversible damage to the freshwater aquifers. Villages affected by excessive fluoride levels in groundwater have increased from 826 in 1991 to 2,826 in 1997. In Mehsana and Sabarkantha districts, 522 and 337 villages respectively suffer from excessive fluoride, which causes a major health hazard. Besides, nitrate contamination of water is also a problem in many areas. In many parts of Gujarat, particularly, Saurashtra and Kachchh, it is difficult to store water in surface structures and underground due to high run-off intensities, wind speed, atmospheric temperatures and evaporation rates. In 1997, Kachchh received three years' rainfall in 14 hours of downpour. Such rainfalls create flash floods. Thus, the utilisable freshwater is even much less although there are 'buffer' during which a well-conceived action strategy can easily be devised for conservation and management.

The state's dwindling forest cover has fallen to a mere 0.042 ha per capita, less than 10% of the norm (Forest Survey of India, 1997). Over 40% of the state's area is identified as wasteland as a result of continuous deforestation, over-exploitation of groundwater, salinity ingress and expanding desertification (Central Statistical Organisation, 1997). All except 3 of the state's 25 districts (Kheda, Surat and Gandhinagar), or 54% of its 184 talukas, are covered by either of the two the Central government's desert-fighting programmes, Drought prone area programme (DPAP) or (Desert Development Pogramme). The state's rich groundwater reservoirs are severely depleted — in 1984, 88% of the state's talukas had sufficient groundwater resources but this figure plummeted to 51% in 1997 (White Paper of Gujarat, 1999). At places, the water table is as low as 900 feet! (SEWA Annual Report 1999:22) Excessive levels of nitrates, fluoride or salinity affect all the districts. Groundwater in almost 30% of the state's area is affected by salinity while 14% of the 18,000 villages have high levels of fluoride. Excessive nitrates are found in 3% of the villages. Between 1975-93, the salinity-affected area expanded over 8 times due to over-exploitation of groundwater, destruction of the mangroves on the seacoast and over-use of canal irrigation by lifting groundwater.
However, the approach has remained ad-hoc, reflecting knee-jerk reaction, and worse, avoidable expenditure on water transportation, ever more bore, wells, and social conflicts, not to talk to general human misery and political interplay.

Lack of access to safe drinking water is made worse by mismanagement of water sources and of water distribution. The multiple agencies in-charge of water-related activities and lack of coordination between them is one reason. The other is the low priority given to drinking water compared to water for irrigation by the state government. Groundwater is used extensively for irrigation and this continuously pushes the water table lower. The government's focus on piped water supply from bore wells also lowers the water table. Conflicts over scarce drinking water sources are high. Thus, proper management of water resources and equitable distribution of water, as well as recharging of groundwater is critical for future water security of the state. In many ways, the prime reason of Gujarat's growing water demand is the rapid growth in irrigated agriculture. Though this was unavoidable due to the agriculture-based economy of the state, one needs to recognise that irrigated agriculture consumes the bulk of Gujarat's water resources. In this regard, it is crucial to understand the role women can play since they are also very active in irrigation but traditionally less recognized due to their lesser decision making power.

Nevertheless, for the rural women, who have to travel up to six kilometer for potable water and pay transportation charges especially in the scorching summers, lack of access to drinking water impinges on their productive time, their health and family welfare (Misra 1999). Adverse impact of droughts and water scarcity is by no means uniform across all socio-economic strata of society. Well-off sections are able to stave off the worst effects of drought by measures such as building their own water harvesting structures, drilling deeper to access groundwater, buying water at a high price and so on. In contrast, economically poor people are the ones, who are affected most. So the women have much at stake and they therefore take keen interest in avoiding wastage and over exploitation of water for agriculture, especially if it is taken from water sources that are also meant for drinking water like ponds and underground water.
Water scarcity also results in competition for and conflicts over water-between towns and villages, and between industry and agriculture. Several newspaper reports show that in many parts of Gujarat, conflicts between farmers and urban dwellers over the re-allocation of water from irrigation reservoirs have in the recent times become more frequent, intense and occasionally violent. On December 14, 1999 three people were shot and 20 injured in Falla village by the Gujarat police when villagers protested against the state government’s decision to reserve the remaining water in the Kankavati dam for the nearby Jamnagar town (Times of India 1999). The state’s ruling politicians themselves were busy sowing confusion. While one set wanted to reserve water for Jamnagar residents because of the forthcoming city corporation election, another set wanted to keep it for the rural folk because of the upcoming panchayat elections. 'If there are no rains in early 2000, we will have to migrate from the village, said Veljibhai Dhamsania, vice president of the Falla gram panchayat. 'This is the worst drought I have ever seen in my life,' claimed 48 year old Lasan Bhilwad of Rentina village in Dahod district. In September, when India’s Home minister, L K Advani was fighting for re-election from a constituency in Gujarat, newspapers were reporting about election slogans like 'Pehle Pani Phir Advani' (first Water then Advani).

**Gender specific impact of Water Crisis**

The crisis of drinking water in the state has affected rural women’s life chances and their home life. Women, particularly in arid and semi-arid districts, spend up to six hours a day or more for fetching water, often traveling over hostile terrain that may be hilly or too sandy to walk on comfortably. Scarce water resources often result in water conflicts injuring women. Even during pregnancy there is no relief and women recount tales of miscarriage due to ferrying heavy head loads. Getting water is also a dangerous task with women forced to haul water from deep, open wells as well as face snakes and other wild animals while trekking through open spaces and scrub forests. Health concerns and education are traded for getting enough drinking water for the family and the livestock.

