COMPENDIUM OF CASE STUDIES

….Water for All & Always

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Study Review:

Water Team – Development Alternatives

Framework Research and Writing:

Mr. Amod Khanna, TAAL, Bhopal

Photos:

Development Alternatives

Layout and Design:

Mr. Motilal B. Soni

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1. WATER ENTERPRISE MODEL AT KACHIPURA

1.1 Context

In Bundelkhand region 90 per cent of the drinking water needs of the household (including livestock) are met by ground water sources. These sources are often found to be contaminated with Bacteria, Turbidity and Nitrates leading to adverse impact on health with frequent recurrence of diarrhea and dysentery among children and adults. Water quality surveys conducted by Development Alternatives in the rural areas of the region had indicated that 65-70% of the samples collected were contaminated with coliform bacteria and nitrate that makes it unsafe and hence unfit for drinking water purposes.

The responsibility of ensuring safe drinking water to the people lies with the government. However, due to improper maintenance and lack of ownership by the community over the water resources most drinking water facilities become non functional especially during periods of water stress. This leads to a situation where by households have to travel long distances to fetch safe drinking water, incur health costs and loose livelihood opportunities on account of frequent occurrence of diseases.

1.2 Concept

Water Enterprise is a micro- enterprise that has the capacity to deliver clean drinking water at an affordable price to the households. The enterprise can be owned and managed either by an individual entrepreneur or by a group that is willing to conduct it as a livelihood generation activity. The aim is thus to develop a self supporting water delivery mechanisms that have the capacity to provide quality water, managed as commercially viable units, using reliable technology, and have the scale to be sustainable as a livelihood option.

In the context of unsafe drinking water the concept of Water Enterprise involves developing a package comprising of purification technology; undertaking investments in creation of infrastructure, namely, the water source and installation of purification technology; development of a revenue generation model and management of enterprise; and ensuring profitability as a business unit. The assumption here is that there is demand for **safe** drinking water and that the households are willing to pay if a product (clean water) is developed and sold to them at an affordable price.

1.3 The Model

Kachipura, the village is located in Binwara Gram Panchayat of Niwari block in Tikamgarh district. The village had registered 53 households during 2001 Census with a total population of 298 persons of which 19% were children below the age of 6. The dominant caste of the village comprise of persons belonging to Kushwaha caste (recognized as Other Backward Classes) with couple of families belonging to scheduled caste also residing in the village.

Need

There is no hand pump in the village and households are dependent on dug wells as the common source of drinking water. During drought, and periods of water stress, most of these sources were dried and households had to walk to their fields to collect water for domestic purposes. However these sources were contaminated with villagers reporting blackening of teeth and frequent occurrence of diarrhea in the village. According to the local traditional healer of the village children were affected on an average of 8 to 10 days in the month on account of diarrhea. There was loss of wages of at least two days in a month for adults on account of diarrhea.

Entrepreneur

Jairam who is the entrepreneur of the story, belongs to Kushwaha caste and is a small farmer of the village with landholding of 10 bigas (3 acres) of irrigated land. Through his dug well in the field he is able to take three crops of vegetables in a year. For drinking and domestic purposes the family had a dug well within the house. The water from the dug well was however neither clean or safe nor adequate for the household requirement. With prolonged period of water stress this well was getting dried up and the family had serious problem of securing safe water for the household.

Investment

Development Alternatives(DA) had tested the water for its quality of Jairam's dug well and found it to be unfit for drinking water purposes. Jairam had indicated to DA that he is planning to invest money for deepening a bore well and a motor for pumping water. The total package was defined as follows:

(a) Development Alternatives would provide purification technology worth Rs 30,000. This technology would include Jal -TARA Water a Purification System based on Bio-Sand Filtration Technology.
(b) Land, power connection, civic construction worth Rs 25,000 will be borne by the entrepreneur, that is, Jairam
(c) Installation of a bore well worth Rs 15,000 and motor worth Rs 33,000 will be borne by Jairam,
(d) Jairam will provide service and generate revenue from providing safe drinking water to the villagers. The business unit will be wholly managed by the entrepreneur.
(e) Development Alternatives will undertake regular testing of water and provide report to the entrepreneur.

Income

Jairam decided to price his water at the rate of Rs 20 per household per month for a 12 liter **Jerry Can** (food grade quality). There being 25 household it would imply an income of Rs 500 per month or Rs 6000 per annum. In terms of pricing each of the user households will be able to get safe drinking water at the rate of 0.66 paisa per liter.

Safe Water

Parameters	Observed value		Standards (BIS 10500, 1991)
	Bore Well (6 Oct 2007)	After Purification System (24 Oct 2007)	
PH	7-8	7-8	6.5-8.5
Temperature	-	-	27^{0}C
Coli form	Present	Absent	Nil
Fluoride-F (mg/l)	<0.6	0.6	1.0
Residual chlorine-RC (mg/l)	NA	NA	0.2
Nitrate (NO_3),mg/l	<45	<45	45
Iron (Fe), mg/l	<0.3	<0.3	0.3
Hardness (HRD),mg/l	350	260	300-600
Chlorides (Cl),mg/l	240	198	250-1000
Ammonia (NH_3),mg/l	Nil	Nil	Nil
Turbidity(NTU)	25	<5	<10

After Jairam had installed the bore well the water was tested by Development Alternatives on 6 October 2007. The Jal- TARA Filter was installed and the water from the filter was again tested on 24 October 2007. The water test reports are given in the accompanying table.

The test reports were shared with the members of the household at Kachipura. They were informed about the quality of water and what different parameters meant in terms of their implication on health and taste.

Woman carrying clean water in a can from Jal-TARA Water Filter, Kachipura

Operation

The Water Enterprise for Jairam was lucrative. This was because of the prevailing drought conditions in the area, lack of alternative water sources to the villagers, and the safety factor of the water that was publicized by DA. The households not only from Kachipura but also from nearby villages, Asathi and Binwapara, also collected purified water from Jairam. People come with their Jerry Can from the neighbouring village and take filtered water that is primarily used for drinking water purposes only.

1.4 Challenges

Though the income projections of providing safe drinking water at the rate of Rs 0.66 liter were lucrative for the entrepreneurs, but the ability of the entrepreneur to carry on revenue generation on a sustained basis was the major challenge. This is especially in a culture where making provisions for drinking water is considered as a *dharma ka kaam* (work for humanity/religion) it is difficult for the people to pay and for the entrepreneur to realize regular payments for water.

There was fall in income for the entrepreneur when some of the households from the village migrated. This fall was more than complemented by the increase in area of his business (from near by villages). However, given the fact that the household was able to earn sufficient levels of income from agriculture its dependence on income from water enterprise was to a much lesser degree hence he did not give enough priority to make income from selling water a regular revenue generation activity.

Given the conditions of drought in the region had created a situation where all the households had to travel considerable distance to secure water for the household. In such a scenario availability of water near to their houses (by creating a safe water source by Jairam and DA) was a god sent alternative. However with rains setting in and their own water sources became functional the dependence of other households on Jairam's water source decreased. Only those households where the water was of very bad quality (blackish in colour) continue to take water from Jairam.

1.5 Learning

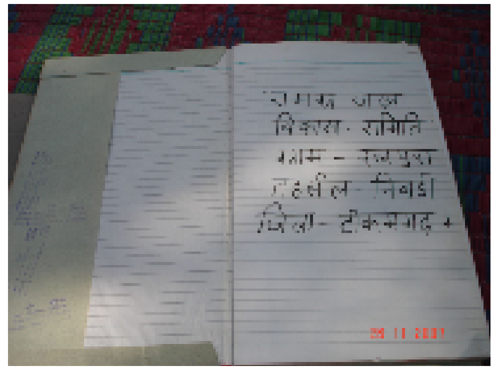
There is a great demand from the community on safe and clean drinking water. The community is willing and has the ability to pay for safe drinking water.

There is potential to develop a revenue generating model based on provision of safe and clean drinking water to the households. The success of the model will be dependent on the ability of the entrepreneur to realize payments from the households on a sustained basis.

Community members when informed about and educated on different quality parameters demand water that with high quality standards. This latent however needs to be translated in to felt and expressed demand to the service providers either in the government or the non government sector.

