Rural Drinking Water Service Levels: A Study of Andhra Pradesh, South India

Snehalatha M., Busenna P., Ratna Reddy V., Anitha V.

Abstract

"Water for all at all times" is a policy objective for the Government of India, which is close to achieving full coverage of safe water. However, the vision of adequate quantity, quality, reliability and a predictable water supply at household level to everyone has yet to be achieved. In 2010/11 data was collected from 5000 households in over 100 villages in 9 agro-climatic zones in Andhra Pradesh, India, using a range of quantitative and qualitative methods to assess service delivery. Analysis reveals that users receive "basic" and "sub-standard" services despite high levels of investment in infrastructure. Maps using geographical information systems (GIS) demonstrate inequitable distribution of services among households; often the poorest families and disadvantaged caste groups receive relatively lower service levels. The study highlights the need for strategies to improve service delivery, build the capacities of communities and establish governance structures to ensure equitable services across social and economic groups.

I Introduction and context

According to Government publications[1] 94% of the rural population of 741 million (2001 census) has access to safe drinking water through 4 million handpumps and 0.2 million-piped water schemes. At the same time, waterborne diseases affect 37.7 million Indians annually, 1.5 million children are estimated to die of diarrhoea and 73 million working days are lost due to waterborne disease. The estimated annual economic burden is about US$ 600 million a year, which is more than the annual expenditure (US$ 460 million) of the sector (Ratna Reddy V. & Batchelor, C., 2010). In the six years to 2008/09, the annual WASH sector budget rose by 67% and the current 11th plan (2007–2012) budgets for US$ 2.62 billion (Rs. 126.8 billion) per year. It is estimated that more than 90% of the rural population of India has access to handpumps or taps or other infrastructure that is capable of providing safe drinking water. It is also estimated that these systems fail to deliver sustainable services resulting in 30 % of habitations "slipping" from full coverage to partial coverage or unsafe sources (Reddy, et. al., 2011). This means that about 30 % of annual investments i.e., US$ 0.79 billion (30 % of US$ 2.62 billion) become ineffective or lost.

[1]Rajiv Gandhi National Drinking Water Mission, Department of Drinking Water Supply Ministry of Rural Development, Government of India (Presented in February, 2008)

In Andhra Pradesh, in 2009, out of 72,040 habitations in the state, 46 %[2] were considered fully covered for water (FC)[3]; 52 %partially covered (PC); and 1 % not covered (NC) while about 1 % of habitations have no safe source (NSS) of water for drinking. The approximate amount spent in creating rural water supply and sanitation infrastructure including rehabilitation and extension during the four years from 2004 to 2008 is more than US$ 4.16 billion (Rs 200 millions) in Andhra Pradesh. Groundwater schemes cover about 72 % of the villages while surface water schemes cover about 28 %.

Despite this investment, services received by large numbers of users are not up to the expected standard or official norms in terms of water quantity, water quality, reliability and accessibility. An analysis of the investments indicates that the Government has focused on infrastructure provision with little focus on the services actually delivered at village level. Completed schemes are handed over to Village Panchayats (the lowest level of local government) which are expected to take responsibility for service delivery. While it is essential to monitor investments against the services delivered, little research has focused on the extent to which the availability and/or nature of finance is a constraint on provision of services. To address this gap the WASHCost Project developed a framework for analysis which makes use of service ladders for water and sanitation with key parameters against which to measure services received by users. This paper uses this framework to analyse water services received by the households within and across villages that were studied in Andhra Pradesh.

II Methodology

The WASHCost research involved key stakeholders of implementing agencies from the beginning of the study and a consultative process was adopted to design the methods and tools for undertaking the study with the main objective of assessing the costs and service delivery. The present paper focuses on two components of the research:

i) assessing the variations in rural drinking water service delivery across agro-climatic regions and villages in Andhra Pradesh;

ii) analysing variations in service levels across households within the villages especially for the poor

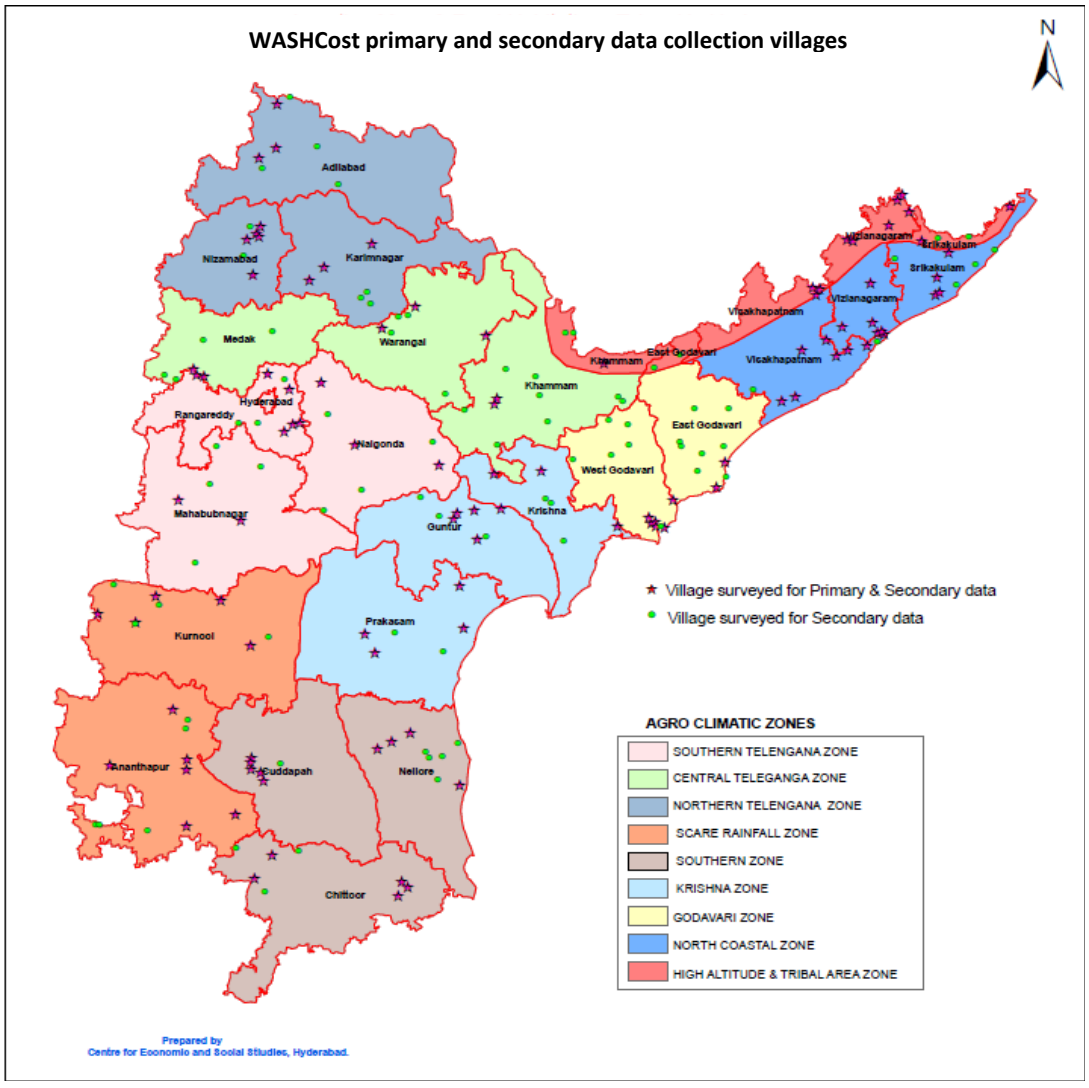
[2]Online data accessed from www.indiawater.gov.in on 1st April 2011