To quote from the newspaper reports, when Gujarat was reeling under drought in June 2000, "two young women from village Dhokawada in Banaskantha fell into an open surface well. One of them was a newly married women who survived, but with injuries which may not allow her to
bear a child. The wall of the well collapsed under their weight because the stones had been glued with soil and mud and not with cement. It was an old well, built about 60 years back, and no repairs had been carried out by the panchayat. In the same year, several tragedies were reported from village Vauva in Banaskantha, Dahiben, 13, was jostled aside and fell into the village well when people fought to fill water from the mobile water tankers, which arrived after three days to the village. In the following summer months, two teenage girls and a young woman were injured when they fell into the well while lifting water out. These women were fortunate to survive but they suffered severe injuries imposing a financial burden on their families for treatment."

In arid and semi-arid regions of the state, particularly during the pre-monsoon season, families migrate in search of water, work and food. Mainly dependent on rain-fed agriculture and animal husbandry, they also have to go in search for water and fodder for their cattle. In Kachchh, for instance, there are 'ghost villages' from which entire populations migrate in summer (SEWA 1997). Women's economically productive time is adversely affected by the time taken for fetching drinking water. In district Banaskantha, women said the time spent in collecting water could be productively used to embroider and earn more income. In Sabarkantha, the trade off is agriculture labour. More water available for livestock increases milk production and hence women's income from selling of milk through their own co-operatives. Apart from cost, the physical and mental stress that rural communities, particularly women, have to endure for fetching water from a distance source or from tankers is a major issue affecting the overall social and economic development of rural areas in Saurashtra, Kachchh and north Gujarat. Saurashtra and Kachchh region have not developed rapidly primarily because of inadequate water supply. During periods of water scarcity, it is the rural poor and their livestock who are primary victims, compelling many of them to migrate and/or adopt other coping strategies which includes relying on larger social networks, non governmental organizations and government relief programmes. In addition, competition for scarce water between sectors and between users is leading to conflict, often violent, as different stakeholders begin to assert their rights. While the state's ability to allocate water equitably or to enforce pollution control is limited, it has begun to recognize the need for long-term sustainable strategies involving community participation, locally appropriate technology and a stronger role for women as critical agents of change in the water sector.
Water Governance: Institutional Structure in Gujarat

Water administration in the Gujarat state is the responsibility of the three ministries, namely, Ministry of Water Resources (also includes minor and medium irrigation systems), Ministry of Narmada and Major Irrigation and Ministry of Water Supply. Besides, other ministries such as industry, environment and local self-governments are also associated with administration of water.

The Ministry of Water Resources is responsible for management of water bodies, which includes conservation and protection of water resources, besides designing, construction and operation and maintenance of small and medium size irrigation systems based on both surface and groundwater resources. To assist the Ministry in promoting groundwater development, the Gujarat Groundwater Resource Development Corporation (henceforth, Corporation) was established in the year 1972. The Corporation is an autonomous body and its primary responsibilities are survey, monitoring and development of groundwater. The Corporation has established over 3000 public tube wells all over the state to promote groundwater utilisation. In addition, the Ministry is also responsible for management of drainage and drainage-based irrigation within the command areas of major canal systems in the state. The two state level institutes, Gujarat Engineering Research Institute (GEM) and Water and Land Management Institute (WALMI) established to support design, construction and management of water resources and services also fall within the purview of this ministry.

The Ministry of Narmada and Major Irrigation is responsible for designing, construction, operations and maintenance of major canals and irrigation systems. The Narmada Board, headed by a Chairman, looks after the construction of Sardar Sarovar Dam. The Board is an autonomous body. The inter-linkages between the Narmada Board and the Ministry are for the purposes of resource generation. Quite a few employees of the Ministry are working with the Board as design and construction engineers on deputation. Besides, the Ministry is also responsible for negotiation and settlement of disputes related to the Sardar Sarovar Dam in the other states.
The Ministry of Water Supply is responsible for providing all water services other than irrigation. Thus, it is responsible for identification of sources of water and design, construction and operation of water supply systems for domestic and industrial purposes. The sources of water supply may be groundwater, dams, canals, water tanks, ponds, water streams or a notified river. Depending upon the source of water, the ministry has to constantly coordinate its activities with other ministries of water sector such as the Ministry of Water Resources (Minor and Medium Irrigation) or the Ministry of Narmada and Major Irrigation. For water supply to rural areas, it has to build strong linkages with village Panchayats, Gujarat Industrial Development Corporation (GIDC) and municipalities for operation and management of water supply systems. The design, construction and implementation of water supply schemes is done through Gujarat Water Supply and Sewerage Board (GWSSB), which is an autonomous board, headed by a Chairman appointed by the State government. The relationship between the Ministry of Water Supply and GWSSB is similar to that between the Ministry of Narmada and Major Irrigation and the Sardar Sarovar Narmada Nigam. The GWSSB sells water to GIDC, industries, municipalities and village panchayats.

One could infer from the above description that there are overlaps of authority and control exercised by various water ministries of the State government. For example, the Chief Engineer, Command Area Development, who works as part of Ministry of Narmada and Major Irrigation, is also accountable to the Ministry of Water Resources on two counts, i.e., for activities related to water conservation and minor irrigation networks within canal command based on drainage water, and ground water. Similarly, the GWRDC has a role within the command areas of canals for groundwater development and utilization. This overlap of authority and jurisdictions creates confusion among water resources and services managers, which leads to inefficiency and delay in implementation of the projects. While it is possible that top officials within the Water Ministries may coordinate their activities, the same cannot be said about lower level functionaries within each ministry. As a result, it creates frustrations among the personnel of each ministry.