2. SAMAGRA JAL VIKAS SAMITI(SJVS) AT RAJPURA

2.1 SJVS



Samagra Jal Vikas Samiti (SJVS) within the project has been conceived as a community based organization to develop institutional mechanisms for:

- implementing works identified during the Micro Planning exercise at the village level;
- develop management systems including methods of water distribution, revenues collection and conflict resolution;
- undertake operations and maintenance of community works installed by the project;
- provide institutional and financial sustainability to the investments made by the project so that benefits are available to all the households in the village;
- emerge as a representative body of the community on issues related to water and sanitation at the village level as well as to connect and coordinate with Gram Panchayat and Government Agencies at the village level.

The process of formation of SJVS started towards the end of the PRA exercise for data collection and as it moved towards identification of core issues and problems and exploring alternatives for improving the access and availability of water for all and always in the project villages.

2.2 Rajpura

Rajpura is situated at a distance of 50 kms from the Niwari block headquarter. It has a population of 1162 persons belonging to Lodhi Rajputs, Ahirwars, Pal, Dhimar, Sen, Banskar and Pandit in the order of their numerical dominance. In terms of caste composition, 80% of the population belongs to Other Backward Classes and 20% belongs to scheduled caste.

Rajpura has a female sex ratio of 911 with female literacy as low as 33% and male literacy being 61%. According to the villagers 23% of the families in the village fall in the rich household category where as 48% of the households are either poor or very poor. The remaining 28% of the households comprise of the middle class of the village.

The main occupation of 78% of the households is agriculture and 10% as wage labourers. Another 6% of the households report livestock rearing as their main occupation with3% households dependent on trade as their primary occupation and 1% on services. However, only 1% of the households in the village are landless with medium and small and marginal farmers having approximately equal proportion of households, namely 40 and 39%. Big Farmers, with land more than 5 acres, comprise 20% of the households of the village.

35% of the households used to meet their water requirement from 2 hand pumps and 25% households from the community open well. There were 39% families that were their irrigations wells for drinking and domestic purpose. However, water from open well is not preferred by the households as they found it is polluted. The PRA data in the village revealed that 90% of the water needs are met by women in the village. It was also estimated that one woman carries 30-40 liter of water in 2-3 pots at a time. The maximum distance to fetch drinking water primarily from 2 hand pumps is up to 0.5 kms and it takes her 2 to 4 hours to collect water for domestic purpose.

The series of discussions identified the core problems in water as rocky terrain, low water table and drought conditions as the major environmental factors and defunct hand pumps as the institutional issues affecting availability of water in the village. The community agreed on providing piped water supply with household connections as the main supply network to ensure for water for all in the village.

2.3 SJVS at Rajpura

The discussions related to issues in water and sanitation was held with different groups in the village since the process of PRA had started at Rajpura. The first formal meeting for the formation of SJVS in the village was held on 23 January 2007. This meeting discussed the need for SJVS and its area of operation and responsibility under the project. The meeting also identified the type and characteristics of members of SJVS that will be nominated and selected in such a way that all caste groups are represented in the committee. At present the SJVS has 11 members of which 3 are women and 8 men. The Secretary of the Samiti is a person nominated by the project Team.

Month	**Major Milestones of SJVS Rajpura**
Jan 07	• SJVS Formation
Feb 07	• Water Resistivity Survey
Apr 07	• Nomination of Office Bearers Opening of Bank account • Collection of Contribution
May 07	• Exposure visit • First and Second Bore
Jun 07	• Resistivity Survey • Third Bore and Construction of Pump house • Laying of Pipe line
Jul 07	• Plantation of Anwla and Karonda
Aug 07	• Toilet construction • Drainage and soak pit

Sep 07	• Water testing • Printing of receipt book for each tap stand • Tool kit for O&M • Purchase of generator set
Nov 07	• NADEP • Water Filter
Dec 07	• Jal Kal Campaign • Income and expenditure finalized
Jan 08	• Finalization of check dam
Feb 08	• Jal Tara Filter • Meter Reading at each tap stand
Mar 08	• Repair of generator • Finalization of Samiti accounts
May 08	• Tap repair

Since its formation SJVS at Rajpura has undertaken the following activities:

(a) Conducting Meetings: During the first 20 months of its formation (From January 2007 to August 2008) the SJVS at Rajpura had conducted 41 meetings, indicating the intensity of consultation among members as well as faith of the project in involving the community and its representative groups during different phases of implementation. The Samiti has its bank account with Canara Bank and is operated with the joint signatures of its President, Treasurer and the Secretary.

(b) Leadership in Provisioning of Water: SJVS at Rajpura has emerged as the community organization that has taken leadership in establishing coordination for securing water for all the households in the village. This has been best exemplified in the digging of bore wells under the project in the village.

The site for installation of bore well was finalized after water resistivity survey and communicated to the project team. On 20 May 2007 the bore well was declared a failure when despite digging up to 100 ft it did not strike water. A meeting of SJVS was immediately convened for selection of an alternative site and this time they took the help of water diviner who identified site on a private land. The person (Ghamandi Lal Ahirwar) demanded Rs 1 lakh for the land and appointment of his son as the motor operator. SJVS refused and asked the water diviner to identify another site. This site was also on private land. The SJVS members met the landholder and convinced him of giving a no objection certificate and donation of 10x10 ft of land to SJVS which he (Vishal) promptly did. This led to digging of bore well and it stuck water at 45 ft. However, after a week when the bore was being tested the motor left water implying that the bore did not have sufficient water.

2 June 2007 the SJVS met again and requested for a third bore in the village. The project team informed the committee that it does not have funds to invest on the third bore in the village. The SJVS promised to bear half the cost of installation of the third bore well. The site was identified by the water diviner and also confirmed by resistivity survey. The site was located at private land of Meghraj Rajput who donated 15x15 ft of land to SJVS. The third bore was successful with bore well giving water up to 2.5 to 3 inches at 105 ft.

SJVS was persistence in developing a water source that will be able to supply water for the village as and demonstrated character by not bowing down to pressure tactics of private land owner of giving them money/appointment. It has been a complete sense of ownership that led the SJVS to explore alternatives and seek success in installing bore well with sufficient water for all the households in the village.

(c) Ensuring Community Contribution: There have been three instances where community contribution was ensured for continued water supply to the households in the village: *one*, for installation of the third bore; *second*, for laying down the pipeline in the village; and *third*, collection of water charges per month. The former two are in the nature of one time payments where as the third is in the nature of regular monthly payment.

The SJVS at Rajpura allocated the total cost of the former two (Rs. 43000) equally amongst all households of the village. The households were however given the option of contributing either by way of cash or labour. Later on, when SJVS decided to buy a generator to overcome the problem of frequent and prolonged power cuts, it collected Rs 33,000 from the community to buy a generator set. The monthly payments were decided to be Rs 20 per household per month to take care of the honorarium of the operator, minor repair of the tap stand/pipe line, and to pay for the electricity charges. These payments were collected by one point person for each of the tap stands in the village. In case of defaulters the matter is brought to the notice of the office bearers of the Committee who visit the defaulting household and pressurize them to make payments regularly.

In addition to the above mentioned contributions, the SJVS has also ensured beneficiary contributions in case of construction of toilets and other expenses for construction of soak pit and roof water harvesting in the village.

(d) Revenue Collection: A system for collection of water charges from each household in the village has been developed by SJVS. The water charges are collected for each of the 12 tap stands, with approx 15 households per tap stand. A separate receipt Book has been printed for each tap stand. One person has been nominated by the SJVS to collect water charges by the 10th of every month and deposit the amount to the SJVS Treasurer. The amount so collected is deposited in the bank account of the Samiti.

(e) Works Implemented: SJVS at Rajpura had directly implemented the works that included Installation of Bore Well; Construction of Pump House; Purchase of Generator Set; Laying of Pipe Line (2.75 kms); Installation of Tap Stand (12); Roof Water Harvesting Systems (4); Installation of Water Meters (13); Construction of NADEP Pits; Construction of Check Dam and Plantation of Anwala and Karond saplings(350); Installation of Jal Tara Filters and Construction of Latrines in households. .

(e) Leveraging Resources: SJVS in coordination and collaboration with Gram Panchayat has been able to leverage the following resources for the village:

Leveraged Works	Name of the Scheme	Amount
500 meters of CC Road	NREGA	4.99 lakhs
600 meters of drain line	NREGA	1.35 lakhs
Pond (*talab)*	NREGA	2 lakhs
2 Farm Ponds	NREGA	50 thousand
150 Tree Guards	NREGA	1.5 lakhs
50 Latrines	TSC	2.5 lakhs
2 Wells	NREGA	3.48 lakhs
Total		**16.32 lakhs**

The SJVS at Rajpura has thus generated Rs 16.32 lakhs as funds from the Gram Panchayat for the benefit of the community. It needs to be underlined that these schemes are directed either for water harvesting (wells, ponds, and farm pond); or related to sanitation (drainage, and toilets).