[3]Fully covered (FC) means that each person in the village receives 40 litres of drinking water a day. The village is considered partially covered (PC) when some people receive <40 litres a day. If the village does not have a safe source of water or the water is polluted with fluoride or other pollutant or is brackish, that is considered no safe source (NSS). NC: Not covered means there is no formal source of water and households depend on streams, canals or rivers etc.

Location of the study and sample

The study was conducted in the state of Andhra Pradesh covering all nine agro-climatic zones[4] and 22 out of 23 districts. Secondary data was collected from 187 villages selected using statistical methods, and detailed surveys were conducted in 107 of these 187 villages. A total of 5233 households were interviewed to assess service delivery. In addition, focus group discussions took place at water points in each village using quantitative participatory assessments to turn views expressed into scores that can be recorded. Village maps were prepared using GIS data to identify the water and sanitation infrastructure and also to display the household level service delivery. The location of study areas in Andhra Pradesh is illustrated in Figure 1.

Figure 1: Location of the study areas in Andhra Pradesh



[4]The zones are classified using the criteria such as range of rainfall received, type and topography of the soils and temperature. The state of Andhra Pradesh is divided into 9 agro climatic zones.

Analysis framework: water service levels

Key parameters for defining a water service were identified as *quantity*, *accessibility*, *quality* and *reliability* and norms for each of these parameters were adapted for determining a "*basic*" service level. Services not satisfying the basic norms/standards were categorised as "*sub-standard*" or (worse) "*no service*" while "*improved*" and "*high*" standards were categorised above the basic level of service.

The service levels adopted in the India (Andhra Pradesh) context are described in Table 1. The background and details of the overall framework of analysis are detailed in a WASHCost working paper (Moriarty et al., 2010). Service ladders can effectively be used not only to assess present service levels but as a baseline or benchmark for monitoring efforts to improve service levels. Each service level parameter can be assessed independently, or the lowest level indicator can be considered to set the overall service delivery standard; i.e. If there is sufficient water of the right quality but the supply is unreliable, then the whole service can be said to be sub-standard. The service comprises multiple sources and multiple uses and for an overall assessment it is the overall service that the household receives from multiple sources that counts.

Table 1: Water Service ladder for assessing service levels

Service level	Quantity	Accessibility	Quality	Reliability/Dependability
High	80lpcd+	0-10 mins to collect water per day	In addition, water quality has been tested independently using a water quality test kit.	As 'improved' but a system for handling breakdowns exists and it functions well.
Improved	60-80 lpcd	10-20 mins	Users are aware that RWSS officials have certified that there are no water quality problems.	Meets basic standards and a system for handling breakdowns exists, but the system is not reliable.
Basic	40-60 lpcd	20-30 mins	No complaints by users	Network supply according to an agreed schedule and duration. HPs are dependable. But no system for handling breakdowns exists.
Limited (sub-standard)	20-40 lpcd	30-60 mins	Water is used for drinking but users complain of bad smell, bad taste or colour or appearance.	Network supply has scheduled times and duration and delivery, but supply is still haphazard. Handpumps are not dependable because recharge rates are low.
No service	Less than 20 lpcd.	60+ mins	Water is unfit for drinking by humans or animals.	Network supply is haphazard. Handpumps are not dependable because ground water is exhausted

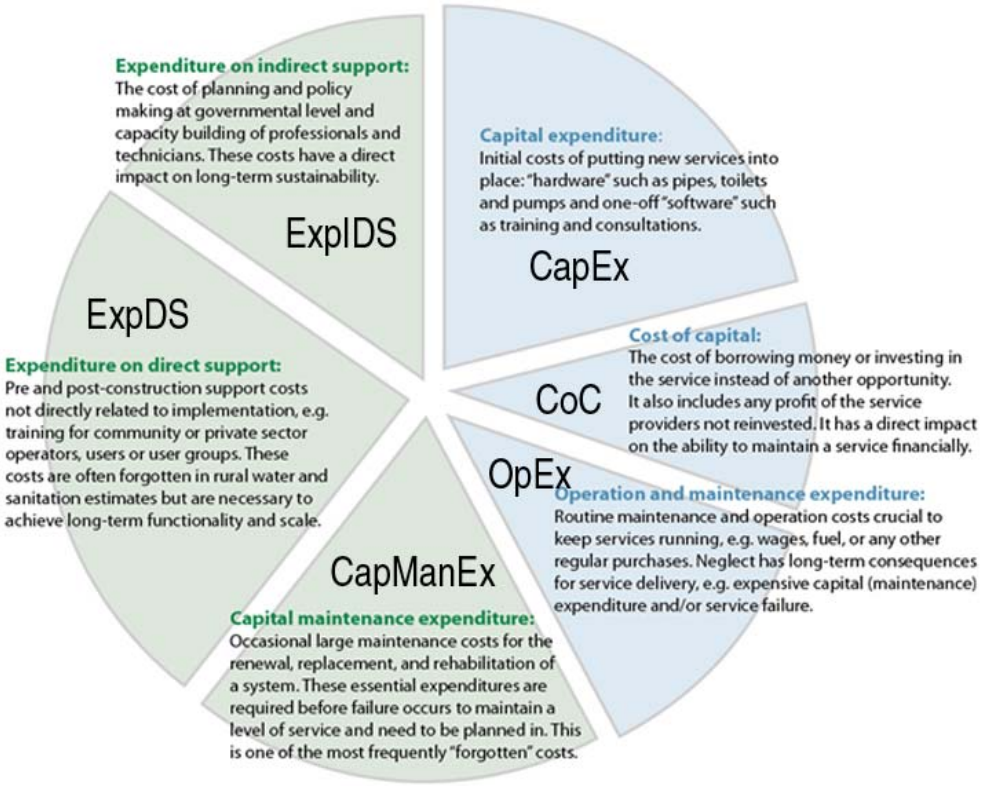
Lpcd= litres per capita per day. HP = handpump