The lack of coordination is not limited to each of the Ministries involved but transcends across ministries and departments including Panchayati Raj institutions. In an attempt to bring the existing Panchayat Legislation in Gujarat in conformity with this, the Gujarat Panchayat Act
1961 was replaced by the Gujarat Panchayat Act 1993. Among the 29 functions devolved to the Panchayati Raj Institutions in the Eleventh Schedule (Article 243 G) of the 73rd Constitution Amendment, minor irrigation is listed as number 3 along with water management and watershed development, while maintenance of community assets is placed at number 28. The maintenance of minor irrigation, tanks, and ponds suffers greatly and there is no allocation of manpower or funds for the preventive maintenance of these structures. Individual village panchayats are responsible for the operation and maintenance of village water supply schemes. Pani samitis, or village-level water committees, formed within panchayats are responsible for managing these schemes and setting up of water distribution networks within their constituencies. Legally, a third of the seats in the pani samities are reserved for women. Yet, most women are members only in name because they are not given any space by the many more male members in the committees. The works involving expenditure of three to five lakh are carried out by the Executive engineer working with the Zilla Panchayat, while works costing Rs 5 to 15 lakh are taken up by the Superintending Engineer at the circle level (i.e., the state government), and those beyond Rs. 15 lakh are within the domain of Chief Engineer, Ministry of Water Resources, Minor and Medium Irrigation. It may be added that till 1990, about 50 per cent of the Medium Irrigation works in the state used to be below Rs. 15 lakhs. Now, because of cost escalations, almost all sizeable minor irrigation works worth mentioning cost over Rs. 15 lakh. Considering the limited staff at the taluka level, it seems difficult for the government to look after these structures. Therefore, it was being actively considered by the State government to assign such responsibilities to Panchayati Raj Institutions. (IRMA, 2000).

In this context, the administrative procedure may entail a system where Gram Panchayats may be asked to send their reports regularly to Taluka Panchayats, and they in turn may send their periodic reports to Zilla Panchayats, which in turn will be required to report to the concerned Superintending Engineer. At the moment, however, no management information system right from taluka to state level seems to be in place for collection of data related to damages recurring every year, their impact over cropping pattern, increasing number of wells, improvement in water table, wells, etc. This gives little space for the Panchayati Raj Institutions to operate in this connection. (IRMA, 2000).
Nevertheless, once the projects/works are sanctioned by the state government, the execution is done through the District Development Officer (DDO)/Executive Engineer of the Zilla Panchayats. At the Zilla Panchayat level, there is an Executive Committee headed by a Chairperson. It is composed of the Member of Legislative Assembly (MLAs) and Member of Parliament (MPs) from the constituencies falling within the jurisdiction of the district, DDO and his staff from various departments. The committee is expected to meet once every month. This Executive Committee accords administrative sanction to all minor irrigation works undertaken in the district. In normal course, any proposal for a new scheme goes through a very long and tedious route. It begins with an application made by the beneficiary to the Zilla Panchayat. The application is routed through a number of intermediaries, viz. Gram Panchayat, and Taluka Panchayat concerned and is processed by the Executive Engineer, Superintendent Engineer, Minor Irrigation Department, Tribal Development Department, DRDA, and the Executive Committee of the Zilla Panchayat. If everything is found in order, the process terminates with the invitation of tenders by the state government and gradual implementation of the irrigation works. Thus, execution and completion of a scheme is a long drawn process, which entails innumerable stages of processing on the way and delays at every level. 'Though the Panchayati Raj Institutions are expected to contribute apart of the project costs from their own resources, common experience in the past has been that none of the Panchayati Raj Institutions have contributed anything instead the entire expense was borne by the state government.' (Vani Vina, R. Prabhakar and V. Ballabh, 1999).

Gujarat Water Supply & Sewerage Board (GWSSB)

Gujarat Water supply and Sewage Board (GWSSB) is the nodal agency responsible for implementing bulk of the drinking water supply schemes to rural areas and therefore it is important to understand its functions and role in greater detail. GWSSB has been constituted under the GWSSB Act and its jurisdiction extends to the whole state of Gujarat, excluding cities and cantonments. The GWSSB is the state level autonomous organization responsible for proper development and regulation of rural drinking water supply schemes covering more than one village (comprehensive). Its duties and functions are to:

- Prepare, execute, promote and finance water supply sewerage schemes;
- Prepare state plans for water supply and sewerage under direction from Government;
- Review and advise on tariffs, fees and water charges;
- Procure and utilize materials;
- Establish state standards for water supply and sewerage services;
- Operate, run and maintain water works and sewerage facilities as may be entrusted by the state government;
- Carry out applied research and organize manpower development and training.

The GWSSB is responsible for the operations and maintenance of the regional piped water schemes and for the handpumps installed by it. The piped water schemes for individual villages are handed over to the local village Panchayats for operations and maintenance.