(f) Conflict Resolution: In the initial period of water supply through the piped water supply, instances of conflict at the tap stand were reported to the SJVS at Rajpura. These conflicts were mostly related to who will take water first from the tap stand. Once the families at the tap stand were not able to resolve the conflicts on their own SJVS resolved that one family will take water in two utensils at a time and then will allow the person next in line to take water. Once all the families at the tap stand have taken water then the family that was first in line can take water again but in no case in not more than two utensils at a time.

Another conflict is related to non payment of water charges. In such cases the SJVS as a group approaches the defaulter and pressurizes him to make the payment. According to SJVS this tactics has ensured payment from all the households in the village.

(g) Water Testing: Gajraj has been nominated by the SJVS in the village to collect water samples from all the taps and in all seasons and test the samples according to the training provided to him. The test report is sent to TARAgram and also discussed during the SJVS meetings.

(g) O & M: SJVS Rajpura has been provided with a tool kit for undertaking repair and maintenance of the piped network and the tap stand. Training has also been provided to the members in undertaking repairs. Cost of repair in terms of replacement of equipment or part thereof is to be borne by the Samiti from the monthly revenue collection from users.

(f) Water Metering: Community level water meters have been installed at the main supply as well as the individual tap stands at Rajpura. The reading at each of these meters is taken once a month so as to assess the total supply at the water source, that is, at the pump house and also at the tap stand. For example, by April 2008 the water supply at the pump house had been 2989 units, where as at Tap Stand 2 the supply had been 236.2 units for the same period.

2.4 Sustainability of SJVS

As an institution SJVS has been able to establish its identity in the community as an institution that works on issues related to water and sanitation. The sustainability of the Committee has been ensured by:

(a) Agenda: The water supply system developed under the project has been handed over to the SJVS which is responsible for its management and O&M. This is sufficient reason for the SJVS to meet regularly at least once and ensure water supply for the village.

(b) Institutional: Presence of office bearers, recording the minutes of meeting, maintenance of receipts and accounts, nomination of Field Worker of DA as the Secretary, maintenance and custody of records related to Rajpura (PRA, Village Plan etc) are factors that are directed to reinforce the institutional sustainability of SJVS. Moreover with leveraging of resources from Gram Panchayat and providing technical help to Panchayat during implementation the SJVS has been institutionalized as a representative and technical body of the village.

(c) Financial: Having its own bank account and receiving regular flow of funds by way of per month collection charges, appointment of motor operator, ability to raise funds from the community on its won (generator) has given the financial strength and confidence of the Committee to sustain beyond the project period.

(d) Promoting Other Institutions:SJVS has been instrumental in promoting other community based institutions in the village, namely self help groups. Prior to its formation there were two self help groups in the village. However, after the SJVS had been formed and during its interactions with DA it learned about the concept of, and the functioning of, Self Help Groups. Since then it has promoted 6 more Self Help Groups of men and women in the village. This has led to interlocking of membership among different community institutions which in the long run will promote each other's cause and sustain each other's activities.

3. PIPED WATER SUPPLY

3.1 Government Schemes

The prevalent and popular models for Water Supply by government agencies are either based on provisioning of hand pump, construction of dug wells, construction of Overhead Tank with Piped Water Supply, or supplying water through the Tankers. The PRA exercise at the village level during the early stages of project implementation had highlighted the following:

(a) Hand Pump: There were 63 hand pumps in the 10 project villages of which only 36 were functioning at that time. The main reason for non functionality of the 27 hand pumps was that the ground water had depleted rendering them useless for supplying water. The repairs of such hand pump would have required substantial investment and these could not have been undertaken by the community given the fact that the funds for repairs is available with Public Health Engineering department of the respective state governments.

Name of the Village	Number of Hand pumps	Functional	Users (HHs)
Kalothra	3	4	45
Hastinapur	3	0	0l
Gopalpura	3	2	45
Ganeshgad	10	3	141
Rajpura	4	2	83
Maharajpura	7	5	126
Bagan	2	1	80
Pipra	11	4	275
Bilt	10	8	175
Bamori Sheetal	10	7	280
Total	**63**	**36**	**1205**

On an average more than 33 households were dependent on hand pumps for accessing drinking water which is way above the UNICEF norm of 12 households per hand pump.

The location of hand pumps is based on the socio political dominance of the social groups of the village which adversely affects the ability of other caste households to access water from these hand pumps. As a result the household's preference is to access water from sources that are socially accessible even of it implies walking a considerable distance in securing water for the households. This had led a number of households to access water from private irrigation wells that are spread in agriculture fields in and around the villages.

(b) Dug Wells: The second major source of drinking water for the households is government dug wells. There are 25 such dug wells in the 10 project villages among which only 8 were functional at the time of the survey.

Name of the Village	Number of Wells	Functional Wells	Users (HHs)
Hastinapur	1	0	0
Gopalpura	1	1	7
Ganeshgad	3	0	0
Rajpura	3	1	60
Maharajpura	4	3	46
Bagan	2	0	0
Pipra	4	0	0
Bilt	3	2	55
Bamori Sheetal	4	1	0
Total	**25**	**8**	**168**

The main reason for non-functionality of these wells has been their drying up on account of poor rains. To make these wells functional would require investment in making them deeper and also harvesting water during rains.

The repair and maintenance of dug wells is with the state government through the Public Health Engineering department. Any investment made for revival of these wells would have implied duplication of resources.

(c) Tankers: Supplying water through tankers is a temporary measure and is undertaken during times of extreme water stress. The water in such cases is supplied at periodic intervals and it requires private investments in storing of water as the supply may be irregular due to pressure from other villages also.

(d) Overhead Tank: The scheme for water supply through construction of an overhead tank and piped water supply in the settlement was tried under Swajaldhara programme of the state government. This primarily required that there should be 10% contribution by the community and formation of Swajal committee to operate and manage water distribution. This programme could not become popular because it was primarily dependent on the government functionary for its design and implementation. The 10% of community contribution was sought to be made based on the budget so developed. Secondly, the process of planning and implementation was with the department and the Panchayat and situation that allowed extremely limited and restrictive participation. Thirdly, there was considerable gap between planning and implementation that was de-motivating and made members of the community look for alternative sources of drinking water. Fourth, the scheme was for drinking water only. It did not take an integrated view of the demand for water and in that sense was directed to fulfill only limited demand for water.

3.2 Project Approach

The **Status Report of Water Resources in Tikamgarh and Jhansi districts** prepared by Development Alternatives and supported by the project had made three key recommendations, namely, implementation of integrated resource management approach; facilitating community water management initiatives; and promoting economic instruments for efficient and sustainable water resource management. Given these approaches it became critical for the project to ensure that **all** households in the village are covered, planning and implementation is done by a **community institution**, the users **pay and use** water, and interventions are designed comprehensively to cater to different demand for water- domestic, irrigation, livelihood, ecological etc.

The strategic element for project implementation was the formation of Samagra Jal Vikas Samiti. This is a community based organization with representation from all the social groups of the village that was to be capacitated for planning and implementation of water supply to all the households of the village. The values inculcated in the members of the SJVS and the pro activeness of the committee was to be a decisive factor in ensuring water supply in the village. Since SJVS came in to existence along with the process of finalization of village plan and budget it did not have any personal interests in the choice of technology and the preparation of the water supply plan of the village.

3.3 Piped Water Supply

The review of different schemes of the government and consultations held with the community during PRA exercises had led to a strategic plan under the project as follows:

(i) Hand Pump: The objective here was to increase the ground water table as this would revive the hand pumps in the long run. This would require adoption of watershed approach and identify and construct water harvesting structures in and around the village. Minor repair of hand pump (e.g. platform repair etc) would be undertaken to make the hand pump functional.

(ii) Dug Wells: The long term plan for revival of dug well is directed at improving the ground water table in the region through construction of water harvesting structures by adopting a watershed approach. Minor repairs of these wells would also be taken up to make them functional.