NB: The term 'limited' has been used internationally for a service level below basic level. In India the term sub-standard has been used. These are equivalents.

Cost components: the life-cycle cost approach

The WASHCost project has disaggregated and itemised the costs of various components responsible for ensuring effective service delivery. Unless there are allocations made and incurred for each of the components, service delivery might be adversely affected. The cost components are defined (Fonseca et. al, 2011) as shown in Figure 2.

Figure 2: Life-cycle cost components (WASHCost 2010)



- Capital Expenditure (CapEx) capital costs spent on hardware and software for infrastructure provision where software is such things as supervision of the contract;
- Operational Expenditure (OpEx) operation and minor maintenance costs;
- Capital Maintenance Expenditure (CapManEx) the cost of major repairs and replacements;
- Expenditure on Direct Support (ExpDS) support to the community, such as training, capacity building and awareness raising;
- Expenditure on Indirect Support (ExpIDS) the indirect support -costs of planning, budgeting and monitoring at department level; and
- Cost of Capital (CoC) the cost of borrowing capital i.e. the interest on loans taken out.

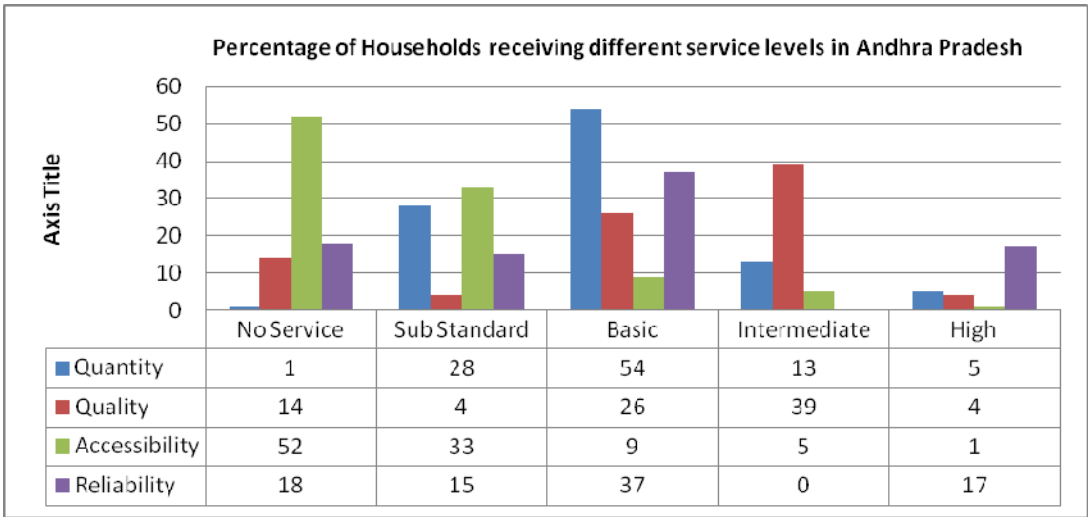
The results of the present study have been analysed using these cost components where available.

III Results and Discussion

Service Levels in Andhra Pradesh

Detailed analysis of service delivery parameters (*quantity, quality, accessibility and reliability*) in all zones indicate that the overwhelming majority of users are receiving *"basic"* and *"sub-standard"* service levels while very few households receive *"intermediate"* or *"high"* service levels on all four parameters (Figure 3). Accessibility is the most problematic quality.

Figure 3: Percentage of households receiving different service levels in Andhra Pradesh



	No Service	Sub Standard	Basic	Intermediate	High
Quantity	1	28	54	13	5
Quality	14	4	26	39	4
Accessibility	52	33	9	5	1
Reliability	18	15	37	0	17

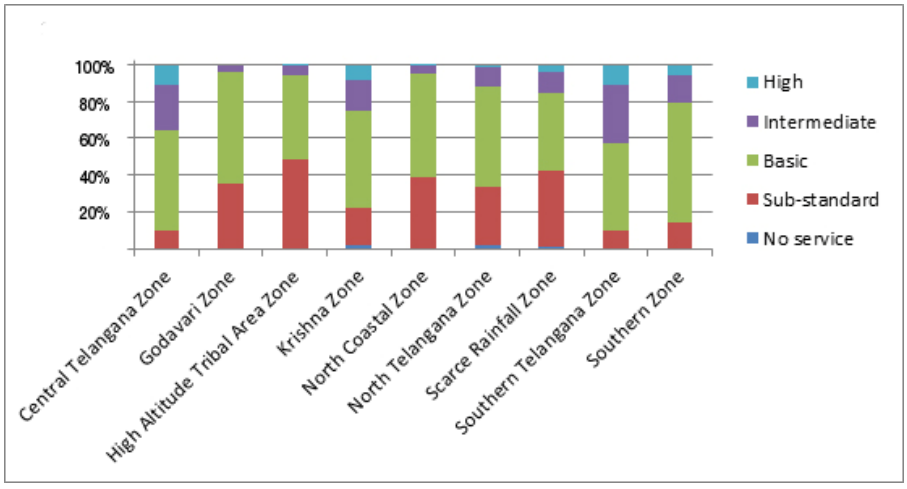
Source: Data collected by WASHCost Project, 2010/2011