GWSSB is presently developing its own guidelines to achieve new levels of efficiency in terms of creating conditions, through collaborative efforts, for people in rural Gujarat to get safe drinking water on sustainable basis. It is hoped that this initiative of GWSSB to act as an agent of change will prove to be a milestone in the state’s water supply and sanitation sector. The Community Management Support Unit (CMSU) of the GWSSB may emerge as an autonomous 'Water and Sanitation Management Organisation' (WSMO). The Government of Gujarat is currently engaged in reviewing CMSU's experience toward decentralization that can be truly demand-responsive. Independent of the GWSSB, the new institution would have strong links with related departments and to at least 150-200 communities representing 1% of panchayats in the state. (Gujarat Jal-Disha 2010, Dec. 2000). CMSU was formed in January, 2000 within the GWSSB with an evolving mandate or facilitating village-level management. It has over the year demonstrated and promoted community management concepts, and helped to build capacity for this need within GWSSB and NGOs. It has worked on documentation, networking, communication and training, and support to projects and efforts at sector reform. A major role for the proposed WMSO would be as Gujarat's think-tank for the sector, bringing official and non-government partners together toward policy development, capacity building, networking and communication. Experiments with new concepts and models to match the variety of Gujarat's conditions would be united by the intention, to demonstrate community abilities for sector self-management in ways that are sustainable and efficient. Another important objective is for the new institution to act as a knowledge centre for WSS strengthening linkages and collaboration between all stakeholders. Developing a modern information system (MIS) would be a key responsibility, providing at last an accurate database
Documentation would provide a critical resource for sharing experience. It would contribute through innovating and demonstrating technical alternatives and options in drinking-water supply and sanitation. These must essence of a demand-responsive approach that is sympathetic to Gujarat's range of geographic, economic and social needs.

**Gujarat Jalseva training Institute (GJTI)**

Another institution that needs special mention in the context of training in rural areas is the Gujarat Jalseva training institute. The institute based in Gandhinagar, the state capital was established by the state government and GWSSB, realizing the need of human resource, development and training in the drinking water sector in rural areas. The institute has been recognized as a key institution by the Government of India, the World Bank, World Health Organisation (WHO) and Unicef. It provides in-service training to the engineers, managers and grassroots persons involved in the drinking water sector. The Institute has been conducting courses in maintenance of hand-pumps, source development, pipes and conduits, water treatment, operational management of Rural Water Supply Schemes, finance and management, pumps and machinery, village level caretakers training, and computer-based techniques. Some of the contents and impact of these training programmes have been discussed in chapters ahead as part of the issues related to field work conducted for the in-depth study.

**State Sector water policy and Schemes**

Surprisingly, the Government of Gujarat did not formalise the state-level policy for water management at least till now. However, a policy decision already exists, which gives priority to drinking water in overall water management. Gujarat has also adopted a policy under which supply of water in the rural areas is taken as a state responsibility with a view to mitigate the water scarcity faced by the rural population. Rural Water Supply Schemes are implemented at 100% cost being provided by the state government under the Minimum Needs Programme (MNP) and the centrally sponsored Accelerated Rural Water Supply programme (ARWSP). It has formulated an action plan for providing drinking water to not covered (NC) habitations and
partially covered (PC) habitations and 1480 villages, which are presently getting non-portable water due to excessive fluorides/salinity/nitrates in the ground water (Gujarat Jal-Disha 2010 Dec. 2000). During the international water supply and sanitation decade (1981-1990), it was planned that 100% of the rural population would be provided safe and adequate drinking water by the close of decade. Both India and Gujarat had accepted these targets. Due to multiple reasons (non-availability of assured drinking water source, paucity of funds among them), these targets were not met. Achievements were restricted to just above 70% in terms of water supply (rural 36% according to UNFPA 1995 estimates), if other criteria are applied (such as walking to a distant source, year-round functionality and 40 lpcd availability to all consumers), the statistics for water supply would become considerably lower. (Gujarat Jal-Disha 2010 Dec. 2000).

The government of Gujarat has in the last seventeen years, spent Rs. 86,036 lakhs as a part of the State Plan (1982-83 to 1998-99) and Rs. 41,862 lakhs under the Accelerated Rural Water Supply programme sponsored by the Government of India. The total investment made for providing drinking water as a part of Government’s development plain in last seventeen years has been of the order of Rs. 1,27,898 lakhs. Over and above this, Gujarat has spent Rs. 84,375 lakhs for providing bare minimum drinking water scarcity conditions prevailing in different parts of the state (GOI 2000).

The state Government had set up a committee of secretaries, headed by the Chief secretary, to develop a forward strategy for the development of water resources in Gujarat. The programme has continued during the Ninth Five year plan. The approach of this strategy was based on the following considerations:

- Provide drinking water to all the non-covered (NC) habitations and partially covered habitations (PC) in the category of 0-10 lpcd;
- Improve the performance of existing regional schemes by modification and augmentation;
- Concentration on rainwater harvesting and ground water recharge schemes.

Sources and Current Uses of Water: Technology Options for Drinking Water
Groundwater is one of the most important drinking water sources identified by the state government and is extracted mainly from tube wells in the deep alluvial areas of Gujarat mainland. Normally ground water is considered safe for drinking, as it is generally pollution free at reasonable depth although it contains mineral and chemicals that dissolve in contact with soil and rocks as it infiltrates and flows. 78% of the rural drinking water demands in Gujarat are met by groundwater. (Gujarat Jal-Disha 2010, Dec. 2000). Area irrigated by groundwater account for 79% of the net irrigated area in the State in 1996-97. (IRMA, 2000). Thus, groundwater is Gujarat’s mainstay and therefore there is need for its judicious use and management, particularly in view of the emerging threats of dwindling quantity and deteriorating quality. Hardly any data is available on the range of groundwater extraction, rate of aquifer recharge and water quality especially in drought-prone areas except that according to official figures, water levels are dropping at a rate of 1-2 metres a year throughout Gujarat and 5-8 metres in some pockets. (Government of Gujarat, 1992). Several factors have led to uncontrolled exploitation of groundwater. In most parts of north Gujarat (especially in districts Mehsana, Ahmedabad, Gandhinagar and Banaskantha), the demand for water is very high due to extensive adoption of modern agricultural practice crops, and heavy investment in groundwater development through tube wells. (IRMA, 2000). In many areas with a rich groundwater potential (especially in the alluvial areas of north and central Gujarat), at the aggregate level, the rate at which groundwater is being pumped is far exceeding the average annual replenishment. Therefore extraction is highly unsustainable. This has led to alarming drops in groundwater levels, enormous increases in pumping depths, astronomical increases in the cost of well construction and a resultant increase in the cost of extraction per unit volume of water. (IRMA,1999). The well yields are fast declining to levels that are no longer economically efficient.