(iii) Overhead Tank with Piped Water Supply: The cost of implementing this scheme is high and given the current experience of the community it is not likely to find many takers. Hence the project decided to develop its own model of water supply for the village.

(iv) Piped Water Supply: The model developed by the project included a package of providing water through tap stands that are connected with a network of piped water supply to the water source. The essential components of the Piped Water Scheme under the project included:

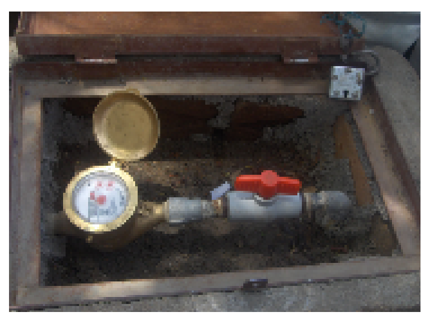
(a) Installation of a Bore Well: Bore well would provide the opportunity to develop water source for the village. The bore well will be installed on land that will be owned by the SJVS. Incase the site for bore well has been identified on a private land it will be donated and transferred to SJVS before digging for the bore well.

(b) Construction of Pump House for the Bore Well: The bore well was secured by construction of pump house where the motor was installed and where the electricity meter was also installed. The pump house was also on land that was accessible to the SSJVS. For example at Pipra the bore well and the pump house was constructed on school land. The money for the bore well was provided by the school and the resources for the pump house was provided by the project.

(c) Installation of Pipe Line Network in the village: The pipe line network was finalized by the village community with technical assistance provide by the technical staff of the project. The cost of laying the pipe line was shared between the community and the project. The actual sharing was different for each village depending on the local context and resources.

(d) Tap Stand Post: The tap stand is located within the village in such a manner that the number of households for each tap stand is approximately the same in the village. The location of tap stand was the source of conflict between households and it had to be negotiated and settled by the members of the SJVS.

The tap stand was made from a reinforced concrete structure to provide strength and also to ensure that only one vessel can be kept under the tap at a time. Secondly, the concrete structure also provided the space for the water meter to be installed.



(e) Water Meter: Water meters have been installed at each stand post and a water meter at the pump house as well to assess the total water supplied in the village. The aim initially is to allow community to assess how much water is consumed and what are the possible differences in consumption pattern among households in the village.

For example, at Pipra there were 11 Hand pumps and 4 government dug wells. At the time of survey of only 4 hand pumps were functional and were catering to more than 275 households of the village. None of dug wells were functional since they had dried up. The village was served with water tanker but it was providing water to only 12 families that are related to Sarpanch in the village. Given the population of the village- 289 households and in the context of the UNICEF norm of one hand pump for 2 households it would require 24 hand pumps in the village. The dug wells were reported to go dry after December every year. There were around 40 families which had irrigation wells in their agriculture fields and they would draw water from these wells for drinking and domestic uses.

Particulars	Project Cost	Community Contribution	Leveraged Resource	Total
Bore well	-	-	15000	15000
Pump House	13975	10705	-	24680
Pipe Line	184092	31950	-	216042
Stand Post	27576	51185	-	78761
Total	**225643**	**93840**	**15000**	**334483**

The plan for Piped Water Supply for the village led to development of 19 tap stand post that would serve 15 households approximately. The total cost of the package is given in the accompanying table.

Each household pays Rs 15 per month as fixed charges for water that is able to take care of the honorarium of the motor operator and payment of electricity charges to the Electricity Board.

The taps are located within the colonies and none of the households have to travel a distance of more than 20 meters to access water which in contrast to the distance of not less than half a kilometer they had to travel to access water from the hand pump and more if they were accessing it from irrigation wells in the fields.

3.4 Challenges

The major challenge faced by the Piped Water Supply system is the regularity with which electricity is available to the village. This is because the motor is electric operated and can only run when and for the duration power is supplied to the village. In cases where the community could afford and where the electric supply was erratic, e.g. Rajpura, the community has contributed to purchase generator so that water can be supplied to the community at fixed time.

It needs to be highlighted that the Piped Water Supply system was installed when the region had faced drought continuously for the third year. There were extreme cases of water stress and the community was desperate to find lasting solution to the problem. In such a scenario getting community contribution and regular monthly payment was much easier. As the rains were normal and the private water sources of the households were filled again there has been resistance from the households regarding monthly payment. The SJVS is dealing with this situation in its own way (e.g. not supplying water in a daily basis).

4. ROOF-TOP WATER HARVESTING

4.1 Context

The document titled Water Resources in Tikamgarh and Jhansi districts A Status Report states that both the districts have experienced rapid and mass scale degradation of natural resources resulting in a very high proportion of wastelands and acute scarcity of water. This is despite that fact that both the districts receive decent amount of rainfall (1000 mm and 850 mm for Tikamgarh and Jhansi respectively). In terms of ground water availability Tikamgarh has been placed in the semi critical category though the situation of Jhansi in this regard is much better. The two districts have a strong history of construction of water harvesting structures, namely, the step wells, Bundela tanks, village ponds, haweli bundhies and so on. Many of these are in a state of neglect and are not able to harvest water for use during dry periods.

The challenges in making water available to the rural communities in the two districts as identified by the report include, wide variations in seasonal availability of water; reduced ground water recharging and over exploitation of ground water and neglect of traditional water harvesting structures among other trends. The data on functioning of hand pumps and dug wells in the 10 project villages had revealed that 43% of the hand pumps and 64% of the dug wells are non functional because the water table had dried up. The short run measure for increasing the water availability may lead to sinking of more hand pumps, or deepening of existing hand pumps and wells but in the long run measures will have to be in place that lead to improvements in water table in the region. These measures will be essentially rooted in the development of and use of water harvesting technologies in the region.

4.2 Water Harvesting

Rain water harvesting is the process of collecting rainwater directly or recharging it in to the ground water storage with the aim of in creasing the availability of ground water during dry periods; preventing ground water depletion in areas of over exploitation; and enhancing sustainable yields of aquifers including the quality of ground water. The water harvesting technologies are based on the three principal components that include the catchment area, conveyance system and collection devices.

Depending on the local conditions and the pattern of rainfall each region has developed its own technology of water harvesting structures. Some of the traditional water harvesting techniques include Recharge wells; Percolation ponds; Contour bunding; Check dams and gully plugs; Sub surface dams; Tankas; Step wells, Baolis etc. All these techniques were however developed on the basis of land surface as the catchment area hence their tools and methodologies of their construction were accordingly defined.

In the present context these technologies have been integrated in to the watershed approach that include both the water conservation and water harvesting measures that are directed to improve the ground water table as well as make water available for agriculture during non monsoon periods as well. These technologies require substantial investment in terms of labour and material and also availability of community land for the construction of these structures. These technologies have been implemented by government and non government agencies in the Bundelkhand region under different projects and programmes. Development Alternatives also decided to introduce the Roof Water Harvesting technology in the region under the present project and assess its viability, relevance, adoptability and acceptability in the region.

4.3 Roof-top Water Harvesting

Roof Water Harvested has the advantage of supplementing other sources of water supply, has lower cost of supplying water, and taps high quality water which is safe and free from chemicals. The technology has been found to be useful in places where groundwater is scarce and/or contaminated where population density is low and where water is too hard and mineral laden, and where electric supply is irregular which adversely affects the ability of the household or the community to draw water.

Catchment System: Roof Water Harvesting follows the basic principles of other water harvesting structures with a major difference in that it uses roof as its catchment. In its most basic form the rain water is collected in simple vessels or drains at the edge of the roof and conveyed by pipes to containers for settling particulates before being conveyed to the storage container. The water so collected can be used for drinking, cooking, bathing, cleaning of house and toilet, washing clothes, livestock requirement and even irrigation.

In the project the main aim of installing Roof Water Harvesting was to demonstrate the effectiveness and benefits of the technology at rural level. Initially village Bilt was selected mainly because the resistivity surveys failed to identify any suitable source which can be used for the piped water supply. Hence as an alternative approach it was decided to improve/repair the existing hand pumps and to reduce the load on ground water resource through rainwater harvesting.

The selection of beneficiary was based on the suitability of Roof Water Harvesting to their house type and size (cost effectiveness), their interest to adopt the technology, and commitment to contribute in the intervention. Households with kachha roofs were also selected to demonstrate it in the rural context. The RWH system was installed on all the different types of roofs- tiled roof, stone slabs roof, and roof made from reinforced concrete.