The quantity of water received by the majority of households was *"basic"* (40-60 litres per person per day) despite many households having individual tap connections at home. The quality received was quite poor and about 14% of the households were buying bottled water either from private vendors or from the water treatment plants available in their village (an indication that they are not confident of their 'normal' supply). As many as 15% of households depend on unsafe sources such as streams and canals for their drinking water. In terms of the time taken to fetch the water (accessibility), in almost all the zones the majority of households spent more than 60 minutes a day fetching water. The daily time ranged from 30 minutes to 8 hours across different villages with the longest average times observed in High Altitude and North Coastal Zones and the shortest in Southern and Central Telangana zones. The reliability of sources across zones indicated a *"sub-standard"* level. Households depend on their villages having multiple sources and they switch from one to the other depending on season and availability. In most villages, multiple sources and multiple technologies were observed as being necessary to meet demand for a certain level of service

Inter-zonal variations in service levels

There were differences in services levels between zones when individual parameters are considered. The quality indicator showed high service levels in the Krishna zone and "no service" in the tribal High Altitude Zone (HAZ), where households still use informal unsafe sources like streams and canals for drinking water. The Southern and Central Telangana Zones (STZ and CTZ) have fluoride affected villages and households were buying water from water treatment plants. In the Krishna zone, as well as buying water, many households are dependent on open wells, agricultural wells and borewells. Figure 4 illustrates analysis by zone, in this case for the quantity of water received by households.

Figure 4: Inter-zonal differences in quantity received by households



Source: Data collected by WASHCost Project, 2010/2011

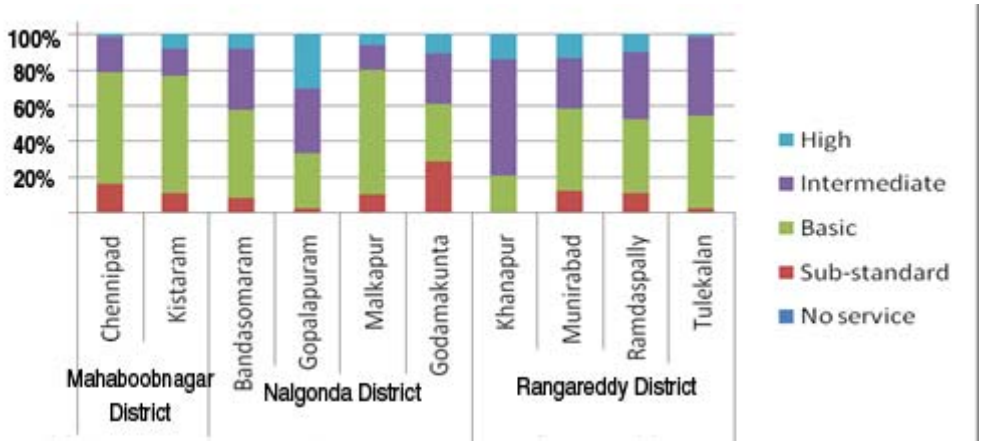
It can be observed that households in Southern and Central Telangana zones received better quantities ranging from *"basic"*(40-60 litres per person per day) to *"intermediate"* (60-80 litres) and *"high"* (>80 litres),while in High Altitude, North Telangana and North Coastal Zones the service levels are mainly *"basic"* (40-60 litres per person per day) to *"sub-standard"* (20-40 litres). Southern and Central Telangana villages are closer to urban areas and one possible explanation is that more households have tap connections and can therefore access more water. Out of the 20 villages surveyed in these two Zones, 10 were given the Nirmal Gram Puraskar (NGP) award for achieving open defecation free status, suggesting that the communities were active and successful in ensuring WASH service delivery. The High Altitude, North Telangana and North Coastal zones have more remote and tribal villages with water sources at longer distances and fewer WASH facilities, multiple sources and systems. Godavari and Scarce Rainfall zones also had *"basic"* to *"sub-standard" services in terms of quantity of water accessed a day.* Such difficulties are not sufficiently recognised in national budgeting. Despite the variations across hydrogeological conditions the per capita investments made by the Government are the same, which makes it difficult to ensure the service delivery with similar rates across all the villages and geo physical and

socio economic zones. There is an urgent need to investigate and link the factors affecting investments to issues of service delivery, replacing the present model of blanket allocation per capita under each scheme/technology.

Inter-village variations within Southern Telangana Zone:

If we look at details within one zone, we see that villages receive various levels of service. Figure 5 shows the quantity parameter for households in Southern Telangana Zone (STZ), where 10 villages were surveyed. It can be seen that the quantity that households accessed in Chennipadu, Malkapur, Tulekalan, Godumakunta and Kistaram are low compared to households in the other villages. In Gopalapuram and Khanapur a big majority of villagers have a better than basic service in terms of quantity (intermediate or high). These villages are within the urban fringes and have access to a piped water supply and the majority of households have tap connections. Despite this access to infrastructure communities do not seem able to manage service delivery effectively. There is a need to monitor service levels and governance at local level.

Figure 5: Percentage of households in each service category for villages in Southern Telangana Zone



Source: Data collected by WASHCost Project, 2010/2011

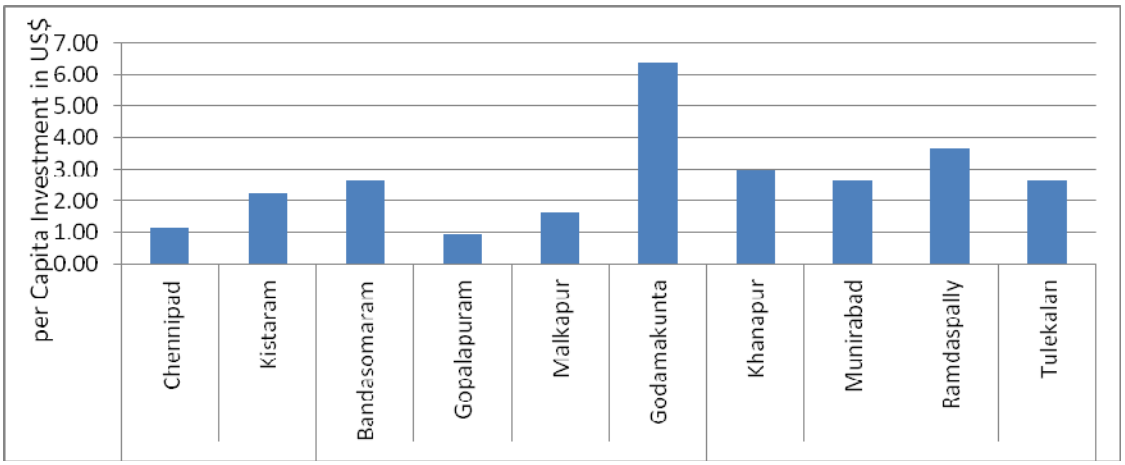
It can also be seen from Figure 5 that the quantity of water received by households in Chennipad, Malkapur, Tulekalan, Godumakunta and Kistaram was low compared to the other villages.