The various technology options available for groundwater extraction are discussed below.

**Bore wells** with depths ranging from 200-300 metres are very common in the region for harnessing groundwater. (Gujarat Jal-Disha 2010, Dec. 2000). Boreholes may be drilled using manual labour, or by use of mechanically operated drilling equipment depending on the soil conditions and depth of ground water availability. The water from boreholes is normally extracted either by use of hand-pumps or through an arrangement of reservoir and distribution
system. Dug Wells are provided if the soil condition is unsuitable for bore wells. Dug-cum-bore wells are used in South and Central Gujarat for extraction of groundwater where groundwater levels are shallow. Dug wells are in vogue in Saurashtra with around 700,000 wells scattered across the seven districts of the region. (Gujarat Jal-Disha 2010, Dec. 2000). In case of shallow dug wells, lining either with locally available burnt bricks, stones or concrete rings for a depth of about 3 to 4 m should be provided to act as a seal against pollution. Layers of course gravel of a maximum thickness of 0.5m help the well to receive filtered water from the bottom. The diameter of such wells may be kept to, say 1.5m to reduce cost of lining and covering. In case of low yielding aquifers, hand dug wells may be provided. (Gujarat Jal-Disha 2010, Dec. 2000). However, as the expense for high depth well is likely to be equally high, the yield of such sites may be confirmed by drilling boreholes before starting expensive construction. Sometimes it may be essential to provide high diameter wells with/without horizontal bores to increase the yield of the wells. To prevent entry of external pollution, construction of headwall and a drainage apron is a must. Covering the well is an additional guard against pollution. The use of a windlass instead of rope and bucket system often guards against pollution. This prevents contamination from the bottom of the bucket and from the rope coming in contact with the ground. For shallow wells, the wells may be covered and handpumps may be fitted to prevent possible contamination. In case the well is far from the dependent community, pumping water is usually done to a reservoir from which it normally flows to supply nodes through a distribution system. In Kachchh, mostly tube wells are used for groundwater pumping, though dug wells and dug-cum-bore wells are also used. However, dug-wells have somehow retained their popularity though innumerable others like visas, tankas, vavs (step wells), etc. have got overlooked by the technocrats schooled entirely in western science and technology. Ponds continue to be dug only as drought-relief and employment-generation measures.

**Hand pumps and piped water systems have become the most popular technological choices in Gujarat.** Handpumps are used in the hard rock areas of Saurashtra, Sabarkantha and Panchmahals and Dangs district for drinking water supplies, where aquifers are relatively shallow. In Gujarat, specific rod-operated deep well handpumps (India Mark II and Mark III) have been promoted due to their advantage of lifting water from a moderate depth ensuring safe water and simplicity of their operation and maintenance. India Mark II handpumps are
suitable for lifting water up to a depth of 45 meters. Beyond this depth, the extra deep-well version is needed which can lift water from as deep as 90 meters. (Gujarat Jal-Disha 2010, Dec. 2000). The implementing authorities of handpumps are rural development agencies and Gujarat Water Supply and Sewerage Board (GWSSB). These programmes have not been very successful. Several reasons have been sited for the limited success of hand pump programmes, which include the following; first is the overlooking of training of the users for operation and maintenance by the implementing agencies. Since operation and maintenance training programs of Gujarat Jalseva training Institute (GJTI) are insufficiently integrated with the implementing agencies. As a result the community capacity for operation and maintenance has not reached all the places where these are installed. Second aspect is the lack of involvement by communities, especially women, in the planning stages (such as during silting of handpumps) leading to inappropriate location for users and hence to their non-use or misuse. Third, due to inadequate suction depth and as a result of lowering of water table many of the installed handpumps run dry, during summer. This leads to the abuse of hand-pumps as they run dry over months and handpumps demand common repair, which are not readily available; Fourth reason relates to the insufficient staff and machinery, lack of planning and inadequate priority for maintenance of the handpumps. Since the Implementing authorities take a long time to respond to the request of communities for both major and minor repairs, this leads to abuse to defunct handpumps and to look for alternate sources. Handpumps necessarily tap the local sources but in fact have remained in the ownership and control of the state agency, which monopolised the skills of repairs and maintenance. Some statistics illustrate this: 459,887 (22.2%) of a total of 2,071,569 handpumps require repair or rehabilitation; 254,000 (12.3%) of the handpumps are defunct (Rehoej et al.1997). This study will further look into issues related to handpump repair and maintenance the chapters ahead.