Setting up RWH at slanting roofs

Conveyance System: The conveyance system for water from the catchment o the storage tank included water collecting systems- pipes and gutters, down take system comprising of vertical pipes including first flush device (which is used for removing the silt coming through the first rains), and a de-silting chamber.

Storage System: Most of the Roof Water Harvesting structures are built with the aim of storing harvested water for the purpose of recharging ground water. At places where the dry season and spells are long, as is the case with Bundelkhand, it is always recommended to use this technology for recharge purposes because the storage structures will be of large dimension and will increase the cost of installation of the system. However, at the time of design and in consultation with the beneficiaries it was found out that there is always demand for water at the household level. During periods of water scarcity investments on storage tanks will be fully realized as it will reduce the uncertainty, drudgery of drawing water over long distances, and reduce the cost of accessing water. Small hand pumps were also provided on the tank structure to develop conservative practice of drawing and using water. Consequently in Bilt and later on in other villages most of the structures are designed for storing the harvested water. The design and location of storage tanks allows the beneficiary to store the tanker water also during severe water scarcity when they are dependent on tanker supply only, which is also supporting the livelihoods by providing water to livestock when required.

Check list for Roof top Rainwater Harvesting Systems

Collection and Conduit System

- Consider increase in weight of conduits as there will water be flowing in them. Secure them properly with wall and each other. As a general principle there should be clamp at every 5 to 6 feet distance along the pipe/gutter. Join two gutters/ pipes through proper fixtures.
- Ensure water tight and secure joints.
- Provide proper slope in conduits including gutters (minimum 1.5 inch in 10 ft length).
- Preliminary filtration system and first flush device is installed in down take pipes. If water is not coming all along the roof, provide closed pipes as conduits instead of half cut pipes/gutters along with proper fixtures
- Use splash protection system if gutters are being used as collection system.
- Number of outlets should be enough for flow i.e. area and according to slope direction.
- Down-take pipes should also be secured properly with wall with the help of clamps.

Recharging and Peripheral Component Systems

- Install a de-silting system before any kind of recharging measure (whether it is through recharge pit or through bore well or any other method).
- Recharge pit and de-silting pits should be covered properly and there should be no risk of breakage of cover or someone falling in the pit.
- If there is any minute possibility of contamination of any other material especially any organic compound add a layer of charcoal in filter media (minimum 6 inch thick layer).
- Do not use open wells as direct recharging, there is risk of contaminating water resource (not only well water but the aquifer too). Always prefer recharge through filter media (that might be nearby well).
- Avoid recharging through bore well unless you can guarantee that there is no risk (even slight) of contamination of oil/ kerosene/ diesel, insecticides/ pesticides/ chemical fertilizers etc in the recharging water.
- If deep recharging methods are being used **or** recharging is being done near any water source (well/ hand pump/ bore well etc) ensure that there is **no** contaminated (drainage) water is mixed with the recharging water.

Always remember that water harvesting has to be for client's facility so it should not hinder any movement, accessibility to any facility and also consider aesthetic value of building and client's facility.

Fifty rainwater harvesting structures covering 18 kachha roofs with sloppy chappar and storing water in 42 storage tanks (rest recharging into the aquifers) is covering approximate 29,000 sq ft roof area. It turns into the average roof size of approximate 600 sq ft. the total storage capacity of the installed tanks are 300 m^3 which has the potential to harvest about 3500,000 liters of water.

Roof Water Harvesting Structures were built in three other villages of Tikamgarh in addition to Bilt, namely Bahmori Sheetal, Bagan and Rajpura. The cost of the structures was shared between the project and the beneficiary depending on the ability to pay of the latter.

5. BIO-SAND FILTERS

5.1 Water Quality

The study on ***Water Resources In Tikamgarh and Jhansi Districts- A Status Report*** had found, during the primary survey of 5 villages done in these two districts, that:

- *"in almost 59 out of 64 samples, the drinking water was contaminated with either coliform bacteria, nitrate, fluoride or iron which made the water unfit for drinking without treatment*
- *Coliform Bacteria and nitrate presence in the drinking water sources is primarily due to poor sanitation practices (water sources were seen to be surrounded by domestic sewage and cow-dung heaps nearby water sources) and agricultural operations (run-off from agricultural fields, use of fertilizers)*
- *Fluoride and Iron are mainly present naturally in the groundwater due to the rocks and minerals that form the geology of the region*
- *Due to poor quality of drinking water, there is high prevalence of diseases such diarrheal infections, cholera, typhoid, Hepatitis A, Gastro-enteritis, skin diseases and dental problems."*

Later on when the water quality testing of all the 10 villages under the project, of water samples collected in the three seasons during 2006 and 2007 was conducted it found out that Nitrate, Fluoride, faecal coliform and Iron were above the limits prescribed by IS 10500:1991/93.

Water Quality Report of Project Villages
The parameters and methods used for water quality testing in the 10 villages for 70 water samples have been given in the accompanying table.

Parameter	Method/ Protocol
Fluoride	APHA 4500 FC (ion selective method) in Lab Testing
pH	Electrode method
Nitrate	APHA 4500 NO_3 B UV Spectrophotometer
Faecal Coliform/ Thermotelorent Bacteria	MPN method BIS
TDS	Gravimetric and digital TDS meter
Hardness	Titration/ Volumetric method
Chloride	Titration/ Volumetric method
Turbidity	Visual method

The test report found out wide variations in these parameters across the three seasons. For example, Coliform bacteria were present in 50% of the samples during winter but it was identified above the prescribed limits in 38 and 42 during Summer and Monsoon months. Similarly presence of Fluoride ranged from 19 to 38 percent during the year. Presence of Nitrate was maximum during winter season in 26% of the samples and minimum during monsoon in 8% of the samples. Iron was present in 217% of the samples in monsoon and 5% during the winter months.

Based on the results of the Water Quality report the Project formulated a multi pronged strategy that included raising awareness in the community on issues related to implications of drinking contaminated water and simple water management practices; water purification measures based on the type of contamination in different villages; inculcate holistic water management practices including maintaining cleanliness around the water source, preventing water stagnation, keeping waste materials and drains away from the source and regular cleaning of storage tanks and utensils. Community based institutions formed under the project will be sensitized and trained for effective management of drinking water systems including purification systems and pipelines. These interventions will be complemented with regular surveillance mechanisms to monitor quality of water and take immediate measures.

5.2 Water Purification Measure: Slow Sand Filters

Sand filtration process has been used by man since centuries. Technological adaptation of this process has evolved in two types of sand filters: slow sand filters with the capacity of 2 to 6 m^3/m^2/day and rapid sand filter that has the capacity of 100 to 150 m^3/m^2/day. Slow sand filtration process has been found to be effective in simultaneously removing microbiological and physio-chemical qualities of water. Using the slow sand filtration process the project has used Jal-TARA Bio-sand Filters one at household and and at community level.

5.3 Jal -TARA Biosand Filters

Jal-TARA Biosand Filter is a household level 'Green technology' works on the principle of gravity sand filtration employing of bio-mechanical advantage. The filter uses biological and mechanical action in sand without adding any chemicals to the water. Large and fine particles of suspended matter are deposited on the surface of the filter bed by the action of mechanical straining and sedimentation respectively. The colloidal and dissolved impurities are removed by adsorption, whilst the organic matter is converted into organic salts by the purification mechanics. The filtered water is collected at the top via pipe system. Most microbiological action takes place in the' ***Schmutzdecke' (Bio- film)*** formed at the top of the sand bed. Jal-TARA filter is durable and has a very long life (approx. 10-15 years).

Filtration process

When the filter is first put into operation or after it is cleaned, a living 'Community' of aquatic aerobic, predatory microscopic organisms grow and form what is called

'Schmutzdecke' or biolayer in the top 5 to 10 cm of wet sand which must always be under oxygen rich water. This biolayer is very effective at mechanically filtering very small particles out of the water flowing through it. Also, the living organisms in the biolayer literally 'eat' pathogens in the water that get caught in the biolayer. Some filtering also happens due to the physical action of the sand below the biolayer. Water must not flow through the filter faster than the biological action occurs in the Schmutzdecke. In small versions of sand filters the drainpipes at the bottom connect to a (usually PVC) pipe that runs out and up to an outlet several inches above the top of the sand. This way water drains slowly and never leaves the surface of the sand exposed to open air (this will kill the biolayer very quickly). The action of water seeking its own level is a key part of the filtering operation as it helps to regulate the speed and pressure at which the water passes through the sand.