Service delivery and per capita Investment

The average per capita investments made in these villages varied from US$ 0.96[5] in Gopalapuram to US$6.9 in Godumakunta (Figure 6).

[5] 2010 figures converted from rupees at a rate of 1 US $ to Indian Rs 48.40

Figure 6: Per capita investment for water service provision by the government in STZ



Source: Data collected by WASHCost Project 2010/2011

From these figures it can be seen that although Godumakunta had the highest per capita investments among all the villages in the zone, this village had the highest percentage of households receiving a sub-standard service levels. Gopalpuram which had least per capita investment had the highest percentage of households receiving a high service level. This strongly suggests that better service delivery does not depend on having more infrastructure, but on better management of services, including source protection. The better operation and management systems present in some of these award winning (Nirmal Gram Puraskar) villages probably had much to contribute to better service delivery.

Comparing official coverage figures with service level analysis

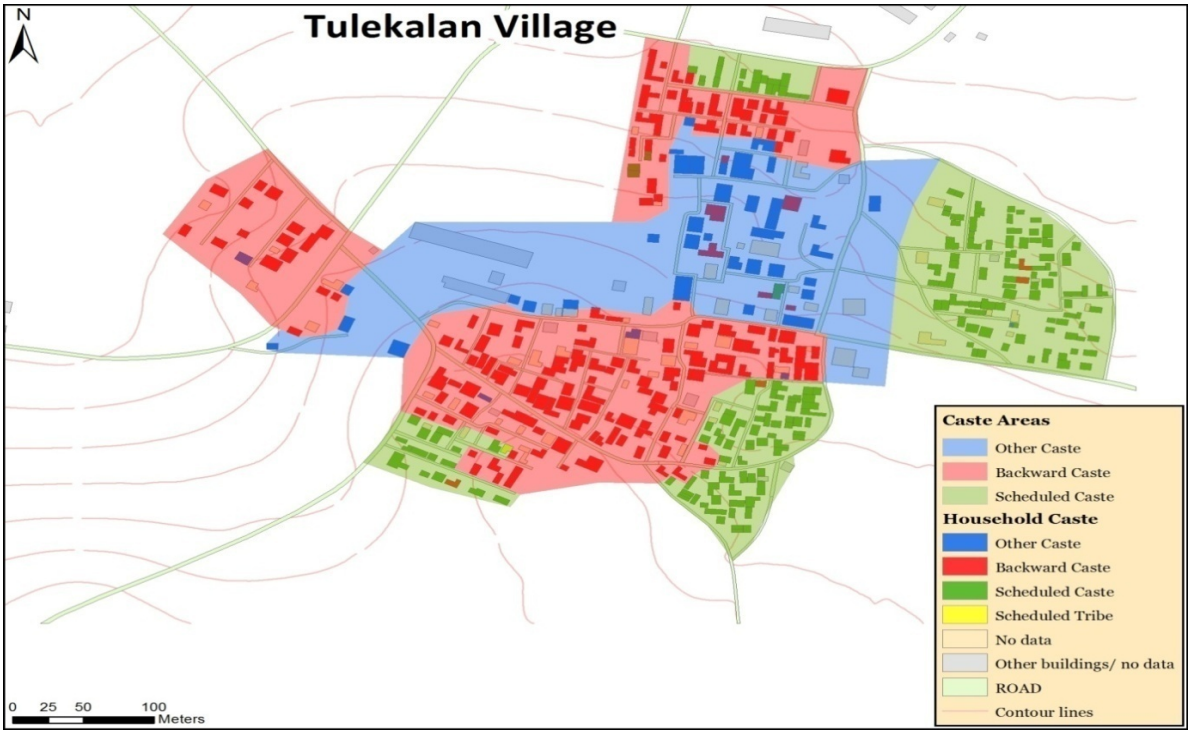
The coverage status for each village as given by the Rural Water Supply Department (RWSS) is not based on the water ladder but their official categories do use 40 litres per capita per day as the coverage criteria. If every person in a village receives 40 lpcd or more the village is categorised as Fully Covered (FC).If (some) households receive less than 40 lpcd the village is referred to as Partially Covered (PC). If the village has quality problems then it is regarded as being in the Not Safe Source (NSS) category. In Southern Telangana Zone villages, Godumakunta, Ramdaspally, Tulekalan, Kistaram are categorised officially as PC and the WASHCost study concurs, since all these villages fall into the sub-standard category for quantity of water per person. However, Munirabad, Chennipad, Bandasomaram Gopalpuram are classified officially as fully covered but the study findings categorise these villages as sub-standard - the equivalent of partially covered. Khanapur is only PC according to official statistics, but would be considered FC from the WASHCost study. In the view of the current authors, the present method of determining the official coverage status does not reflect the realities of life at household level. The WASHCost approach to service delivery measurement at various levels (household, colony, habitation) is very much advocated.

Intra-village service level variations among different social and income groups

Tulekalan village has been selected from the 10 villages in Southern Telangana Zone to demonstrate variations in service level across different caste and income groups. GIS maps have been used to map these variations.

The relationships between caste, class, income and social position are complex. However, there is an association between caste and position in the social structure of communities. Castes can be broadly divided into three categories, 'scheduled', 'backward' and 'other'. Scheduled Castes (SC) and Scheduled Tribes (ST) are at the lowest social rung and have constitutional provision of reservations in educational institutions and public sector jobs (15%). Backward Castes (BC) also have some reservations in educational institutions and public sector jobs which vary from state to state. Other Castes (OC) are considered to be at the highest rung of the social ladder and not need positive action.

Figure 7: Location of households based on caste in the Tulekalan village



The households in this village are spread over clear and distinct localities within their social groups (Figure 7). Other Caste households are in the centre of the village, with Backward Caste households forming blocks just outside the central area. Scheduled Castes and Scheduled Tribe households are located at the edges of the village.