Piped Water Supply: The piped water supply system usually has a source(s) (usually groundwater) from where the water is pumped or flows through gravity to a reservoir(s). The water is then distributed through a distribution system to standpoints and/or house connections. Branch systems of water supply are usually economic and appropriate to serve standpoints. They can also serve house connections in the lanes where pipelines are laid. Rural Water Supply Schemes are implemented either as individual village piped water supply or regional piped water supply facility. The differentiation is based on the availability of water
source and the number of villages covered. In Gujarat, there are nearly 7000 individual rural water supply schemes and 372 Rural Regional Water Supply Scheme covering more than 4000 village/habitation (Gujarat Jal-Disha 2010 Dec. 2000). Individual village Water Supply Scheme are ruin and maintained by the Village Panchayats for which the government provides grant-in-aid ranging from Rs. 15000 to 25000 per year, depending on the population of the village. All power bills relating to village water works are paid by the government, relieving the village Panchayat from this responsibility. Besides repairs and maintenance, the operation of piped water system also stayed in the hands of the state through the linesman, appointed and paid by the state agency. Operations and maintenance (O&M) is one of the biggest casualty of this system. 26% of all piped water schemes require repair or rehabilitation; 278,000 (18.2%) of the 1,528,000 stand posts are in need of repair or rehabilitation and without taps; The GWSSB spends Rs. 10 crores annually on the 343 rural regional schemes covering 3453 habitations; —the GWSSB spends Rs. 450 per hand pump and it had almost 70,000 of them in 1998 (Gujarat Jal-Disha 2010 Dec. 2000). In addition to these common problems in village water supply schemes, there are other issues in the case of the large-scale RWSS. These include inequity in distribution of water across villages, and heavy system losses. Often, water supplies the-tail end villagers is very erratic and inadequate while the villages in the head reach tap large quantities from the system. The competition faced by drinking-water needs from other rural sectors of water use (mainly irrigation and cattle use) is severe. The farmers often resort to breaking of water supply pipelines to divert water for irrigation and cattle drinking

As already mentioned, the most common problem faced in such a system is the lack of involvement of community in planning, designing and implementation. In the planning stage, community involvement for selecting standpoints to ensure adequate coverage, access, security and safety of users are normally overlooked. Further design aspects of stand-posts such as the height of stand posts and type of taps to be fitted need special attention, as these are to face maximum community interface. Other important aspects such as implication in operation and maintenance for the selected technology viz. training of local plumbers and masons to meet the requirements of both minor and major repaired, establishing contribution system for immediate and future operation and maintenance etc. should be institutionalized with appropriate capacity building. The water board's policy has been to exploit the
groundwater by lifting water from bore wells and transporting the water through extensive pipelines to distant villages, many of them between 100 to even 300 km away from the water source. This has proved to be economically expensive, administratively cumbersome and environmentally exploitative. Delivery organization in the state often use standardized design without properly analysing local situation and with inadequate consultation with communities, leading to misapplication of technologies. This result in costly and over- designed systems, and high costs for operations and maintenance. The long-term sustainability of the current approach is questionable, especially with regard to the appropriateness of current institutional structure for groundwater management and recharge.

However, it is interesting to see a model of pipeline water supply and maintenance in Gujarat, where some of these above stated bottlenecks have been checked and an attempt on increasing women's interest by way of including them for its operation and maintenance has made a pretty successful impact. We will also look into the details of this model in the chapters ahead.

Rainwater Harvesting: Rainwater is collected directly by channeling water falling on roofs, or other impermeable surfaces, into storage vessels and tanks. The quantity of water available from this source depends on the rainfall pattern, the area of the collecting surface, the available surface and the available storage capacity. Rainwater collection is promoted in places where water sources are inadequate or unreliable or the quality of water available is low, especially in dry seasons and also in the case of scattered communities who travel long distances to collect their water.

Roof Rainwater Harvesting: The essential components of a roof rainwater collection system are roof, gutter, down pipe and a storage tank of appropriate capacity. Tiles of baked clay, micro-concrete and sheets of corrugated or galvanized iron are most suitable roof materials to collect safe water with high runoff. Roofs painted with lead-rich paints or rusted roofs are not supposed be used for collection of water for potable purpose as they may cause serious problems to health. Thatched roofs capture organic materials and have a very low runoff coefficient. Therefore, such collected water is not suitable for portable purpose. In case the roof size is inadequate, artificial roofs made of plastic sheets are used for collecting and
directing the water to the storage tank. Gutters are designed with adequate capacity and slope to carry rainwater without overflow from roofs, during intense rainy periods. The position and method of handing gutters is such that they can collect trajectory of flowing water from roofs during heavy rain without overshooting it. Care is taken so that the gutter does not bend while carrying the peak flow. Gutters are made of materials like galvanized iron so that they do not rust easily and are able to sustain high tropical temperatures. They are well constructed to prevent leakage. The down pipe is of adequate size and capacity to collect water in the storage tank. The down pipe is fitted with a rotating spout to avoid the entry of initial showers that are polluted as they clean the rooftops. The storage tank has adequate capacity to store water required for dry season use. The capacity of the tank is estimated by taking the average monthly rainfall over at least the last ten years or a rainfall of the driest year. The tank is constructed either over-ground or underground. The advantage of over-ground tank is that water can easily be collected through a tap without polluting it. The advantage of underground tanks is that they restrict evaporation loss. The water from an underground tank is accessed making an arrangement of steps to reach a tap or by providing a small hand pump on the top of the tank. The provision of hand pump restricts users' direct contact with the tank water, limiting the possibility of pollution. The tank is built of masonry or reinforced cement concrete or ferro-cement.