Salient Features of the technology

Jal -TARA Biosand Filter is the current generation's Green sustainable Technology. It's salient features are:

- It is a low cost, affordable, environmental friendly water filter. The cost of filter is Rs 450.
- It can provide a minimum of 20-25 liters per hour of safe drinking water to the community, sufficient for a family size of 5-6 members. Filter System removes Bacteria and Turbidity with efficiency up to 99.99%.
- Easy to install at any site in rural, urban, semi-urban and remote areas
- Removes Bacteria and Turbidity with efficiency up to 99.99%.
- System can even remove Viruses up to 91 to 99.99 %.
- System also removes iron with efficiency up to 75-80%.
- Improves water clarity substantially.
- Does not require addition of Chemicals nor power to function
- Works on the power of gravity
- Less maintenance and does not require skilled labour. Simple wet harrowing is required once in 6 months to a year.
- No reject water during or after filtration process nor any sludge formation.
- Life expectancy is of many years-approximately 5 -10 years, unless filter is not tampered or abused.

Operation and Maintenance

The operation of the filter is very simple: remove the top lid, pour water in to the filter and collect the treated water in another container. The maintenance of the Biosand filter requires removal of material that clogs and decreases the flow of water. This is maintained by stirring or replacement of the top layer of sand.

S. No	Source	pH 6.5-8.5	Coliform 0/ml	Iron 0.3	Turbidity 5-10 NTU
Source: Bore 12 May 2008					
01	Water source	7-8	Yes	1.0	<10NTU
02	Filtered Water	7-8	Nil	1.0	<10NTU
Source: Bore 14 July 2008					
01	Water source	7-8	Yes	-	< 1 NTU
02	Filtered Water	7-8	Nil	-	< 1 NTU

Studies have shown that Bio-sand filter have the capacity to remove 95 to 99% of organic contaminants (bacteria, protozoa, worms and particles).The water produced by the filter is free of discolouration, odour, unpleasant taste and can be used for drinking, cooking, personal hygiene and sanitation. The water quality tests conducted under the project before and after the filtration through Bio-Sand filters found that filter is extremely effective in controlling the microbial contamination as indicated by the presence of the coliform in the water. The coliform was not found in the water filtered through the Bio sand filters, provided they are being used regularly for last one month (approx.).

5.4 Jal TARA Water Filter at Community Level

Jal-TARA water filter is a 'Green technology' works on the principle of gravity sand filtration by employing bio-mechanical advantage.

Jal-TARA Filter at Community level: The Jal-TARA Water Filter is standardized in 1000 liters water tank with the output water supply of 2500-3000 litres per day. The filter that works using biological and mechanical action in sand without adding any chemicals to the water. Large and fine particles of suspended matter are deposited on the surface of the filter bed by the action of mechanical straining and sedimentation respectively. The colloidal and dissolved

impurities are removed by adsorption, whilst the organic matter is converted into organic salts by the purification mechanics. The filtered water is collected at the top via pipe system. Most microbiological action takes place in the' ***Schmutzdecke' (Bio- film)*** formed at the top of the sand bed. Jal-TARA filter is durable and has a very long life (approx. 15 years).

Filtration process

When the filter is first put into operation or after it is cleaned, a living ‘Community’ of aquatic aerobic, predatory microscopic organisms grow and form what is called ‘Schmutzdecke’ or biolayer in the top 5 to 10 cm of wet sand which must always be under oxygen rich water. This biolayer is very effective at mechanically filtering very small particles out of the water flowing through it. Also, the living organisms in the biolayer literally ‘eat’ pathogens in the water that get caught in the biolayer. Some filtering also happens due to the physical action of the sand below the biolayer. Water must not flow through the filter faster than the biological action occurs in the Schmutzdecke. In small versions of sand filters the drainpipes at the bottom connect to a (usually PVC) pipe that runs out and up to an outlet several inches above the top of the sand. This way water drains slowly and never leaves the surface of the sand exposed to open air (this will kill the biolayer very quickly). The action of water seeking its own level is a key part of the filtering operation as it helps to regulate the speed and pressure at which the water passes through the sand.

Salient Features of the technology

As stated earlier it is the current generation’s Green sustainable Technology. The salient features include:

- Low cost affordable, environmental friendly water filter, which can provide a minimum of 2500-3000 liters per day of safe drinking water to the community, sufficient for 500 people. Being modular a combination of units can be used to service as many people as required. The cost of installation is approximately 75000.00. The cost may vary depending on the site.
- Easy to install at any site in rural, urban, semi-urban and remote areas.
- Removes Bacteria and Turbidity with efficiency up to 99.99%.
- System can even remove Viruses up to 91 to 99.99 %.
- System also removes iron with efficiency up to 75-80%.
- Improves water clarity substantially.
- Does not require addition of Chemicals nor power to function
- Works on the power of gravity
- Less maintenance and does not require skilled labour. Simple wet harrowing is required once in 6 months to a year.
- No reject water during or after filtration process nor any sludge formation.
- Life expectancy is of many years-approximately 15 years

Studies have shown that these systems are capable of removing Faecal Coliform and Streptococci with an efficiency of 99 to 99.9%. In addition the system removes bacteria that cause Cholera, Typhoid, Dysentery, Amoebic dysentery, Giardia enteritis, and Hepatitis etc. The Jal TARA filters have been found to be of treating the following parameters:

- Removal of turbidity of value greater than 30 NTU to lesser than 10 NTU.
- Removal of coliform bacteria of varying between 25-100 MPN per 100 ml to nil.
- Reduces excessive Iron to permissible limit of 0.3 mg /l.
- Apart from this the system also improves the taste of the water and the odour removal.

These filters are most suited for institutions that have a daily high demand for water, e.g. schools in rural areas, haat or other markets, and bus stands. Under the project Jal- TARA filters have been installed in all the existing schools in the project villages. The filter has been connected with the pipeline which fills up the filter at the same time the households in the village receive their water. By the time the children get ready and reach the school they can have filtered water. The implementation of the Jal -TARA Filter has been undertaken by the Samgra Jal Vikas Samiti of the respective village. The members of the committee have been trained in the construction of the Filter as well as in its maintenance.

5.5 Learning

The main aim of introducing sand filters was to ensure safe drinking water to the community as well as to introduce proven technology in the villages that can be managed by the community itself. In so far as these objectives are concerned the project has been able to achieve its aim. The community has not only adapted the technology but has also expressed its demand for safe drinking water by agreeing to pay for the cost of filters. The articulation of the felt need of the community has provided confidence to the project team to experiment with the introduction of enterprise models for supplying safe drinking water to the households.

Samagra Jal Vikas Samiti has been trained in installation of the filters and also on their operation and maintenance. This has led to enhancement of capacity within the community and has decreased their dependence on outside sources.

6. VILLAGE SANITATION

6.1 State of Sanitation

Personal Hygiene: In villages where the water source is at a distance and the community has to draw water over a long distance the frequency of bathing and washing clothes is once a week or once in ten days. It is water shortage that determines the frequency of bathing and hence is an important determinant of hygiene behaviour. Hand washing by using soap or ash after defecation, before and after meals is not a common practice in the villages. The hygiene practice related to cleaning of teeth, and cutting and cleaning of nails was found to be wanting in it prevalence and adherence. At the time of conducting PRA exercises in the villages the team observed the rampant spread of skin rashes especially among children at Maharajpura, Bilt and Bamhori Sheetal.

Toilets:The coverage of households having toilets is extremely low in the rural areas of Jhansi and Tikamgarh districts. The data of the project villages collected during PRA revealed that toilets were constructed in 15-20% of the houses in only two of the 10 project villages. In other villages the practices of open defecation was widely prevalent. In other villages toilets have been constructed in school or at Sarpanch house. The toilets in school were mostly defunct and not in use whereas the toilet at Sarpanch house was used by some other households also.

Name of the Village	Number of Toilets in the Village
Kalothra	None
Hastinapur	1 in School
Gopalpura	1 in School
Ganeshgad	1 in Sarpanch house
Rajpura	15% of the houses
Maharajpura	2 in School
Bagan	1 in Sarpanch house
Pipra	1 in Sarpanch house
Bilt	2 in School
Bamori Sheetal	20% of the houses

During discussions with the community it was found out that there were four major reasons for non-construction of toilets in the villages: *one*, lack of awareness on the method of construction and the knowledge of appropriate technology with the community; *second,* lack of financial resources for construction of toilet; and *third,* shortage of water, as toilets require water for flushing that is not easily and readily available; and *fourth*, lack of awareness in the community with respect to poor sanitation facilities and its impact on health and hence on expenditure.