Figure 8 indicates income levels of households in the village which coincide to some extent with caste group locations. Most Scheduled Caste households are in the income categories

below Rs 25,000 (US$ 516) a year (green yellow and red on the map). Further, the better-off, above Rs 125,000 (US$ 2,500) a year (light blue and dark blue) are mainly situated in the centre of the village and coincide with higher caste families.

Figure 8: Location of households based on their annual income in Tulekalan village

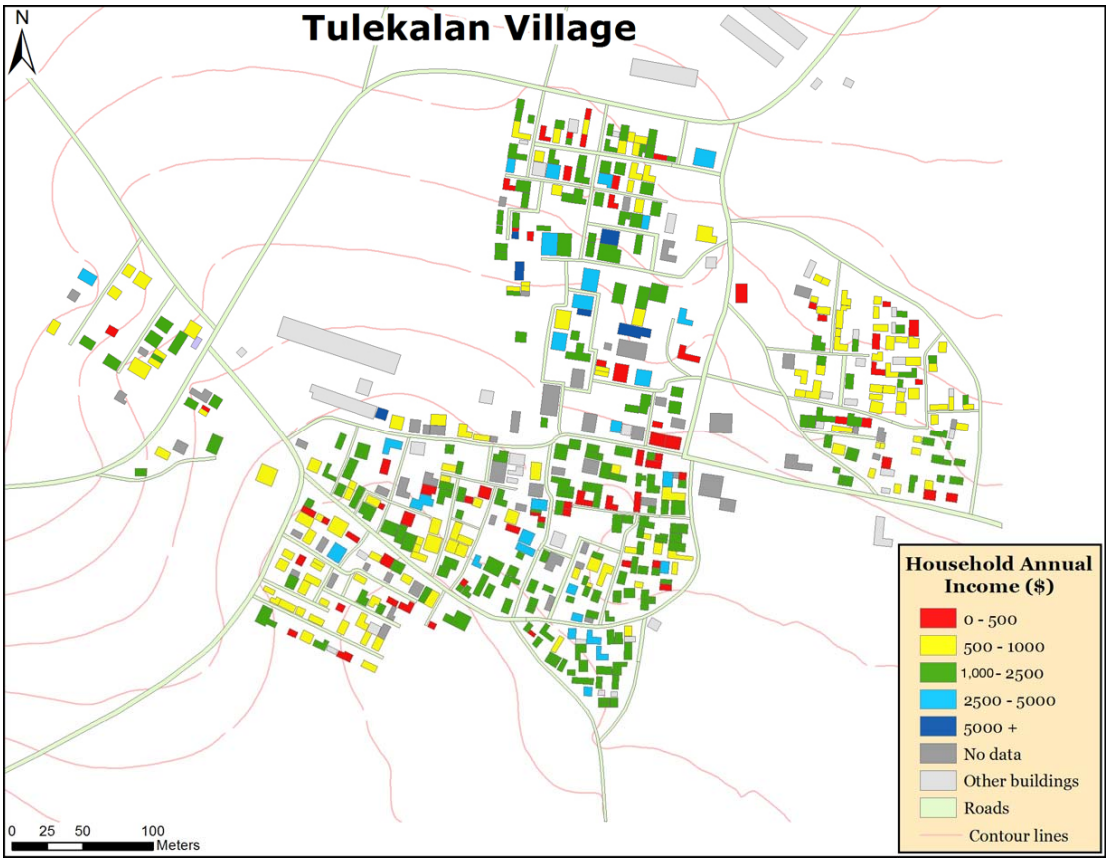
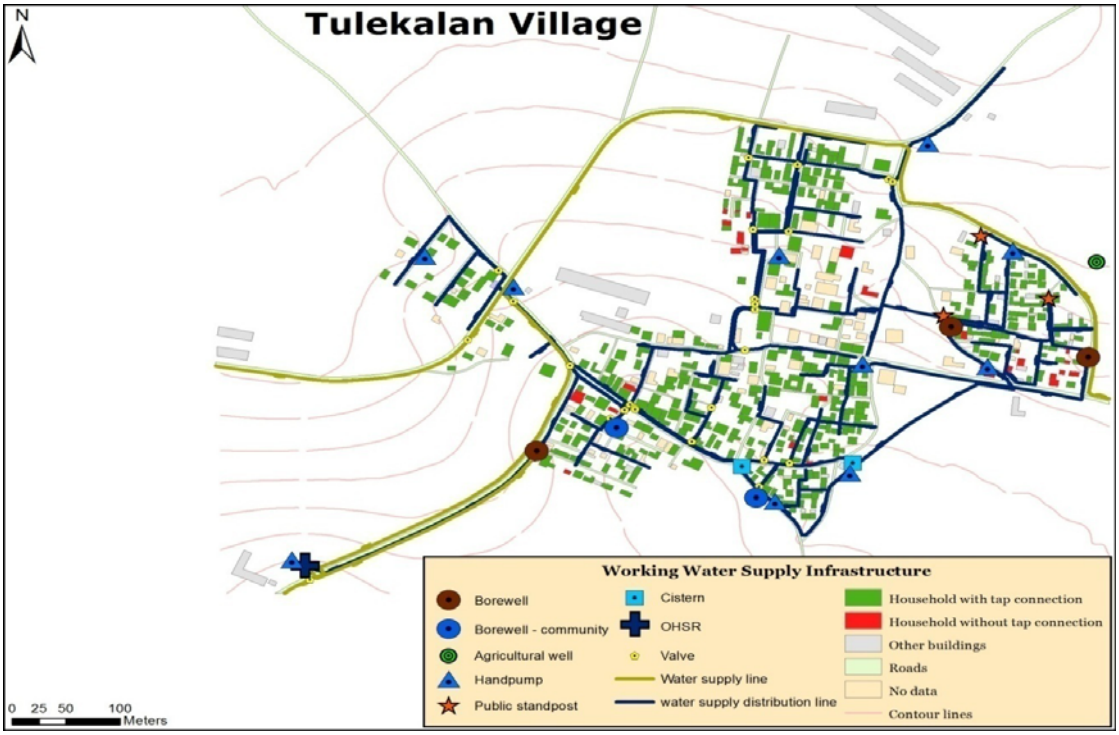


Figure 9 shows that infrastructure provision in this village is skewed, with WASH assets concentrated in or near higher caste group localities. The majority of Other Caste and Backward Caste households have household tap connections but very few Scheduled Caste and Scheduled Tribe households have tap connections and so depend on public standposts.