It is essential to point out here that Gujarat has successfully experimented with rooftop water harvesting, ever since the efforts began in 1998-99 with a project that included almost 12500 families. GWSSB worked as a nodal agency and facilitator, with implementation carried out by NGOs through community mobilization and information campaign. The importance of this project was highly appreciated by communities during the 1999-2000 scarcity. The Government of Gujarat has decided to promote the concept through a household subsidy scheme ranging from 75-90% of storage tank costs. An outlay of Rs. 10 crore has been provided for the year 2000-01 (Gujarat Jal-Disha 2010 Dec. 2000). Several organization in Gujarat (Uthan, Mahiti, AKRSP and SEWA are among them) have actively promoted this programme with GWSSB assistance up to 70% of the total cost. The programme provides a strong demonstration of the demand-driven approach. Active community participation and management, particularly indicates that the communities adopting this alternative have been able to adsorb the technology as well as its operation and management implications, learning
from other regions of the state where this tradition is still maintained. Changes in hygiene behaviours are also noticed such as the use of a long-stemmed dipper for removing stored water, the use of clean vessels and filters, and effort to protect/clean storage tanks with lime. Some families have installed hand pumps on sealed tanks, a practice that needs promotion. Experience has also indicated the importance of close attention to gutter and pipe arrangement and for training in monitoring water quality (Kapoor, et al. 2002). Rainwater harvesting having been successfully adopted in several villages of Gujarat has also been studied in detail in the chapters ahead.

**Surface Water:** Surface water from stream, rivers, lakes and reservoirs may be plentiful, but it likely to be of poor quality (unless abstracted from the upper reaches of the catchment) because of bacterial and chemical pollution. It is usually abstracted and distributed for use with proper treatment either by conventional mechanically operated plants or by use of combinations of sedimentation and slow sand filtration. For rural supply, a combination of sedimentation and slow sand filtration is often suitable. The conventional approach to development of water resources has been segmented, with both surface and groundwater resources treated separately for the purpose of exploitation. While the government initiated large and small reservoir schemes to harness surface water, groundwater development took place almost entirely in the private sector. Lack of adequate scientific basis in planning of surface water systems—including inadequate time series data on runoff and its dependability—and a piecemeal approach to development, which has looked mainly at water availability in catchment areas rather than in the entire river basin; has led to several problems. These include over-appropriation of runoff and increasing reallocation of water from previously wet areas to dry areas. Such an approach has had several social and ecological consequence The Sabarmati River Basin is a classic example of this (IRMA 1999).

**Watershed Management:** The Watershed approach is holistic, multidisciplinary and practicable approximation of the systems approach. Watershed development and management activities are being taken up in many districts of Gujarat since 1995 (IRMA, 2000). There are several government agencies and donors, which provide funds for watershed development projects in the State. Numerous agencies including NGOs, Government departments, private and community organisations are engaged in implementing these
programmes. Though the implementation of the programme has been, by and large successful, there are some critical issues that need to be addressed for making these programmes more effective. This approach essentially requires: increasing the vegetable cover over the land, soil and moisture conservation, proper land use practices, building appropriate structures such as check dams across streams and nallahs. A watershed is a defined area, which has an undulating terrain from which the entire rainfall drains out through a single outlet. This outlet may be a nallah, stream, tributary or a large river. Thus, in terms of area, a watershed may be a large area having a number of villages, roads, hills, fields and forests within it. Moreover, the ongoing watershed programme of the Government seeks to involve village communities including farmers, cattle rearers, household water users, and landless workers in planning, implementation and management. Creation of Users Groups and Watershed Committees (at the village level) and Watershed Associations (at the watershed level) are envisaged. In several instances, user organisations are formed for the sake of routing funds to the villages. The processes required for forming effective peoples organisations are not followed. The result is that the village communities take part only in the physical activities such as construction for the sake of employment. There is a need to ensure that effective and responsible village level organisations are built for taking up activities and the right kind of inputs, in terms of information and training are delivered to them. A movement to establish a more complete economically viable model of watershed development, on the lines of milk co-operatives, will have to be developed for scaling up (Vani et al.1995).

Basin approach for water management: It is stated that local water development projects such as watershed development, water harnessing and groundwater recharging alone may not be adequate to address water scarcity problems in Gujarat in the coming decades. Some dependence will continue on water projects involving large-scale storage and transfer of water within river basins and transfer of water from water abundant basins to water scarce basins. However, such projects involve serious social and environmental risks. Experiences indicate, local water harvesting and recharge initiatives can contribute significantly to addressing local groundwater scarcity problems and help farmers achieve water security for protecting their crops. However, when such activities are taken up on a large-scale, more systematic and scientific planning would be required to assess their impacts on the overall water balance at the regional/basin level, more specifically, the impact on storage of existing reservoirs in the
region/basin and the environment. Therefore, they should be part of planning of water resources management activities in river basins, thereby helping to integrate water management activities and large-scale interventions at the basin level. Therefore, there is a need for approaches that can integrate the concerns of local communities (such as addressing local water scarcity, environmental protection and ecosystem management) with regional concerns of balancing overall supply and demand. The basin approach to water resource management integrates various physical systems affecting water availability-groundwater surface water, base flows, catchments- etc- so as to estimate the effective supplies within the river basin and also the amount of water that can be sustainably harnessed. It incorporates socio-economic systems affecting the use of water so as to analyse various demands existing within the basin that need to be met. The approach also helps identify "problem areas" or water abundant/water scarce areas, where local interventions are needed, as well as the types of possible interventions possible (watershed treatment, water harnessing, groundwater recharging). Such an approach can optimise the number and size of large projects, and also other interventions for water resource management such as inter-seasonal and multi-annual storage of reservoirs, conjunctive management of surface and groundwater and evaporation control from reservoirs. The basin approach can thus help minimise the negative social and ecological consequences of water development (IRMA 2000).