Despite the foregoing constraints the focus group discussions with women had listed need for toilet as priority during the preparation of the village level plan. Disputes and conflicts arising on account of use of private fields for defecation during agriculture season and adherence to early mornings and late nights for answering the call of nature by women and adolescent girls was listed as major problem areas in the village. In fact in villages' shortage of water was accorded first priority by women, burden of carrying water over long distance as second priority and open defecation as the third priority. However, availability of land for open defecation was also one of the factors that determined the demand for toilets. For example, at Maharajpura as there was acute shortage of open land the demand for toilets was very high in the village as compared to Bagan where there was open land that was accessible to women for open defecation as a result of which the toilets were given a lower order priority in the village.

Waste Water Disposal: In all the villages except at Bhamori Sheetal the waste water from the houses is discharged in open. In the absence of any open drainage channel or soak pits the water would be let out in the street leading to mud and even water logging in certain cases (e.g. Rajpura). At Bhamori Sheetal there was an underground drainage that helped in keeping the streets clean and dry.

Storm Water Disposal: Bagan is moderately sloped and at Bhamori Sheetal and Maharajpura there are nallah for drainage of rain water from the village. Other villages face the problem of water logging and presence of stagnant water in and around the village that poses health hazard to the residents.

Solid Waste Disposal:The traditional manner of waste disposal from the household included earmarking a particular site not too far away from the house as *ghoora* where the household solid waste would be disposed off. The waste material used to get decomposed as it was in open and receive direct sunlight. However with increase in population and growth of the houses in the village the ghooras have become part of the village being near the main street of the village. As a result the refuse and garbage that is blown away by the wind litters the village streets and lanes. Secondly, with increase in use of plastic and synthetic material the solid waste does not decomposes as easily as it used to earlier. At present there is no mechanism for collection, segregation or disposal existing in the rural areas for disposal of solid waste.

6.2 Village Sanitation

The project took a holistic view of sanitation in that it included personal hygiene, toilets, disposal of waste water from houses, rain water disposal and solid waste disposal mechanism as part of its interventions. Availability of adequate water was taken as a prerequisite for ensuring improved sanitary practices at the household as well as community level. It was also deemed necessary that the water should be available within easy reach so that carrying it over to the house for toilet does not impose additional burden on the person procuring water for the house. This was one of the major considerations that was critical in deciding the water supply model in favour of piped water supply through community tap stands within the village.

Personal Hygiene: The issues of personal hygiene were made part of the Jal Kal Campaign. Hand washing practices, bathing and cleaning behaviours were highlighted during the campaign in all the villages. Since the campaign was carried out immediately after the implementation of piped water supply works the acceptability of these messages was high and people were motivated to adopt these practices.

Toilets: Two types of toilets were introduced by the project: Ecosan and Two Pit Latrines. Showcased models of these two toilets were demonstrated in the villages so that the households can express their preference for the particular model that they would like to install in their house.

Ecosan: The Ecosan model separates human excreta, urine and wash water in to separate chambers that form part of the model. The excreta collected in the chamber below the toilet seat is allowed to decompose for a period of 6 to 9 months and then used manure in the fields. The wash water is diverted to plants that are raised near the toilet. The toilet has proven its merit in areas where the water bodies need to be protected, to substantially reduce health risks, increase soil fertility and need to use of grey water for irrigation. As demonstration units two Ecosan models have been constructed in school at Maharajpura.

S.No	Village	No of Toilets Constructed
1	Rajpura	25
2	Bagan	15
3	Maharajpura	25
4	Bilt	33
5	Pipra	70
6	Bamhori Sheetal	48
7	Ganeshgarh	55
8	Gopalpura	45
9	Rund Karai	20
10	Hastinapur	5
	Total	**341**

An important aspect of the Ecosan model is that it requires a major shift in the social outlook of practicing and viewing sanitation in the area. For example, human excreta that has since generations been treated as a waste, now requires to be looked as a resource. The toilet does not require flushing hence the concept of cleanliness also needs to undergo change.

Twin Pit Latrine: The toilet consists of a pan with steep slope (250-280 degree) and designed with a trap with 20 mm water seal requiring 1.5 to 2 liters of water for flushing. The toilet is connected to two pit of varying sizes and capacity depending on the number of users. When one pit is full the excreta is diverted to another pit. Normally the pits are designed for three years usage. In about two years the sludge is digested (becomes odour less) is dry and free of pathogens and can be handled as a manure.

This model is socially and culturally acceptable and can be constructed with low cost and with locally available material. This toilet requires less space than septic tank and does not need scavengers for cleaning or disposal of sludge.

Among the two models the Twin Pit model found more acceptance within the project villages as it was less expensive and culturally acceptable. The cost of one twin pit model is Rs 6000 including the superstructure of which 50% is contributed by the community by means of cash or material or labour. As innovation DA has also developed the superstructure based on prefabricated cement slabs which substantially reduces the time required in construction of toilets.

A total of 341 toilets have been constructed at the household level within the project villages. Among these the 20 toilets that have constructed at Rund Karai have been made from pre fabricated sheets. All the toilets have been Twin Pit model toilets.

Waste Water Disposal: Channel for disposing waste water from the household and linking them with the soak pits was adopted as the mechanism for waste water disposal from the houses. However as the village streets were paved with cement concrete the soak pits had to be designed and located accordingly. In other cases the households disposal channel has been linked with the drainage line that was constructed along the CC road for disposal.

S. No	Village	Soak Pits
1	Rajpura	6
2	Bagan	7
3	Billt	7
4	Bamhori Sheetal	3
5	Pipra	6
6	Ganeshgarh	9
7	Gopalpura	1
8	Rundkarari	4

Storm Water Disposal: A big debate took place in the project villages, namely whether to have CC roads or not? Technically it was expressed that village streets should be constructed of porous material like payer blocks or bricks and lined with concrete channel on both sides. This would ensure ground water recharge through surface absorption during rains. However, there two factors that were in favour of concrete road: one, CC roads would have a longer life; and second, these roads were sanctioned by government under the NREGA programme and any change in its design or use of material would involve the project in a long tedious process of changing the government norms. The project had viewed the sanctioning of the CC roads as part of leveraging resources and not making investment from the project funds.

The project provided technical inputs for the design of storm water drains along the CC roads for disposal of rain water from the village. The drains were connected to the village nullah or other natural drainage lines to ensure safe disposal of the water.

Solid Waste Disposal: NADEP pits have been constructed in some villages to experiment with and to institutionalize the system of disposal of household waste. The pits are expected to convert the solid waste in to green manure that will be used by the farmers in their fields. However, the mechanism related to collection and ensuring that only organic matter is disposed off in the pit has not been developed. Secondly, the disposal mechanism for in organic waste has not been developed so far.

6.3 Institutional Mechanism

The Samgra Jal Vikas Samiti has been the institutional mechanism for the implementation of sanitation works in the village. The Samiti works closely with the Gram Panchayat in accessing and leveraging funds from government and Gram Panchayat for the improvement of water and sanitation situation in their village. The Samiti also acts as the institution through which village sanitation works (except Storm Water Disposal) are implemented. The members of the Samiti have been trained on Water and Sanitation issue which include, among other things, issues of Personal Hygiene (use of toilets; hand washing practice; cleaning of teeth, tongue, eye and ears; cutting of nails; taking bath; spitting etc); Cleanliness of the House (food, water, disposal of liquid and solid waste, disposal of human excreta, low cost toilets etc); and Cleanliness of Anganwadi and School. In addition, training has also been conducted in the construction of toilets and their repairs and maintenance. A three day training module for local skilled and semi skilled masons, women and teachers has been conducted. The training was provided on Ecosan model, the Twin Pit and Pour Flush toilet as well as Dry Toilets. This would enable the users to contact people in their own village for the operation and maintenance of their toilets in case the need arises.

The Samagra Jal Vikas Samiti also interacts with their respective Gram Panchayats with the aim of influencing them on accessing services related to water and sanitation for their villages. It is in pursuance of this that the Samiti was able to provide technical help to the Gram Panchayat in preparing design and estimates for the drainage along with the CC roads that were sanctioned under NREGA programme.