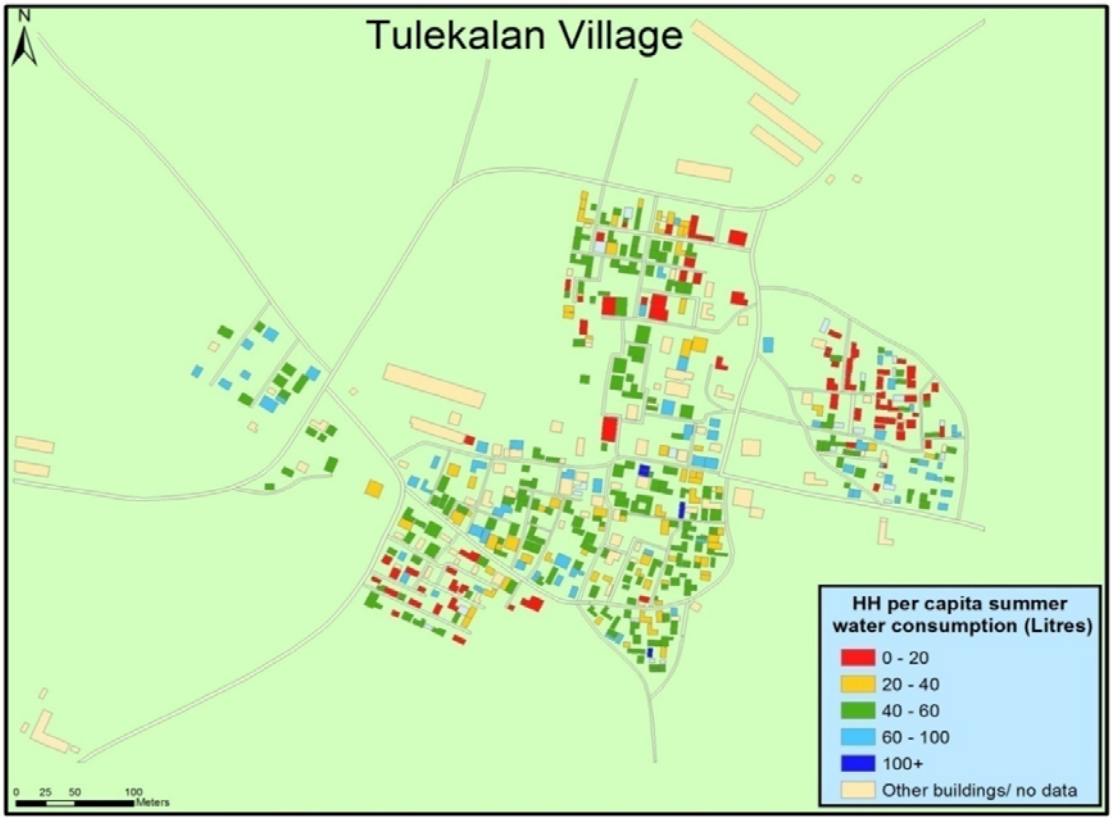
Figure 9: Distribution of water infrastructure in Tulekalan Village



Scheduled Castes and Tribes and lower income households receive a lesser quantity of water as they are located at the tail end of the water distribution network and depend to a greater extent on the public standposts (Figure 9). Lower income groups can generally not afford to invest in infrastructure that has the potential to improve their services (e.g. private borewells, booster pumps, household storage tanks). WASHCost research also shows that they have little say in decisions made in WASH service delivery (Safa 2011).

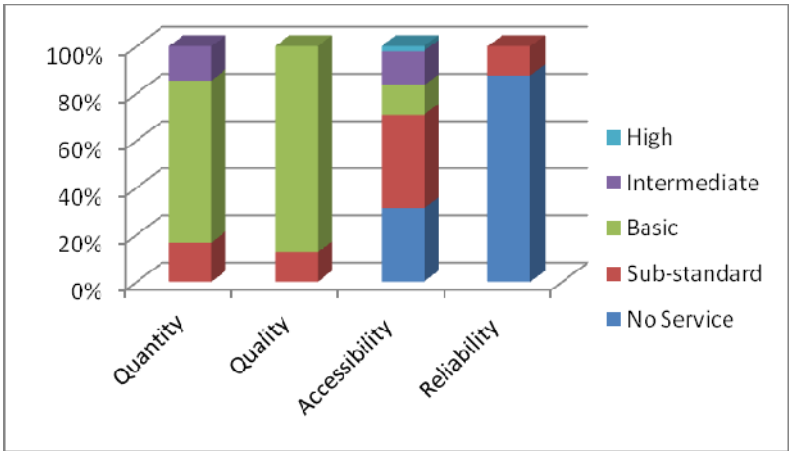
Figure 10 shows how this mapping of caste, income, and infrastructure relates to household access to water. Scheduled Caste (or Tribe) households are more likely to receive less than 20 lpcd per day ("no service") or 20 -lpcd ("sub-standard") while Other Caste and Backward Caste households receive 60-80 lpcd ("intermediate service"). Only three households in this village access more than 80 lpcd and so achieve a high level of service, despite the village having multiple sources of water, albeit via water supply systems that are unreliable in terms of quantity and quality of water provided.

Figure 10: Quantity of water received by households in litres per capita per day in Tulekalan



Overall service delivery in Tulekalan village

Figure11: Tulekalan village water service levels



Source: Data collected by WASHCost Project 2010/2011

Tulekalan village has a combination of technologies from handpumps to piped schemes. The original water supply was via a community well, followed by handpumps, some of which were later converted into direct pumping borewells. The village also has a single village piped water supply scheme and it is one of the villages that receive drinking water from the Krishna River, albeit sporadically, through a multi village piped scheme. Despite the presence of these multiple sources and schemes, service delivery is poor. Not only is the village assessed as

being substandard to basic for quantity, it was also judged as sub-standard to basic for quality, and "no service" for accessibility, which means that households spend more than 60 minutes a day fetching water, while the water sources are completely unreliable (Figure 11). According to the official data, this village is considered Partially Covered i.e. not all households receive 40 lpcd.