Vision 21 in Gujarat

Within state institution, a movement toward visionary thinking and action commenced early in 1999, when a decision was taken to articulate a future for the state in several areas of development priority. Interaction between NGOs in Gujarat with the global VISION 21 effort of the Water Supply & Sanitation Collaborative Council (WSSCC) began in 1998, leading to the GUJARAT 2010 document on 'A vision of safe water, Hygiene and sanitation for all'. (Vasavada, B.J. 2000). This reflected a joint effort of some thirty institution and their constituencies throughout the state. Partners in Government assisted this process, which was presented for discussion and analysis to the WSSCC's Global Forum, which met in Ahmedabad in November 1999. A few months later, at the World Water Forum in The Hague, a special session on GUJARAT 2010 brought government and NGO stakeholders together with the international community in understanding the state's challenge and the effort
underway to respond them. The deliberations at the World Water Forum were followed by a workshop organized by State authorities in Gandhinagar in April 2000. Almost simultaneously, two other initiatives got underway: Vision 2020: Social Sector (Gujarat Social Infrastructure Development Board) and a White Paper on drought proofing commissioned through the Institute of Rural Management, Anand by Unicef. Thus, three studies have simultaneously focused on issue of water demand and supply. The key instruments of change in the reports are seen as empowering and placing of the people and communities at the centre of decision-making and action for affordable services through the recognition of these services as human rights. Also new roles and responsibilities are expected to be taken within both governments and non governmental organisations, with Government moving toward a major role as facilitator, and people’s organization accepting new responsibilities for planning, implementation, resource mobilization and maintenance. The recommendations of the report include partnership between local communities, local NGOs, local entrepreneurs and enlightened local government toward initiating and managing improved systems and services. These demand a collective decision to put water programmes at the core of Gujarat strategies for human development. Another study prepared in the 2000 by Tata Energy Research Institute (TERI) on behalf of the Gujarat Infrastructure Board examined the scope for private sector participation in Gujarat against a backdrop of experience elsewhere in India and overseas in keeping with the regulatory framework of water services in the state of Gujarat. The study includes legal and regulatory issue, tariff setting, quality standards and recommendations for legislative changes.

The approaches to water resource management by NGOs and communities and religious groups in Gujarat have been mainly focused on local water management activities comprising local water harnessing, small water harvesting and ground water recharging, and watershed development and management. Gujarat provides a unique demonstration, through several examples of successful experiences of NGOs and government agencies, of the range of technologies that are available for water harvesting and artificial recharge of groundwater in different geological settings. NGOs such as SEWA, Shri Vivekananda Research and Training Institute (SVRTI), Mandvi Kachchh, and Aga Khan Rural Support Programme (I), have implemented several water management activities using small water harvesting structures, namely check dams, percolation tanks, recharge tube wells, and underground dykes. In
contrast to official approaches, water resource management by NGOs and Communities and religious groups in Gujarat have mainly focused on local water management activities. Although these innovative approaches address water scarcity problems, they remain localised. Although it has been criticised that these approaches are not implemented at scales, which can make an impact on the water situation at a regional level (Vani et al. 1999), yet the successful experience of these organisations had inspired the state government to take up local water conservation and artificial recharge projects on a significant scale, especially in the water scarce regions of Saurashtra, Kachchh and North Gujarat. The challenge has been to revive traditional sources and harvest sweet rainwater but these imperatives have not been taken up at the policy level except when pushed by the Non governmental organisations. Thus, the Government of Gujarat launched "Sardar Patel Participatory Water Conservation Project" in the scarcity-hit districts in 1999. While 60 per cent of the cost was borne by the Government, the remaining 40 per cent cost came through contributions from the beneficiaries. In Saurashtra alone, 10,708 check dams have been built in a short span of six months during the year 2000 with active participation of local people under this scheme, and work on another 1200 check dams is in progress (Government of Gujarat 1999-2000). Recent schemes of the government include, a scheme called "Construct Your Own Check-Dam" being implemented by the state for the first time in the history of Gujarat. Under this scheme, if the beneficiaries or a concerned NGO is ready to bear 10% of the cost of check-dams, the state will bear the remaining 90%. The basic idea is to create awareness of quality of work among farmers, a sense of ownership among users (since they spend 10% of the cost), encourage economic use of water, and transfer the responsibilities of operating and maintaining the check dams to user groups. Therefore, a number of salinity ingress prevention works to prevent salinity ingress in water-scarce coastal areas of Saurashtra and Kachchh, have been taken up such as construction of tidal regulators, 'bandharas' recharge reservoirs, spreading and radial channels etc. It is visualized that the basic effort will involve ground water recharge and rainwater harvesting for collecting as many water as possible for drinking water needs. Lined ponds, unlined traditional ponds and tanks, small check dams and other water harvesting surface structures, ground water recharge, hand pumps, shallow aquifer recharge, roof rainwater collection and several other existing possible alternatives will be considered first.
It can be concluded from the above analysis that many of the problems facing water supply schemes and projects are due to the lack of institutional arrangements at the local level that can take care of the management of infrastructure and services. As institutions engaged in drinking water supply services have been technically oriented, they have not been much concerned with social factors that actually determine a community’s access to water supply. There is a clear need for building institutional capabilities for addressing the social issues that often impede the success of water supply projects. Local community based organization exist today like pani samitis and village water committees under the Umbrella Non-government agencies (NGOs) in Gujarat. These NGOs are actively participating in drinking water programmes.

In the above context of community action, an analysis of the role of women’s groups has not been particularly looked at in studies undertaken earlier. This study seeks to bridge this gap and make visible the issues and role of women in efficient water management programmes for good governance through the case study based in the state of Gujarat, which has many examples of community involvement through women’s empowerment. For this purpose a field study was conducted in Gujarat and the case of SEWA was studied to understand how rural women have been involved in the grassroots campaign for access to water and how this has brought them into direct negotiation with the state at all levels. The chapters ahead therefore describe the field study in detail.