7. WOMEN: CATALYSTS IN THE PROCESS OF CHANGE

7.1 Sharda Devi: Collective Efforts by Enterprising Women

Sharda Devi, President Samagra Jal Vikash Samiti

"Change is not something that happens automatically. Our collective effort is what acts as a catalyst in the process of change" said Sharda Devi, President of Samagra Jal Vikash Samiti of Pipra Village. Earlier, women of this village had to walk 2 to 3 kilometers for collecting water. Young girls and children were also affected as they could not attend school because their family would have had to go without water if they the children not fetched it.

Now the village has 2 hand pumps and 19 stand posts because of DA-Arghyam intervention. The villagers are happy that now they do not have to walk miles after miles to fetch water. For the location of the water sources, choices and preferences of villagers were taken into consideration. The villagers were also briefed about safe drinking water practices. It was of great help specifically for women of Pipra village.

"Now I want every household of the village to have toilets. I can understand how difficult it is for women to go out for defecation. I have two daughters, they motivated me to build toilet at our home. Now we do not have to go out for defecation," says Ms. Devi.

Sharda is a woman of substance who has encouraged leadership among women in her village. She has been able to give space and voice to other women. All the women of this village want to tackle the problem of water logging and waste water disposal.

Despite a major change in the village the task seems to be unfinished. Women in the villages still spend most of their time in collecting water. "I make 4 to 5 trips a day to the hand pump and to the stand post. Since last two months there is no electricity so we could not avail the advantage of pipe water supply", says Ms. Devi. Villagers do not have enough money to pay their dues. Operation and maintenance cost of the water supply scheme is provided by the Gram Panchayat. Moreover, there is no one in the village who is trained to repair the hand pumps. As a result if there is some technical fault, the villagers have to wait for the mechanic at least for 2 to 3 days.

7.2 Amma: Water Supply Scheme belong to everyone

She is fondly called by her fellow villagers Amma in Hastinapur village. Amma is around 60 years old. She says, "I still feel the pain of carrying 3 to 4 liters of water everyday. I belong to backward caste. We were not allowed to fetch water from the sources used by the upper caste people." The upper caste people conveniently gave the lower caste villagers a well

A Relieved Amma, Who can now rest her back

that was located in an agricultural field far away from the village. She used to walk 1.5 kilometers in one trip everyday to fetch water. Because of the heavy water pot she used to carry, she had this regular back pain that she mentioned in the interview.

When the water supply programme came to the village, she was relieved of the pain a little bit. It meant that she no longer had to traverse huge distances to fetch water. “Now upper caste people cannot look down upon us because we also pay the same charges for the water. As we pay the same charges, we also have the right to fetch water from these stand posts,” said Amma.

Now, building a toilet in her house tops her priority list. Amma has a daughter-in-law and she needs a toilet. Aays Amma, “Our time has gone. It is now my prestige issue.”

7.3 Prema Ahirwar: Ensuring the Commitment of Women

Prema Ahirwar is the secretary of Ravi Das Shayam Sahayata Samuh of Pipra village. She and her group members fought for their water rights in their village. Earlier, they had to walk at least a kilometer to collect water and per day they used to make 4 to 5 trips in a day. It was a tough time. “Men do not understand our problems, water collections and providing water to the families is completely our job. They never understand how difficult it is to carry 5-6 liters of water on our shoulders and heads. We still feel the pain of it,” said Ms. Ahirwar.

When DA-Arghayam project came to help them, many people of the village opposed it. Convincing them took a lot of efforts. It was women of the village who came together as they understood the problems associated with the scarcity of water. Soon women realized that mere availability of water cannot solve the problem. After getting the facility of water sources now different kind of problem started. The village is facing power shortage. Without power they cannot solve the problem of water supply. “Our next target is to get proper and regular electricity supply,” Ms. Ahirwar said.

“Today is the 15th day the hand pump nearest to my house is not working. We made complaints about the problem but Gram Panchayat is not taking any action. There is no mechanic in our village who can solve this kind of a problem. We have to wait for mechanic to come. We need training programmes for minor repairing works, so that we do not have to wait for mechanics." Prema continues and states that, "Women have to come forward other wise this problem will never solve. The water problem in the village could be solved only after the women came forward. Hence, it is time the women again take up the cudgels and commit themselves in right earnest to the solution of the problem."

7.4 Arti: Youth and Sustainable Water Management

Arti is a student of class VI and a member of Bal Panchayat of her school. Her duties include making people understand the importance of safe drinking water and basic hygiene practices. She tells her fellow students about the water borne diseases. She instructs students to use Jal TARA water quality testing kit of DA.

"I got training at my school to use the water testing kit and our teachers told us why we should drink only clean and safe water," said Arti.

The Bal Panchayat members inform their parents and others about the diseases that occur due to unsafe drinking water. They also motivate other children of the village about the basic hygiene practices.

In the village many households do not have toilets. The village does not have any mechanism for waste water disposal also. Because of stagnant water, various diseases such as malaria, diarrhea, etc., frequently occur. Arti is too aware of all these aspects of her village. She finds that the root lies in water and philosophies, "People should respect water resources. *Jal hi Jiwan hain*. No one can survive without water."

7.5 Savita: Changes in Hastinapur

Behind the thin veil of the dark green *saree,* her smile and with a sparkle in her eyes reveal a sense of empowerment, determination and happiness for Savita. She played the role of a catalyst in bringing water to Hastinapur village. Savita says, "I do not remember how many times I fell down while carrying the water pot. I had to wake up early in the morning to collect water before my family woke up."

It was a tough job to find water in Hastinapur village. It was particularly tough because the village is situated atop a hillock. It took the villagers many months in finding sources of water to meet their daily needs.

Savita, her friend Mithila Devi and many other women of the village came forward to collect money from each household to set up a water pump in their village. They individually took the responsibility and asked all the women to come forward to tackle the problem of water scarcity. Their efforts paid dividends; now the women of the village can easily fetch water from the water pump set up as a result of the collective effort.

It has proved that women have to come forward; otherwise, change is not possible. “We have to raise our voice. We have to demand our rights, otherwise nobody will listen to us” said Savita.

7.6 Meera Devi: Stepping out to lead the change

Meera Devi, a resident of Bagan Gram Panchayat, has been associated with many developmental works in her village. “Women can do anything if they want, but it is so difficult to motivate them to come forward,” she said.

In summer months, there is an acute shortage of water in the village. People, particularly women, have to face a lot of problems in the months of May, June and July. During the last two years, this area has received a fair amount of rainfall. “We could not store the rainwater; due to lack of proper rainwater harvesting structure, most of the water ran off. The villagers were not aware of rain water harvesting. Then they came to know about water harvesting technology from DA-Arghayam project. Meera Devi participated in a programme aimed at training people about rain water harvesting. She motivated large number of households to construct rainwater harvesting structures. Now they are able to store rainwater. “We can use rain water to irrigate our fields in the months of summer, when water is scarce. Now people can grow more then one crop in a year,” Ms. Devi says proudly.

Meera Devi is not a one-off example. Women, especially in backward rural areas, are coming to the forefront by motivating fellow villagers to stand in unison so that collectively they can play a substantial role in solving the age-old problems that the villages are faced with.

Development Alternatives (DA) is one of the most innovative and successful organization dedicated to the design and large scale delivery of concepts, methods and technologies for sustainable livelihoods.

DA has been working in water sector since its inception in all the fields from water augmentation, water quality monitoring and management, technology development and dissemination for water quality, waste water management and good sanitary practices.

Arghyam Trust was et up in 2001 with a personal endowment from Ms. Rohini Nilekani, Arghyam seeks to drive strategic and sustainable efforts in the water sector that enhance equity in access to water for all citizens. The vision of Arghyam is “Adequate water, safe water ….. always and for all”

The Trust supports innovative approaches in areas like water purification, rainwater harvesting, watershed development, small-scale distribution systems and governance of water projects. The foundation also aims to develop models for integrated water management in rural areas by working in close partnership with grassroots organizations.

Development Alternatives

B-32, TARA Crescent, Qutab Institutional Area, New Delhi – 110016
Tel: +91-11-26134103, 26890308, Fax: +91-11-26130817
E-mail: kvijayalakshmi@devalt.org; mkumar@devalt.org
Website: www.devalt.org