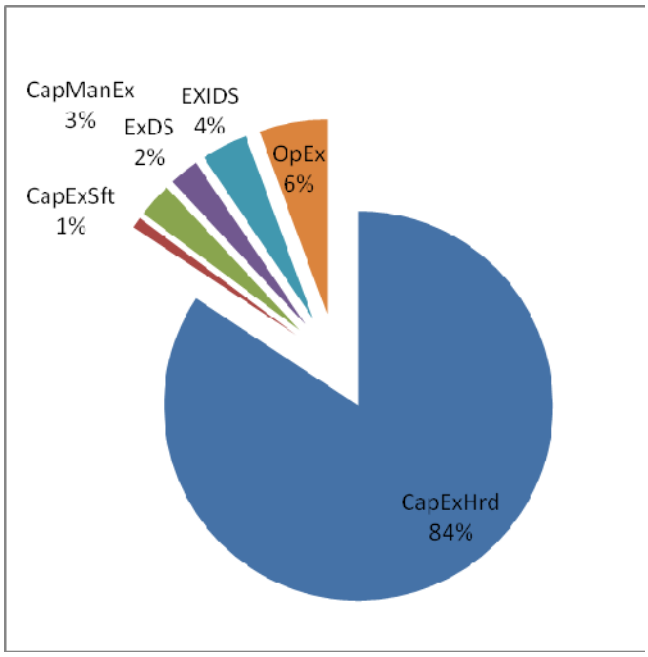
Costs and service levels in Andhra Pradesh

The new National Rural Drinking Water Programme (NRDWP) guidelines developed by the Ministry of Rural Drinking Water and Sanitation, Govt of India (GOI, 2010)[6] have been widely appreciated for their focus on service delivery. But there is resistance to change and the sector still focuses on infrastructure costs rather than the software and post construction costs that connect services with people. Consequently, the guidelines are at risk of becoming an unfulfilled promise.

The analysis of the expenditures made in Andhra Pradesh reveal that the average cost of provision of water ranges from US$ 9.2 to US$ 23 per capita per year across nine agro climatic zones (averaging US$12.2 at the state level)[7].

The disaggregated costs (Figure 12) reveal about 84% of overall expenditure was on capital costs, while each of the other components range from 1% to 6%. This illustrates how the focus is on constructing new infrastructure but not on operation and maintenance or support systems required to ensure service delivery. The critical expenditures need to support communities by building their capacities (such as IEC, training, capacity building etc) are negligible or not made at all. In addition to these investments at state level, households spend considerable sums themselves to boost their services, in some cases to achieve even a basic service.

Figure 12: Disaggregated life-cycle costs in all WASHCost research villages in Andhra Pradesh



Source: Data collected from WASHCost Project 2010/2011 from the department of rural water supply Andhra Pradesh

[6]http://www.ddws.gov.in/sites/upload_files/ddws/files/pdf/RuralDrinkingWater_2ndApril.pdf

[7]The median value is US$ 11.20 per capita per year ranging from US$1.5 to US$ 135 across 187 habitations. All figures are at 2010 values, converted from Rupees at US$ 1 = Rs 48.4.

IV Conclusions

Government of India and Andhra Pradesh have been investing in drinking water by focusing on providing infrastructure. It is equally important to look at the services people actually receive at household level. Official coverage status does not reflect household realities and there is a need for an accurate analysis framework to assess service delivery. In the inequitable distribution of services found among the households within villages, it is often the poorest families and disadvantaged caste groups that receive the lowest services. Socio-political and economic decision-making processes play an important part in the pattern of WASH facilities available at zonal, district and sub-district levels. At the village level these factors play a big role in influencing WASH asset provision and ownership. Pro-poor strategies need to be designed and integrated to achieve equitable service distribution. Ensuring support structures for operation and maintenance, improving budget allocations and designing systems that are accountable to deliver the services are essential in addition to infrastructure provision. Building the capacities of local/grass root organisations is also essential for equitable service distribution.

The analysis of investments made using the life-cycle cost approach reveals a skewed expenditure pattern concentrated towards capital costs and neglecting other important components necessary for service delivery. Village level infrastructure provision reveals an engineering bias that duplicates infrastructure without analysing the services received. This is not to suggest that allocations towards infrastructure should not be made, but these investments need to be complemented through supporting investments in protecting sources and governance structures within the villages to ensure sustainable and equitable services. Further the capacities of the communities need to be built at various levels to monitor the service levels by the Government and by non-governmental organisations. Policy initiatives need to focus on ensuring at least basic level services to poor and disadvantaged groups.

Current methods of disbursement of funds follow blanket allocations/money for infrastructure that fail to take into account the differences in agro climatic conditions, terrain, hydro geological conditions and source protection requirements across zones, districts and villages. Adoption of the life-cycle costs approach allows disaggregated cost data to be collected and considered against the service levels received by households. National and state policy should adopt a service delivery approach with proper monitoring systems for measuring service parameters. A service delivery approach also needs to create the space and platforms for poor and disadvantaged groups to voice their demands for more equitable service delivery. To achieve this aim would seem to require the building of strong governance bodies at village and higher bodies that oversee service delivery and equity issues and which have the capacity and power to make changes to improve both.

References:

Fonseca, C. et al., 2011. *Life-Cycle Costs Approach. Glossary and Cost Components.* (Revised) Briefing Note 1, IRC International Water and Sanitation Centre, The Hague, The Netherlands.

GoI, 2010.*Rajiv Gandhi National Drinking Water Mission - Movement towards Ensuring People's Drinking Water Security in Rural India – Framework for implementation 2009 – 2013* Department of Drinking Water Supply, Ministry of Rural Development, Government of India.

Moriarty, P. et al., 2010.WASHCost Working paper 2 - *Ladders for assessing and costing water service delivery*. IRC International Water and Sanitation Centre, The Hague, The Netherlands.

Reddy, V. Ratna and Batchelor, C., 2010.*Can water, sanitation and hygiene services be improved by mainstreaming life-cycle cost approaches (LCCA) into planning and other governance processes?* (An initial assessment of LCCA in Andhra Pradesh), Working Paper No. 7, Centre for Economic and Social Studies, Hyderabad.

Reddy, V. Ratna and Jaya Kumar, N, 2011. *Financing the WASH Sector in India Cost of Provision and budget Allocations*. Working Paper No. 12, Centre for Economic and Social Studies, Hyderabad.

Safa, F., 2011.*Transparency, accountability and participation (TAP) in the WASH sector in Andhra Pradesh* http://www.washcost.info/page/1469